

BASIC LIFE INSURANCE UNDERWRITING

ALU 101 TEXTBOOK

Tenth Edition – 2020

THE ACADEMY OF LIFE UNDERWRITING

GUIDING PRINCIPLES FOR THE UNDERWRITER

Act promptly, while exercising sound, objective, and consistent judgment, in making underwriting decisions.

Follow established risk classification principles that differentiate fairly on the basis of sound actuarial principles and/or reasonable anticipated mortality or morbidity experience.

Treat all underwriting information with the utmost confidentiality, and use it only for the express purpose of evaluating and classifying risk.

Comply with the letter and spirit of all insurance legislation and regulations, particularly as they apply to risk classification, privacy, and disclosure.

Avoid any underwriting action which is in conflict with the obligation to act independently and without bias.

Act responsibly as an employee with scrupulous attention to the mutual trust required in an employer/employee relationship.

Provide information and support to sales personnel to help them fulfill their field underwriting responsibilities in selecting risks and submitting underwriting information.

Strive to attain Fellowship in the Academy of Life Underwriting, maintain a high level of professional competency through continued education, and help promote the further education of all underwriters.

Maintain the dignity and sound reputation of the Underwriting Profession.

Increase the public's understanding of underwriting by providing information about risk classification.

These Guiding Principles are presented, not as specific standards for others to measure individual performance, but for the self-guidance of all those who are striving to understand and meet the responsibilities of an underwriter.

GENERAL NOTES FOR ALU TEXTS

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Gender Neutrality

The pronouns "he, his, him" are to be interpreted as pertaining to both male and female genders wherever appropriate in context.

Laws

Laws and regulations discussed in the ALU text series are those of the United States of America, unless specifically noted as applying to other countries.

Acknowledgements

The Academy of Life Underwriting thanks all the authors who contributed to the ALU textbook series. We are grateful for their professionalism, dedication, and commitment to the future of quality underwriting. Their efforts are integral to the continuing success of the ALU education and examination program.

Endnotes and Bibliography

Endnotes, references, and bibliographies have been removed from the end of each chapter and can be found on the ALU Website, under the Curriculum section at www.alu-web.com.

THE ACADEMY OF LIFE UNDERWRITING

Dedication

This text is dedicated to Rick Weaver in recognition of his many contributions to the advancement of our profession and to the continuing education of underwriters.

Special Appreciation

The Academy of Life Underwriting wishes to express its gratitude to William Camm, MD, FALU, FLMI, CLU, for his exceptional contributions to the revision of the ALU curriculum. He served not only as a working member of the Curriculum Committee but also as the medical consultant on all four texts. Dr. Camm was indispensable in bringing our idea of a new curriculum to fruition. Without his knowledge, support, and enthusiasm, it would not have happened.

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ALU EXAM 101
ASSIGNED READINGS FROM
ESSENTIALS OF ANATOMY AND PHYSIOLOGY

Required Text

Scanlon, Valerie C. and Sanders, Tina, Essentials of Anatomy and Physiology, Eighth Edition, Philadelphia, PA, F. A. Davis Company, 2014. (The Seventh Edition of the text can also be used.)

Essentials of Anatomy and Physiology, Seventh or Eighth Edition is no longer available from the ALU. It can be purchased from an online bookseller such as [Amazon.com](https://www.amazon.com) or from the publisher.

The ALU 101 student will be responsible for the material in the following chapters. The contents of each chapter, including the material in the boxes, tables, and figures, will be tested.

Chapter 1 Organization and General Plan of the Body

Chapter 4 Tissues and Membranes

Chapter 10 The Endocrine System

Chapter 12 The Heart

Chapter 16 The Digestive System

Chapter 18 The Urinary System

Appendix F Prefixes and Suffixes

TABLE OF CONTENTS
Basic Life Insurance Underwriting - ALU 101
Tenth Edition - 2020

CHAPTER	TITLE
1	DIAGNOSTIC TESTS Terry Feer, RN, FALU, FLMI/M, CLU, MBA, edited by Maryam B. Shapland, MD, DBIM
2	BUILD AND BLOOD PRESSURE Marianne E. Cumming, MSc(Pharm), MSc, MD, DBIM, FALU, FAAIM, ALMI
3	DIABETES Sandra K. Patterson, FALU, CLU, FLMI
4	CANCER Hank George, FALU, CLU, FLMI, edited by Elyssa Marcus Del Valle, MD, DBIM
5	CORONARY ARTERY DISEASE Rosalie Mastropolo, MD
6	BASIC LABORATORY TESTING Robert Stout, PhD, Michael Fulks, MD, and Steven Rigatti, MD
7	MOTOR VEHICLE RISK Michael Clift, FALU, FLMI, ACS, AIAA
8	INTRODUCTION TO FINANCIAL UNDERWRITING Richard Weaver, FALU, FLMI, CLU, edited by James Steffen
9	LIFE INSURANCE PRODUCTS, MARKETING, AND DISTRIBUTION Frank Goetz, FALU, FLMI, and Christopher Witte, edited by Martin Brophy
10	CONTRACT LAW AND LEGAL FACTORS AFFECTING UNDERWRITING Vickie L. Fleming, FALU, FLMI, CLU, ACS, ChFC, FLHC
11	AVIATION Susan L. Bailey Mayer, FALU, FLMI
12	SELECTED AVOCATIONS, PROFESSIONAL SPORTS, AND OCCUPATIONS Richard Weaver, FALU, FLMI, CLU, edited by Michael Clift, FALU, FLMI, ACS, AIAA
13	INTERNATIONAL RISK Glen Preston, FALU, FLMI, and Melissa Gallegos, FALU, FLMI, ACS, ARA
14	INSURANCE REGULATION, BASIC COMPLIANCE, AND MIB Kevin P. Cunningham, FALU, FLMI, CLU ChFC, ACS, and Sue Corey
15	UNDERWRITING ALCOHOL AND SUBSTANCE USE DISORDERS Cathy Percival, RN, BSN, MBA, FALU, FLMI, edited by Maryam B. Shapland, MD

ALU 101 Students: See page iv for assigned readings in Essentials of Anatomy and Physiology.

CHAPTER 1

DIAGNOSTIC TESTS

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Revised 2020

DIAGNOSTIC TESTS

Introduction

An individual's history and physical are the foundation of any diagnosis. When these are combined with routine blood and urine tests, the physician gains insight into an individual's general condition. When these tests are abnormal or insufficient to make a diagnosis, more specialized testing is required. The purpose of this chapter is to familiarize the student with diagnostic tests, other than routine blood and urine, that are often reported in the attending physician's statement or clinical notes. The tests covered are an overview and not intended to be all inclusive or provide in-depth detail.

Diagnostic tests can be invasive or non-invasive. Invasive tests are techniques that involve the puncture or cutting of the skin, or entry into an orifice, for the purpose of introducing an instrument or catheter. Non-invasive techniques are those that do not puncture or cut the skin other than possibly intravenous injection or access. The most common diagnostic imaging tests are plain x-rays, computed tomography (CT), ultrasound (US), magnetic resonance imaging (MRI), and radionuclide studies.

Diagnostic Imaging

X-rays

Regular x-rays, also known as plain x-rays, are a common imaging technique. The beam of radiation emitted is scattered or absorbed in differing amounts by different tissues. Fat, water (found in blood and soft tissue), air, and bone are the four densities that produce shades of black, gray, and white on the x-ray film. The imaging receptor for the plain x-ray is a flat plate (i.e., a fluorescent film held in a flat plate) that is then developed and viewed on a lighted panel. Newer techniques include computed radiography that uses a laser and a computer to read and store the image from the plate. There is also digital radiography in which digital x-ray sensors are used to transmit the image immediately to a computer where it can be viewed on a monitor—no plate required. Digital radiography is faster, emits a lower dose of radiation than earlier methods, and allows the radiologist to manipulate the images stored in the computer.¹

Because regular x-rays produce two-dimensional images, several views can be necessary (e.g., posteroanterior [PA], lateral, and oblique views of the chest). Though multiple views enable the radiologist to view structures from different angles, each image increases the total dose of radiation.²

Fluoroscopy

Fluoroscopy is an imaging tool that allows the physician to view, in real time, moving parts of the body, such as when barium moves through the intestine. Fluoroscopy is used for both diagnosis and treatment. It involves a continuous x-ray beam that makes moving structures or objects visible. A special x-ray scanner produces images of the area of interest that are then projected onto a monitor. It is a valuable visual aid for minimally invasive surgery such as the placement of

catheters, arthroscopy, removal of foreign objects, image-guided therapeutic injections into joints, and percutaneous interventions such as cardiac catheterization and stent placement. It is most often used with contrast agents.³

Contrast Agents

Contrast agents allow the radiologist to obtain a better image of tubular or hollow structures (e.g., the spinal canal, blood vessels, gastrointestinal tract, common bile duct, or bladder) than is seen on plain x-rays. Barium, iodine, and gadolinium-based contrast agents are the most common contrast materials, though others are available. Contrast media can be used with plain x-rays, CT, and MRI studies.

Contrast agents that are taken orally or instilled into hollow organs are usually tolerated well, and the risk of allergic reaction is low. Intravenous (IV) contrast, particularly iodine-based agents, can cause hypersensitivity reactions. Most adverse reactions are easily treated with diphenhydramine (Benadryl[®]) and/or prednisone, however anaphylactic reactions may require critical interventions such as epinephrine, airway protection, and ICU admission. IV contrast materials should be used with caution in individuals with known allergies or impaired renal function.⁴ Contrast agents are eliminated in feces and urine.

Nuclear Medicine

Nuclear medicine involves the use of small amounts of a short-lived radioactive substance (radioisotope) that is formulated to be absorbed by targeted tissues. A radionuclide (also known as a radiopharmaceutical) can be attached to a carrier substance that is injected intravenously, taken orally, or inhaled by the individual. The most common radionuclides include radioactive iodine, technetium, thallium, gallium, and indium, though others are available. Radionuclide imaging uses a scanning device or gamma camera (scintigraphy), which records the distribution of the radioactive material in the target organ. The images are displayed as planar images, which are three-dimensional data displayed in two dimensions (like plain x-rays). In some cases, computers are used to quantify measurement or to display the images as thin slices, similar to CT scanning. Nuclear studies are useful in imaging of bone, and for determination of thyroid and hepatobiliary function. A variety of radionuclides are used to assess for coronary artery disease because of their ability to image aspects of cardiac physiology, such as perfusion and ejection fraction.^{5,6}

Ultrasonography

Ultrasonography is a procedure that utilizes high-frequency sound waves to image soft tissue and produce an image known as an ultrasound. A transducer is placed on skin that has been prepared with a transmitting gel, sound waves are transmitted into the individual, and echoes are received back. Depending on the tissues involved, the waves can be scattered, refracted, or attenuated. The size of an organ is calculated by measuring the time it takes for the sound waves to travel from the transducer to the reflecting surface being studied and back to the transducer where they are amplified and displayed on a monitor.

Different tissues reflect sound waves in varying degrees. This is referred to as the “echogenicity” of the tissue.

1. Hyperechoic tissues reflect a large number of sound waves. They are white on the image.
Examples: fascia, connective tissue strands
2. Hypoechoic tissues reflect only a few sound waves. They are gray on the image. Examples: cartilage, muscles, lymph nodes
3. Anechoic refers to the total absence of reflected sound waves. These appear black on the image. Examples: bone, blood vessels, fat.

Fluid can be anechoic or hypoechoic.

Advantages of US over MRI and CT scanning include:

1. its ability to differentiate solid from fluid-filled structures
2. lower cost
3. portability
4. accessibility
5. no exposure to ionizing radiation.

Limitations to ultrasonography include:

1. the skill level of the ultrasonographer
2. image resolution that is not as good as other techniques
3. “noise” produced when US waves hit gas and bone.^{7,8}

There are a variety of different ultrasound techniques used to produce images, such as A-mode, B-mode, M-mode, grayscale, real-time, and Doppler. A-mode, B-mode, M-mode, and grayscale all produce images that provide information on structural size, motion, or both. Real-time US allows scanning at a rate rapid enough to create a moving image of the heart, including the motion of the valves and walls. The ability to analyze wall motion changes is the basis of echocardiographic stress testing.

Doppler ultrasonography is used to measure the velocity and direction of blood flow within the heart and blood vessels by measuring changes in pitch (i.e., sound-wave frequency). It is useful in the evaluation of venous insufficiency, blood clots, arterial occlusion or stenosis, and for identifying valvular disorders and congenital defects. A *duplex scan* combines the B-mode with the Doppler US.⁹

Computed Tomography

Computed tomography (CT) scans, also known as computed axial tomography (CAT) scans, are created by passing a rotating beam of x-rays into the individual and obtaining thousands of point images at specific depths (tomography or sectional radiography). This digitized data produces a cross-sectional, two-dimensional image. The computer can also manipulate the stored data and produce rotating, three-dimensional images. It has been compared to taking a loaf of sliced bread then examining it one slice at a time. The images can be reconstructed from the digitized

information in any plane, similar to the MRI. CT produces images at a much higher resolution than either plain x-rays or ultrasound, but also exposes an individual to a significantly higher dose of ionizing radiation than plain x-rays.

Early CT scans were produced as the x-ray scanner rotated around the individual, producing a single “slice.” It was then stopped, the table was moved in increments, and additional slices were made. Newer scanners, known as *spiral or helical scanners*, are faster, can have multiple rows of detectors, provide thinner slices, minimize motion artifact, and move continuously as the table moves.^{10,11}

Like the x-ray, the CT scan sees fat, air, soft tissue, and bone or calcium as varying shades of black, gray, and white. CT can separate anatomical structures at different depths within the body. Since specific tissues absorb x-rays differently, the absorption of different tissues is quantified as Hounsfield units (i.e., the density of water being zero Hounsfield units).

Oral or instilled contrast medium (particularly barium and iodine-based agents), intravenous contrast, or a radionuclide can be used to enhance CT images. It is particularly useful for intracranial (brain), neck, abdominal, pelvic, and lung images as well as for detection of pulmonary embolism, aortic aneurysm, aortic dissection, or acute hemorrhage. It is used to define the size, precise location, and extent of a tumor's involvement with surrounding tissues. CT can also be used for image-guided biopsies or treatments.

Electron beam CT scans, also known as *ultrafast CT* scans, use an electron beam that allows such rapid acquisition of images that it can produce images of the coronary arteries despite the motion of the heart.¹²

Magnetic Resonance Imaging

Magnetic resonance imaging (MRI) uses a magnetic field to induce changes in proton spin within tissues. Radio waves are emitted at specific frequencies that make atoms resonate and absorb energy. The tissues then release a weak radio wave that can be measured by a scanner and amplified. A computer is utilized to take the cross-sectional slices of the body part being imaged and reconstruct these images in two or three dimensions. MRI produces unparalleled pictures of soft-tissue, organs, bone, and other internal structures without ionizing radiation.^{13,14}

Because of the strong magnetic field associated with MRI machines, it cannot be used for individuals with implanted metal, such as pacemakers, pins and plates, implanted defibrillators, cochlear implants, or artificial joints as they can be displaced by the powerful magnet, causing significant damage. Currently, individuals with implanted metal coronary stents are able to have MRIs six months after the stents are implanted.

MRI is preferred to CT scanning when soft tissue resolution is needed. It is particularly useful in imaging the spinal cord or spinal column, brain abnormalities, internal joint derangements, and trauma. Contrast agents can be used to highlight vasculature, areas of inflammation, and tumors. Gadolinium is a common contrast medium used for MRIs.¹⁵

Positron Emission Tomography

Positron emission tomography (PET) scans are diagnostic images obtained from the decay of a positron emitting radionuclide agent. A doughnut-shaped machine records these energy emissions in real time. Fluorine-18 [¹⁸F]-labeled deoxyglucose (FDG) is the agent used for PET scans. FDG is similar to glucose and is metabolized by active cells that utilize glucose for energy. Abnormal tissues and cancerous cells absorb and utilize FDG differently than normal tissue and will show up on the scan as different colors or degrees of brightness.

PET scans are used to evaluate pulmonary nodules to determine if they are metabolically active, and to evaluate lung cancer, colorectal cancer, esophageal cancer, head and neck cancer, lymphoma, and melanoma. Because a PET scan measures abnormal cellular activity, it is a useful adjunct in the diagnosis of Alzheimer's disease, Parkinson's disease, epilepsy, and hibernating myocardium (i.e., potentially viable cardiac tissue that could benefit from vascular intervention). PET scans also differentiate metabolically active tissue from scar tissue and can help physicians detect alterations in biochemical processes that suggest disease before anatomical changes are apparent on other imaging tests. PET scans can be used in conjunction with CT or MRI images to correlate structural abnormalities with functional information. PET scans and MRIs are among the most expensive of the imaging studies.^{16,17}

Limitations to PET scanning include:

1. cost
2. accessibility
3. the nature of the radionuclide agent—FDG has a very short half-life and requires special arrangements for the radionuclide to be produced and received in a timely manner.
4. the fact that elevated serum glucose or insulin levels can adversely affect the results
5. limited sensitivity for defining tumors smaller than 10 mm
6. the high degree of expertise required for proper interpretation.

Angiography

Traditional angiography is an imaging study used to visualize the major blood vessels in the body including those of the heart, carotids, brain, kidneys, lungs, and legs. When the study is done to image veins, it is a venogram; if arteries are visualized, it is an arteriogram. Angiography utilizes a contrast material to enhance the images. Access is usually gained by inserting a needle into an artery or vein, most often in the femoral area of the leg (though the arm or neck can be used). Then, a catheter is inserted through the needle and threaded to the targeted vessel where the contrast material is injected. The contrast material creates an image of the inside of the vessel or lumen, which allows identification of obstruction (stenosis), aneurysms, arteriovenous malformations, pulmonary emboli, and deep vein thrombosis. Traditional angiography is the gold standard for vessel imaging and is the study of choice when intervention is necessary.

Advances in computed tomography angiography (CTA) and magnetic resonance angiography (MRA) allow these techniques to be used for blood vessel imaging. Compared to traditional angiography, CTA and MRA are less invasive, have less risk, and produce reasonably accurate

images of arteries and veins. For these studies, the contrast material is inserted intravenously into a peripheral vessel and the computer produces two or three-dimensional images of the blood vessels.¹⁸

Endoscopy

Endoscopy allows the physician to look into the body and inspect cavities or hollow organs. It is an invasive procedure that employs the optical qualities of fiberoptic technology and a powerful lens system that allows light to travel and images to be transmitted through curved structures. The endoscopic instrument is a hollow tube with a light source that illuminates the cavity and an image fiber that brings the image back to a lens where it can be viewed. It also has a port that allows for:

1. instillation of drugs, air, or fluid
2. suction, irrigation, and cauterization
3. equipment needed to perform biopsies.

Endoscopes are designed for specific purposes, such as colonoscopy, gastroscopy, duodenoscopy, laparoscopy, bronchoscopy, cystoscopy, colposcopy, proctoscopy/ sigmoidoscopy, thoracoscopy, or arthroscopy. Endoscopy has moved from being solely a diagnostic modality to having major surgical applications as well.

Endoscopes can be used with cameras for documentation and with digital equipment to enhance the images. They can also be equipped with laser technology to remove tissue and small tumors or to cauterize lesions from easily accessible areas. Some endoscopes can be equipped with ultrasound capabilities to evaluate blood flow or to provide additional information such as the depth and extent of a lesion (e.g., coronary intravascular ultrasound).¹⁹

General anesthesia or conscious sedation is used for most endoscopic procedures, but some procedures require only topical anesthesia or none at all. Most endoscopic procedures can be done on an outpatient basis or in the doctor's office. Recovery time is short. Endoscopy is useful for visualizing polyps, tumors, bleeding sites, inflammation and erosion, biliary cirrhosis, gallbladder stones, abscesses, and degenerative disease, to name just a few.^{20,21}

Specialized Diagnostic Tests

Testing of the Skull, Brain, and Nervous System

All of the imaging modalities have some use for defining cranial and central nervous system pathology. X-rays are particularly useful to define post-traumatic skull or facial fractures and for identification of osseous changes, as seen in multiple myeloma and Paget's disease. When the brain is involved, CT and/or MRI imaging are invaluable. The choice of which test to use depends on the condition of the individual, the presenting symptoms, and the facilities available (see Table 1). Insurance approval can also be a factor in determining which test is done.

Table 1. Diagnostic tests for the brain and nervous system.²²

Diagnosis	Diagnostic test
Acute head trauma	CT without contrast
Transient ischemic attack (TIA)	CT/CTA, MRI/MRA carotid ultrasound
Acute hemorrhage, acute hemorrhagic stroke	CT/CTA, MRI/MRA
Brain abscess	CT or MRI with contrast
Sinus disease	CT, MRI
Hydrocephalus	CT, MRI, Cisternography
Aneurysm, arteriovenous malformation	MR angiogram, CT angiogram
Acute non-hemorrhagic stroke	CT/CTA, MRI/MRA
Tumor or metastasis	CT/MRI
Multiple sclerosis	MRI
Alzheimer's	MRI, PET/CT scan

Ultrasound is used to estimate carotid intima-media thickening that is considered a risk factor for cardiovascular disease. *Carotid duplex ultrasound* measures focal blood flow velocities in the carotid artery and provides an estimate of carotid stenosis and residual lumen diameter.²³

Magnetic resonance angiography (MRA) and *computed tomography angiography (CTA)* are non-invasive studies that specifically target blood flow and blood vessel abnormalities. These angiography techniques use intravenous contrast material to provide highly detailed images of blood vessels and identify areas of stenosis or aneurysm. MRA and CTA are employed to view vessels of the face, neck, and head. *Cerebral angiography* is an invasive study in which a catheter is inserted into the femoral artery and threaded through the aorta to inject a contrast agent into targeted arteries of the head and neck. Though considered the gold standard, it has a higher risk than the non-invasive imaging studies and, therefore, is not used as a screening test.

A *PET scan* is a valuable tool to:

1. identify the extent and spread of certain brain cancers, evaluate the efficacy of chemotherapy, and identify recurrent lesions
2. diagnose early Alzheimer's disease and differentiate this disease from other dementias
3. localize epileptic foci.²⁴

Single photon emission computed tomography (SPECT) is similar to the PET scan and is used for functional brain imaging. SPECT uses a gamma camera, computer, and IV radionuclide (usually a technetium-labeled radiopharmaceutical) to look at blood flow and provide three-dimensional images. It is useful in the diagnosis of dementias and neurodegenerative disorders but has proven to be less sensitive than PET scans for the brain.²⁵

Lumbar puncture or "spinal tap" is the insertion of a needle into the subarachnoid space between the fourth and fifth lumbar vertebrae to withdraw cerebrospinal fluid (CSF) for testing, usually to check for bacteria, protein, immunoglobulins, and red or white blood cells. It is useful for diagnosis of subarachnoid hemorrhage, infection/inflammation, multiple sclerosis, and

Guillain-Barré syndrome. Lumbar puncture can also be used to administer: dye to detect disc protrusion (*myelography*) or tumors that obstruct the spinal canal, chemotherapy, or anesthesia.²⁶

Cisternography is the radiographic imaging of the subarachnoid spaces that contain spinal fluid (cisterns). It is used to diagnose cerebral spinal fluid problems such as normal pressure hydrocephalus, spinal fluid fistulas, or leaks. It requires the injection of a contrast or radionuclide material into the subarachnoid space after a lumbar puncture is performed. It is often combined with CT or MRI scans.

A *tilt table test* is used to evaluate syncope (fainting), particularly when cardiac testing and seizure evaluation have not provided a diagnosis. For this test, the individual fasts, then an IV line is inserted. The individual then lies flat and is strapped to a footed table. After 15 minutes, the table is tilted to a 60-80 degree angle for up to 45 minutes. This causes venous blood to pool in the legs and can trigger neurocardiogenic (vasovagal) syncope. If syncope does not develop, the test is repeated and isoproterenol is administered through the IV line to induce symptoms. Symptoms associated with vasovagal syncope include a decrease in blood pressure and a decrease in heart rate. If only blood pressure decreases, it is dysautonomic syncope (an autonomic nervous system disorder).²⁷

Electroencephalography measures and records the low voltage electrical activity produced by the brain. Electrodes are placed at defined points on the scalp and 16-20 electrode pairs are evaluated. *Electroencephalograms (EEGs)* record standard patterns of alpha, beta, delta, and theta waves that are influenced by the individual's state of alertness and level of consciousness. Abnormalities in the standard patterns can be localized, generalized, or paroxysmal and usually represent pathology. Seizures are characterized by abnormal electrical discharges in the brain, and an EEG is part of the standard work up of suspected epilepsy. However, the EEG is frequently normal between attacks in many people with established epilepsy.

Electromyography (EMG) is an invasive procedure that involves the insertion of a needle electrode into a muscle and the recording of electrical activity of muscle fibers individually and collectively. Readings are made at the time of insertion, at rest, and with voluntary muscle contraction. It is used to diagnose neuropathy, myopathy, and certain neurodegenerative diseases such as amyotrophic lateral sclerosis (ALS) and myasthenia gravis.

Evoked potentials are the measured electrical response of the brain to stimulation of specific sensory pathways. Wires are placed on the scalp overlying areas to be stimulated and electrical impulses are recorded on a graph. Visual, auditory, sensory, and motor evoked potentials can be performed.

1. *Visual evoked potentials (VEPs)* are used in the diagnosis of multiple sclerosis. They detect slowing of electrical conduction due to demyelination.
2. *Brainstem auditory evoked response (BAER)* is an electrical response to a click or noise made in each ear. BAERs help in the diagnosis of deafness, particularly in infants, and the response is delayed in multiple sclerosis.

3. *Somatosensory evoked potentials (SSEPs)* detect sequential activation of nerves along a pathway. Though MRIs have replaced SSEPs for the diagnosis of peripheral neural disorders, they are still used to monitor nerve function during surgery.²⁸

Testing of the Skin and Nails

Skin biopsy is used for skin lesions that are considered suspicious for malignancy and to confirm a clinical diagnosis. Shave and punch biopsies remove small pieces of tissue, whereas excisional biopsies are used for both larger and pigmented lesions. Pathology reports usually provide the diagnosis, the size and depth of the lesion, any involvement of the margins, and recommendations for further intervention.

Nailfold microscopy is the use of an optical microscope to visualize, and a computer to quantify, changes in size, shape, and number of capillaries in the digits. *Laser and color Doppler ultrasound* is also used to assess digital vascular changes and microvascular changes associated with various connective tissue diseases.

Testing of Eyes

Fluorescein angiography involves the intravenous injection of fluorescein dye into an arm vein to image the retina and choroid vasculature of the eye. A special camera is used to take pictures before and after the injection of the dye. It is used to detect diabetic retinopathy, vascular occlusions, leaks, and macular degeneration.

The *Snellen test* is a common test for visual acuity. It involves the reading of block letters of graduated sizes at a specified distance (the eye chart).

Tonometry measures intraocular pressure. Non-contact tonometry uses an air puff to gently flatten the cornea and is often used to screen for glaucoma. Touching the cornea with a small probe that measures the force needed to flatten the cornea is a more accurate method of determining intraocular pressure.

The *Schirmer tear test* is used to determine if the eye is producing sufficient tears to keep it moist. A strip of filter paper is placed under the lower lid and the amount of tears absorbed over a five-minute period is measured. It is most useful for determining severe dry eye conditions as seen in Sjogren's syndrome.

Tests for Hormonal/Glandular Disorders

Thyroid uptake and scans are used to evaluate thyroid function and investigate palpable lumps, hyperactivity, and/or enlargement of the thyroid gland. A radioactive iodine uptake (RAI) utilizes a small dose of an iodine-based radionuclide agent to determine the function of the thyroid. Hypoactive thyroid cells take up less radioactive iodine whereas hyperactive cells utilize more iodine. RAI is usually done in conjunction with a thyroid scan that provides information on the size and shape of the gland. Technetium can be used for scanning (not uptake), when thyroid

function is suppressed or iodine cannot be used. The image is created by a gamma camera or a computerized scanner. Nodules that are noted on thyroid scan are classified as:

1. cold (i.e., less uptake than normal thyroid tissue)
2. functional (i.e., uptake similar to normal tissue)
3. hot (i.e., greater uptake than normal tissue).

Cold nodules have an increased probability of malignancy and are usually referred for further testing. Functional and hot nodules are less likely to be cancerous and can usually be observed over time. A thyroid ultrasound is often done if a suspicious nodule is seen on thyroid scan to determine if the nodule is solid or cystic, to provide a more accurate measurement of the size of the nodule, or to guide the biopsy or fine needle aspirate (FNA). Whole body iodine¹³¹ scans are used after surgical removal of the thyroid and ablation of any thyroid remnants to look for extra-glandular metastases, to evaluate the effectiveness of treatment, or to look for recurrence.^{29,30,31}

A *fine needle aspirate (FNA)* is done by inserting a needle into the thyroid nodule and obtaining cells and/or fluid for pathological diagnosis. It is used to differentiate whether a cold nodule seen on a scan is benign or malignant. FNA cannot be used to diagnose follicular or Hürthle cell carcinomas. When the pathology is equivocal, indeterminate, or negative but a high degree of suspicion remains, further intervention is required.³²

Parotid sialography is used in the diagnosis and management of parotid lesions. It involves injection of a contrast material into the parotid duct. PA and lateral x-rays are then performed. Parotid sialography can differentiate intrinsic from extrinsic masses, inflammatory lesions from neoplasms, and allow visualization of stones or ductal abnormalities. Though MRI and CT scans have diminished the need for sialography, it is still used for the diagnosis of xerostomia (dry mouth) in Sjogren's syndrome.

Pheochromocytoma (often found in the adrenal gland) and neuroblastoma are usually diagnosed with CT or MRI, but when these fail to provide a diagnosis, a *MIBG scan* can be useful. It involves the intravenous injection of the radionuclide MIBG (iodine-131-meta-iodobenzylguanidine), a chemical similar to norepinephrine that attaches to tumor cells. A specialized scanner is used to measure the radioactivity. Besides MIBG, PET scans are useful in localizing pheochromocytomas that can develop outside the adrenals.³³

Testing of the Neck, Chest, and Lungs

All of the major diagnostic techniques have value in the diagnosis of chest pathology. Plain x-rays are valuable screening tests because of their low cost and availability. They are useful for visualizing lung aeration, heart contours, mediastinal structures, calcifications, and the diaphragm.

Table 2. Diagnostic tests for disorders of the neck, chest, and lungs.³⁴

Diagnosis	Diagnostic Procedure
Placement of tubes and in-dwelling lines	Ultrasound, X-ray
Pneumonia, atelectasis	X-ray

Shortness of breath, asthma, chronic obstructive pulmonary disease (COPD), interstitial lung disease, chronic cough	X-ray, Pulmonary Function Tests (PFTs), CT
Bronchiectasis	X-ray, PFTs, Bronchoscopy, CT
Pneumothorax	X-ray, CT
Blebs and bullae	X-ray, CT
Foreign body, aspiration	X-ray, CT, Bronchoscopy
Trauma	X-ray, CT
Asbestosis	X-ray, CT
Hemoptysis	X-ray, CT, Bronchoscopy
Mediastinal mass	CT with contrast
Pulmonary nodules	CT, X-ray
Lung tumor	X-ray, CT, Bronchoscopy
Localization of pleural effusion before thoracentesis	X-ray, Ultrasound
Interstitial lung disease	CT, PFTs
Pulmonary embolus	CTA, V/Q scan

Computed tomography provides images of bronchi, pulmonary parenchyma, and mediastinal structures. It is often enhanced by using thinner slices (i.e., high resolution CT) and contrast agents. Advances in helical (spiral) and multi-slice detector CT technology allows for imaging of the entire chest in one breath. Suspicious pulmonary nodules seen on chest x-ray are evaluated further or followed by CT scans. CT with contrast allows better visualization of lesions, lymph nodes, and vasculature. PET scans can be useful for differentiating benign from malignant tumors. A lung lesion must be at least 8-10 millimeters for PET scans to provide useful information.

Mediastinal and hilar lymph nodes, with or without parenchymal nodules, can be incidental findings on routine chest x-rays. Though some radiologic findings are adequate to differentiate sarcoidosis from neoplasm, most require routine follow-up CT or biopsy to establish the diagnosis.

When pulmonary lesions are large, growing, or obstructing (causing pressure on bronchi or trachea), biopsy is usually necessary. Diagnosis is often made by a biopsy performed via bronchoscopy or mediastinoscopy. For peripheral tumors not readily accessible by bronchoscopy, CT- or fluoroscopy-guided percutaneous needle aspiration or an open surgical resection is performed.³⁵ Endoscopy allows direct visualization of structures in the bronchi, larynx, or mediastinum. The instrument can be flexible or rigid.

1. *Laryngoscopy* can be done indirectly, with the use of a hand-held mirror while reflecting light into the upper throat, or directly, using a flexible laryngoscope, a specialized instrument inserted through the nose or mouth to visualize the pharynx, larynx, and vocal cords.
2. *Mediastinoscopy* uses the fiberoptic endoscope to examine the structures in the chest between and in front of the lungs. It requires a small incision for insertion of the mediastinoscope and is used when CT-guided biopsy cannot be done.

3. *Bronchoscopy* permits visualization of the trachea and vocal cords, as well as the main bronchial tubes and smaller branches but does not give a direct view of the lung parenchyma. It allows biopsy of tissue by bronchial washing, brushing, or direct tissue removal. Bronchoscopy is done for diagnosis when hemoptysis, chronic cough, infection/inflammation are presenting symptoms, or when an abnormality is seen on imaging. *Transbronchial needle biopsy* can be done during bronchoscopy for accessible lung lesions. Besides visualization and biopsy, these endoscopic procedures allow the physician to remove foreign objects or provide laser and other treatments. *Endobronchial US* is a bronchoscope with a special US probe at its tip, used to image chest structures and aid in cancer staging.³⁶

Thoracentesis is performed when fluid accumulates between the visceral (lung) and parietal (chest wall) pleura. Thoracentesis is an invasive procedure in which a needle, attached to a syringe, is inserted into the pleural space to remove fluid. Thoracentesis can be done to establish a diagnosis or to treat symptoms. Fluid removed is sent for analysis and culture. Small effusions usually do not require treatment, but larger ones often cause shortness of breath and inhibit ventilation. For persistent effusions, a chest tube can be inserted or more aggressive therapy instituted.³⁷

Pulmonary angiography utilizes fluoroscopy and intravenous contrast injected into a catheter inserted into the femoral vein and guided to the pulmonary artery to visualize or to exclude pulmonary embolus, to identify vascular anomalies, or to delineate vessels before surgery. Today, *CT digital subtraction angiography*, which removes bone and tissue artifact, is the imaging technique of choice for pulmonary angiography.³⁸

The *ventilation perfusion scan* is performed to study air-flow (ventilation) and blood flow (perfusion) in the lungs. After inhalation of a radionuclide gas or aerosol, initial scintigraphic (a camera that senses radioactivity/gamma camera) studies are done, then a radiopharmaceutical agent is injected intravenously and pulmonary vasculature is imaged. The *ventilation/perfusion ratio (V/Q)* is a mathematical calculation using these measurements. The V/Q ratio and scan are most commonly used for the diagnosis of pulmonary emboli. It is often done in conjunction with a chest x-ray or CT scan of the lungs.³⁹

Oxygen saturation measures the percentage of red blood cells “saturated” with oxygen. Oxygen saturation is measured with a pulse oximeter that is attached to the index finger and measures oxygen based on how red blood cells absorb and reflect light. The partial pressure of oxygen (pO_2) and oxygen saturation can be measured directly by looking at the oxygen present in an arterial blood sample; pO_2 is normally greater than 80 torr. Healthy individuals have an oxygen saturation level above 95% by either method.⁴⁰

Pulmonary function tests (PFTs) record the movement of air into and out of the lungs and plot it against time. For the most part it is accurate, reproducible, and provides information about numerous obstructive (e.g., asthma), restrictive (e.g., sarcoidosis), or mixed respiratory diseases. Though multiple measurements are made, those most commonly seen in underwriting are the:

1. *forced vital capacity (FVC)* that measures the maximum volume of air exhaled after deep inspiration

2. *forced expiratory volume at 1 second (FEV₁)*, which is the measurement made at 1 second after exhaling as hard and as fast as possible
3. *FEV₁/FVC ratio*
4. *diffusing capacity (DLCO)*, a measure of the ability of inhaled carbon monoxide to move out of the lungs and into the blood—It gives important information about the gas exchanging capacity of the lungs.

FVC and FEV₁ are compared to predicted values based on age and height and presented as a percentage. Values above 80% of predicted are considered normal. FEV₁/FVC ratio is used to identify obstructive (low FEV₁/FVC ratio) from restrictive (normal or high FEV₁/FVC ratio) diseases.⁴¹ Restrictive lung diseases typically exhibit low lung volumes. The value of PFTs is limited if the individual does not provide a good effort or cannot understand the instructions.

Polysomnography (sleep study) is used to confirm a diagnosis of obstructive sleep apnea-hypopnea syndrome. It is performed in a sleep lab at night. Data is recorded on a polygraph or computer system. The following are recorded during a sleep study:

1. EEG to observe sleep stages
2. electro-oculogram (EOG) to record eye movement
3. respiratory effort
4. airflow
5. oxygen saturation
6. electrocardiogram
7. body position
8. submental and anterior tibialis movements
9. noises, including snoring.

A technician confirms recorded events. The data collected is analyzed and integrated and provides information on:

1. total sleep time and sleep efficiency
2. the percentage of time in each stage of sleep
3. time it takes to get to sleep (sleep latency)
4. arousals from sleep
5. the number of obstructive apneas (cessation of airflow despite inspiratory effort), hypopneas (partial cessation of airflow despite inspiratory effort), and central apneas (lack of inspiratory effort).

The apnea index (AI) is the number of apneas divided by the total sleep time in hours. The apnea-hypopnea index (AHI) is the number of apneas plus hypopneas divided by the total sleep time.⁴²

The *purified protein derivative (PPD)* test is done to diagnose tuberculosis (TB). It involves the injection of a small amount of bacterial antigen under the skin of the forearm. In 48-72 hours, any area of induration and erythema is measured by the care provider. Positive tests signify exposure to TB and are followed by a chest x-ray that looks for active disease or granulomas

(characteristic nodules) that can indicate prior disease. An interferon-gamma assay (a blood test) can also be performed for diagnosis of TB.

Sputum for analysis is often collected after a deep cough or suctioned from the bronchial tubes and placed in a sterile container. It is observed for the presence of blood and color and is then sent for culture. It is an adjunct to clinical findings and provides information about sensitivity of antibiotic treatments. When malignancy is suspected, sputum can be sent for cytology.

Breast Imaging

Mammography is a routine screening test for breast cancer, recommended for females over age 40 and sometimes at younger ages for those with a family history of breast cancer. It is an adjunct to routine breast examination and is done in the hope that breast cancer can be diagnosed at an early, treatable stage. It is also the first diagnostic test done when a palpable mass is detected. It is a non-invasive study. It involves compression of the breast between two plates that evens out the tissue, limits motion, and positions the breast as low dose x-rays are taken from different angles. Digital mammography with computer-aided detection (CAD) have generally replaced traditional film x-rays. Mammograms can identify calcifications, cystic structures, solid masses, and areas of thickening. Limitations to mammography include: dense breast tissue, implants, and the skill of the radiologist. Mammography misses 10-20% of clinically palpable breast cancers and does not detect inflammatory breast cancer, so if there is a clinically suspicious mass, further testing or biopsy is necessary.⁴³

Breast MRIs with gadolinium have recently been advocated for females at high risk of breast cancer or who have dense breasts or implants. Though it does not identify calcifications, MRI with contrast does show the characteristic increase in vascularity associated with breast tumors. It is also useful in evaluating the extent of a known breast cancer (staging) and monitoring for recurrence.⁴⁴

Breast ultrasonography is done for females with dense breast tissue. If a mass is detected on mammography, ultrasound can often differentiate simple from complex cysts, and cystic structures from solid nodules. Simple cysts are usually benign, though aspiration of fluid can relieve discomfort. Complex cysts and solid nodules are usually biopsied. Biopsy techniques include:

1. *Fine needle aspirate* that involves stabilizing the lesion and inserting a needle with a syringe or vacuum to withdraw fluid or cells. Fluid, particularly if bloody, is sent for pathology. If the lesion is solid, cells can be aspirated for pathology. *Core biopsies* are done with a larger bore needle and are vacuum-assisted to ensure an adequate sample.
2. *Stereotactic biopsy* is performed with special computerized mammography that uses intersecting coordinates to pinpoint the suspicious area.
3. *Open surgical biopsy/excisional biopsy* of breast lesions requires a small incision after local or general anesthesia is given. The surgeon removes the entire lesion and a portion of surrounding tissue (the margins). Prior to surgery, mammography is performed to insert a needle or wire to localize the suspicious area.

Tests for Heart, Blood Vessels, and Circulation

Electrocardiograms (EKGs), stress tests, myocardial perfusion scans, electron beam CT (EBCT) scans, intravascular ultrasound (IVUS), cardiac catheterization/ventriculography, echocardiogram, and ankle-brachial index (ABI) are covered in coronary artery disease study material. Other tests done for arrhythmias, structural abnormalities, and peripheral vascular disease will be discussed below.

Table 3. Diagnostic cardiovascular tests.⁴⁵

Diagnosis	Diagnostic test
Most cardiac problems	Chest x-ray, EKG, Stress test, Echocardiography
Left ventricular ejection fraction	Echocardiography, Myocardial Perfusion Imaging (MPI)
Congestive heart failure	Chest x-ray, Echocardiography
Thoracic aneurysm	CTA, Echocardiography
Aortic aneurysm	CTA, Ultrasound
Coronary artery ischemia	EKG, Stress test with or without imaging, Cardiac catheterization, MRA, CTA
Arrhythmias	EKG, Holter/Event monitor, Stress test, EP testing
Congenital heart disease	Chest x-ray, Echocardiography, Cardiac catheterization
Endocarditis/pericarditis	Echocardiography
Valvular disease	Echocardiography
Peripheral vascular disease/claudication	Doppler ultrasonography, Ankle-brachial index
Carotid bruit	Doppler ultrasonography, CTA
Deep vein thrombosis	Doppler venous ultrasonography

CT and *MRA* are techniques that use contrast material to image the coronary arteries and the aorta. They provide detailed information on the heart and vessels including coronary artery stenosis, atherosclerotic burden (via CAC/calcium score and CCTA/coronary CT angiography), chamber volumes, ejection fraction, and aortic dimensions. Though traditional catheterization is the gold standard for diagnosis of coronary artery disease high resolution MRA or CTA provides accurate two- and three-dimensional pictures of arteries and veins, and often catheterization is reserved for times when intervention (e.g., balloon angioplasty or stenting) is necessary. Magnetic resonance and radionuclide studies (e.g., SPECT) can be gated to the cardiac cycle to measure ejection fraction.

Stress testing. Stress tests are performed to test for coronary heart disease (ischemia, infarction). Different modalities include exercise EKG testing (i.e. Bruce or modified Bruce protocol) and pharmacologic (done when patient is unable to exercise), which uses drugs such as adenosine, regadenoson, and dobutamine to stress the heart. The EKG portion can be combined with imaging, which includes echocardiogram, radionuclide myocardial perfusion imaging (MPI) using single photon emission computed tomography (SPECT) or positron emission tomography (PET), and MRI. The most commonly used SPECT MPI agents are thallium and sestamibi.

Echocardiograms are usually transthoracic (TTE), meaning the transducer sends the sound waves across the chest wall. Transthoracic echocardiography combined with Doppler studies allow

painless assessment of chamber sizes, sizes of great vessels, valve structures, valve function, and pressures within the heart and have fundamentally changed the ability to assess the heart over the last 30 years.

In ~~rare~~ instances where TTE is not adequate, the transducer can be positioned (with conscious sedation and/or local anesthesia) in the esophagus to allow better visualization of cardiac structures. This is called a *transesophageal echo* or TEE. It allows imaging of the heart in all planes without the interference of the chest wall. It can be used with agitated saline (a bubble study) injected into an arm vein, which when combined with increased intrathoracic pressure (obtained by coughing or forcibly exhaling), allows for visualization of bubbles moving from one side of the heart to the other, a right to left shunt. Echocardiography with bubble study is used to diagnose a patent foramen ovale or atrial septal defect.

Electrophysiological (EP) mapping of the heart is a study that is done to assess significant arrhythmias. The cardiologist threads a catheter from the femoral vein into the right heart and stimulates various parts of the heart to induce cardiac arrhythmias under controlled circumstances. If the source of the arrhythmia is identified, radiofrequency energy is sometimes used to ablate the abnormal conduction pathway or arrhythmogenic focus. EP studies are done for supraventricular and ventricular arrhythmias such as atrial fibrillation or ventricular tachycardia.⁴⁶

A *Holter monitor* is an ambulatory electrocardiogram (EKG). Leads are applied to the chest and continual or periodic EKGs are recorded for 24 hours or longer. An event monitor is used when the patient can detect the onset of symptoms, and self-triggers the recording. A diary is usually kept by the individual to record the time of his activities or symptoms that he has. Entries in the diary are correlated with the EKG at that time. The Holter is done to diagnose arrhythmias that cause palpitations, dizziness, syncope, or chest pain associated with ischemia. Cardiac monitors can also be inserted subcutaneously.

Endomyocardial biopsy is a rare procedure done by catheterization of the right or left heart. It is done by an instrument added to the catheter that excises small samples of tissue which are sent for pathology. It is performed when cardiac sarcoidosis or hemochromatosis is suspected, to identify the cause of myocardial dysfunction, or to monitor for transplant rejection.⁴⁷

Testing of the Digestive System, Liver, Pancreas, Gallbladder, Bile Ducts, and Abdomen

The flat plate of the abdomen, or KUB, is the most common x-ray of the abdomen. Though KUB stands for kidney, ureter, bladder, it does a poor job of imaging these structures. What it does see are organ shapes and sizes, gas patterns, and calcifications and is often the first in a series of tests done for abdominal pain. The *barium swallow*, better known as the *upper GI*, involves the ingestion of contrast material that coats the esophagus, stomach, and small intestine for better x-ray or fluoroscopic visualization of these organs. The *barium enema* provides similar imaging of the colon. The *small bowel follow-through* takes x-rays for a period of time as the barium passes through the small intestine into the right colon. Barium studies are done to show areas of stricture, ulceration, obstruction, and inflammation.

Ultrasound is used extensively to image the liver, kidneys, gallbladder, common bile duct, pancreas, and to identify ascites. Abdominal ultrasound can be limited by gas and overlying loops of bowel.

CT is the most common technique for diagnosis of non-intestinal pathology and is often used to follow-up on abnormalities seen on ultrasound. CT can image the entire abdomen (solid organs, peritoneum, and retroperitoneum) and pelvis in a few minutes, and, with the addition of IV contrast, blood vessels can also be seen. “Virtual” colonoscopy is a CT technique that produces 3-dimensional images of the colon.⁴⁸

Radionuclide scans are used for functional analysis of abdominal organs and staging of tumors.

1. *Gastric emptying* is the time it takes for an ingested meal, containing a small amount of a radioactive isotope, to pass out of the stomach. It is done for gastric outlet obstruction and gastroparesis.⁴⁹ If further testing is necessary for gastroparesis, manometry is done to measure the strength and coordination of muscular activity of the esophagus and stomach during swallowing and digestion.
2. *Reflux testing* is done with a detector on the chest to monitor an ingested radioactive isotope for one hour while pressure is applied to the abdomen. If this does not produce reflux, *pH monitoring* is done by a probe placed at the gastroesophageal junction to measure gastric acidity.
3. *Cholescintigraphy*, a radionuclide scan of the gallbladder, is better known as a *HIDA scan*. The radionuclide is injected intravenously and disperses where bile travels. Depending on where the radioactive material collects, or does not collect, it defines various pathologies including liver disease, gallbladder disease, bile duct obstruction, or cystic duct obstruction.⁵⁰

Direct visualization of the abdomen and its organs is often necessary. Endoscopic exams play a large role in the diagnosis and treatment of abdominal pathology:

1. *Laparoscopy* is usually performed under general anesthesia. A small incision is made near the navel and carbon dioxide is pumped in to move the abdominal wall and separate surrounding structures. The laparoscope is then inserted, and the structures of the abdomen and pelvis can be visualized as needed. Today, many surgical procedures, lysis of adhesions, and biopsy are all done via laparoscopy.
2. *Gastroscopy* and *esophagogastroduodenoscopy* (EGD) permit visualization of the esophagus, stomach, and duodenum to look for inflammation, erosions, tumors, polyps or ulcerations. They also allow biopsy and cauterization of lesions.
3. *Colonoscopy* is the insertion of a flexible endoscope into the colon from the anus to the terminal ileum. It is usually done with conscious sedation. It allows for biopsy and the removal of polyps and small tumors, and photographs are often taken. The sigmoidoscope and anoscope (a rigid instrument) are limited by how far they can be inserted; no sedation is necessary for sigmoidoscopy and anoscopy.
4. *Video capsule endoscopy* is a wireless imaging device that is swallowed. Sensors are placed at various points on the abdominal wall that receive jpeg images that are stored in a recorder for later viewing. Two images per second are taken as the capsule moves through the stomach, small bowel, and colon. It is particularly useful in the diagnosis of Crohn’s disease, obscure bleeding, or tumors in the small bowel. It does not permit tissue sampling.⁵¹

5. *Endoscopic retrograde cholangiopancreatography (ERCP)* is a long endoscope that enters from the mouth into the stomach and duodenum. Under fluoroscopic guidance, a tube is passed through the endoscope that allows for injection of dye into the biliary ducts and pancreas. It is done for bile duct abnormalities (particularly primary biliary cirrhosis), biliary duct dilation, obstruction, malignancies, and stones. *Endoscopic ultrasound (EUS)* and *magnetic resonance cholangiopancreatography (MRCP)* are beginning to replace ERCP for imaging of the bile duct and pancreas.⁵²

Hepatic angiography and CT hepatic angiography are done after direct injection of contrast material into the hepatic artery via a catheter inserted into the femoral area. It is done to image the liver and bile ducts for tumors, tumor-feeding arteries, or structural anomalies. Besides the liver, angiography can be directed to most organs in the abdomen including the renal and mesenteric arteries and portal vein. MRA is also available.

Liver biopsy is done to obtain a sampling of liver tissue for pathology. It is most commonly performed, after using local anesthesia, by inserting a needle attached to a syringe directly into the liver. It can also be done during laparoscopy or after a needle is inserted through a catheter in a neck vein.

Percutaneous transhepatic cholangiography is another method of imaging bile ducts. It is performed by the radiologist by inserting a needle through the skin and liver into the hepatic duct and injecting dye. The biliary tree is then visualized by x-ray. It is done under local anesthesia.⁵³ It has largely been replaced by MRA and CTA.

The *peroral pneumocolon* is an x-ray of the terminal ileum and right colon done by insufflating air through a small catheter inserted into the rectum just as orally ingested barium reaches the right colon. The examination is indicated if a detailed view of the ileocecal region is required.⁵⁴

Fecal occult blood (FOB) or guaiac test is a screening test done to detect blood in stool. Three fecal samples are usually obtained and sent for analysis. It does not identify the source of the blood, but if blood is detected, it usually warrants further investigation.

Blood Imaging

The *indium scan* utilizes white blood cells isolated from the individual's own blood that are collected and tagged with radioactive indium, then re-injected intravenously. The tagged white cells are tracked by special cameras as they migrate to areas of infection, inflammation, or abscess.

Bone marrow produces red blood cells, white blood cells, and thrombocytes. When pathology is suspected that relates to over- or underproduction of one or more cell line, a *bone marrow biopsy* and *aspiration* are done. After local anesthesia, a large bore needle is inserted and marrow is aspirated; the needle is then repositioned for biopsy. Both are sent to the laboratory for analysis. It is done for hematological disorders usually found on routine blood testing, amyloidosis, and certain malignancies.

Lymph nodes produce white blood cells known as lymphocytes. At times of infection lymph nodes often become enlarged. Persistently enlarged or suspicious lymph nodes are usually biopsied. It is done via a small incision after local anesthesia, followed by removal of the lymph node for pathology.

Urinary Tract Tests

Table 4. Diagnostic tests for genitourinary disorders.⁵⁵

Diagnosis	Diagnostic test
Calculus	KUB, CT
Hematuria	Intravenous pyelogram (IVP), Cystoscopy, CT
Renal trauma	CT with contrast
Hydronephrosis/obstruction	Ultrasound, CT, IVP
Renal vein thrombosis	CTA, MRI
Probable cyst as incidental finding on IVP or CT	Ultrasound
Probable mass found on IVP	CT, MRI
Polycystic kidney disease	CT, US
Bladder tumor	Cystoscopy, CT with contrast
Renal artery stenosis	Captopril renal scan, CTA, MRA

Plain x-rays provide the general size and shape of the kidneys and identify gross calcifications.

The *intravenous pyelogram (IVP)* uses a contrast agent to provide detailed images of the collecting system, calyces, and renal pelvis of the kidneys, and also images the ureters.⁵⁶

A radionuclide *renal scan* is done to evaluate blood flow to the kidneys, to image the kidneys, and to observe renal function. It uses a gamma camera to produce images. If renovascular hypertension or renal artery stenosis is being evaluated, captopril is injected. A renal scan is often the first test done to diagnose atherosclerotic renal artery stenosis, but CTA and MRA are also used.⁵⁷

Ultrasound and CT images of the kidneys are done to image renal parenchyma, particularly when contrast agents cannot be used.

Cystoscopy is the insertion of a flexible cystoscope into the bladder in order to look for causes of bladder dysfunction or for inflammatory or malignant causes of hematuria. *Retrograde pyelogram* involves the injection of dye into the ureters. It is often used with cystoscopy to inject dye into the ureters to image obstructing ureteral stones or lesions.

A percutaneous *renal biopsy* is recommended for diagnosis of kidney disease and evaluation of reversible versus irreversible renal changes.

Musculoskeletal Tests

History and physical plays a particularly useful role in skeletal disorders and many times imaging is done for confirmation of suspected diseases. Plain x-ray, CT, and MRI all have their place in identification of skeletal abnormalities. Table 5 reviews the most common uses for these tests. For prolonged pain and progressive dysfunction, MRI is the most useful for imaging bone and soft tissue abnormalities. It has essentially replaced CT scanning, except for guided biopsies.⁵⁸

Table 5. Diagnostic tests for musculoskeletal disorders.⁵⁹

Diagnosis	Preferred diagnostic test
Fracture, subluxation of the spine	X-ray, CT
Occult fracture	CT
Stress fracture, occult hip fracture	CT, Bone scan
Bone/mineral loss	DEXA scan
Metastases	X-ray, CT, Bone scan, PET
Osteomyelitis	X-ray, CT, Bone scan, MRI
Back pain with radiculopathy, herniated disc	Xray, MRI, Myelography, CT
Arthritis	X-ray
Spinal tumor	MRI
Shoulder pain	X-ray, MRI
Neurogenic claudication	MRI, CT
Temporal bone, cholesteatoma	CT
Myelopathy	MRI
Carpal tunnel syndrome	Nerve conduction tests

The *dual energy x-ray absorptiometry (DEXA)* scan is a painless screening test done to evaluate bone mass and monitor therapeutic intervention. It is reported as a T-score; a T-score less than minus 1 (-1.0) is considered abnormal.⁶⁰

Bone scans produce radionuclide images of the bones. A radioactive tracer is injected intravenously and the body is scanned with a gamma camera. Areas of little or no activity appear dark or “cold,” areas that appear bright or “hot” are often areas of increased cellular activity. Cold areas indicate ischemia or bone infarct and certain types of cancer; hot spots are often areas of tumor, fracture, or inflammation. A bone scan is done to detect metastasis, Paget’s disease, stress fractures, and for persistent bone pain. MRI can be done to follow up suspected lesions but is limited as a screening test for metastases.⁶¹

Nerve conduction studies (NCS) or *nerve conduction velocity (NCV)* studies are usually done in conjunction with EMG (described earlier in this chapter). NCS/NCV involves electrode placement along the nerve to be stimulated. A weak electrical stimulus is emitted and the time it takes for the impulse to travel from one electrode to the next electrode is recorded. It detects sensory and motor neuropathy and can differentiate demyelinating neuropathies from axonal neuropathy. NCS/NCV and EMG done simultaneously help to characterize the pathology as neurogenic or myopathic.⁶²

Testing for Reproductive Health

Table 6. Diagnostic tests for disorders of the reproductive organs.⁶³

Diagnosis	Diagnostic test
Pelvic or scrotal pain	Ultrasound
Uterine fibroids	Pelvic ultrasound
Cervical, uterine, ovarian cancer	Ultrasound, CT, MRI
Follow up for abnormal Pap smear	Colposcopy
Abnormal uterine bleeding	Ultrasound
Endometriosis	Ultrasound, Laparoscopy
Prostate	Ultrasound
Testicular/scrotal masses	Doppler ultrasound
Postvoid residual urine	Catheter insertion after voiding, Ultrasound

The *Papanicolo (Pap) test* is by far the most common screening test for cervical cancer. It is done during a gynecological exam after a speculum is inserted into the vagina. Scrapings and/or brushings of the cervix are placed on glass slides, fixed, and sent for pathologic examination. Cells from the endocervical and transformation zone should be present for evaluation. If abnormal cells are present on Pap smear, or if human papilloma virus (HPV) testing is positive, a *colposcopy* can be done to further investigate. A lighted binocular microscope (colposcope), which does not enter the body, allows direct visualization of the cervix, vagina, and surrounding tissues. If abnormal areas are visualized, vaginal, cervical, and/or endocervical biopsies (endocervical curettage) are done.

Dysfunctional uterine bleeding, polyps, fibroids, masses, adhesions, and atrophy are often diagnosed by *pelvic or transvaginal ultrasound* of the uterus. Transvaginal ultrasound utilizes a probe inserted into the vagina. It allows for visualization of the ovaries and permits measurement of endometrial thickness. A Doppler can be used with the transvaginal ultrasound to look at uterine blood flow. *Hysterosonography* is an ultrasound done after saline is infused into the uterus via a catheter. The saline acts to distend the uterus and provide contrast to outline the uterus. Ultrasound is also used extensively during pregnancy to monitor maternal and fetal progress.

The *hysterosalpingogram* utilizes fluoroscopy and x-rays after the infusion of contrast material into the uterus and fallopian tubes. It is used to test for causes of infertility, adhesions, masses, and uterine fibroids.

Hysteroscopy involves the insertion of a small, lighted tube through the vagina and into the uterus to allow visualization of the uterine lining. Endometrial biopsy can be done during this procedure. Endometrial biopsy permits a sampling of the uterine lining by inserting a small device into the uterus and aspirating a small amount of tissue. It is done to look for malignancies, to find the cause of postmenopausal bleeding, or to look for hyperplasia. Biopsy can also be done by dilation and curettage (D & C), electronic suction, or by using a jet spray to wash off uterine cells that are then aspirated.

Transrectal ultrasound (TRUS) is done when the prostate specific antigen (PSA) in the blood is elevated or rising rapidly, or an abnormality is felt on digital rectal exam (DRE). For prostate ultrasound, the probe is inserted into the rectum. Prostate ultrasound allows for measurement of prostate volume, detection of prostate masses, and to guide prostate biopsy. Local anesthesia or a periprostatic block can be used, if necessary.⁶⁴

Uroflowmetry is done to evaluate voiding problems caused by enlargement of the prostate, neurological disease, or muscle dysfunction. The individual urinates into a special toilet equipped with an uroflowmeter. It measures the flow of urine per second that is then graphed. *Cystometry* is a more involved and a significantly more invasive method of determining bladder muscle function.

The final test is *postvoid residual (PVR)*, a measurement for urinary retention. Urinary retention is most often seen in males with prostatic obstruction of the urethra, but females with bladder dysfunction will also have this test as part of a urodynamic evaluation. PVR is the amount of urine left in the bladder immediately after voiding, normally less than 50 cubic centimeters. It is most often measured by inserting a catheter through the urethra, into the bladder, and draining residual urine. It can also be measured by transabdominal ultrasound.⁶⁵

Review Questions – ALU 101, Chapter 1

1. A procedure that uses high frequency sound waves to image soft tissue is:
 1. x-ray
 2. fluoroscopy
 3. ultrasonography (US)
 4. computed tomography (CT)
2. Procedures used to identify coronary artery disease include all of the following EXCEPT:
 1. coronary CT angiography (CCTA)
 2. myocardial perfusion scan
 3. positron emission tomography (PET)
 4. magnetic resonance angiography (MRA)
3. Tests used to assist in identifying lung cancer include which of the following?
 - A. chest x-ray
 - B. computed tomography (CT) scan
 - C. bronchoscopy

Answer Options:

1. B only is correct.
2. A and C only are correct.
3. B and C only are correct.
4. A, B, and C are correct.

4. Describe the tests used to diagnose brain and nervous system disorders.
5. Describe the difference between invasive and non-invasive testing techniques.

6. Which of the following are recorded during a sleep study?

- A. body position
- B. oxygen saturation
- C. electroencephalogram (EEG)

Answer Options:

- 1. A and B only are correct.
- 2. A and C only are correct.
- 3. B and C only are correct.
- 4. A, B, and C are correct.

7. Obstructive sleep apnea is diagnosed by:

- 1. pulmonary angiography
 - 2. pulmonary function tests (PFTs)
 - 3. polysomnography
 - 4. bronchoscopy
8. List the endoscopic exams used to diagnose and treat abdominal pathology.
9. List common medical conditions often diagnosed by pelvic or transvaginal ultrasound.
10. What are the most common measurements of pulmonary function seen in underwriting?

Answers and Sources of Review Questions

Review Question 1

Answer 3: ultrasonography – page 2.

Review Question 2

Answer 3: positron emission tomography (PET) – page 15

Review Question 3

Answer 4: A, B, and C are correct – pages 10-12.

Review Question 4

Refer to pages 6-9.

Review Question 5

Refer to page 1.

Review Question 6

Answer 4: A, B, and C are correct – page 13.

Review Question 7

Answer 3: polysomnography – page 13.

Review Question 8

Refer to pages 17-18.

Review Question 9

Refer to page 21.

Review Question 10

Refer to pages 12-13.

CHAPTER 2

BUILD AND BLOOD PRESSURE

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BUILD AND BLOOD PRESSURE

Introduction

Build and blood pressure are two of the most common measurements in medical underwriting today, with the insurance industry playing an important role in understanding extra mortality related to both areas. Life insurance mortality studies for build date back to 1903, while some life insurers were recording blood pressures as early as 1906, even before blood pressure machines were used in medical practice. In 1925, the Joint Committee of the Association of Life Insurance Medical Directors of America and the Actuarial Society of America published the first mortality study of blood pressure in insured lives. Inter-company studies, including the Blood Pressure Study 1939, Build and Blood Pressure Study 1959, Build Study 1979, and Blood Pressure Study 1979, followed. Large population studies began in the 1950s, supporting the findings of the insured lives studies.

Both measurements continue to be vital today for life insurers and are often interrelated. Obesity, which has an increasing prevalence in most developed countries, can cause hypertension, cardiovascular disease, diabetes, and cancer. Meanwhile, hypertension is also linked to coronary heart disease and stroke. As these are the most common causes of death, recognizing risks associated with build and blood pressure is essential in underwriting and risk assessment.

Build

Build, also known as the body habitus or physique, is the physical makeup of the body. Overweight and obesity are disorders related to build defined by amount of excess body fat by weight or by body mass index (BMI). Underweight is defined as weight or BMI below the lower limit of the normal range. BMI is calculated as weight in kilograms/height in meters squared (kg/m^2) using the following formula:

$$\text{BMI} = (\text{weight in pounds}/\text{height in inches}/\text{height in inches}) \times 703, \text{ or}$$
$$\text{BMI} = \text{weight in kilograms}/(\text{height in meters})^2$$

A BMI calculator can be accessed through the web site of the U.S. Department of Health and Human Services, National Heart, Lung, and Blood Institute: <http://www.nhlbi.nih.gov/guidelines/obesity/BMI/bmicalc.htm>

Overweight and Obesity

Overweight and obesity describe different severities of excess total body fat.

Adult Overweight and Obesity

1. overweight – defined as BMI between 25 and 29.9 kg/m^2

2. obesity – defined as excess fat resulting in BMI above 30 kg/m^2 – alternately, it can be defined as weight 20% or more above normal weight. Obesity can be further subdivided into three grades:
 - a. grade 1 – BMI 30 to less than 35 kg/m^2
 - b. grade 2 – BMI 35 to less than 40 kg/m^2
 - c. grade 3 – BMI 40 kg/m^2 and above.

Clinically severe obesity, also called morbid obesity, is synonymous with grade 3 obesity ($\geq 40 \text{ kg/m}^2$) or can be defined as weight 50-100% over normal, or as more than 100 pounds overweight. However, grade 2 obesity ($BMI 35 < 40 \text{ kg/m}^2$), with significant obesity-related complications, can also be considered clinically severe obesity.

Childhood Overweight and Obesity

1. overweight – BMI between 85th and 95th percentile for age and sex
2. obese – $BMI \geq 95\text{th percentile for age and sex}$
3. severe obesity – $BMI \geq 99\text{th percentile for age and sex, or } BMI \geq 35$.

An estimated 72% of U.S. adults are either overweight or obese, with 39.8% considered obese, according to the National Health and Nutrition Examination Survey (NHANES) 2015-2016. Obesity is more common among middle-aged adults (ages 40-59) compared with younger and older adults. While the prevalence of obesity more than doubled over the last 30 years and continues to increase, the pace has slowed in recent years. Between 1960 and 2002, the average weight for both males and females increased by more than 24 pounds, while the average height increased by about an inch. Average BMI increased from 25 to 28 during the same time period.

Rates of obesity in children and adolescents have also increased with obesity reported in 9%, 17%, and 21% of children ages 2-5 years, 6-11 years, and 12-19 years respectively.

While many factors contribute to these increases, the fundamental cause of obesity is energy imbalance with caloric intake in excess of caloric needs over a long time period. Individual behaviors, environmental factors, and genetics can all contribute to this imbalance and include:

1. physical inactivity – Physical activity has many benefits, among them burning calories. However, many aspects of today's lifestyle promote less activity. Technology has removed much of the physical labor from occupational work and household chores. Suburban residential areas often require using automobiles rather than walking or bicycle riding. In addition, activities involving computers, televisions, and video games have replaced more active pursuits.
2. food selection – Today's consumer faces larger portion sizes and more food choices. The more readily available options include prepackaged and fast foods, which, along with soft drinks, tend to be high in fat, sugar, and calories.
3. age - Metabolism slows and fewer calories are required to maintain weight as individuals get older.

4. gender – Males have higher metabolic rates at rest and require more calories to maintain body weight than do females. Females' metabolic rate slows even further after menopause, meaning they require fewer calories.
5. genetic factors – Genetic factors can play a role in obesity.
6. behavioral and psychological factors – Obesity has been associated with depression, and some individuals overeat in response to negative emotions.
7. medical factors – Some endocrine disorders, including hypothyroidism, Cushing's syndrome, and polycystic ovary syndrome, can lead to obesity. Drugs such as steroids and some antidepressants also can cause weight gain.

Childhood obesity is also associated with parental obesity, higher socioeconomic status, higher parental education, small family size, and family patterns of inactivity.

Diagnostic Tools

Height, Weight, and Body Mass Index (BMI)

Underwriting manuals generally provide guidance in defining overweight and obesity based on both height and weight measures and BMI calculations. Although BMI is not a direct measure, it is a good indicator of body fat. Individuals classified as obese based on BMI tend to have excess body fat. A BMI in the overweight range generally corresponds with excess body fat, although some can be due to muscular build. Similarly, individuals with BMI within normal range can have excess body fat.

For insurance underwriting in the United States, build measurements are frequently provided as part of the examination. These measurements vary with shoes, clothing, and even time of day. It is also important to know if height and weight were actually measured since there is a tendency for self-reported weight to be underestimated. Many overweight and obese individuals tend to fluctuate in weight and often regain lost weight. Such fluctuations can be an important consideration in underwriting individuals who recently experienced significant intentional weight loss.

Waist Circumference

Waist circumference, another measure used to assess abdominal fat content, is sometimes available for insurance underwriting. Waist circumferences above 40 inches (102 cm) in males and above 35 inches (88 cm) in females are considered to indicate an increased risk of developing hypertension, cardiovascular disease, diabetes, and cancer. Another way to identify increased fat around the middle is using the ratio of an individual's waist circumference to hip circumference. A waist-hip ratio (WHR) of 1.0 or higher is considered increased risk.

Treatment

Lifestyle Measures

The most effective way to lose weight is to reduce calorie intake and to increase physical activity. Counseling or support groups have been shown to be helpful for individuals making these lifestyle changes.

Medications

Weight-loss medications can be used in addition to lifestyle measures for individuals with BMI over 30, or for those with a BMI exceeding 27 kg/m² who have overweight-related complications. The limited number of currently available prescription medications may not be effective in all individuals and can cause important adverse effects.

1. orlistat (Xenical®, Alli®), approved by the Food and Drug Administration (FDA) for long-term use, inhibits fat absorption from the intestine and can decrease absorption of important vitamins and nutrients. It has been associated with severe liver injury.
2. central nervous system stimulant drugs - Diethylpropion (Tenuate®) and phentermine (Suprenza®, Ionamin®), can be effective, and are FDA-approved for short-term use, although have potential for abuse. A phentermine/topiramate combination (QYSMIA®) was recently FDA approved.
3. bupropion/naltrexone combination (Contrave®) – approved in 2014 for the treatment of obesity.
4. locaserin (Belviq®) - FDA approved in 2013, acts on the brain to promote satiety and can result in weight loss in the 5% range.
5. anti-diabetic drugs – Liraglutide (Victoza®) is FDA approved. Metformin (Glucophage®), exenatide (Byetta®), and pramlintide (Symlin®) are not FDA-approved for obesity treatment but when they are associated with weight loss, can have been prescribed for individuals with type 2 diabetes or for those who are at high risk of developing diabetes.
6. other non-approved drugs associated with weight loss – the antidepressants bupropion, fluoxetine, and sertraline and the anti-epileptic drugs topiramate and zonisamide
7. drugs withdrawn due to safety concerns - sibutramine (Meridia®) (withdrawn 2010, due to increased heart attack and stroke risk); ephedra (withdrawn 2004, due to serious adverse cardiac and other effects, several deaths); fen-phen, a prescription combination of fenfluramine and dextfenfluramine (withdrawn 1997, due to valvular heart disease)
8. dietary supplements - While popular for weight loss, dietary supplements are not proven effective and can have significant adverse effects.

Surgery

Bariatrics is the field of medicine involved in the study of overweight and obesity. Bariatric surgery treats obesity by altering the digestive process and generally involves surgery that is either restrictive, malabsorptive, or both. Candidates for surgery can include individuals with BMI 40 kg/m² or above, those with BMI 35 to 39.9 kg/m² with complications, or those with BMI 30 to 34.9 kg/m² with uncontrollable diabetes or metabolic syndrome. Surgery has been shown to produce effective weight loss for clinically severe obesity, with a reversal or reduced risk for associated complications such as diabetes, hypertension, hyperlipidemia, and obstructive sleep apnea.

Operative mortality rates are similar to those for any major surgical procedure, but adverse effects are relatively common. About 5 to 10% of individuals regain the weight lost. Reoperation is required in 10-20% of individuals who have had surgery in order to correct complications.

Currently, the most common procedures are the Roux-en-Y gastric bypass (RYGB), laparoscopic sleeve gastrectomy (LSG), and laparoscopic adjustable gastric band (LAGB).

Restrictive surgery

Restrictive surgery closes off parts of the stomach to make it smaller.

1. sleeve gastrectomy (SG), laparoscopic sleeve gastrectomy (LSG) - A procedure in which most of the greater curvature of the stomach is removed creating a tubular (and smaller) stomach. Weight loss is similar to loss with gastric bypass. It was originally developed as the first stage or bridge procedure prior to bypass or biliopancreatic diversion (BPD) and was found to be effective on its own. It is the most common bariatric surgery performed with relatively low complication rates.
2. laparoscopic adjustable gastric band (LAGB) - A hollow band of special material is placed around the stomach near its upper end to create a small pouch and a narrow passage into the larger remainder of the stomach. The band is then inflated with salt solution and can be tightened or loosened. Banding can be performed using laparoscopic surgery technique such as the lap-band procedure.
3. vertical banded gastroplasty (VBG) – Both a band and staples are used to create a small stomach pouch. It has generally been replaced by LAGB.

Combined restrictive and malabsorptive surgery

Roux-en-Y gastric bypass (RYGB) – a relatively common procedure—A small stomach pouch is created and a Y-shaped section of the small intestine is attached to the pouch. As a result, food bypasses the lower stomach, the duodenum, and the first part of the jejunum.

Malabsorptive surgery (*for information only, not tested*)

Malabsorptive surgery is a more extensive operation that involves bypassing a portion of the digestive tract, thus preventing absorption of calories and nutrients. These surgeries, which are either less common or now considered obsolete, generally result in more successful weight loss than that achieved with restrictive procedures alone.

1. biliopancreatic diversion (BPD) - complex procedure in which portions of the stomach are removed, and a small remaining pouch is connected to the ileum, the last part of the small intestine
2. biliopancreatic diversion with duodenal switch (BPD/DS) – BPD with a larger portion of the stomach left intact and with a small part of the duodenum kept in the digestive pathway
3. jejunoileal bypass (JIB) – no longer performed but caution is warranted if it is encountered at time of underwriting. High complication rates include liver failure, cirrhosis, nephrolithiasis, and malnutrition. Reversal or conversion to a gastric bypass may need to be considered.

Individuals who undergo malabsorptive surgery can require nutritional supplements and possibly vitamins to prevent nutritional deficiencies, anemia, and osteoporosis, which are relatively common after surgery. “Dumping syndrome,” a result of stomach contents moving too rapidly through the small intestine, can occur after surgery. Its symptoms can include nausea, vomiting, diarrhea, sweating, dizziness, and palpitations. Surgical complications can also include intestinal obstruction, hernia, and gastrointestinal bleeding and ulceration.

Prognosis

Obesity is associated with increased morbidity and mortality and is estimated to cause over 100,000 deaths per year in the United States. As to be expected, the risks associated with obesity increase with increasing weight. Abdominal fat, when out of proportion with total body fat, has been shown to be an independent risk factor for obesity-related complications.

Increased all-cause mortality risk with both increases in BMI and waist circumference has been reported in an insured lives population study. The two measures were found to be essentially equivalent in their ability to predict mortality risk in a male insurance population.¹

Obesity is likely to aggravate diseases such as diabetes, high blood pressure, and heart disease, as well as complicate the treatment of these conditions. Because extra weight puts more stress on joints, especially the knees, hips, and back, accidents and injuries are more common in obese individuals and recovery can be prolonged. Impairments associated with overweight and obesity are outlined in the following table.

Table 1. Partial list of complications of overweight and obesity.

Type 2 (non-insulin dependent) diabetes	Impaired glucose tolerance
Coronary artery disease	Congestive heart failure
High blood pressure	Stroke
Metabolic syndrome	High blood cholesterol, triglycerides
Cancers – endometrial, breast, prostate, colon	Obstructive sleep apnea
Depression, eating disorders	Osteoarthritis

Similarly, overweight and obesity in childhood and adolescence can be associated with endocrine abnormalities (e.g., impaired glucose tolerance, diabetes mellitus, metabolic syndrome, hyperandrogenism), and cardiovascular abnormalities (e.g., hypertension, hyperlipidemia, early atherosclerosis, and adult coronary heart disease). Overweight and obesity can also be associated with fatty liver disease, obstructive sleep apnea, idiopathic intracranial hypertension, orthopedic problems, including increased injury and fracture risk, and psychosocial consequences. Elevated adolescent BMI has been associated with increased adult mortality risk in general population studies.

Underweight

Underweight is defined as being consistently 5-10% below the lower limit of normal range, or a BMI of less than or equal to 18.5. Some individuals who meet the underweight definition can be healthy, whereas others can be underweight due to illness. Unintentional weight loss, also

called involuntary or unexplained weight loss, often defined as loss of 5% of usual body weight over a six-month period, is an independent predictor of mortality. Recent unexplained weight loss is an important underwriting consideration since it can signify serious underlying disease not yet identified. Low BMI in any age group can be a marker for disease, including cancer, type 1 diabetes mellitus, intestinal malabsorption, depression, anorexia nervosa, bulimia, drug or alcohol use disorders, or hyperthyroidism.

Unintentional weight loss is relatively common in the elderly and requires thorough evaluation. Frequently, it is associated with chronic impairments such as dementia, Parkinson's disease, or other chronic diseases, but in some individuals, no cause is found. Some older individuals lose weight because of a general loss of interest in eating related to fewer social opportunities or loss of smell and taste. In the elderly, being overweight is actually protective, whereas in younger and middle age groups, being underweight without disease can lower mortality risk. Weight loss of more than 5% over age 65 is associated with increased morbidity, including functional decline, falls and fractures, increased infection risk, and osteoporosis. It is also associated with increased mortality risk. However, an elderly individual with a stable BMI in the underweight range may not have increased mortality.

Blood Pressure

Blood pressure (BP) is a measure of the interaction between two forces: the pressure required to move blood through the blood vessels (i.e., cardiac output), and the tone or tension of the arteries i.e., (peripheral resistance).

Blood pressure commonly include two measurements. Systolic blood pressure (SBP) is the maximum pressure achieved during systole, the period of contraction of the heart, especially in the ventricles. Diastolic blood pressure (DBP) is the minimum pressure occurring at the end of diastole, the relaxation phase of the heartbeat. Pulse pressure (PP) is the difference between the systolic and diastolic blood pressures. BP values are given in millimeters of mercury (mmHg) and recorded as systolic blood pressure/diastolic blood pressure, the average being about 120/80.

Blood pressure can increase with physical exertion, anxiety (stress), smoking, caffeine, alcohol, or other drugs. It normally drops during sleep and rises abruptly on awakening. High blood pressure is called hypertension and low blood pressure is called hypotension.

Hypertension

While no one threshold level marks the difference between normal and elevated BP, hypertension is generally defined as a sustained elevation in systolic BP above 140 millimeters of mercury (mmHg) or in diastolic BP above 90 mmHg. The U.S. Seventh Report of the Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure (JNC-VII) further defines blood pressure as follows:

1. normal BP – less than 120/80
2. pre-hypertension – systolic 120-139 or diastolic 80-89
3. stage 1 hypertension – systolic 140-159 or diastolic 90-99
4. stage 2 hypertension – systolic 160 and over, or diastolic 100 and over.

Hypertension can be further classified as:

1. *primary hypertension* – also known as essential or idiopathic hypertension—It has no identifiable cause and accounts for 95% of hypertension. Hypertension tends to run in families and ethnic groups, with a genetic component present in about 30% of primary hypertension cases.
2. *secondary hypertension* – accounts for 5% of cases and is due to an underlying disease or an external cause—Diseases of the kidney, thyroid, and aorta, Cushing's syndrome, acromegaly, pheochromocytoma, primary hyperaldosteronism, sleep apnea, and pregnancy all can cause hypertension. Agents that can cause hypertension include non-steroidal anti-inflammatory drugs (NSAIDs), steroids, nicotine, alcohol, amphetamines, and cocaine.
3. *white-coat hypertension* – high readings in the physician's office with normal readings in other settings, also called labile hypertension
4. *systolic hypertension* – systolic BP over 140, diastolic less than 90, which is more common over age 50
5. *pseudo-hypertension* – inaccurately high readings in the elderly due to stiff, calcified arteries or in the obese due to a BP cuff that is too small
6. *borderline hypertension* – BP in the high range of normal
7. *resistant hypertension* – inadequate BP control despite the use of three or more anti-hypertensive drugs.

The prevalence of hypertension increases with advancing age and with obesity and is the most common reason for physician visits. Approximately 20% of the population has hypertension.

Diagnostic Tools

Most individuals with hypertension have no specific symptoms, with the elevated blood pressure usually being the only clinical sign.

1. *blood pressure measurement* – Blood pressure recordings are based on sounds associated with the pulse as heard through a stethoscope placed over the brachial artery in the arm using a sphygmomanometer. Systolic BP is recorded at appearance of these sounds; diastolic BP is recorded at their disappearance. If the sounds are not correctly identified, blood pressure can be inaccurately measured. It is best measured in the seated position with a series of readings. Often, the first reading is higher than subsequent ones. Underwriters use single measurements or averages of available BP recordings.
2. *ambulatory blood pressure monitoring* – This is the monitoring of blood pressure over a 24-hour period. It can be used to identify white-coat hypertension, to evaluate borderline hypertension, and to monitor response to treatment.
3. *home blood pressure monitoring* – Monitoring of blood pressure at home can similarly be used to identify white-coat hypertension, to evaluate borderline hypertension, and to monitor response to treatment.
4. *other investigations* – Other tests can be conducted to determine possible secondary causes of hypertension, damage directly related to hypertension (i.e., end-organ or target organ damage), and associated conditions. These tests include:

- a. fundoscopic exam – An examiner uses an ophthalmoscope to examine the small blood vessels at the back of the eye, which gives information about the duration and severity of hypertension.
- b. electrocardiogram – a record of electrical activity of the heart that looks for left ventricular hypertrophy (LVH) or ischemic ST and T wave changes
- c. echocardiogram - an ultrasound of the heart that looks for heart enlargement, LVH, heart valve abnormalities, or heart failure
- d. blood evaluation – measures hematocrit, glucose, electrolytes, blood urea nitrogen (BUN), creatinine, cholesterol, and triglycerides (lipid profile)
- e. urinalysis – measures protein, blood, glucose, and also includes a microscopic evaluation
- f. renal evaluation – involves more detailed renal function studies such as creatinine clearance, renal ultrasound, or scan
- g. special studies – includes urine and plasma catecholamines, cortisol, or aldosterone levels looking for pheochromocytoma, Cushing's syndrome, or primary aldosteronism, respectively.

Treatment of Hypertension

- 1. lifestyle measures – Lifestyle interventions can include weight reduction, decreased alcohol intake, smoking cessation, exercise, control of stress, and dietary adjustments that decrease sodium intake and ensure adequate intake of potassium, calcium, and magnesium.
- 2. medications – Drugs are commonly used to treat hypertension, with the goal being to achieve a target blood pressure of less than 130/85 in most individuals. Underwriters commonly encounter individuals with recognized hypertension who are not being treated, or who are not being treated adequately to achieve target blood pressure, despite widely published treatment guidelines. Drugs used to treat high blood pressure are not exclusive to hypertension and can be used to treat other cardiovascular conditions. Many are available as combination products. The eight major classes of drugs include:
 - a. thiazide diuretics, such as hydrochlorothiazide (HCTZ), are often used as first-line drugs and are particularly useful in elderly people or in individuals with coexistent heart failure or peripheral edema.
 - b. calcium channel blockers, such as amlodipine (Norvasc®), felodipine (Plendil®), and diltiazem (Cardizem®), are often used in older individuals, and some are used to treat angina.
 - c. angiotensin-converting enzyme (ACE) inhibitors, such as enalapril (Vasotec®), ramipril (Altace®), and lisinopril (Prinivil® or Zestril®), are commonly used in hypertensive individuals, particularly those with diabetes or with heart failure.
 - d. beta-blockers, such as atenolol (Tenormin®) and metoprolol (Lopressor® or Toprol®), are commonly used, especially when there is associated coronary heart disease. They can aggravate asthma, peripheral vascular disease, heart block, and depression.
 - e. angiotensin II receptor blockers (ARBs), such as losartan (Cozaar®) and valsartan (Diovan®), are commonly used similarly to the ACE inhibitors.

- f. alpha-blockers, such as doxazosin (Cardura®) and terazosin (Hytrin®), are not as commonly used but are particularly useful if prostate hypertrophy is present.
- g. vasodilators, such as hydralazine (Apresoline®) and methyldopa (Aldomet®), are older drugs and can be used in certain cases.
- h. renin inhibitors, such as aliskiren (Tekturna®), are a newer drug class that can be used alone or in combination with other medications.

(Refer to Appendix for a more complete listing of selected antihypertensive medications.)

Prognosis

Apart from age, BP level is the most powerful single predictor of future mortality, with systolic BP and diastolic BP being independent risk factors. Although risk increases with rising levels of blood pressure, even mild hypertension significantly shortens life expectancy. The list of complications related to hypertension is long. Among them are left ventricular hypertrophy (LVH), which is a marker for poorly controlled hypertension and can contribute to congestive heart failure, ventricular arrhythmias, myocardial ischemia, and sudden death. Coronary artery disease with hypertension can lead to myocardial infarction or sudden death due to arrhythmias. Hypertension also can lead to stroke, renal failure, peripheral vascular disease, and heart failure. Although successful treatment that results in adequate BP control lowers morbidity and mortality risk, the hypertensive group's risk remains higher when compared with the general population.²³

Complications of high BP are summarized in the following table:

Table 2. Complications of high blood pressure.

Left ventricular hypertrophy	Congestive heart failure
Myocardial infarction/ischemia	Coronary artery disease
Atrial fibrillation	Arterial aneurysms
Carotid artery stenosis	Stroke
Proteinuria	Renal insufficiency/failure
Peripheral vascular disease	Cognitive impairment/dementia

Increased (widened) pulse pressure (PP), defined as a difference between SBP and DBP of greater than 40 mmHg, results from either increased SBP or decreased DBP and can add prognostic information. In older individuals, cardiovascular morbidity and mortality is predicted by elevated SBP. Presence of increased PP with elevated SBP, which represents increased arterial stiffness in the aorta, is associated with increased cardiovascular disease risk. Increased PP can also be found with aortic valve regurgitation, diseases of the thoracic aorta, severe anemia, or thyrotoxicosis. A low (narrow) pulse pressure (<30 mmHg) can be associated with severe aortic valve stenosis or heart failure.

Hypotension

Hypotension, also called low blood pressure, is defined as a sitting position systolic BP of 90 mmHg or lower that causes symptoms. Postural or orthostatic hypotension is defined as a drop in systolic BP of at least 20 mmHg or a drop in diastolic BP of 10 mmHg or more upon standing

from a supine (lying) position. Symptoms can include dizziness, syncope, and blurred vision. Some normal (usually younger) adults have low levels of blood pressure without any symptoms, while low blood pressure in the elderly is more often symptomatic and associated with disease. Acute causes of hypotension include infection and significant blood loss. Chronic postural hypotension can result from these factors:

1. disorders of the autonomic nervous system such as Parkinson's disease, diabetic or alcoholic neuropathy, multiple sclerosis, and chronic renal or liver diseases
2. other diseases, including aortic stenosis, pericarditis, and myocarditis
3. adverse effect of certain drugs, including those for hypertension, depression, and Parkinson's disease.

Hypotension is treated by treating the underlying cause. Hypotension can contribute to falls and fractures and can limit activities of older people. Hypotension related to underlying disease, particularly cardiovascular disease, can be associated with increased mortality.

Underwriting Considerations

Underwriters need to identify the magnitude of risk associated with build and blood pressure. Obesity has been associated with several cancers, and hypertension has been associated with renal cancer. Both conditions contribute to increased stroke risk, are independent risk factors for heart disease, and contribute to metabolic syndrome (a combination of cardiac risk factors, including abdominal obesity, elevated blood pressure, blood lipid abnormalities, and elevated fasting blood glucose). Risks associated with metabolic syndrome increase as the number of factors increases.

Case Studies

Case 1 – Obesity

50-year-old male, non-smoker, life insurance application, height 6 feet 0 inches (183 cm), weight 310 pounds (142 kg), BMI 42; blood pressure, total cholesterol, and blood glucose all at the high end of normal range, has a desk job, does not like to exercise, lost 40 pounds in last six months by severe dieting.

1. What is his mortality risk compared with the standard population? (better, worse, or same?)
2. What factors contribute to mortality risk?
3. What is the most likely direction his weight will take in the future?
4. What do you think will happen with his other cardiac risk factors with age (and weight)?
5. What could he do to alter his potential risk?

Cardiac risk factors of male, age over 45, clinically severe obesity (BMI above 40), and physical inactivity are identified. He also has several borderline risk factors with high normal values for BP, cholesterol, and glucose. His mortality risk is worse than that of a group of healthy 50-year-old males. His weight loss was rapid and by drastic short-term measures. In all likelihood, he has not made significant lifestyle changes that would help sustain long-term weight loss, so future weight increases could be expected. With advancing age and increasing weight, increases in blood pressure, total cholesterol, and possibly his glucose can be anticipated. He could make lifestyle changes to improve his eating and exercise habits and could be monitored for possible treatment of

BP and/or cholesterol.

Case 2 – Hypertension

50-year-old male, non-smoker, life insurance application, BMI 30, total cholesterol 250 mg/dL (6.5 mmol/L), blood glucose and urine protein both normal, treated for high blood pressure since age 30, currently on ramipril (Altace®) and no other medications. EKG and echocardiogram both show mild left ventricular hypertrophy, blood pressure only fairly well controlled. BPs in attending physician's statement over last year: 150/90, 160/100, 155/100, 140/95; on paramedical examination, BP average: 120/85 (average 145/94).

1. What is his mortality risk compared with the standard population? (better, worse, or same?)
2. What are the most likely events that would lead to death in this case?
3. Do you think his blood pressure is adequately controlled?
4. What are possible reasons for fluctuation in his blood pressure?
5. What does the left ventricular hypertrophy mean in terms of blood pressure control and prognosis?

His mortality risk is worse than that of a group of healthy 50-year-old males. His cardiac risk factors include male, age over 45, obesity (BMI 30), high total cholesterol, and hypertension. Additional unfavorable factors include early onset of hypertension (age 30), only fair control (average of 145/94 is above the treatment goal of less than 130/85), and evidence of target organ damage (left ventricular hypertrophy). LVH is a marker for poorly controlled hypertension and can contribute to congestive heart failure, myocardial ischemia, ventricular arrhythmias, or sudden death. Fluctuations in blood pressure can be related to poor compliance with antihypertensive therapy. He may take his medication regularly at the time of doctor visits or insurance paramedical exams but not at other times. Other factors that can interfere with good blood pressure control include diet, alcohol, stress, or other drugs that raise blood pressure.

Case 3 – Underweight

75-year-old female, ex-smoker, life insurance application, height 5 feet 5 inches (165 cm), weight 114 pounds (52 kg), BMI 19, attending physician's statement indicates weight 130 pounds (59 kg) one year earlier with a comment that she just is not doing as much cooking as before.

1. What is her mortality risk compared with the standard population? (better, worse, or same?)
2. What qualifies as a significant weight loss?
3. What can be possible reasons for the weight loss?

She has unexplained weight loss of 16 pounds in the last year. This is a significant loss as it represents over 12% of her body weight. The BMI of 19 is at the low end of normal. Weight loss could be related to change in diet with less cooking as suggested in the case study but also could be due to a serious disease including early dementia. Presently, her mortality risk is worse than that for a group of healthy 75-year-old females. A full investigation to rule out cancers or chronic diseases, along with demonstrated weight stabilization for a significant period of time, is required to be able to consider this risk closer to the healthy group.

Case 4 – Hypotension

75- year-old female, non-smoker, life insurance application, BMI 24, blood pressure 100/70, reports dizziness upon standing and almost fell once; attending physician notes drop of systolic blood pressure with standing.

1. What is her mortality risk compared with the standard population? (better, worse, or same?)
2. What could be causing the low blood pressure?
3. What is mortality risk if she were a 30-year old with no symptoms?

Mortality risk is worse than that of a group of healthy 75-year-old females. In her age group, low blood pressure with symptoms is more likely associated with disease. A full evaluation is required to rule out cardiovascular or other chronic diseases that contribute to an increased mortality risk. Low blood pressure could be caused by many conditions including heart valve disease, Parkinson's disease, excess alcohol, or diabetes. Concern for excess mortality relates to underlying disease and to the potential for injury with falls. Low blood pressure without symptoms in a healthy young female carries no excess mortality risk.

APPENDIX
(For students' information only; this material will not be tested.)

SELECTED ANTIHYPERTENSIVE MEDICATIONS
Listed as: generic name (Trade name)

Thiazide diuretics

chlorthalidone (Hygroton®, Thalitone®)	indapamide (Lozol®)
chlorothiazide (Diuril®)	metolazone (Mykrox®, Zaroxolyn®)
hydrochlorothiazide, HCT, HCTZ, (Esidrex®, HydroDIURIL®),	

Loop diuretics

bumetanide (Bumex®)	furosemide (Lasix®)
ethacrynic acid (Edecrin®)	torsemide (Demadex®)

Potassium-sparing diuretics

amiloride (Midamor®)	spironolactone (Aldactone®)
epplerenone (Inspra®)	Triamterene (Dyrenium®)

Non-selective beta-blockers

carteolol (Cartrol®)	pindolol (Visken®)
carvedilol (Coreg®)	propranolol (Inderal®)
labetalol (Normodyne®, Trandate®)	sotalol (Betapace®)
nadolol (Corgard®)	timolol (Blocadren®)
penbutolol (Levatol®)	

Selective beta-1 blockers

acebutolol (Sectral®)	esmolol (Brevibloc®)
atenolol (Tenormin®)	nebivolol (Bystolic®)
betaxolol (Kerlone®)	metoprolol (Lopressor®, Toprol®)
bisoprolol (Zebeta®)	

Adrenergic neuron blocking agents

guanadrel (Hylorel®)	reserpine (Serpasil®)
guanethidine (Ismelin®)	

Alpha-1 adrenergic blockers

doxazosin (Cardura®)	terazosin (Hytrin®)
prazosin (Minipress®)	

Centrally-acting agents

clonidine (Catapres®)	guanfacine (Tenex®)
guanabenz (Wytensin®)	methyldopa (Aldomet®)

Calcium channel blockers

diltiazem (Cardizem®, Dilacor®, Tiazac®)
verapamil, (Calan®, Isoptin®, Covera®, Verelan)

Dihydropyridine calcium channel blockers

amlodipine (Norvasc®)	nicardipine (Cardene®)
felodipine (Plendil®)	nifedipine (Adalat®, Procardia®)
isradipine (DynaCirc®)	nisoldipine (Sular®)

Angiotensin-converting enzyme (ACE) inhibitors

benazepril (Lotensin®)	moexipril (Univasc®)
captopril (Capoten®)	perindopril (Aceon®)
enalapril (Vasotec®)	quinapril (Accupril®)
fosinopril (Monopril®)	ramipril (Altace®)
lisinopril (Prinivil®, Zestril®)	trandolapril (Mavik®)

Angiotensin-II receptor blockers (ARBs)

azilsartan (Edarbi®)	olmesartan (Benicar®)
candesartan (Atacand®)	telmisartan (Micardis®)
eprosartan (Teveten®)	valsartan (Diovan®)
irbesartan (Avapro®)	
losartan (Cozaar®)	

Vasodilators

hydralazine (Apresoline®)	minoxidil (Loniten®)
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Renin inhibitors

aliskiren (Tekturna®)

Combination Products

ACE inhibitors and Diuretics

benazepril + HCT (Lotensin HCT®)	lisinopril + HCT (Prinzide®, Zestoretic®)
captopril + HCT (Capozide®)	moexipril + HCT (Uniretic®)
enalapril + HCT (Vasorectic®)	quinapril + HCT (Accuretic®)
fosinopril + HCT (Monopril HCT®)	

ACE inhibitors and Calcium-channel blockers

benazepril + amlodipine (Lotrel®)	trandolapril + verapamil (Tarka®)
enalapril + felodipine (Lexxa®)	

Angiotensin II receptor blockers and Diuretics

azilsartan + chlorthalidone (Edarbyclor)

candesartan + HCT (Atacand HCT®)

eprosartan + HCT (Teveten HCT®)

irbesartan + HCT (Avalide®)

losartan + HCT (Hyzaar®)

olmesartan + HCT (Benicar HCT®)

telmisartan + HCT (Micardis HCT®)

valsartan + HCT (Diovan HCT®)

Angiotensin II receptor blockers and Calcium channel blockers

hydrochlorothiazide + olmesartan + amlodipine (Tribenzor®)

olmesartan + amlodipine (Azor®)

telmisartan + amlodipine (Twynsta®)

valsartan + amlodipine (Exforge®)

Angiotensin II receptor blockers and beta blocker

nebivolol + valsartan (Byvalson ®)

Beta-blockers and Diuretics

atenolol + chlorthalidone (Tenoretic®) propranolol + HCT (Inderide®)

bisoprolol + HCT (Ziac®) timolol + HCT (Timolide®)

metoprolol + HCT (Lopressor HCT®)

Diuretic combinations

amiloride + HCT (Moduretic®) triamterene + HCT (Dyazide®, Maxzide®)

spironolactone + HCT (Aldactazide®)

Renin inhibitors combinations

aliskiren + amlodipine (Tekamlo®)

aliskiren + amlodipine + hydrochlorothiazide (Amturnide®)

aliskiren + HCT (Tekturna HCT®)

aliskiren + valsartan (Valturna®)

Review Questions – ALU 101, Chapter 2

1. A low body mass index (BMI) can be a marker for all of the following diseases EXCEPT:
 1. cancer
 2. anorexia nervosa
 3. hypothyroidism
 4. alcohol abuse
2. The maximum pressure achieved during contraction of the heart is the:
 1. systolic blood pressure
 2. pulse pressure
 3. diastolic blood pressure
 4. atrial pressure
3. Which of the following statements regarding hypertension are correct?
 - A. Hypertension can lead to stroke.
 - B. Mild hypertension can shorten life expectancy.
 - C. Left ventricular hypertrophy can develop with uncontrolled hypertension.

Answer Options:

- 1. A and B only are correct.
- 2. A and C only are correct.
- 3. B and C only are correct.
- 4. A, B, and C are correct.

4. Name at least five classifications of hypertension.
5. Treatment for high blood pressure typically consists of lifestyle changes or medication, or both. Explain what lifestyle changes are helpful in reducing blood pressure.

6. Classes of drugs that can be used to treat hypertension include which of the following?
- sulfonamides
 - calcium channel blockers
 - angiotensin-converting enzyme (ACE) inhibitors

Answer Options:

- A only is correct.
- C only is correct.
- A and B only are correct.
- B and C only are correct.

7. All of the following are potential complications of gastrointestinal surgery for obesity EXCEPT:
- dumping syndrome
 - anemia
 - nutritional deficiencies
 - diabetes
8. Explain the mortality and morbidity implications of unintentional weight loss in the elderly.
9. Explain the difference between primary and secondary hypertension.
10. What are some conditions that can cause chronic postural hypotension?

Answers and Sources of Review Questions

Review Question 1

Answer 3: hypothyroidism – page 7.

Review Question 2

Answer 1: systolic blood pressure – page 7.

Review Question 3

Answer 4: A, B, and C are correct – page 10.

Review Question 4

Refer to page 8.

Review Question 5

Refer to page 9.

Review Question 6

Answer 4: B and C only are correct – page 9.

Review Question 7

Answer 4: diabetes – page 6.

Review Question 8

Refer to page 7.

Review Question 9

Refer to page 8.

Review Question 10

Refer to page 11.

CHAPTER 3

DIABETES

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DIABETES

Introduction

Diabetes mellitus (DM) is a condition commonly encountered in life and health insurance underwriting. To accurately assess the degree of risk presented, it is important to have a thorough understanding of this disorder of glucose metabolism. The purpose of this chapter is to present basic information regarding the anatomy and physiology of the disease, the types of diabetes, diagnosis and treatment, and complications.

Anatomy and Physiology

Each of the cells in our bodies requires energy to function. This energy is derived from the food we eat. During the digestive process, food is broken down in a series of processes into molecules of simple sugar, or glucose, which can be absorbed by cells. The glucose is transported to the cells through the blood stream.

However, glucose cannot pass from the blood into the cell through the cell membrane on its own. This process requires the hormone insulin to “unlock” the cell to allow the glucose to enter.

Insulin is produced in specialized cells, the beta cells, in the pancreas. The pancreas is a long, narrow gland, approximately six inches long, which lies in the upper mid-to-left side of the abdomen behind the stomach. In a normal healthy individual, eating results in a rise in the blood sugar level, which triggers a rise in insulin secretion.

In a diabetic, the body is either unable to produce insulin or the body's cells are resistant to insulin. The result of either is that the cells cannot obtain the glucose from the bloodstream. As blood glucose levels rise, excess glucose can be excreted by the kidneys into the urine.

The resulting hyperglycemia (i.e., high glucose levels in the blood) causes problems in two ways: the cells do not get the energy they need to function properly and the excess glucose begins to damage tissues at the cellular level.

Types of Diabetes

Diabetes mellitus could perhaps be more correctly described as a collection of related disorders rather than as a single disorder. There are several types of diabetes that differ in their cause, treatment, typical age of onset, and prevalence. The most common forms are type 1 and type 2.

Type I diabetes has also been called insulin dependent diabetes mellitus (IDDM) or juvenile diabetes. Type 1 DM results when the beta cells in the pancreas have been either damaged or destroyed, and the pancreas is no longer able to produce insulin. The cause of the disorder is not completely understood, but the damage to the beta cells appears to be related to an autoimmune response – that is, the body's own immune system attacks the beta cells. Symptoms usually

develop quickly and can include hunger and weight loss, increased thirst (polydipsia) and urination (polyuria), blurred vision, and fatigue. The acute onset of type 1 DM can be life-threatening if diagnosis and treatment are delayed. Since the body is unable to produce insulin, treatment requires daily injections of insulin. Onset of type 1 DM is usually in childhood or early adulthood, but it can occur at any age.

Type 2 diabetes has also been called non-insulin dependent diabetes mellitus (NIDDM) or adult onset diabetes mellitus (AODM). As these names imply, insulin injections typically are not required to treat type 2 DM, and onset is usually in adulthood. The pancreas of a person with type 2 DM usually still produces insulin, but the body's cells are not able to effectively use the insulin, a condition known as insulin resistance. Symptoms of type 2 DM are similar to those of type 1, except the onset is more gradual, and symptoms often are unnoticed or attributed to other causes. The American Diabetes Association estimates that in the U.S., up to one-third of those with type 2 DM are unaware that they have it.¹ Worldwide, up to half of those with diabetes are undiagnosed.² The vast majority (around 90%) of individuals with diabetes have type 2.³

The condition in which an individual has blood sugar levels that are higher than normal, but not high enough to be diagnostic of diabetes, is pre-diabetes. Individuals with pre-diabetes include those with impaired fasting glucose (IFG), in which the blood sugar is mildly elevated after an overnight fast, and those with impaired glucose tolerance (IGT), when the blood sugar is mildly elevated on a 2-hour oral glucose tolerance test. These individuals have an increased risk of developing type 2 diabetes.

Metabolic syndrome is a term that can be seen in connection with insulin resistance. Metabolic syndrome (e.g., insulin resistance syndrome, or metabolic syndrome X) is not a disease, but rather a group of cardiac risk factors often seen together that cause an increased risk that is greater than the sum of the individual risk factors. Metabolic syndrome is diagnosed when at least three of the following five factors are present:

1. abdominal obesity
2. elevated triglycerides
3. low HDL cholesterol
4. elevated blood pressure
5. elevated fasting blood sugar.

Individuals with metabolic syndrome have an increased risk of developing type 2 diabetes and cardiovascular disease.

Gestational diabetes mellitus (GDM) is a form of diabetes that develops in some females during pregnancy and generally resolves after delivery. Risk factors for developing GDM include obesity, family history of diabetes, and race/ethnicity, with higher risk among Native Americans, African Americans, Hispanic/Latino Americans, Asians/Pacific Islanders, and aboriginal populations.^{4,5} It is recommended that all pregnant women be screened for GDM between the 24th and 28th weeks of pregnancy, or earlier if at high risk.

Gestational diabetes affects approximately 2-10% of pregnancies. It can lead to health complications for both the mother and the baby. High glucose levels can result in large babies, leading to high rates of cesarean section. Babies born with high birth weight have an increased risk of future obesity and glucose intolerance.

Some females who develop GDM during pregnancy do not return to normal blood glucose levels after delivery and are diagnosed with diabetes, usually type 2. Those with GDM whose glucose levels do return to normal after delivery have a 35-60% chance of developing diabetes in the next 10-20 years.⁶

Diagnostic Tools

Various tests are available to diagnose the presence of diabetes, monitor the level of blood sugar in known diabetics, and determine the presence or absence of complications.

Diabetes can be suspected based on the typical symptoms of the disease or from glucose in the urine, but blood testing is required to confirm the diagnosis. The oral glucose tolerance test measures an individual's blood glucose level after fasting and again two hours after drinking a high-glucose solution. Diabetes is diagnosed if the two-hour blood glucose level is 200 mg/dl or higher. A two-hour blood glucose level between 140-199 mg/dl is considered impaired glucose tolerance (IGT).

A fasting blood glucose test (i.e., fasting blood sugar, or FBS) is often done instead of the glucose tolerance test, as it is easier, less expensive, and provides results more quickly. A fasting blood glucose of 126 mg/dl or more on two separate occasions is diagnostic of diabetes. A fasting blood glucose between 110 and 125 mg/dl is considered impaired fasting glucose (IFG).

Over the past several years, many medical organizations have moved toward using the glycohemoglobin test, also called hemoglobin A1c, or simply the A1c test, to diagnose diabetes. The A1c reading represents the average blood glucose level over the prior three months. A normal A1c level is below 5.7%. A level of 5.7-6.4% represents prediabetes, while an A1c level of 6.5% or greater on two separate occasions is diagnostic of diabetes.

Once an individual has been diagnosed as diabetic, a physician can monitor the degree of blood sugar control in a number of ways. A random blood glucose test (one that is drawn when the person has not been fasting) can be done but does not provide a reliable estimate of degree of blood sugar control, since blood glucose levels fluctuate widely depending on what has been eaten recently. A fasting blood glucose is more reliable but is still subject to some fluctuation.

The level of fructosamine, a protein in the blood, provides an even better indication of blood sugar control, as it represents the average blood glucose level over the prior three-week period. However, the best test for monitoring blood sugar control is the A1c. A level of 6-7% is optimal, although up to 8% is usually considered acceptable blood sugar control.

Treatment

A variety of treatments are available to control the blood glucose level and delay or prevent complications in an individual with diabetes.

A proper diet and exercise is important for all diabetics, and for some with type 2 diabetes, this can be the only treatment required. For the majority of type 2 diabetics, however, medication is needed to maintain the blood glucose level within an acceptable range. Oral medications work by increasing the production of insulin in the pancreas, decreasing the insulin

resistance of the body's cells, or decreasing the body's ability to absorb glucose from the intestine when food is digested.

Some type 2 diabetics, and all type 1 diabetics, require insulin. There are several types of insulin preparations, which vary based on their source (some are derived from the pancreases of pigs or cattle and some are synthetic) as well as the timing of their effect (rapid acting, intermediate, or slow acting).

Insulin is typically administered several times daily by injection, usually into the skin of the abdomen, arms, thighs, or buttocks. Insulin can also be administered by using an insulin pump, which is a small device worn on the body that allows more frequent doses of insulin to be administered without multiple injections. The insulin pump contains a reservoir for the insulin and is connected to a needle under the skin via a thin tube. The pump is programmed to deliver fast acting insulin on a continuous basis at varying rates. The use of an insulin pump does not imply a more difficult or refractory case of diabetes; instead, the use of an insulin pump can reflect a high level of self-care and can result in improved blood glucose control.

Not all injectable medications are insulin preparations. There are also non-insulin injectable medications that may be used, typically for type 2 diabetes. These are often used in combination with other medications and have mechanisms of action similar to those of oral medications.

Researchers are continually working to find other forms of treatment, and there is hope that a cure can someday be found. One treatment that some have considered a cure for type 1 diabetes is a pancreas transplant. This procedure has allowed a few individuals to reduce or eliminate their dependence on insulin, but the risks of tissue rejection and immunosuppression are still a concern, and the long-term benefits are uncertain. This is better described as a treatment rather than a cure.

Regardless of the type of treatment, good ongoing care for diabetic individuals should include frequent self-monitoring of blood sugar levels. This is especially important for type 1 diabetics to enable them to adjust their insulin dosages throughout the day to avoid hypo- and hyperglycemia. Several types of monitors are available to make this task less difficult.

Traditional blood glucose monitors require an individual to prick a finger to obtain a drop of blood which is placed on a test strip. The test strip is inserted into a meter to read the blood glucose level.

A newer option is the Continuous Glucose Monitor (CGM) which automatically tracks blood glucose levels around the clock. A tiny sensor inserted under the skin of the abdomen or arm measures the glucose level in the interstitial fluid between the cells. A wireless transmitter sends the information to a receiver. The data from the receiver can be downloaded to a computer or smart phone to show trends in glucose levels. Some models can provide an alarm if the blood sugar gets too low or too high, which can be very helpful for those that do not recognize the symptoms of low blood sugar, and also for parents of children with type 1 diabetes.

Good diabetes care should also include regular exams to follow blood sugar control and to check for the development of complications. A thorough exam will include blood testing, including the A1c level, urine testing to check for albumin, and a retinal exam to check for early signs of retinopathy.

Complications

Complications of diabetes can be categorized as acute or chronic. Acute complications are more common with type 1 diabetes due to the challenge of adjusting the insulin dosage to match the body's needs. A relatively frequent complication is hypoglycemia, a state of low blood sugar that can occur if a higher dose of insulin than is necessary is taken or if caloric intake is inadequate. An acute hypoglycemic episode can result in seizures or loss of consciousness, which can cause injury and occasionally death.

Another acute complication is ketosis, or ketoacidosis. This can occur when the body does not get enough insulin, such as happens with uncontrolled type 1 DM. When the body has insufficient insulin, it is unable to use the glucose in the bloodstream and instead begins to use fat for energy. Excessive breakdown of fat molecules results in the production of organic acids called ketones. Symptoms of ketosis can include dehydration and excessive thirst, fatigue, nausea, and mental confusion. The individual can have a fruity smell to the breath. Untreated ketosis can lead to coma and death.

Chronic complications can arise with any type of diabetes, but are more common in those whose diabetes has been poorly controlled and/or those who have had diabetes for many years. Common chronic complications can be further subdivided into macrovascular complications (those that result from atherosclerotic disease and damage to the large arteries) and microvascular complications (those that result from atherosclerotic disease and damage to small vessels and other tissues).

Macrovascular complications include coronary artery disease, cerebrovascular disease, and peripheral arterial disease. Since heart disease and stroke account for about two-thirds of deaths among people with diabetes,⁷ it is important to recognize early signs of atherosclerosis. Peripheral arterial disease can result in lower extremity amputations. Macrovascular complications can be revealed by EKGs, exercise stress tests, echocardiograms, angiography, carotid Doppler, and other tests.

Microvascular complications include nephropathy (i.e., kidney disease) and retinopathy, a disorder of the blood vessels in the retina of the eye. Microvascular complications are important to note because they are the earliest indicators of vascular disease. In addition to serving as a marker for advanced atherosclerosis, both nephropathy and retinopathy each have significant mortality and/or morbidity implications.

Diabetic nephropathy is a leading cause of renal failure. The presence of nephropathy can be detected by checking the serum creatinine level on the blood profile or by testing for the presence of protein and/or microalbumin on a urinalysis. Treatment with one of a class of

medications called angiotensin-converting enzyme (ACE) inhibitors (e.g., lisinopril, ramipril, enalapril) can slow the progression of kidney damage.

Retinopathy is a leading cause of blindness. The microvascular changes in the blood vessels in the retina cause them to become fragile and they can bleed, which can result in blindness. Retinopathy can be described either as mild background retinopathy, which is mild damage to the retina, or as proliferative retinopathy, which is a more advanced condition involving the growth of new blood vessels in the retina. Proliferative retinopathy can be treated with laser therapy, which can prevent or delay blindness. The presence of retinopathy can be detected through regular ophthalmological exams.

Some chronic complications do not fit neatly into the macrovascular or microvascular subdivisions. An example is neuropathy, a disorder of the nerves that often presents as a painful sensation, or lack of sensation, in the toes and feet. Diabetic neuropathy can result in disability.

Prevalence and Mortality/Morbidity Implications

Diabetes in its various forms is found in all areas of the world, although currently, the prevalence of diagnosed diabetes is higher in developed countries than in developing countries. However, the greatest increases in prevalence of diabetes are expected to be in developing countries. It is estimated that in 2017 approximately 425 million individuals worldwide have diabetes.⁸ Global mortality from diabetes was higher than the number of deaths from infectious diseases including HIV/AIDS, tuberculosis, and malaria combined.⁹

In the U.S., as of 2015, the Centers for Disease Control estimated over 30 million Americans, or 9.4% of the population have diabetes.¹⁰ The Canadian Diabetes Association estimates that in 2015, approximately 3.9 million Canadians (9.3%) have diabetes.¹¹ The prevalence of diabetes in both countries is rising due to the increasing age of the population, the trend toward sedentary lifestyles, and the increasing incidence of obesity.

The prevalence of diabetes in both the U.S. and Canada differs based on race/ethnicity. In the U.S., Native Americans, particularly those in the southwestern U.S., have the highest percentage of individuals with diabetes. Non-Hispanic blacks and Hispanic/Latino Americans also have a higher prevalence of diabetes than non-Hispanic whites and Asians.¹² In Canada, aboriginal populations are three to five times more likely than the general population to develop type 2 diabetes.¹³

There are no clear risk factors for type 1 diabetes. However, several factors have been identified that indicate an increased risk of developing type 2 diabetes. These include pre-diabetes (IGT or IFG), history of gestational diabetes, obesity, and age. Family history of type 2 diabetes also appears to increase the risk of developing that disorder. It is not clear how much of this is due to genetic factors and how much is attributable to environmental or lifestyle factors that are similar among family members, such as eating or exercise habits.

Researchers are hoping to find ways to prevent or delay the development of type 2 diabetes in those that are at risk for the disease. The most effective means of prevention at this time is lifestyle change focusing on healthier eating habits, weight loss, and exercise.

Assessing the mortality and/or morbidity risk for individuals with diabetes involves a careful evaluation of the following factors:

1. type of diabetes – Type 1 diabetes has a greater mortality/morbidity risk than does type 2 and can be more difficult to control.
2. treatment – If the type of diabetes is not stated, some assumptions can be made based on the treatment. However, this should be done cautiously, as there are some type 2 diabetics who can require insulin therapy. Those type 2 diabetics on insulin can present a greater risk than those on oral medications alone, as this can imply a condition that is more difficult to control.
3. degree of blood sugar control – If possible, the evaluation of blood sugar control should be based on more than just a single test result. It is preferable to review the average blood sugar level over a period of several years. The A1c level is the preferred test to indicate blood sugar control. The better the blood sugar control, the fewer the complications and the less damage from hyperglycemia at both the cellular and organ level. Compliance with medical treatment is vital to achieving good blood sugar control and avoiding complications. Self-monitoring of blood glucose levels and regular follow up with a physician are good indicators of compliance.
4. duration of the disease – Longer durations generally result in higher risk, as the effects of the disease accumulate over time.
5. presence or absence of diabetic complications – Microvascular complications are often the first to be detected. Retinopathy noted during an eye exam or protein found on a routine urinalysis may indicate the presence of generalized atherosclerosis.
6. co-morbidities – The presence of other impairments, such as hypertension, hyperlipidemia, obesity, and smoking, tend to accelerate the progression of complications, and thus increase the mortality/morbidity risk.

Conclusion

Diabetes is a common impairment in the insurance buying population, with significant mortality and morbidity implications. Life and health underwriters must become familiar with the types of diabetes, the tests used to diagnose and monitor diabetes and diabetic complications, and methods of treatment in order to accurately assess the degree of mortality or morbidity risk.

Case Study

A 48-year-old male smoker stated on his life insurance application that he was diagnosed with diabetes three years prior. He is treated with metformin, an oral medication. Since his diagnosis, he has lost 15 pounds through diet and exercise. He sees his doctor every six months for routine follow up and sees an ophthalmologist annually for eye exams. The following information was obtained on the insurance exam and lab studies:

Build:	5 feet 10 inches (178 cm), 245 lb (113 kg)
Fasting Glucose:	135 mg/dl (normal 60-109)
A1c:	8.5 % (normal <6.0)
Serum creatinine:	0.7 mg/dl (normal 0.7-1.5)
Urinalysis:	All test results normal

Questions to consider:

1. What type of diabetes does this person likely have?
2. Identify at least three favorable risk factors in this scenario.
3. Identify at least three unfavorable risk factors in this scenario.

Case Study Discussion

The individual in the case study likely has type 2 diabetes. The age at onset, treatment with oral medication, and history of overweight are all consistent with type 2 DM.

Favorable risk factors include his intentional weight loss (since weight loss can result in better blood sugar control), his regular follow up with his physician and an ophthalmologist (which provides the opportunity for earlier detection and treatment of any complications), and the normal serum creatinine and normal urinalysis (indicating a lower likelihood of renal complications).

His current fasting glucose is not unfavorable, but is not as meaningful as the A1c reading, and thus cannot be considered a favorable or unfavorable factor.

Unfavorable risk factors include his continued smoking (which multiplies the already high risk of atherosclerosis), his build (he is still significantly overweight despite having lost some weight), and his current A1c reading (indicating less than acceptable blood sugar control).

APPENDIX
(For student's information only; this material will not be tested.)

SELECTED DIABETIC MEDICATIONS

Insulins

Rapid or short acting:

- aspart (Novolog®)
- glulisine (Apidra®)
- lispro (Humalog®)
- regular (Humulin R®, Novolin R®)

Intermediate or long-acting:

- degludec (Tresiba®)
- detemir (Levemir®)
- glargin (Lantus®, Toujeo®)
- NPH (Humulin N®, Novolin N®, ReliOn®)

Non-insulin injectables

- amylin (Symlin®, Symlinpen®)
- dulaglutide (Trulicity®)
- exenatide (Byetta®)
- liraglutide (Victoza®)

Oral medications

Hypoglycemic agents (work by increasing insulin production)

- chlorpropamide (Diabinese®)
- glimepiride (Amaryl®)
- glipizide (Glucotrol®, Glucotrol XL®)
- glyburide (Diabeta®, Glynase®, Micronase®)
- nateglinide (Starlix®)
- repaglinide (Prandin®)

Sensitizers (work by decreasing glucose production and increasing insulin sensitivity)

- metformin (Glucophage®, Glucophage XR®, Riomet®)
- pioglitazone (Actos®)
- rosiglitazone (Avandia®)

Starch blockers (work by slowing the breakdown of carbohydrates in the intestines)

- acarbose (Precose®)
- miglitol (Glyset®)

DPP-4 Inhibitors (work by increasing insulin production and decreasing glucose production)

- linagliptin (Tradjenta®)
- saxagliptin (Onglyza®)
- sitagliptin phosphate (Januvia®)

SGLT2 Inhibitors (work by helping the kidneys remove glucose from the bloodstream through the urine)

- canagliflozin (Invokana®)
- dapagliflozin (Farxiga®)

empagliflozin (Jardiance®)

Combination oral agents

glipizide + metformin (Metaglip®)

glyburide + metformin (Glucovance®)

pioglitazone + glimepiride (Duetact®)

pioglitazone + metformin (Actoplus met®)

sitagliptin + metformin (Janumet®)

Review Questions – ALU 101, Chapter 3

1. The best test for monitoring blood sugar is the:
 1. glucose tolerance test
 2. random blood glucose
 3. glycohemoglobin
 4. fasting blood sugar

 2. All of the following statements regarding ketoacidosis are correct EXCEPT:
 1. It can result from uncontrolled type 1 diabetes.
 2. Its symptoms include dehydration and nausea.
 3. It leads to a hypoglycemic state.
 4. It is caused by excessive breakdown of fat molecules.

 3. The laboratory tests used to diagnose diabetes include which of the following?
 - A. oral glucose tolerance test
 - B. fasting serum creatinine test
 - C. fasting blood glucose test
- Answer Options:
1. A only is correct.
 2. C only is correct.
 3. A and C only are correct.
 4. A, B, and C are correct.
-
4. List six factors underwriters need to consider when assessing the mortality and morbidity risk of individuals with diabetes.

 5. Describe the difference between microvascular and macrovascular diabetic complications.
List at least two examples of each complication.

6. Complications of diabetes can include which of the following:
- coronary artery disease
 - retinopathy
 - hepatitis
- Answer Options:
- A and B only are correct.
 - A and C only are correct.
 - B and C only are correct.
 - A, B, and C are correct.
7. A disorder of the nerves that can result from diabetes mellitus is:
- retinopathy
 - nephropathy
 - gammopathy
 - neuropathy
8. Name the five risk factors for metabolic syndrome and indicate how many of them need to be present for the diagnosis to be made.
9. Describe the three types of treatment for diabetes and the type of diabetes with which each is most commonly associated.
10. List the risk factors for developing gestational diabetes. At what point during pregnancy is a female tested for it?

Answers and Sources of Review Questions

Review Question 1

Answer 3: glycohemoglobin – page 3.

Review Question 2

Answer 3: It leads to a hypoglycemic state – page 5.

Review Question 3

Answer 3: A and C only are correct – page 3.

Review Question 4

Refer to page 7.

Review Question 5

Refer to pages 5-6.

Review Question 6

Answer 1: A and B only are correct – page 5.

Review Question 7

Answer 4: neuropathy – page 6.

Review Question 8

Refer to page 2.

Review Question 9

Refer to pages 3-4.

Review Question 10

Refer to page 2.

CHAPTER 4

CANCER

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Revised 2020

CANCER

Background

Cancer is a class of diseases or disorders characterized by uncontrolled cell proliferation and the ability of these cells to invade other tissues through either direct growth into adjacent tissue or metastasis. It is the second leading cause of death in the United States. It can affect people of all ages, but its risk tends to increase with age. Most cancers present as solid tumors, although some, including the leukemias and polycythemia vera, do not.

Cell proliferation is a physiological process that occurs in almost all tissues. Normally the balance between cell proliferation and cell death is regulated through a process called apoptosis, which is a type of programmed cell death that occurs in an orderly manner for the benefit of the entire organ system. Apoptosis is tightly regulated to ensure the integrity of all organs and tissues. Disruption in normal cell proliferation and death occurs as a result of damage to DNA, which causes mutations in genes that encode for proteins that control cell division, causing uncontrolled growth.

DNA mutation can be caused by several factors, including exposure to physical or chemical carcinogenic agents, age, exposure to radioactive materials, genetics, repeated cell injury due to chronic inflammation, certain viruses such as hepatitis B, and HPV or exposure to environmental factors. The resulting uncontrolled and often rapid proliferation of cells can lead to the development of either benign or malignant tumors.

Benign Tumors

Benign tumors lack the ability to invade neighboring tissue or metastasize, generally have a slower growth rate than malignant tumors, and their cells usually have normal features. While most benign tumors have no mortality risk, some have the potential to adversely affect mortality and morbidity.

Benign tumors with higher risk potential include:

1. tumors that have the ability to undergo malignant transformation—Some actually have foci (areas) of cancer cells present when they are resected (i.e, removed). Hepatocellular adenoma is an example.
2. tumors that arise as part of a syndrome that is associated with a high risk of future cancer—Two examples are familial polyposis syndrome, which increases the risk of future colon cancer, or dysplastic nevus syndrome, which can increase the risk of melanoma.
3. highly vascular tumors that have the potential to hemorrhage, particularly with trauma or attempted surgical resection
4. tumors that have aggressive variants capable of locally invasive behavior and even of metastasizing — Meningioma is one example.
5. tumors that, due to their location, that cause a mass effect, resulting in either damage to surrounding tissue due to pressure from the mass or obstruction—The most common examples include benign tumors of the brain and spinal cord, causing neurological deficits, of the heart, causing obstructive heart conditions, and large colon polyps causing bowel obstruction.

6. endocrine tumors, which often release large quantities of hormones that can lead to complications which can be life-threatening—examples include tumors in the adrenal gland (causing hypertension), in the pituitary (causing acromegaly and cardiomyopathy from excessive growth hormone), in the parathyroid (causing hypercalcemia with resultant cardiac arrhythmia), and in the thyroid (causing thyroid storms with high output cardiac failure and tachyarrhythmia)

Because of the potential mortality risk present with some of the benign tumors described above, it is important to have a specific description and diagnosis of the tumor, preferably in the form of a pathology report, when possible.

Cancer

Unlike benign tumors, malignant tumors have the ability to invade other organs, metastasize, and become life threatening. Malignant tumors have several characteristics that both define them and enhance their ability to proliferate (see Table 1). These include:

1. the ability to evade apoptosis
2. unlimited growth potential due to overexpression of oncogenes which promote cell growth, and/or inhibition of tumor suppressor genes which inhibit cell division such as BRCA 1 and 2 mutations
3. increased rate of cell division (i.e., mitotic rate)
4. the altered ability of cells to differentiate
5. the ability to generate/promote blood vessel growth (i.e., angiogenesis).

Microscopic findings in cancer include:

1. large number of rapidly dividing cells
2. variation in nuclear size and shape
3. variation in cell size and shape
4. loss of specialized cell features specific to the organ
5. loss of normal tissue organization
6. poorly defined tumor boundary.

Progression of Normal Cells to Malignant Cells

A malignant tumor occurs as a result of DNA mutations that alter the normal balance of cell proliferation and death, which causes the rapid growth of abnormal cells that invade other organs and metastasize to other parts of the body. While some DNA mutations are genetic, most are the result of repeated injury to the DNA that eventually causes transformation of the cells. Some common terms associated with this transformation include:

1. hyperplasia — an increase in the number of normal cells due to an excessive rate of cell division
2. atypical hyperplasia — cells that are not normal but may not be abnormal enough to be considered dysplastic
3. dysplasia — abnormal type of excessive cell proliferation characterized by loss of normal tissue arrangement and cell structure — can be described as mild to severe
4. carcinoma in situ — a group of abnormal cells, considered to be either a noninvasive cancer or a pre-cancerous condition—Many types have a high probability of progression to invasive cancer, although this is variable depending on the site.
5. invasive cancer — malignant proliferation of cells with the ability to invade other tissue and metastasize.

Table 1. Characteristics of Benign and Malignant Tumors.

	<i>Benign</i>	<i>Malignant</i>
Growth Pattern	Expansion	Infiltration
Growth Rate	Slow	Often rapid (variable)
Cells	Normal	Near normal to anaplastic
Mitotic activity	Little or none	Minimal to extensive
Metastasis	Extremely rare	Common
Effect on host	Usually insignificant	Fatal if untreated

Cancer Diagnosis

Signs and Symptoms

The most important prognostic factors associated with a malignancy are stage and grade of cancer. In general, the earlier the malignancy can be diagnosed and treated, the more favorable the prognosis. Grade is related to the degree of aggression as it relates to how different the cancer cell looks compared to the normal cell, which will be discussed later in this section. One of the biggest challenges to early diagnosis is that most people are asymptomatic in the early stages of the disease, or the symptoms are mild and vague, and therefore easy to ignore. Because of this, regular physical exams and screening at the appropriate ages in relationship to their risk factors are extremely important.

Warning signs that can be suspicious of an underlying malignancy include:

1. change in bowel or bladder habits
2. a sore that does not heal
3. unusual bleeding or discharge
4. thickening or lump
5. indigestion or difficulty swallowing

6. obvious change in a wart or mole
7. nagging cough or hoarseness.

From an underwriting perspective, if medical records document a recent history of these findings, additional testing may be warranted. Other signs or symptoms that can be a cause for concern include:

1. unexplained weight loss
2. poor appetite
3. anemia
4. night sweats
5. thrombosis
6. increased fatigue.

Cancer Screening

Regular screening tests play an important role in the early detection of cancer. Common routine tests include Pap smear for cervical cancer screening, breast self-exams and mammography for breast cancer screening, occult blood testing of stool for colorectal cancer screening, and digital rectal exam (DRE) and PSA for prostate cancer screening. Routine colonoscopy is also recommended for colorectal cancer screening. The age for first colonoscopy and frequency of screening depends on factors such as family history, history of polyps, and presence of symptoms. Additional screening for select groups may include chest radiographic imaging in tobacco smokers or those with asbestos exposure.

Tumor Markers

Tumor marker is a general term used to describe a variety of tests associated with the risk of cancer. With the exception of prostate specific antigen (PSA), none of the others are used for screening in the general population. However, there are some that are used to screen high-risk individuals only.

These markers are also used to follow treated cancer patients. If their levels become elevated, that can be the first clue to tumor recurrence. A full review of tumor markers is beyond the scope of this chapter since there are hundreds of them, each used in one or more specific tumor contexts. Some of the tumor markers most widely used and most often seen in underwriting include:

1. PSA – for prostate cancer
2. carcinoembryonic antigen (CEA) – for colorectal, gastric, pancreatic, lung, breast, thyroid cancer
3. alpha-fetoprotein (AFP) – for hepatocellular, testicular, metastatic liver cancer.
4. thyroglobulin and thyroglobulin antibody – for thyroid cancer especially papillary thyroid

Cancer Pathology

Biopsy

A biopsy is an invasive procedure that involves the removal of tissue or sampling of cells for microscopic evaluation by a pathologist to determine whether a lesion is benign or malignant and to identify the specific characteristics of the lesion in order to determine the most appropriate course of treatment and follow-up. *Definitive diagnosis of cancer can only be determined after microscopic examination of the tumor tissue.*

The method used to obtain the sample depends on several factors, including the location of the lesion, the size of the lesion, and the suspicion of the presence of an underlying malignancy. Common methods for obtaining samples for biopsy include:

1. excisional biopsy — excision of entire tumor or suspicious area (e.g., excisional breast biopsy)
2. incisional/core biopsy — a sample of tissue is removed with preservation of the histological architecture of the tissue's cells (e.g., punch biopsy of suspicious mole, liver biopsy)
3. needle aspiration biopsy — a sample of cells is removed through aspiration with a needle (e.g., thyroid fine needle aspiration).

Common Types of Cancer

After a biopsy has been completed, the pathologist will perform a complete evaluation of the tissue submitted to determine the significant characteristics of the lesion. This is extremely important in assessing prognosis and appropriate treatment methods, as well as underwriting assessment of mortality risk. The most common types of cancer include:

1. carcinoma — cancer that arises from epithelial cells, which line the surfaces of the body—
Types of carcinomas include adenocarcinoma, squamous cell carcinoma, anaplastic carcinoma, large cell and small cell carcinoma.
2. sarcoma — malignant tumor composed of bone, cartilage, fat, nerve tissues— Examples include osteosarcoma, chondrosarcoma, liposarcoma, leiomyosarcoma.
3. melanoma — malignant tumor of melanocytes and, less frequently, of the retinal pigment epithelial cells
4. lymphoma — cancer that originates in lymphocytes and circulates in the vessels of the lymphatic system—Examples are Hodgkin lymphoma and non-Hodgkin lymphoma.
5. leukemia — cancer of the blood or bone marrow, which involves an abnormal proliferation of blood cells, usually white blood cells.

The names of nearly all solid tumors end in -oma and most words ending in this suffix are neoplasms (see Table 2). However, there are some exceptions. One example of a non-neoplastic lesion ending in -oma is atheroma, which is an atherosclerotic deposit in an artery.

Table 2. Common Benign and Malignant Tumors, By Tissue of Origin.

Origin	Benign	Malignant
Tissue		
Squamous epithelium	Papilloma	Carcinoma
Glandular epithelium	Adenoma	Adenocarcinoma
Connective Tissue		
Bone	Osteoma	Osteosarcoma
Cartilage	Chondroma	Chondrosarcoma
Striated muscle	Rhabdomyoma	Rhabdomyosarcoma
Smooth muscle	Leiomyoma	Leiomyosarcoma
Adipose tissue	Lipoma	Liposarcoma
Fibrous tissue	Fibroma	Fibrosarcoma
Blood vessels	Hemangioma	Angiosarcoma
Nervous System	Neurofibroma, Schwannoma Ganglioma	Astroblastoma Astrocytoma Glioblastoma
Lymphoreticular cells	Lymphoid hyperplasia	Lymphoma
Melanocytes	Nevus	Melanoma
White blood cells	---	Leukemia
Red blood cells	---	Polycythemia
Plasma cells	---	Myeloma
Pluripotent cells	Mature teratoma*	Immature teratoma
Trophoblastic cells	Hydatidiform mole	Choriocarcinoma

*Some “mature” teratomas are truly benign; others metastasize.

An adenoma can give rise to an adenocarcinoma. This occurs via a stepwise series of gene mutations. These changes can transform a (usually) harmless benign tumor, genetically programmed for limited growth and lacking the capacity for invasive behavior, into a malignant tumor capable of invading nearby organs and, with further mutations in certain genes, metastasizing to regional and distant sites.

Tumor Grading and Staging

The most essential document in tumor underwriting is the pathology report, which is written by the pathologist who has thoroughly examined the tumor. Many times, there will be more than one pathology report for a tumor. The first one is usually from the initial biopsy and the second one will be from any additional surgical procedure completed.

Examples of situations in which more than one pathology report is present include:

1. prostate biopsy results followed by the pathology report after prostatectomy is performed
2. punch biopsy results for melanoma followed by pathology report after wide excision to clear margins
3. pathology report after lumpectomy for invasive breast cancer followed by pathology report for subsequent mastectomy and lymph node dissection.

A pathology report that reports the findings for an entire lesion and its surrounding tissue will provide the most accurate assessment of stage and grade of tumor.

Tumor Grade

The grade of a malignant tumor correlates with its aggressiveness and thus the degree of the risk of local, regional, and distant metastasis. Differentiation is the extent to which cancer cells differ from normal cells; the more poorly differentiated the cancer cells are from the normal cells, the more aggressive the cancer is, with a less favorable prognosis. *Grade is thus a key predictor in cancer survival, along with stage.*

The conventional grading system for cancer is:

1. grade 1 — well-differentiated
2. grade 2 — moderately differentiated
3. grade 3 — poorly differentiated
4. grade 4 — undifferentiated, anaplastic.

Grade 1 and 2 tumors can be referred to as “low grade,” whereas grade 3 and 4 malignancies are often collectively called “high grade” cancer. When DNA mutations are significant, this would be revealed by the phenotype of a cell. So a cancer cell that looks markedly different from the normal cell, correlates with high grade or poorly differentiated cancer. Poorly differentiated means the cell cannot be identified to a specific tissue type, thus undifferentiated. If the cancer cell has much resemblance to a normal cell, this would suggest fewer DNA variations from normal and would indicate a well differentiated or low grade type of cancer. As a rule of thumb, the higher the grade, the greater the mortality risk. This is not true in all cases, however, and sometimes the differences between the grades are not significant as far as the risk of death, after adjusting for other considerations. An example of improved survival with high grade tumors are lymphomas. Often the aggressive high-grade lymphomas have better prognosis than the low- grade or indolent lymphomas because these high-grade lymphomas avidly take up these toxic chemotherapy agents to render cancer cell death, whereas chemotherapy may be less effective on those slow, indolent type lymphomas.

Staging

Staging of a cancer is a tool that takes into account several factors including:

1. size of a tumor
2. depth of penetration into and/or through an organ
3. whether it has invaded adjacent organs
4. if and how many lymph nodes are involved
5. presence of distant metastasis.

Staging criteria vary with different types of cancer. *The stage and grade of the cancer at the time of diagnosis are the biggest predictors of survival.*

Clinical staging is based on all available information obtained before surgery is performed to remove a tumor or if non-surgical treatment is planned. It is usually based on physical exam, labs, imaging and pathology findings in the biopsy report. A common example of clinical staging is found with prostate cancer. This is based on results of DRE (digital rectal exam), PSA testing and prostate needle biopsy report. The limitation of clinical staging is that it can underestimate the actual stage of the cancer.

Pathologic staging is based on the microscopic findings of the pathologist after complete removal of the tumor. It is considered the most accurate method of staging since it is based on direct examination of the entire tumor and surrounding tissue including pathological evaluation of regional lymph nodes.

The staging process requires an extensive workup. Components of the workup include:

1. thorough physical examination
2. laboratory tests that include liver function tests and CBC
3. biopsies of sites such as the lymph nodes and bone marrow
4. tests such as x-rays, computerized tomography (CT), magnetic resonance imaging (MRI), and sometimes positron emission tomography (PET) scans.

There are two main staging systems. The first assigns staging numerals. While each kind of cancer has its own specific staging criteria, this is a basic example of how staging numerals correlate with the extent of disease:

1. stage 0 — in situ tumor
2. stage I — organ-confined tumor
3. stage II — invasion of adjacent areas or nearby lymph nodes
4. stage III — regional metastases
5. stage IV — distant metastases

Letters are used to expand the staging system, such as stage IA, IIB, IVC and so on.

The other staging approach is called the TNM system. The letters stand for tumor size (T), lymph node metastasis (N) and distant metastasis (M). Each component is separately listed and paired with a number to further identify the stage. The criteria for TNM staging criteria will vary based on the type of cancer.

1. tumor (T)
 - a. refers to primary tumor
 - b. carries a numerical value of 0-4, based on size and degree of invasion
 - c. Tis designation represents carcinoma in situ
 - d. Tx means that the tumor cannot be evaluated
2. node (N)
 - a. represents regional lymph node involvement.
 - b. has a numerical value which indicates the number and location of involved lymph nodes—
The criteria will vary based on type of cancer.
3. metastasis (M)
 - a. represents presence of distant metastasis
 - b. M0 indicates no distant metastasis
 - c. M1 indicates metastasis to distant organs (beyond regional lymph nodes).

Other Pathology Report Factors

There are many other findings on pathology reports that can significantly influence survival. These are pathology report findings that have survival implications for most malignancies:

1. Vascular invasion refers to the presence of cancer cells in lymphatic or blood vessels. This can also be called “lymphovascular invasion.” When it is present, the likelihood of metastatic disease is significantly increased.
2. Mitotic rate is a marker for how rapidly the cells are dividing, which indicates how fast the tumor is growing. Tumors with a high mitotic rate are inclined to enlarge rapidly and develop more gene mutations favoring metastasis. Mitotic rate is a major prognostic consideration in melanoma.
3. Tumor cell DNA is another clue to aggressiveness and risk of metastasis. Most malignant tumors have normal (diploid) DNA. Those with abnormal (mainly called aneuploid) DNA correlate with a higher mortality risk in most but not all kinds of cancer. The presence of solely diploid DNA – as determined by a process called flow cytometry – can be referred to as diploidy, whereas abnormal DNA can be said to exhibit aneuploidy.
4. Comedo necrosis refers to dead or necrotic cancer cells and correlates with rapid growing cancer cells causing them to die when they do not get enough nourishment. This finding is especially prognostically unfavorable in breast cancer suggesting higher grade type cancer

Cancer Treatment

There are many ways in which cancer is treated. Often several treatment approaches are used together in managing a patient. Treatment decisions are usually based on the type, location, and stage of the malignancy. These are the main methods of cancer treatment:

1. surgery — which attempts to remove the tumor or, where appropriate, the entire affected organ. The indications for surgical intervention include confirming the diagnosis (i.e., biopsy), curative treatment by excising the entire tumor and surrounding tissue, or palliative treatment to alleviate symptoms in the case of terminal cancer. Surgery can be performed by an open procedure or by using a device inserted through an incision (i.e., laparoscopic surgery).
2. radiation therapy — which involves the use of ionizing radiation as part of cancer treatment. It can be used as a primary treatment or in combination with surgery and/or chemotherapy. In cases of advanced cancer, it can be used prior to surgery in order to reduce the size of the tumor to make surgery more manageable. Radiation therapy destroys malignant cells, retards growth of a tumor that otherwise cannot be removed and relieves symptoms of metastatic disease, such as bone pain from bone metastasis. There are three types of radiation:
 - a. external beam
 - i. This is the most frequent form of radiation treatment
 - ii. The radiation beam targets a particular part of the body.
 - iii. The radiation interacts with tissues and is absorbed, damaging the DNA of the exposed cells.
 - b. brachytherapy
 - i. A radioactive source is placed inside or next to the area requiring treatment.
 - ii. It is commonly used to treat localized prostate cancer and cancers of the head and neck. It can be used to treat other malignancies.
 - c. unsealed source radiotherapy
 - i. It involves the use of soluble forms of radioactive substances which are administered to the body by injection or ingestion.
 - ii. The most common one is radioactive iodine to treat thyroid cancer.
3. chemotherapy — which can involve a wide range of cytotoxic (i.e., cell-killing) and other drugs, used individually or in groups of two or more drugs (i.e., multidrug chemotherapy). It can be used as either a curative or palliative treatment and is most commonly used in combination with other forms of treatment. It is more effective with high growth rate/metastatic cancers. In general, chemotherapeutic agents inhibit cell division in rapidly dividing cells, causing cell death. New, targeted agents are being used to attack malignant cells based on the cells' specific characteristics. They show promise and may prove to be more effective in treating cancers than non-targeted therapies.
4. hormone therapy — Some cancers, such as breast and prostate cancer, are inhibited or stimulated based on changes in hormone balance. Hormonal therapy can be used to decrease the production of or to inhibit the action of these hormones.
5. stem cell transplantation — which involves infusing healthy cells into the bone marrow
6. organ transplantation.

For some cancers, active surveillance or active monitoring is appropriate. The aim of this approach is to properly time curative treatment or the active decision not to treat the patient immediately. Treatment is held up until a predefined threshold is reached that prompts treatment. This is becoming more common with prostate cancer since most are low grade and locally confined with mean age of death in the 80s. Repeat biopsy and following PSAs at regular intervals help to determine if and when treatment is warranted.

Another approach to cancer treatment is watchful waiting. (Watchful waiting is known as symptoms guided treatment.) In this group, treatment would be palliative, not necessarily curative. This would be a choice for those with unfavorable long-term survival such as those with other medical conditions or comorbidities that have a greater impact on life expectancy than the cancer.

It is quite common now for those with cancer to use alternative and complementary therapies while also receiving conventional care. These therapies often involve the use of vitamins, minerals, herbal (plant) products, and other digestible substances. Over half of these individuals do not disclose their use of such remedies to their physician.

When underwriting cancer cases, it is important to know which types of treatment were used. Some treatments can be associated with significant complications or the risk of second malignancies that can arise years, even decades later. This is particularly important in cases of cancers in children and young adults, who were treated with radiation and/or certain chemotherapeutic drugs, since many of these individuals are cured of the original cancer and long-term survival is more likely to be impacted by the delayed effects of treatment.

Post-Treatment Follow-up

With the exception of low-risk skin cancers, all invasive cancer patients are followed for an extended interval after completion of treatment. The duration of follow-up can be shorter in some cancers than others.

The primary purposes are to detect cancer recurrence, development of new tumors, and delayed side effects of radiation, chemotherapy, and hormone therapy. Depending on the type of cancer and the stage of disease, follow-up can require the use of tumor markers, body scans, and biopsies.

Cancer recurrence can be suspected on the basis of new symptoms or findings either reported by the patient or discovered during routine exam or interim testing. Suspicious findings can require further evaluation before an underwriting assessment can be made. Signs of potential tumor recurrence include:

1. unexplained weight loss
2. persistent or worsening fatigue
3. elevation of liver-related and other blood tests
4. anemia
5. bleeding episodes
6. enlarged lymph nodes
7. localized bone pain
8. neurological abnormalities
9. deep venous thrombosis (DVT)
10. recent onset of undiagnosed or worsening symptoms.

Lack of follow-up after cancer diagnosis and treatment increases the risk of undetected recurrence, secondary cancers, or late complications as a result of treatment.

Cancer Prognosis

Cancer is the second leading cause of death overall and accounts for a disproportionate share of early death claims. Most of the success in improving cancer death rates has resulted from reducing the risk (e.g., decrease in prevalence of smoking, consuming healthier diets) and early detection when the odds of cure are highest. Overall, there has not been a significant decrease in mortality from most internal organ cancers as a result of the curative impact of newer therapies.

A favorable long-term prognosis is highest in early stage (i.e., stages I and II) cancer. Well differentiated or low grade also have more favorable prognoses. Advanced cancers that include lymph node involvement and distant metastasis generally pose a much higher mortality risk and must be carefully underwritten.

Ten Essential Questions to be Resolved in Every Cancer Case

1. What is the specific type of tumor?
2. When was it diagnosed?
3. What was the stage and grade at diagnosis?
4. Are there any pathology reports or other factors that have a significant bearing on prognosis?
5. How was the cancer treated and when did treatment end?
6. Has the proposed insured been compliant with the recommended follow-up?
7. Are there any significant interim symptoms or findings where cancer recurrence has not yet been ruled out?
8. Has there been a recurrence of the cancer and, if so, when was it and what treatment was given?
9. Is there any evidence of delayed adverse effects from treatment?
10. What is the prognosis?

Review Questions – ALU 101, Chapter 4

1. The treatment that is more effective with high growth rate/metastatic cancers is:

1. watchful waiting
2. surgery
3. radiation
4. chemotherapy

2. All of the following are common characteristics of malignant tumors EXCEPT:

1. slow growth rate
2. anaplastic cells
3. infiltrating growth pattern
4. extensive mitotic activity

3. Which of the statements regarding carcinoma in situ is/are correct?

- A. It can be a noninvasive cancer.
- B. It is reported as Tx in the TNM staging system.
- C. It can have a high probability of progression to invasive cancer.

Answer Options: 1. A only is correct.
 2. C only is correct.
 3. A and C only are correct.
 4. A, B, and C are correct.

4. Describe five ways benign tumors can impact mortality.

5. Give examples of situations in which there can be more than one pathology report.

6. An increase in the number of normal cells due to an excessive rate of cell division is:

1. hypertrophy
2. metaplasia
3. atypia
4. hyperplasia

7. All of the following are tumor markers EXCEPT:
 1. alpha-fetoprotein (AFP)
 2. carcinoembryonic antigen (CEA)
 3. C-reactive protein (CRP)
 4. prostate-specific antigen (PSA)
8. Describe the 10 essential questions to be answered when evaluating a proposed insured with a cancer history for life insurance.
9. What are the three common methods for obtaining samples for biopsy?
10. What does the TNM acronym for staging cancer stand for and what are the staging criteria for each?

Answers and Sources of Review Questions

Review Question 1

Answer 4: chemotherapy – page 10.

Review Question 2

Answer 1: slow growth rate – page 3.

Review Question 3

Answer 3: A and C only are correct – page 2.

Review Question 4

Refer to pages 1-2.

Review Question 5

Refer to page 6.

Review Question 6

Answer 4: hyperplasia – page 3.

Review Question 7

Answer 3: C-reactive protein (CRP) – page 4.

Review Question 8

Refer to page 12.

Review Question 9

Refer to page 5.

Review Question 10

Refer to pages 9.

CHAPTER 5

CORONARY ARTERY DISEASE

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CORONARY ARTERY DISEASE

Introduction

Despite recent advances in the understanding and treatment of coronary artery disease (CAD), it remains the number one killer in the United States today, accounting for approximately 370,000 deaths annually. Unfortunately, 30% of the time, the initial manifestation of CAD is sudden cardiac death, so it is important for the underwriter to be aware of not only those proposed insureds with established CAD but also those with a propensity to develop the condition.

Anatomy and Physiology

The heart, a four-chambered muscular structure, is the major organ of the circulatory system supplying the power to propel the blood through the body. The function of the circulatory system, which also includes the lungs, arteries, veins, and capillaries, is to transport oxygen and nutrients to the body's cells and carry away the waste materials of cellular metabolism. The heart, about the size of a clenched fist, is located left of center in the chest cavity between the lungs and under the breastbone or sternum. It is composed of three layers:

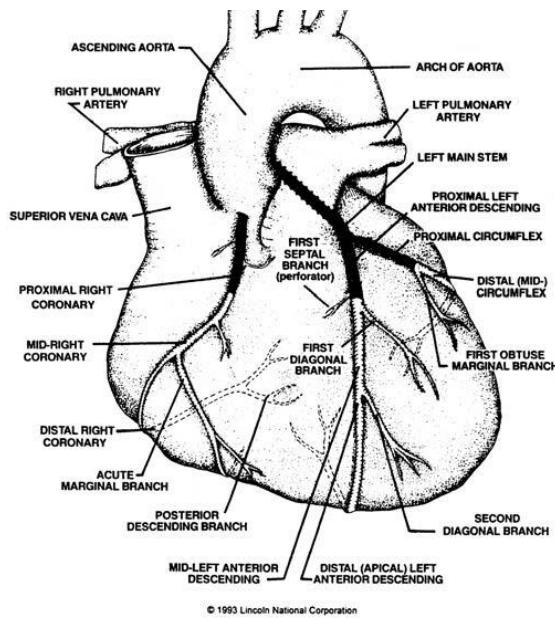
1. the inner endocardium
2. the middle muscular myocardium
3. the double-layered outer sac, the pericardium.

The four chambers of the heart are the two top chambers or atria that receive blood in diastole (relaxation) and the two bottom muscular chambers or ventricles that propel the blood in systole (contraction). The conduction system of the heart is responsible for coordinating this motion. The heart also has four valves, which are thick, flexible structures that, when working correctly, ensure that blood flows in the correct direction. The two atrioventricular valves—the right-sided tricuspid valve and the left-sided mitral valve — separate the atria from the ventricles. When open in systole, the two semilunar valves — the pulmonic valve on the right and the aortic valve on the left—allow the flow of blood from the ventricles into the major arteries of the body.

The circulatory system can be divided into two separate entities: the pulmonary circulation and the systemic circulation, which includes the coronary circulation. The pulmonary circulation supplies blood solely to the lungs. Oxygen-depleted blood is carried to the right atrium of the heart via the superior and inferior vena cavae, the main veins of the body. This blood subsequently passes through the tricuspid valve into the right ventricle. With ventricular systole, the blood then passes through the pulmonic valve and into the lungs via the pulmonary artery. Accumulated carbon dioxide is exchanged for oxygen in the pulmonary capillaries in the lungs. This oxygenated blood is then transported through the pulmonary veins to the left side of the heart. The pulmonary circulation is the only place in the body where veins traveling toward the heart carry oxygenated blood, while arteries traveling away from the heart carry oxygen-depleted blood.

The systemic circulation takes over at this point in order to supply the body with this oxygenated blood and also with nutrients obtained through the digestive process. Once oxygenated blood returns to the left atrium from the lungs, it travels through the mitral valve and into the left ventricle. With systole, the blood is then ejected through the aortic valve into the aorta, the main artery of the body. The aorta eventually branches into smaller arterioles, which merge into the capillary network, very thin vessels where the exchange of nutrients and waste products occur. The capillary network then joins the venules that merge to become veins, which eventually become the vena cavae that carry this waste-laden blood back to the right side of the heart. This completes the circulatory process.

Since the heart muscle requires more oxygen than any other organ in the body except the brain, a large amount of blood is required to meet its oxygen needs. This coronary circulation is achieved via the coronary arteries (right and left), which branch off the ascending aorta. The left main (LM) coronary artery extends approximately 0-10mm before it bifurcates into the left anterior descending artery (LAD) and the left circumflex (LCx). The LAD runs down the front of the heart to its apex and supplies the anterior wall, the anterolateral wall, and the septum via its branches of diagonals and septal perforators. The LCx travels towards the back of the heart and supplies the lateral wall via its obtuse marginal branches. The right coronary artery (RCA) gives rise to the acute marginal that supplies the thin walled right ventricle, and most of the time to the posterior descending artery (PDA) that is responsible for supplying the inferior and posterior walls of the left ventricle.



Pathophysiology

While the blood flow through the coronary arteries can be affected by various conditions such as vasculitis, aneurysms, or spasm, usually the pathology that leads to the demise of an individual

is atherosclerosis. This is a systemic degenerative process that involves the gradual accumulation of a fatty-fibrous material on the inside walls of large and medium-sized arteries, eventually compromising blood flow and causing ischemia (lack of oxygen) in the involved organ. It affects not only the coronary arteries, often leading to angina and myocardial infarction (MI), but also the cerebral vessels causing cerebral vascular accidents (CVAs), the peripheral arteries causing the painful claudication of peripheral arterial disease (PAD), and the aorta causing aneurysm formation. The presence of vascular disease in any one of these areas significantly increases the likelihood of disease in the other vascular distributions.

The atherosclerotic lesion begins in childhood as the “fatty streak,” an accumulation of smooth muscle cells and lipids in the intima or inner layer of the blood vessel in response to some injury. As the individual ages, this lesion evolves into the atheroma and fibrous plaque of atherosclerosis via further accumulation of lipid-laden smooth muscle cells, connective tissue, and calcium. When this lesion impinges on the lumen of the blood vessel, blood flow is often impeded. However, atherosclerosis is generally asymptomatic until the vessel is 70-80% obstructed. At that point, a reduction of blood flow to the myocardium produces angina (chest pain), especially during exercise or stress, which are conditions that increase the oxygen requirement of the heart. Unfortunately, the progression of CAD is neither linear nor predictable. A mild lesion can undergo significant progression in a short period of time. At least half of all myocardial infarctions are caused by lesions of less than 50% obstruction and are the result of plaque hemorrhage or rupture with subsequent thrombus causing total occlusion of the vessel.

Cardiovascular Risk Factors

Major Risk Factors

Epidemiologic studies have shown that atherosclerosis is a multifactorial disease with a variety of risk factors, which frequently act synergistically, increasing the likelihood that atherosclerotic plaque will develop and progress in the arterial beds. Besides the unmodifiable risk factors of age, gender, and family history, the most important and modifiable risk factors include hyperlipidemia, smoking, hypertension, and diabetes. The importance of these risk factors is influenced by gender, with diabetes and low HDL cholesterol being more significant in females and smoking being more significant in males. Modification of risk factors is an important method of preventing, retarding, or even reversing the progression of atherosclerotic heart disease and of stabilizing atherosclerotic plaque, which reduces the risk of rupture and coronary thrombosis.

1. *age and gender* – Males are more likely than females to develop CAD; the age adjusted incidence of coronary heart disease (CHD) in males is 12.5 for every 1000 person-years while in females it is 4 for every 1000 person-years. This is believed to be secondary to the beneficial effect of endogenous estrogens on serum lipids, as CHD rates in females after menopause are two-to-three times those of females the same age before menopause. Studies suggest that the use of post-menopausal hormone replacement, however, does not improve cardiovascular risk. It can, in fact, increase the likelihood of a female having a myocardial infarction, so hormone replacement therapy (HRT) is no longer recommended

for the prevention of CAD. The incidence and prevalence of CAD increases sharply with age; the average annual rate of first major cardiovascular event increases from 3 per 1000 in males 35-44 years old to 74 per 1000 in males in the 85-94 age group. For females, comparable rates occur ten years later in life.

2. *family history* – Individuals with at least one parent with premature CAD (before age 55 in a father or 65 in a mother) have a two-fold increase in risk for a cardiovascular event even after adjusting for other cardiovascular risk factors. The risk is also increased if a sibling has CAD.
3. *hyperlipidemia* – There is a strong association between CAD risk (and associated mortality) and altered lipid levels: (elevated total cholesterol [TC], elevated low-density lipoprotein cholesterol [LDL-C], low high-density lipoprotein cholesterol [HDL-C] and elevated triglycerides). The relationship between these lipid components can be expressed by the following equation: $TC = LDL + HDL + TG/5$. Since elevated HDL-C levels protect against CAD, the cholesterol/HDL ratio and non-HDL cholesterol levels appear to be valuable methods of assessing cardiovascular risk. Several studies have shown that lowering total cholesterol (in reality, the lowering of LDL-C) decreases this risk. Lowering of total cholesterol produces a 25% to 35% reduction in adverse coronary events, with a 2% reduction in infarction rates for every 1% reduction in total cholesterol.
4. *smoking* – Numerous studies have shown that cigarette smoking increases the incidence of and mortality from CAD. These are increased two- to three-fold when smokers are compared with non-smokers. Continued tobacco use after a coronary event increases the risk of reinfarction and sudden death in the future. There are significant health benefits to smoking cessation, with the risk of further cardiac events halved after one year of smoking cessation and a further decrease in risk in those who persisted in smoking cessation. Pipe, cigar, and passive smoking also carry a small but real cardiovascular risk. There are no long-term studies on the cardiac effects of e-cigarettes (i.e., battery-operated devices designed to deliver nicotine in vapor instead of smoke). It is believed that the ability of nicotine to increase heart rate and blood pressure predisposes those with established heart disease to complications. The role of e-cigarettes in the development of atherosclerosis is more controversial.
5. *hypertension* – Both systolic and diastolic hypertension have a strong, positive, continuous, and graded relationship to the development of CHD, with systolic hypertension being more predictive as age increases. A widened pulse pressure, the difference between the systolic and diastolic blood pressure (BP), is an indicator of arterial stiffness and also predicts risk. Treatment of hypertension confers a modest reduction in CAD risk, though less than that observed for stroke and congestive cardiac failure, but does not eliminate the risk altogether.
6. *diabetes mellitus* – Diabetes predisposes an individual to cardiovascular disease, the relative risk of MI and death being two-fold higher in individuals with diabetes, independent of other CHD risk factors. The all-cause mortality risk of a diabetic is the same as that of an individual who has already had an MI, and diabetics are considered to be in the high-risk group. (The high-risk group is defined as those with a 10-year absolute risk for myocardial infarction of >20%.) Diabetics are more likely to have extensive coronary artery disease and silent ischemia and are less likely to do well after CABG or angioplasty than the non-diabetic with CAD. Although the impact of diabetes diminishes

with more advanced age at onset, in both the young and elderly, diabetic mortality is higher the longer the disease has been present, and mortality is worsened by poor metabolic control.

Other Risk Factors

Other factors also influence the development of CAD, but they are not always available for assessment. They include: elevated homocysteine levels, elevated inflammatory markers such as plasma fibrinogen and C-reactive protein (CRP), and life style factors such as obesity, atherogenic diet, lack of exercise, and psychosocial stressors.

Obesity and metabolic syndrome have become quite prevalent in the United States. Metabolic syndrome is defined as having three of the five following criteria: abdominal obesity, elevated triglycerides, low HDL, hypertension, and insulin resistance. Data from the National Health & Nutrition Examination Survey database suggests that 34.5% of its participants met the criteria for metabolic syndrome. These individuals are also at increased risk of CAD and require intensive risk factor reduction.

Additional Markers

In addition to the consideration of cardiovascular risk factors, other markers that point to an increased risk of atherosclerosis should be considered in the assessment of the probability of CAD. These include:

1. *aortic sclerosis* – thickening of the aortic valve without obstruction, described on the echocardiogram
2. a *decreased ankle-brachial index* – leg BP divided by arm BP of less than 1
3. an *increased carotid intimal-media thickness* – an ultrasound assessment of the wall thickness of the inner two layers of the wall of the carotid artery
4. the presence of *microalbuminuria and/or renal insufficiency*
5. the presence of *left ventricular hypertrophy* on electrocardiogram (ECG) or echocardiogram.

Angina and Myocardial Infarction

Angina pectoris (cardiac chest pain) occurs whenever myocardial oxygen demand exceeds oxygen supply. This usually occurs because cardiac blood flow is impeded due to the accumulation of atherosclerotic plaque; however, spasm of the blood vessel can also cause chest pain in the absence of atherosclerosis. This is variant or Prinzmetal's angina.

Typical angina is frequently described as a squeezing or pressure in the middle of the chest, of a relatively short duration (1 to 15 minutes), with or without radiation to the neck or arms, and usually precipitated by exertion or stress. However, other symptoms (i.e., anginal equivalents) can occur with myocardial ischemia and include: dyspnea (shortness of breath), fatigue, nausea, light-headedness, and/or pain in the upper abdomen, back, jaw, or left arm.

Stable angina is chest discomfort that occurs predictably and reproducibly at a certain level of exertion and is relieved with rest or nitroglycerin. As the coronary artery progressively narrows or if a plaque should hemorrhage or rupture, symptoms usually occur more easily or at rest. At this point, the individual is considered to have unstable angina, a condition that carries a worse prognosis. Sometimes coronary artery disease can be totally asymptomatic (i.e., silent ischemia), but can be diagnosed by cardiac testing. Silent ischemia carries the same prognosis as its symptomatic counterpart.

Prolonged total occlusion of a coronary artery leads to injury and death of the heart muscle, a myocardial infarction (MI). This is diagnosed by the presence of prolonged chest pain in conjunction with either elevated serum markers of myocardial injury, usually creatine kinase (CK)-MB or troponin, and/or with EKG changes. With a large myocardial infarction that significantly decreases the ejection fraction (pumping ability of the heart), the individual can develop congestive heart failure, a condition in which fluid accumulates in the lungs or other body tissues. This carries a very poor prognosis.

Cardiac Testing

The probability of CAD is further increased, over and above that expected by cardiac risk factor analysis and the presence of symptoms, with abnormal cardiac testing.

Electrocardiogram (EKG)

The EKG, a tracing of the electrical activity of the heart, is a non-invasive, inexpensive, and painless test that is frequently obtained in clinical and insurance medicine. It is obtained by placing electrodes (electrical sensors) on various positions of the body. These record this electrical activity from different vantage points or leads. There are 12 leads on the standard ECG, each reflecting a certain area of the heart. In addition to determining if there are any abnormalities of the heart's rhythm or conduction system, the presence of myocardial abnormalities on the basis of ischemic, hypertensive, valvular, or idiopathic disease can be inferred. Ischemic heart disease is usually manifested by EKG changes; however, it is important to realize that the absence or presence of EKG changes is not always predictive of CAD.

Exercise Electrocardiogram

The exercise electrocardiogram (e.g., exercise tolerance test, ETT) is done to determine the heart's response to exercise and is helpful in the diagnosis and prognosis of CAD. The individual is asked to exercise, usually by walking on a treadmill, through various workloads as determined by a standardized protocol (e.g., Bruce, Naughton) while his ECG and blood pressure are monitored. Myocardial ischemia is indicated by specific types of changes in the ECG tracing with exercise.

Other abnormal responses that can be elicited include:

1. the development of chest pain
2. an extreme change in blood pressure, with a decrease being especially worrisome
3. ventricular premature contractions.

Exercise capacity, also known as metabolic equivalent of task (MET) is determined by the duration of exercise and the protocol used, and when above average, is a favorable prognostic factor even in the setting of ischemic heart disease. It is not uncommon to have a “false- positive” ETT, especially in those with a low pretest likelihood of disease (i.e., no cardiac risk factors).

Myocardial Perfusion Imaging (MPI)

Myocardial perfusion imaging improves the sensitivity and specificity of the ETT, making it more accurate in the diagnosis of CAD. In addition, it is also better able to assess the severity of disease by localizing and quantifying the amount of myocardium in jeopardy. In this test a radioisotope, either thallium or technetium, is injected into the individual undergoing exercise or pharmacologic stress testing, and the images are collected using single photon computed tomography (SPECT). This allows three-dimensional visualization of blood flow to the myocardium at rest and with exercise. A normal perfusion scan shows the same concentration of tracer throughout the heart. An area devoid of tracer is called a defect. Reversible defects, those that are visualized with exercise, but not at rest, generally indicate an area of hypoperfused but viable myocardium; whereas, a fixed defect, which is present both with exercise and at rest, indicates a prior myocardial infarction. If the SPECT is gated to the ECG, the left ventricle can also be assessed (see below).

Echocardiogram, Radionuclide Angiogram (RNA), Gated SPECT, and Cardiac MRI

The echocardiogram, the radionuclide angiogram, also known as a multigated acquisition scan (MUGA), the gated SPECT, and the cardiac MRI allow assessment of cardiac chamber size and function. Myocardial ischemia is detected as a decrease in LV ejection fraction, a measure of the pumping ability of the heart, or the development of a regional wall motion abnormality with exercise. For those unable to exercise, pharmacological agents, among them dipyridamole, adenosine, and dobutamine, can be used in conjunction with an imaging technique to detect coronary artery disease.

Coronary Angiography

Exercise testing, while important in the functional assessment of CAD, does not define the coronary anatomy. This is accomplished through coronary angiography, an invasive, radiographic test where dye is injected directly into the coronary arteries to determine the site, extent, and the percentage of the coronary obstruction. Typically, the severity of CAD is determined by the amount of myocardium in jeopardy, that is, how much of the heart muscle would die if the lesions should completely obstruct. Atherosclerotic lesions that narrow the vessel lumen by 50% or

more are considered significant, and when they involve all three coronary arteries or the left main, severe CAD is said to be present. Even though the angiogram is considered the best available test in the diagnosis of CAD (i.e., the “gold standard”), obstructions can be underestimated or missed because the geometry seen on angiograms may not accurately correlate with the true intravascular geometry. Coronary CT angiography (CCTA), a noninvasive test, is increasingly being used to assess the degree of coronary artery disease as it can be performed easily and safely. In this test an iodinated contrast is administered intravenously after which a CT scanner with high spatial and temporal resolution images the heart. Although less accurate than traditional angiography, it still provides a reasonable assessment of the coronary arteries and the amount of disease present. Cardiac CT can be performed at the same time to assess left ventricular morphology and function.

Intravascular Ultrasound (IVUS) & Fractional Flow Reserve (FFR)

These tests are sometimes done in conjunction with coronary angiography to better assess the significance of the obstructions noted. Intravascular ultrasound images atheroma within the vessel wall directly, allowing measurement of atheroma size and distribution and is becoming more frequently used in situations where a “normal” angiogram does not seem to fit with the known facts of the case. Fractional flow reserve (FFR) is a technique used to measure pressure differences across the coronary artery stenosis to determine the likelihood that the stenosis impedes blood flow to the myocardium.

Electron Beam Computed Tomography (EBCT)

Electron beam computed tomography scans and ultrafast CT scans are used to detect deposits of calcium in the arterial walls. Coronary calcium scores that reflect the individual’s burden of atherosclerotic disease are then calculated. While very high scores are associated with a high likelihood of obstructive CAD, an individual with a lower score can still be considered high risk if his calcium score is in the 75th or higher percentile of the calcium score distribution appropriate for the age and gender. In addition, this risk is not totally eliminated in the setting of a normal stress test and appears to be increased in those with elevated hs-CRP, a blood test that is a marker of inflammation.

Brain Natriuretic Peptide (BNP)

Brain natriuretic peptide is a hormone produced by the heart in response to the stretching of myocardial cells due to volume and/or pressure overload. This hormone causes salt and water loss as well as vasodilation helping to maintain an optimal circulatory status. BNP has been found to be useful clinically in the diagnosis, prognosis, and treatment of congestive heart failure (CHF). The normal range of BNP depends on the situation in which it is measured. BNP levels are higher in females, elderly individuals, those with renal insufficiency, and those with cardiac diseases including CAD, CHF, atrial fibrillation, myocarditis, left ventricular hypertrophy (LVH), and valvular regurgitation. Many clinical and insurance studies have shown that elevated levels of BNP are associated with higher cardiac and all-cause mortality. For this reason, NT-pro BNP, a more stable form of BNP, is frequently used in insurance medicine as an adjunct to or in lieu of an ECG.

Treatment: Medical and Revascularization

Once the diagnosis of CAD has been confirmed, treatment is begun in an attempt to balance the supply and demand of oxygen to the myocardium. This can be done with medications or revascularization depending on the underlying problem, the severity of symptoms, and the risk of future events and death.

Medical Therapy

Medical therapy is frequently used for those people with stable angina in order to improve their symptoms. Nitrates, available in oral, transdermal, and sublingual preparations, prompt the coronary arteries to dilate, which improves blood flow and thereby relieves angina. Beta-blockers like propranolol, metoprolol, and atenolol prevent angina by slowing the heart rate and decreasing the force of contraction, which decreases the need for myocardial oxygen. These drugs have been proven to have a cardioprotective effect and improve cardiac mortality in those who have already suffered a myocardial event. Calcium channel blockers, some of which increase coronary artery blood flow (e.g., nifedipine) and some of which decrease oxygen demand (e.g., verapamil), are also used, but no mortality advantage has been proven with their use. Aspirin (ASA), which helps prevent clot formation, is used in all stages of CAD, from primary prevention (it has been shown to decrease the risk of a first MI by one-third in males), to its use in those with acute coronary syndrome (unstable angina and acute MI), to its role in secondary prevention (it has been shown to decrease the risk of a second vascular event by 22%). HMG CoA reductase inhibitors, usually referred to as statins, are also used in the primary and secondary prevention of CAD. While their main function is to lower LDL-cholesterol levels, they also improve the endothelial function of the blood vessels, stabilize atherosclerotic plaques, reduce vascular inflammation, and inhibit platelet aggregation, thereby reducing thrombosis. Statins are highly effective in reducing all-cause and cardiac mortality in those with CAD. A new class of drugs, PCSK9 inhibitor antibody, has been shown to markedly reduce LDLs in those who do not tolerate or respond adequately to statins.

Percutaneous Transluminal Coronary Angioplasty (PTCA) and Atherectomy

PTCA, with or without stenting, is an alternative treatment to medical therapy and can be scheduled in those with stable angina or done acutely in those with acute coronary syndromes. In this procedure, a balloon-tipped catheter is inserted percutaneously into a peripheral artery, threaded through the aorta, and ultimately reaches the coronary circulation. The balloon is then inflated at the site of the obstruction, thereby fracturing the plaque and increasing the lumen of the blood vessel. The problem of restenosis at the site has been greatly improved by the use of stents, small metal coils that hold the “ballooned” artery open. As the technology used during this procedure continues to advance, more of these are being done in lieu of coronary artery bypass grafting surgery.

Atherectomy is a procedure in which plaque is removed from the inside of an artery either by shaving or cutting it away. It is no more effective and has more complications than PTCA in the treatment of CAD, and its use is usually limited to those lesions that are not amenable to PTCA (i.e., those lesions that are very tight or heavily calcified). Anti-platelet drugs (e.g., clopidogrel) are required after these procedures to prevent thrombosis of the blood vessel.

Coronary Artery Bypass Graft (CABG)

Coronary artery bypass graft surgery (CABG) is another method to achieve revascularization. In this procedure a new connection is made from the aorta to the coronary artery by use of a graft, a portion of an artery or vein that creates a detour for blood flow to the myocardium by bypassing the problematic blockage.

Traditionally, this surgery was done through an incision down the front of the chest through the sternum while the heart was stopped. Newer techniques have been developed in an attempt to decrease complications and recovery time and include minimally invasive surgery, done through a smaller chest incision and “off-pump” bypass done on the beating heart. The internal mammary artery (IMA), an artery from the inside of the chest wall, is used as a graft whenever possible in preference to saphenous vein grafts from the leg, as the IMA is less prone to stenosis. At 10 years, 90% of internal mammary grafts remain patent (open) compared to only 50% of the saphenous vein grafts. This has translated into improved survival for those who get an IMA as opposed to a saphenous vein graft. While most treatment modalities improve symptoms, certain subsets of people with severe coronary artery disease live longer with revascularization. These include those with a $\geq 50\%$ left main obstruction, those with three-vessel coronary artery disease or two-vessel CAD with proximal LAD involvement, especially those with a decreased ejection fraction or a markedly positive stress test.

Prognosis/Underwriting Considerations

The prognosis of CAD is variable and influenced by many factors that have to be considered in the evaluation of a candidate for life insurance. In this assessment, one has to consider the following:

1. How has the CAD affected the heart? Many individuals with coronary artery disease ultimately die in congestive heart failure. This occurs when the myocardium is no longer able to pump an adequate amount of blood to meet the body's metabolic needs. Left ventricular function is an assessment of this ability of the heart. It can be measured by angiographic, radionuclide, or echocardiographic techniques and is described as the left ventricular ejection fraction (LVEF), the percentage of blood in the ventricle delivered to the body with each heartbeat. A LVEF of 50% or greater is considered normal. Myocardial infarctions often damage the heart muscle and lower the ejection fraction. Mortality increases as LVEF decreases, with survival percentages falling significantly with ejection fractions of less than 40%. Another predictor of survival is exercise capacity, which can be determined by symptoms. Individuals with symptoms at rest or with minimal activity have a worse prognosis than those with symptoms with increased exertion or on stress testing at a high workload.
2. How can the CAD further affect the heart or how much of the myocardium is in jeopardy? This is a measure of the amount of the left ventricle subject to further damage and is determined by the number, severity, and location of the coronary artery lesions. The more myocardium at risk, the worse the prognosis. So an individual with obstructions in all three coronary arteries has a worse prognosis than someone with one vessel involvement, unless of course that vessel is the left main, which supplies most of the left ventricle. Usually lesions in the LAD are more significant than those in the RCA or LCx; however, one must

also take into account where in the vessel the obstruction is located. A proximal lesion, one close to the origin, affects more myocardium than a distal lesion. While any atherosclerotic lesion can rupture and occlude a vessel, lesions of >50-70% are considered significant. If an angiogram is not available, the amount of myocardium in jeopardy can be estimated by the extent of wall motion abnormalities or perfusion defects on imaging studies.

3. How soon will further damage occur or what is the current stability of the CAD? The presence of a changing pattern of angina, post-infarct angina, or a stress test that becomes positive at a low workload indicates that the CAD is progressing and should be underwritten very cautiously.
4. How will this individual do in the long term or what is the future stability of the CAD? Once someone has established CAD, appropriate treatment includes meticulous control of cardiac risk factors in order to optimize the individual's longevity. In addition to smoking cessation, lipids, diabetes, and hypertension should be carefully managed. Recent trials suggest that the addition of a statin to lower LDL cholesterol and the use of ASA to prevent thrombosis improve mortality.
5. Other factors to consider include: premature onset of CAD, defined as that occurring before age 40, and the presence of arrhythmias, especially atrial fibrillation, and frequent or repetitive ventricular ectopy.

Table 1. CAD Risk Profiles.

Best Case	High Risk
<ul style="list-style-type: none"> ● Onset of CAD at later ages ● Stable angina ● Normal LV function and ejection fraction ● Mild, single vessel disease excluding left main ● No arrhythmias ● No progression of disease ● No diabetes or other significant chronic disease ● Well controlled cardiovascular risk factors including the use of a statin and aspirin ● Good exercise capacity ● Negative stress test 	<ul style="list-style-type: none"> ● Early onset of CAD (before age 40) ● Unstable or worsening disease ● CHF or poor LV function ● Reduced ejection fraction ● Severe 3-vessel disease or left main disease, especially if not revascularized ● Presence of arrhythmias- atrial fibrillation or ventricular premature complexes (VPCs) ● Significant progression of disease over a short period of time ● Poorly controlled cardiac risk factors ● CHD in the setting of other medical conditions like valvular heart disease, pulmonary disease, renal disease, diabetes, or cerebral and/or peripheral vascular disease ● Poor exercise tolerance ● Severe stress testing abnormalities: drop in BP with exercise, early onset of ischemic changes, etc.

Adapted from MacKenzie BR. Coronary Heart Disease. In: Brackenridge RDC, Elder, WJ, eds. *Medical Selection of Life Risks*. 4th ed. New York: Stockton Press: 1998.

Conclusion

Coronary artery disease is a common, complicated condition that is a challenge for life underwriters. With continued technologic advances, more people will live longer with this disease and many will continue to ask for life insurance. Careful assessment of this impairment allows for successful risk stratification and the issuing of these policies, taking into account the appropriate mortality concerns.

Review Questions – ALU 101, Chapter 5

1. The gold standard test for diagnosing coronary artery disease (CAD) is:
 1. an exercise tolerance test (ETT)
 2. coronary angiography
 3. thallium imaging
 4. electron beam computed tomography (EBCT)
 2. Modifiable risk factors for atherosclerosis include all of the following EXCEPT:
 1. family history
 2. smoking
 3. hypertension
 4. diabetes
 3. The MET level of an exercise EKG is determined by which of the following?
 - A. calories burned at rest
 - B. duration of exercise
 - C. protocol used
- Answer Options: 1. A and B only are correct.
2. A and C only are correct.
3. B and C only are correct.
4. A, B, and C are correct.
4. List four major risk factors for coronary artery disease.
 5. Define metabolic syndrome and explain why it is a risk factor for the development of coronary artery disease.
 6. All of the following are layers of the heart wall EXCEPT:
 1. endocardium
 2. pericardium
 3. endometrium
 4. myocardium

7. Medications that dilate the coronary arteries include which of the following?

- A. nitrates
- B. beta-blockers
- C. calcium channel blockers

Answer Options: 1. A only is correct.

- 2. B only is correct.
- 3. C only is correct.
- 4. A, B, and C are correct.

8. All of the following are functions of the circulatory system EXCEPT to:

- 1. transport oxygen
- 2. transport waste materials of cellular metabolism
- 3. propel blood through the body
- 4. raise and lower HDL cholesterol

9. All of the following are measured on an exercise electrocardiogram EXCEPT:

- 1. blood pressure
- 2. exercise capacity
- 3. thickness of the left ventricle
- 4. ECG changes

10. An EBCT scan is used to:

- 1. calculate exercise tolerance
- 2. detect heart murmurs
- 3. detect deposits of calcium in coronary arterial walls
- 4. fracture plaque in an occluded coronary artery

Answers and Sources of Review Questions

Review Question 1

Answer 2: coronary angiography – pages 7-8.

Review Question 2

Answer 1: family history – page 3.

Review Question 3

Answer 3: B and C only are correct – page 7.

Review Question 4

Refer to pages 3-5.

Review Question 5

Refer to page 5.

Review Question 6

Answer 3: endometrium – page 1.

Review Question 7

Answer 1: A only is correct – page 9.

Review Question 8

Answer 4: raise and lower HDL cholesterol – page 1.

Review Question 9

Answer 3: thickness of the left ventricle – pages 6-7.

Review Question 10

Answer 3: detect deposits of calcium in coronary arterial walls – page 8.

CHAPTER 6

BASIC LABORATORY TESTING

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BASIC LABORATORY TESTING

Introduction

This chapter deals with the analysis of the life insurance laboratory test profile that has become an integral part of the evaluation of medical risk and provides explanations of some of the laboratory tests which underwriters routinely encounter when reviewing an attending physician's statement (APS). No matter where an underwriter encounters laboratory test results, an understanding of the relationship between various risk markers and disease and health is essential, as well as familiarity with the common terms used in laboratory testing.

Some Common Laboratory Terms

Blood Samples

Blood is a body fluid comprised of liquid and solid components that can serve as risk markers for disease or abnormal health conditions. When requested, samples of blood are drawn from proposed insureds and sent to the laboratory to be tested. Laboratory tests are performed on both the whole blood and the liquid component (serum). When testing is completed, the underwriter can then evaluate the results as risk markers for health and possible disease.

Serum is the liquid portion of the blood, while red and white blood cells make up the majority of the cellular components. To get serum from a whole blood sample, the blood sample is allowed to clot, and the collection tube is then centrifuged to separate the red and white blood cells from the serum. The quality of several insurance laboratory test results from serum samples can be affected if the serum is not centrifuged within two hours of collection.

Urine Samples

Urine is a fluid excreted by the body that normally contains waste products of metabolism, drugs and their metabolites, many substances found in blood, and excess water. It is the product of blood processed and filtered by the kidneys. It is collected from the proposed insured using a simple plastic container. There are fewer quality issues with the collection of urine than with the collection of blood, other than the potential risk of adulteration, dilution, or substitution of the urine sample by the individual at the time of collection.

Urine contains a number of substances that, like blood, can be used as risk markers to indicate the state of health of the proposed insured. Laboratory testing of urine can reveal the status of the kidneys' ability to function properly, as well as indicate the presence of certain disorders, such as urinary infection and diabetes. Urine testing is frequently relied upon to reveal if the proposed insured is a smoker and/or takes therapeutic or illegal drugs.

Cut-offs, Sensitivity, and Specificity

Laboratory tests serve to identify and quantify risk markers for disease and other abnormal health conditions that the underwriter reviews for each person tested. Typically, there are test values that indicate if an individual is considered healthy/normal on one side of the value or unhealthy/abnormal on the other side. These test values are called “cut-offs.” Selection of the cut-off test values that distinguish between healthy/normal and unhealthy/abnormal can be provided by standard clinical practice guidelines or can be chosen as part of company-specific underwriting guidelines.

An individual who is “positive” for a laboratory test has a test result that is on the unhealthy/abnormal side of the laboratory test value cut-off. That person is positive for the risk marker and thus can present a higher mortality risk. An individual who is “negative” for a laboratory test has a test result that is on the healthy/normal side of the laboratory test value cut-off. That person is negative for the risk marker and thus can present an average or better than average mortality risk.

The use of laboratory test cut-offs must be understood by the underwriter as having a chance of error. Sometimes a positive test result can be caused by a transient health condition or physical variation in the individual so that the positive test result does not reflect a true state of disease or abnormal health. These results are termed “false positives.” Sometimes a negative test result does not detect the proposed insured’s true condition of disease or abnormal health. These results are termed “false negatives.” When questioning the results of a test, the underwriter has two options: having another sample taken from the proposed insured and repeating the test to determine if the results are indeed transient or looking at other information about the individual to determine if the current test results are consistent or inconsistent with this information.

Sensitivity and specificity are terms that describe how well a laboratory test works. Sensitivity is the measure of the test’s ability to detect persons who have a disease or abnormal health condition (i.e., identify true positives). In contrast, specificity is the measure of how well the test excludes the possibility of a particular disease or abnormal health condition (i.e., identify true negatives). The sensitivity of a test can be increased by lowering the cut-off value that defines when a test is positive. By doing so, the test identifies more people with the disease or abnormal health condition, but the specificity usually gets worse. In general, laboratory testing attempts to maximize specificity (minimize false positives), even if it means missing a few true positives. Because most disease is uncommon in a healthy population, this results in only a small error in the identification of individuals at risk of increased mortality.

Proteins, Carbohydrates, Cholesterol, Fat, and Glucose

Blood contains a wide variety of substances that help the body grow new cells, break down old cells, maintain health, and fight disease. Proteins are composed of amino acids and have highly defined molecular structures that determine their function inside and outside of the body’s cells. One special class of proteins is the enzymes, which are proteins that build or break down other proteins, sugars, lipids, or genetic structures, such as DNA or RNA. Another group of proteins is

serum proteins that transport insoluble building blocks and metabolites in the blood. Another large family of proteins is the antibodies; these are produced by the immune system in response to infection or disease.

Carbohydrate and fats are simpler molecules that serve as sources of energy for the body's cells and building blocks used by cells to produce larger, more complex structures. Cholesterol is a special fat present in all cell membranes. It serves many functions, including being a building block for various hormones, such as testosterone and estrogen.

Glucose is a simple carbohydrate, a fundamental source of energy for the body's cells. Abnormally high levels of glucose in the blood and/or urine are a potential indication of impaired glucose tolerance and/or diabetes. Glucose levels in the blood are highest after eating (i.e., postprandial) and can be lowered rapidly with fasting and exercise. A urine sample that is positive for glucose can indicate that the level of glucose in the blood is so high that the kidneys pass it to the urine.

Hemolysis

Hemolysis is the rupture of red blood cells, which releases hemoglobin and other cell contents into the collected serum. This is typically caused by delays in the handling of blood samples and can indicate that the underwriter should use caution when interpreting several of the laboratory test results from that sample. Hemolysis is classified as slight, moderate or severe based on the amount of hemoglobin present in the serum sample. Most chemistry results are unaffected by hemolysis until it is severe. The apparent amounts of creatinine, aspartate aminotransferase (AST), bilirubin, and lactate dehydrogenase (LDH) in a blood sample increase with hemolysis. Fructosamine increases until hemolysis is severe and then decreases, while glucose values decrease with hemolysis. While the average value for most chemistries go unchanged the number of abnormal results, those values considered high, do increase. Each of these tests is described later in this chapter

Lipemia

Lipemia is the presence of high concentrations of lipid (fats) in a serum. Lipemic serum has a characteristic color that, in severe cases, transforms the clear straw-colored serum to milky white. Lipemia can be of two origins:

1. In insurance testing, it is usually due to postprandial hyperlipidemia following a high-fat meal. Most often this is associated with applicants failing to fast, no food, for at least 8 hours prior to supplying a blood sample.
2. The proposed insured's genetic makeup can be another uncommon cause of lipemia.

Postprandial lipemia is associated with potentially large increases in triglycerides and glucose levels. In addition, minor short-term increases in cholesterol and HDL occur, with little impact on the cholesterol/HDL ratio. Almost all serum tests are affected to varying degrees by lipemia; the principle cause is the interference of the lipid with the color result from the individual test(s). Hemolysis is also more prevalent in lipemic samples.

Glycolysis

The usual procedure following collection of the blood sample is that the blood is allowed to clot and the sample is centrifuged to separate the red and white blood cells from the serum. If centrifugation is delayed too long, the red and white blood cells will consume (i.e., metabolize) the glucose. This loss of glucose is called glycolysis.

Almost all insurance samples have glucose test results that are lower than they were at the time of collection due to processing delays. Twenty-five percent of all samples have glucose test values less than 60 mg/dL. These are almost all collection artifacts and do not accurately reflect the individual's true glucose level at the time of collection. Fructosamine and hemoglobin A1c are tests that provide more reliable estimates of a proposed insured's average glucose level and indicate if impaired glucose tolerance and/or diabetes is present.

Units of Measure

Test results are reported in various units of measure. These are most often units of concentration such as:

1. gram/Liter (g/L)
2. milligram per 100 ml of sample (mg/dL)
3. microgram/milliliter (ug/ml)
4. nanogram/ml (ng/ml)
5. units of enzyme activity, normally International units/Liter (IU/L).

The prefix milli- indicates 1 thousandth, while micro- is 1 millionth, and nano- is 1 billionth.

In addition to the traditional U.S. units listed above, much of the world (and increasingly clinical laboratory reports in the U.S.) has switched to "SI" units (International System of Units), such as U/L or mmol/L, requiring conversion to U.S. units for some test values.

Reference ranges (normal or expected range) for a particular test can vary among laboratories due to differences in methods or equipment. What is normal in one laboratory can be abnormal in another because of differences in sensitivity of testing methods. It is, therefore, very important to pay close attention to the reported reference range.

There can also be slight differences in results reported on the same sample. This is due to the normal variation in chemistry testing. The unit of measure is always reported for each test. Units of measure and the normal range can vary from company to company; therefore, the underwriter must always pay close attention to both the individual result and the reference range reported by the testing laboratory. Most laboratory reports flag abnormal results as H (high) or L (low), which serve as an additional warning for the person reviewing the results.

What Samples Are Collected?

Venipuncture

When the policy amount applied for exceeds some predetermined level, blood samples are collected by venipuncture (i.e., blood is drawn from a vein). These samples are obtained by paramedical technicians, phlebotomists, nurses, or doctors. Blood samples include whole blood collected into a tube containing an anticoagulant (an agent to stop the blood from clotting) and a serum tube in which blood is allowed to clot. Both serum and plasma are the liquid portions of blood; the difference between the two is that clotting factors are present in plasma and absent in serum.

If a blood sample is required, the proposed insured is generally told to fast (i.e., have no food) for at least eight hours prior to the time the blood is to be drawn. A non-fasting status can have a small effect on the serum level of alkaline phosphatase, blood urea nitrogen (BUN), and a larger effect on glucose and triglyceride levels, while most other test results are not affected. While fasting samples are preferred for testing, only 50% of proposed insureds are fasting at the time of sample collection.¹

Dried Blood Spot

Dried blood spot (DBS) is another method for collecting a blood sample. The side of the finger is punctured with a lancet and as droplets of blood form, the droplets are transferred to a small piece of blotting paper in a cardboard holder. The sample is allowed to air dry and the specimen is sent to the laboratory. DBS, due to its ease in shipping, is a preferred method for samples collected internationally. HIV, cocaine, cotinine, cholesterol, GGT, and hemoglobin A1c levels can be measured with DBS samples when an adequate sample is collected. Some proposed insureds prefer this simplified collection method to venipuncture for reasons that include fear of needles and prior experience of failed blood draw.

Oral Fluid or Urine

For lower policy amounts and in some selected markets, oral fluid and/or urine only can be collected for risk assessment. In contrast to blood, oral fluid and/or urine samples can be collected by insurance sales agents. When a urine sample is collected, ideally the temperature of the sample is recorded, which should be 90-98 degrees Fahrenheit. This step is done to reduce the chance of substitution of water for the urine sample. Routine testing for urine only (when no blood is collected) can include sugar, cotinine, cocaine, protein, and antibody to HIV as well as indicators for the presence of red and white blood cells. Oral fluid (which is not saliva but a fluid extracted from the gum by the blotting material on a swab) can provide testing for HIV, cotinine, and cocaine.

Pre-Test Processing

Urine, oral fluid, and whole blood samples require no processing prior to testing. In contrast, a serum sample is collected in a blood tube and allowed to clot for one to two hours. The serum is then separated from the clot by spinning the sample in a centrifuge which causes the clot to move to the bottom of the tube. The separated serum is then poured into an identically labeled transport tube.

Transfer of the serum from its collection tube to the transport tube is a manual process that can introduce error in sample identification due to a sample being poured into a transport tube labeled with another person's identification number. This type of error occurs in less than 0.5% of all samples processed. Following processing, the samples and paperwork are shipped by express carrier to the laboratory. The typical transport time is two days.

Interpreting Test Results

The underwriter's use of laboratory test results relies on an understanding of statistics and how statistics are used to determine which results are considered normal/healthy and which results are abnormal/unhealthy. The cut-off test values that are chosen in clinical medicine to indicate the distinction between normal and abnormal are sometimes determined by a purely statistical calculation but, at other times, are based on clinical practice recommendations by expert consensus.

In life insurance underwriting, the selection of cut-off test values used in risk assessment is part of a planned underwriting approach. Knowing which values for a particular laboratory test are considered "normal," which are "abnormal," and how statistics support these decisions helps an underwriter interpret and take action on laboratory test results.

In determining the expected or "normal" range for a test in clinical practice, an analysis is made of the laboratory test values for a large group of people who are mostly in good health. Using total cholesterol as an example, the total cholesterol levels of a large group of relatively healthy people are measured. The test results are typically analyzed statistically to determine the range, the mean, and the standard deviation (statistical variation). This is referred to as a "normal" variation and can reflect differences by age, sex, and/or genetic background of the people tested.

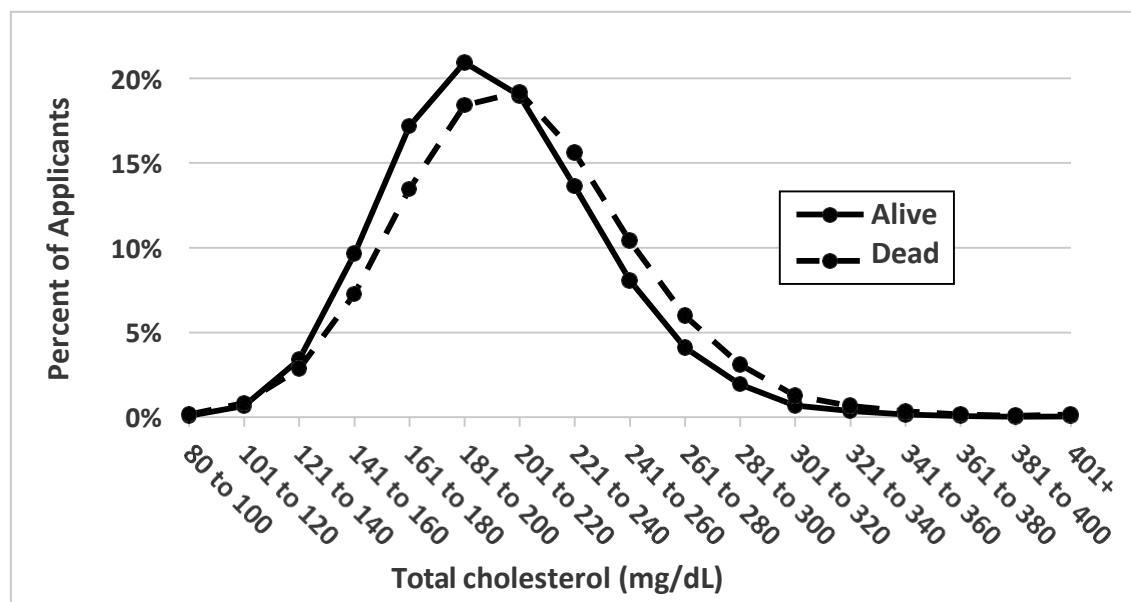
From this data, a range of expected total cholesterol results for healthy people would be predicted. This range usually includes 95% of the population and can serve as a reference to compare against the results for anyone tested for total cholesterol. The corollary is that 5% of even those healthy people would fall outside that range. The reference range is then used in the clinical evaluation of people who may or may not be healthy. This approach allows for the identification of which individuals have total cholesterol values inside or outside the expected range for "normal."

In underwriting, the concern is how much mortality risk is associated with a proposed insured's total cholesterol results. To determine the risk, an analysis needs to compare the mortality of a reference group to the mortality found within subgroups of people identified by their total cholesterol results. It is helpful for the underwriter to understand how mortality risk is calculated and what metrics are used to relate mortality risk to the corresponding test results.

As an example, a study population of proposed insureds tested for total cholesterol illustrates the process used to select cut-offs for total cholesterol guided by the associated mortality risk. Typically, such studies look at separate demographic groups within a population by age and sex (e.g., young females, young males, older females, older males) because test results that indicate health in one demographic group may not be the same for another. In this example, the entire population is studied without regard to age and sex as a simple illustration of the approach taken.

Figure 1 shows the distribution of total cholesterol values within a life insurance applicant population. The number of proposed insureds studied was 8.7 million tested by an insurance laboratory between 1992 and 2007. There were 203,176 deaths among those who were followed until fall 2011. The percent of proposed insureds within each total cholesterol group is shown separately for those who were alive and for those who died.

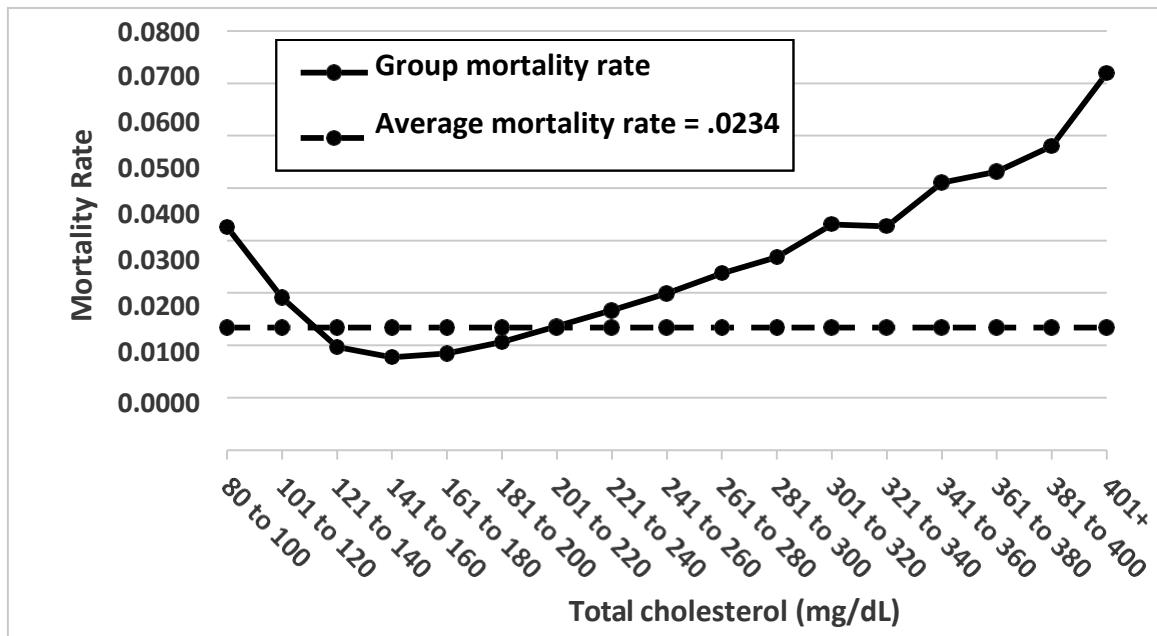
Figure 1. Distribution of total cholesterol for proposed insureds who are alive and who died, by total cholesterol group.



From Figure 1, we can see that this typical proposed insured study population has a range of total cholesterol with the majority of people in the middle values between 140 and 280 mg/dL and relatively fewer people outside of those values. This distribution is similar for people who were alive (solid line) and who died (dashed line), although those who died have slightly higher total cholesterol values generally. For clinical purposes, total cholesterol value cut-offs were set by expert opinion at 200 mg/dL. With that cut-off, most proposed insureds would be considered as “high cholesterol, above the recommended total cholesterol level.”

For underwriting purposes, to distinguish those proposed insureds with cholesterol results that are normal/healthy from those who are abnormal/unhealthy, we have to look deeper at the mortality statistics of this study population using the metrics of mortality rates and mortality ratios.

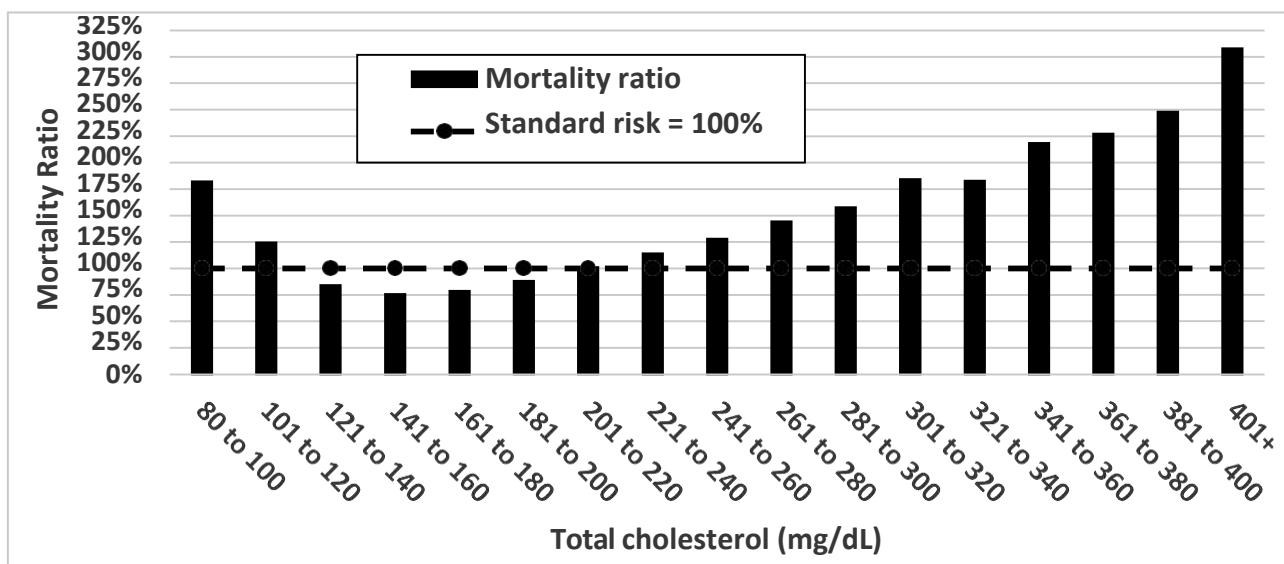
Figure 2. Mortality rate by total cholesterol group.



In Figure 2, the mortality rate of each total cholesterol group is shown (solid line), with the average mortality rate for the entire population also shown (dashed line). To calculate a mortality rate, divide the number of deaths occurring in the specific group or population by the total number of people in that group or population. The average mortality rate for this entire study population is 0.234, which is 203,176 deaths divided by 8,699,429, the population tested.

Note the J-shaped curve of the mortality rates for total cholesterol. Mortality is relatively high for the lowest cholesterol values, drops to better than average mortality, and then climbs steadily for the high cholesterol values. Although mortality rates are a useful metric in understanding how risk occurs in a population, mortality ratios are essential to the development of underwriting risk tables and guidance.

Figure 3. Mortality ratios by total cholesterol group.



In Figure 3, mortality ratios are shown for each total cholesterol group in comparison to the standard risk of 100% (dashed line). To calculate a mortality ratio, divide the mortality rate occurring in the specific group or population by the reference mortality rate. In this example, the reference mortality rate is the average over the total population (0.0234), which is considered here as the average or standard risk.

Mortality ratios indicate the relative risk of the individuals in a group, defining how much mortality risk there is for that specific group compared to the mortality risk of the reference population. In other analyses, the reference population can be limited to the healthier individuals to be used as a comparison; the selection of the reference population criteria has an impact on the mortality ratios that are calculated by defining what is considered to be a standard risk.

Note the higher mortality ratios at the low and high ends of total cholesterol values. The relative mortality for those with total cholesterol values between 121 and 200 mg/dL is lower or better than the standard risk of 100%. Not only does Figure 3 show which total cholesterol values have higher or lower relative risk than standard, it shows how much relative risk is involved. This information is useful in developing underwriting guidance and/or criteria regarding where total cholesterol cut-offs can be assigned to determine substandard, standard, and preferred risks with regard to total cholesterol, and how many debits or credits can be assigned to cholesterol values that fall inside or outside those limits.

Laboratory Testing

A typical laboratory profile of about 20 blood tests has been developed within the life insurance industry to evaluate mortality risks. While most of these tests are also used in clinical medicine, underwriters use them as markers for risk, not for diagnosis. Urine samples are evaluated for drugs of abuse, nicotine, creatinine, protein, glucose, and blood cells. In some cases, urine can also be tested for antibodies to human immunodeficiency virus (HIV).

In contrast, oral fluid is routinely tested for only HIV, cotinine, and cocaine due to limited sample volume and fewer available tests.

In addition to the typical insurance profile, other testing can be ordered either in an automated fashion if a screening test is abnormal (e.g., preset authorization for hepatitis testing when an elevated ALT occurs, or alcohol marker testing when elevated HDL and liver enzymes occur) or manually by the underwriter. This kind of testing is known as a “reflex” test, because it is performed in response to an initial laboratory test result or an applicant-reported health condition such as diabetes. To facilitate underwriter-ordered testing, insurance laboratories routinely retain serum and urine samples for four to five weeks in cold storage.

Urine Testing

Urinalysis is an indispensable test for assessing kidney function. Kidneys form urine by the selective filtration of blood, retaining important substances while excreting substances that are waste products or in excess of what the body needs. Each kidney is comprised of nearly 1.5 million functional filtration units called glomeruli. The best measure of renal filtration function is the glomerular filtration rate (GFR), which can be measured by the rate of excretion of an injected dye or radioactive molecule. Since this type of invasive testing is done only for research purposes, an estimated glomerular filtration rate (eGFR) can be calculated usually using age, sex, and the serum creatinine measurement from the blood profile.

Urine samples are routinely examined for levels of cocaine, cotinine, creatinine, glucose, protein, hemoglobin, and leukocyte esterase. In addition, the urine can be examined for therapeutic drugs and drugs of abuse.

Urine Creatinine

Creatinine is a breakdown product of muscle metabolism. A person produces a very constant amount of creatinine based on his or her muscle mass. The average production of creatinine is 1 gram per day. While the daily amount of creatinine varies little, the daily volume of urine production varies greatly depending on how much fluid an individual consumes. The more fluid consumed, the more urine produced and the more dilute the urine sample is.

Using the creatinine concentration of the urine sample as a guide to how dilute the sample is, the other urine tests can be adjusted for variation in daily urine amount by calculating their equivalent concentration per gram of urine creatinine. Adjustments are normally made for total protein and albumin by calculating protein/creatinine or albumin/creatinine ratios. Both ratios are superior to urine protein or albumin in the assessment of proteinuria. Extremely low urine creatinine values can indicate a very high fluid intake or addition of fluid to the urine so test results for substances like cocaine will be negative or indeterminate. If the creatinine is less than 11 mg/dL in males or 9 mg/dL in females, careful review of the case and/or a request for a new sample is likely indicated.²

Urine Total Protein (Proteinuria) and Albumin (Albuminuria)

The presence of protein in urine greater than 150 mg/day is associated with excess mortality because of likely kidney impairment or damage.³ One form of protein, globulin, is not detected by this test. Due to normal variation in hydration state, the measured protein concentration is adjusted using the urine creatinine value. First-morning urine is more concentrated than urine from later that day.

A urine sample that is initially considered positive for urine protein can be negative when the creatinine calculation is applied to correct for variation in urine concentration. Proteinuria can be benign (i.e., not associated with disease). Likely possible causes for benign proteinuria include recent strenuous exertion, orthostatic proteinuria, viral infections, and post-collection contamination. To determine if the proteinuria is significant, a second later urine sample can be collected from the individual to determine if the condition is chronic.

A urine sample positive for proteinuria can be tested for albumin, a protein which normally makes up approximately one-half of urinary protein excretion. When kidney disease is present, that percentage increases. When the urine albumin level is between 30-300 mg/day, the condition is referred to as microalbuminuria. The term "microalbuminuria" is currently being replaced in clinical reports with "albuminuria." Urine albumin amounts exceeding that level are clinically considered to be "albuminuria" or "proteinuria."³

Excess loss of albumin into the urine (i.e., albuminuria) is an indicator of glomerular disease. Additional possible causes for albuminuria include damage to the kidney from high blood pressure and/or impairment of the kidney's ability to reabsorb small proteins (tubular proteinuria). Albuminuria is a worrisome finding (especially in diabetes) because it is associated with a substantial increase in both all-cause and cardiovascular mortality.²

Urine Glucose

If the urine test for glucose is positive, the whole blood sample should be tested for the hemoglobin A1c level. The clinical diagnosis of diabetes is based on a fasting blood glucose concentration greater than 124 mg/dL or a hemoglobin A1c level greater than 6.4%. Hemoglobin A1c is the definitive test for classification of the degree of diabetic risk and will be discussed later in this chapter.^{4,5} Short-term transient increases in urine glucose can occur in healthy people after ingestion of a food or beverage that contains a large amount of sugar. If the hemoglobin A1c is normal in such a situation, the individual is not diabetic. The authors have also studied mortality risk in proposed insureds when no blood sample is collected and suggest that when urine glucose is greater than 0.05 g/dL, a blood test should be requested.⁶

Urine Leukocyte Esterase and Hemoglobin

Urine samples are tested for leukocyte esterase (an enzyme present in white blood cells) and hemoglobin (the protein present in red blood cells). If either test is positive, the urine samples are examined by flow cytometry (sophisticated automated microscope) for the presence of white and red blood cells. Hematuria is the presence of red blood cells in the urine. The urine sample examination also reports the presence of crystals (solid forms of various salts), sperm, and casts.

The presence of blood cells in the urine is a particular concern. Possible explanations include infection, glomerulonephritis, cancer of the kidney or urinary tract, a metabolic disease, or a possible collection artifact in menstruating females. Based on a study of proposed insureds, there is an increase in mortality risk for males of all ages and for females over age 60 when the number of red blood cells exceeds nine. No level of hematuria appears associated with increased risk for females who are younger than age 60.⁷

Urine Casts

Casts are tiny aggregates of proteins or red or white cells shaped like a tube. Their shape derives from the inside wall of the kidney tubules in which they were formed. Red and white cell casts occur when large numbers of these cells are present in the tubules of the kidneys, become packed tightly together into a mass, and then pass into the urine. In the absence of a likely explanation for the presence of red or white cell casts, another sample can be requested to verify the initial test result and determine if the condition is chronic. Protein casts may be either glomerular or tubular. The casts formed from excessive glomerular protein loss are problematic and normally associated with proteinuria/alBUMINuria. Tubular casts are from the lining of the tubules of the kidney and normally do not have albuminuria. As a general guideline, glomerular proteinuria contains more than 80% albumin while tubular proteinuria contains less than 50% albumin.

Urine Drug Screens

Abuse of drugs can increase mortality risk. Individuals age 18 to 34 present the greatest risk due to the increased chance of traumatic death.⁸ However, since 2010, the leading cause of unintentional death is opiate overdose⁹ and this risk occurs across all age groups.

Methods of testing for all drugs of abuse are similar. The test for cocaine will be used as the representative example. The urine sample is first screened using a simple and rapid antibody test. When the sample is positive for metabolites of cocaine, the presence of a metabolite is verified by the more precise gas chromatography mass spectroscopy (GCMS) test or, alternatively, by the liquid chromatography mass spectroscopy mass spectroscopy (LC-MS/MS) test. When examined by mass spectroscopy, each drug produces a unique fingerprint.

The antibody test for cocaine is generally performed on all insurance urine samples. Some insurers also test for marijuana, and amphetamine and for opiates with an expanded opiate profile. The psychoactive agent analyzed in marijuana testing is tetrahydrocannabinol (THC). Tests for other drugs of abuse including opiates (e.g., fentanyl, oxycodone, methadone, hydrocodone, heroin), benzodiazepines, phencyclidine (PCP), and barbiturates are typically only ordered "for cause" by the underwriter reviewing the case. The relative mortality for cocaine has been reported for insurance applicants by the authors.¹⁰

Urine Nicotine/Cotinine

Following use of tobacco (or any nicotine delivery system), nicotine is rapidly absorbed through the lungs or mucosal surfaces and metabolized. The half-life of nicotine (i.e., the time it takes for half the drug to be removed from blood) is one to two hours. In the liver, nicotine is converted to a long-lived metabolite, cotinine. The clearance rate from the body for cotinine is substantially longer than nicotine at 16-18 hours. Cotinine is the target for detection of tobacco use instead of nicotine because of this long-term retention. The cotinine test can be performed on serum, urine, or oral fluid. Cotinine detection is highly specific, with a laboratory determined accuracy of 99.0% for both urine and serum, but there can be false positives.¹¹ The specificity of the test is only slightly lower in oral fluid.

Cotinine is detected in 9-29% of proposed insured samples.¹²⁻¹⁴ Approximately one-third to one-half of cotinine positive samples are from individuals applying as non-tobacco users.¹⁵ Due to the high percentage of unadmitted use, positive cotinine test results can be one of the more contentious issues that the underwriter will face. When confronted with a denial of use, the original sample can be tested with GC-MS or LC-MS/MS to confirm the presence of cotinine. When such testing is performed for those denying any tobacco use, a minority will be negative for cotinine. Smokers are typically positive for cotinine for one to three days after last use.

Common explanations from the proposed insureds who self-reported no tobacco use and who were positive for cotinine include exposure to side-stream smoke (second-hand smoke, environmental smoke), nicotine substitutes (gums, patches, e-cigarettes), and cigar use. Sometimes the source of nicotine can be herbal teas and betel nut that are mixed with tobacco. Ingestion of mixtures containing tobacco will cause a positive test in the absence or presence of smoking. In addition, cotinine testing cannot differentiate cigar or nicotine substitutes from cigarette smoking.

In contrast to other sources of nicotine, second-hand or environmental smoke will not cause positive test results for the range of cut-off values used by insurers. The level of urine cotinine from second-hand smoke is less than 50 ng/ml. The authors found in a study of proposed insureds that the actual urine cotinine result was the driver of mortality risk, not what the individual self-reported for tobacco use.¹⁶

Vaping or e-cigarettes are recently marketed alternatives to cigarette smoking. The system delivers nicotine as a vapor. It was introduced and marketed as a safe alternative to cigarette smoking. While the manufacture and distribution of these products are now regulated by the FDA, the nicotine content and other non-nicotine additives varies substantially. Proposed insureds who vape tobacco products should test positive for cotinine; cotinine positive proposed insureds are most commonly treated by underwriters as tobacco users. There is no scientific study to support the marketing claims of “a safe alternative to smoking.” In 2019, several hundred vaping-related lung injuries, including many deaths, were reported to the Centers for Disease Control. Preliminary investigation has suggested that the culprit may be a vitamin E additive used in some vaping cartridges though other factors may also contribute. This has created a great deal more skepticism about the claims of safety.

Urinary Infections

In clinical settings, urine can be cultured to detect various bacterial or fungal infections. The method involves adding a specific amount of urine to a sterile broth and letting the infectious agent grow. Results from urine culture can be highly variable due to time delays between collection and culture, the presence of antibiotics, and the hydration state of the individual. A normal result for a urine culture is to have no growth of any bacteria or fungi. Culture methods are being replaced by molecular tests that detect infection by the presence or absence of specific bacterial, fungal, or viral genes (i.e., their RNA or DNA). Normally urinary tract infections by themselves cause no increase in mortality risk. The exception to this could be chronic infection of the kidney or bladder.

Oral Fluid Testing

Oral fluid is usually collected from proposed insureds applying for lower policy amounts. The three tests routinely run on oral fluid samples are for HIV antibodies, cotinine, and cocaine. Additional tests are available for four drugs of abuse: THC, amphetamine, opiates, and PCP. The normal range for oral fluid test results is different than that for urine and blood. In testing of proposed insureds, the prevalence of HIV, cocaine, and cotinine is higher in the oral fluid-tested population than in any other group.¹²⁻¹⁴

Blood Testing

Blood testing is usually performed for larger risk amounts almost always in conjunction with a urine sample. One consideration in evaluation of the results is pregnancy. During the second and third trimester, the level of serum albumin is reduced due to expanded blood volume. In addition, alkaline phosphatase can be elevated and small amounts of albumin can appear in the urine due to increased blood flow and glomerular filtration. There is a transitory increase in cholesterol and HDL. While this affects the concentration of both, it does not alter the cholesterol/HDL ratio. These findings are not associated with increased risk. During this same period, A1c results in pregnant self-reported diabetic individuals can be “normal/ less than 6.5%.” This result is likely due to the expanded blood volume and/or better patient management of the diabetes.

HIV

Human immunodeficiency virus (HIV) is the virus that causes acquired immunodeficiency syndrome (AIDS). Most infected individuals produce antibodies to HIV within four to eight weeks after infection. Negative HIV results are reported based on an initial simple and rapid antibody screen. If positive, the antibody screen is then repeated to confirm that result. The approach taken is similar to drug testing in that all initially positive samples are tested by more specific methods to verify the result.

Repeat positive samples for HIV are tested with a recombinant protein dot blot, in which the sample is tested for reactivity against the separated, individual HIV proteins. Only if the sample is reactive on the dot blot is the proposed insured reported to be positive for HIV antibodies or HIV antigen (protein). With the increased sensitivity of the dot blot, no additional testing is indicated. In a clinical setting, HIV-RNA results can also be present in an attending physician’s report, since it is done to determine viral load and to follow an individual’s anti-HIV drug therapy.

During successful treatment, the HIV-RNA test should be negative or show a non-detected status, although the HIV antibody test result remains positive. Recent innovations in testing allow for the detection of the 'p24' HIV protein marker and antibodies simultaneously. This innovation allows the identification of early infection prior to the patient developing antibodies against HIV. This '4th generation' test is replacing the older, multi-step process.

For most insurance companies, negative (non-reactive) HIV samples are reported to underwriting. Positive (reactive) and indeterminate results are reported directly to the medical director. The HIV test can be performed on oral fluid, urine, dried blood spot (DBS), serum, or plasma. HIV positive specimens customarily are retained by the insurance laboratory for at least two years.

Serological Testing for Hepatitis

Hepatitis is inflammation of the liver, and it can be acute or chronic.

Acute hepatitis can be caused by an infection with one of the hepatitis viruses (i.e., hepatitis A, B, C, D, or E) or by another viral infection, such as mononucleosis. Non-viral causes of acute hepatitis include drugs, alcohol abuse, heavy metal poisoning, environmental toxins, or acute obstruction of the portal vascular system (blood vessels) that drains the liver. A marker of acute hepatitis is liver enzymes elevated from three to ten times the upper limit of the normal reference range. Occasionally, abnormal liver enzyme levels can be in the thousands. With acute hepatitis, liver enzyme elevations will return to normal in less than six months.

Chronic hepatitis is defined as liver enzyme elevations lasting longer than six months. Typically, liver enzyme levels in chronic hepatitis can vary from normal to three times the upper limit of the reference range. The common causes of chronic hepatitis include non-alcoholic fatty liver, over the counter anti-inflammatory drugs (e.g., acetaminophen), hepatitis B or C, and alcohol abuse. Chronic inflammation of the liver increases the risk for development of fibrosis (scarring), cirrhosis (scarring and death of liver cells), and hepatocellular carcinoma.

Individuals with a history of chronic hepatitis or with abnormal levels of ALT or AST can be tested for the presence of antibodies to hepatitis C virus (HCV) and/or surface protein from hepatitis B virus (HBV). Hepatitis is normally detected by an increase in liver enzyme levels, but advanced fibrosis/cirrhosis can cause low enzyme levels because few functioning liver cells remain. Proposed insureds with low AST and ALT levels (usually in conjunction with low albumin and high globulin levels) have high excess mortality and should be evaluated carefully.

Hepatitis B becomes chronic in about 0.5 to 2.0% of adult-infected individuals.^{18,19} This percentage can approach 25 to 90% if the infection has been passed from mother to child or was acquired during childhood.²⁰ HBV is detected by the presence of surface antigen, which is a protein that is present on the outside of the virus. If the sample is confirmed positive for HBV, additional tests for "e" antigen (a protein produced during active viral replication), for antibody to surface antigen, and for antibody to core antigen (a protein from inside the virus) can be requested. A word of caution: an active infection (as opposed to "carrier" status) can also be present, even if "e" antigen is negative. The new methodology for HBV testing is to detect the viral DNA. If it is present, the person is infected.

Hepatitis C is the leading cause of liver failure and transplantation.²¹ Hepatitis C, in contrast to hepatitis B, becomes chronic in 70-85% of infected individuals. Following infection, the antibody against HCV will become detectable in six to twelve weeks. Infection is inferred by the detection of antibody specific to HCV proteins. Antibodies can remain detectable for decades, even in individuals who have cleared the infection.

As with HBV, the definitive test for HCV is a molecular test for hepatitis C RNA (HCV- RNA). If it is present, the person is infected. Since molecular tests vary widely in their sensitivity, when reviewing an attending physician's statement, the sensitivity of the test that was reported for HCV needs to be determined. In 2013, a new drug, sofosbuvir, was approved by the Food and Drug Administration (FDA). This drug and similar ones now cure a high percentage of HCV infections with few side effects.²² With new drug combinations, cure rates approach 95-99% even for the most difficult to treat HCV genotypes. However, cure does not mean the risk has ceased to exist. Any residual risk would be due to the amount of fibrosis and/or cirrhosis that was present before treatment and any continued adverse habits. Mortality risk remains high for untreated chronic hepatitis.²³

Markers of Glucose Metabolism

Glucose is the only energy source used by the brain and is utilized by all other tissues as well. High fasting glucose values in the blood are indicative of impaired glucose tolerance and/or diabetes. After sample collection, glucose continues to be metabolized by the red and white cells until the blood sample is centrifuged. In the laboratory, 25-35% of samples have low glucose values (<60 mg/dL). These levels usually represent physiologically unlikely values and are actually post collection artifacts. If the glucose level is high (≥ 109 mg/dL), the companion sample of whole blood is often reflexed to a hemoglobin A1c test.

Fructosamine measures the amount of glucose that becomes attached to serum proteins and is a general but inexpensive indicator of average glucose levels over the past two weeks or so. If elevated, the more expensive, but more predictive, hemoglobin A1c test can be performed to more accurately provide a specific and reliable measure of average long-term glucose levels.

Hemoglobin A1c is the gold standard test for the evaluation of diabetic risk. It is also called HbA1c, glycohemoglobin, glycated hemoglobin, and glycosylated hemoglobin. In the red blood cell, glucose binds chemically to hemoglobin, forming a stable combination for the remainder of the cell's life. Red blood cells have a half-life of about 120 days; therefore, a measure of the amount of hemoglobin A1c is a measure of the average glucose concentration over the prior 120-day period. The higher the average long-term concentration of glucose in the blood is, the higher the percentage of hemoglobin A1c is. However, if the individual has a blood disorder that shortens the life of red cells, such as sickle cell disease or thalassemia, the hemoglobin A1c level can be reduced relative to the actual average glucose level.²⁷ When HbA1c levels are lower than 4.0 the case should be reviewed carefully for underlying anemia and abnormal hemoglobin(s).

Hemoglobin A1c is clinically considered to be abnormal if 6.0% or higher. Values of 6.5% or higher are considered to be diagnostic of diabetes. Insurers may consider avoiding adverse underwriting action until values of 6.1% or higher are reached. This approach likely captures most of the risk while avoiding acting on hemoglobin A1c values that may be slightly lower (and therefore "normal") on repeat testing at another laboratory or on another day.

Clinical and CRL studies report that “all-cause” mortality begins to increase as hemoglobin A1c concentration reaches 6.0% and increases further for higher values.²⁴⁻²⁶ One comorbidity associated with diabetes is renal disease. If the hemoglobin A1c value is elevated, the companion urine sample can be tested for albuminuria directly or based on the protein/creatinine ratio.²⁷

Liver Enzymes

The liver is a biosynthesis, storage, and detoxification center, as well as being the largest internal organ in the body. Cholesterol, albumin, glucose, transferrin, and the clotting factors are a few of the important substances synthesized by the liver. The liver also forms bile to facilitate the breakdown of fats in the intestine, and stores fat, sugar, and iron. It transforms water-insoluble products of metabolism into water-soluble substances to facilitate their removal from the body by the kidneys.

Five liver enzymes are used as measures of liver well-being. These include aspartate aminotransferase (AST, also known as SGOT), alanine aminotransferase (ALT, also known as SGPT), gamma-glutamyl transpeptidase (GGT or GGTP), lactate dehydrogenase (LDH) and alkaline phosphatase (AP). All of these enzymes have high concentrations in the liver, although, except for ALT, they lack specificity for liver disease due to their production in other non-hepatic tissues as well.

ALT and AST, the transaminases, are elevated in most cases of hepatic disease, with the degree of elevation proportional to the severity of injury or inflammation. One notable exception is hepatitis C infection, in which poor correlation is found between ALT level and degree of organ damage. AST elevation can be associated with alcohol damage to the liver and fibrosis and is far more predictive of increased mortality risk as compared to ALT elevation.²⁸

Both of the aminotransferases are normally less than 45 International Units per liter (IU/L); however, elevations greater than 1000 IU/L can occur with drug toxicity or acute viral hepatitis. In chronic viral hepatitis, transaminase levels can vary between normal to levels in the hundreds of units per liter, with ALT being more commonly elevated than AST. The most frequent causes of minor elevation of ALT (very common) and AST (much less common) are fatty liver and non-alcoholic steatohepatitis (NASH), both of which can be associated with obesity. A diagnosis of NASH is associated with an increase in mortality.

Elevations of gamma-glutamyl transpeptidase (GGT) and alkaline phosphatase (AP) are associated with biliary obstruction or inflammation. If both enzymes are elevated, biliary obstructive disease is often present. If only GGT is elevated, drugs, alcohol, or other conditions can be the cause. Substantial recent research suggests a strong connection between GGT elevation and cardiovascular risk as well.

Elevation of alkaline phosphatase in the absence of the other liver enzyme elevations can indicate an extrahepatic origin for the enzyme (usually a bone disorder). Serum alkaline phosphatase levels can be increased in non-fasting samples due to uptake of increased amounts of alkaline phosphatase from the intestine. Late pregnancy is often associated with elevated alkaline phosphatase due to its production by the placenta.

Lactate dehydrogenase is present in almost every cell type in the body. Elevations can be associated with hemolytic or megaloblastic anemia, cancer, kidney or liver disease and or heart disease. Due to the lack of specificity, this marker may or may not be included in the standard blood profile.

Alcohol Markers

Alcohol abuse is a significant mortality risk.²⁹ Self-reported alcohol use is often inaccurate and less than the amount of alcohol actually consumed. Indirect markers of excess alcohol use or associated findings include high HDL levels, liver enzyme elevations (especially GGT), smoking, and low blood urea nitrogen. Direct markers include self-reported alcohol use and blood alcohol levels.

Blood samples with high liver enzyme results and high HDL can be evaluated by secondary confirmation methods, including carbohydrate-deficient transferrin (CDT) and hemoglobin-associated acetaldehyde (HAA). Neither CDT nor HAA has 100% sensitivity and specificity, but confirmed CDT-positive samples have a high correlation with chronic alcohol abuse, defined as five to six drinks per day or more. Hemoglobin-associated acetaldehyde can be elevated by chronic or recent alcohol use.

There are a few conditions and disorders that can cause false positive results for CDT. Some of these conditions included primary biliary cirrhosis, a rare genetic variant of transferrin, and some types of anemia. When conflicting information about a proposed insured's risk arises, the underwriter should investigate further the likely underlying cause of abnormal test results.

Lipids

Cholesterol is present in blood as part of different lipoprotein particles:

1. high density lipoprotein (HDL)
2. low density lipoprotein (LDL)
3. very low-density lipoprotein (VLDL).

Lipoprotein particles are aggregates of specific carrier proteins, cholesterol, and triglyceride. The majority of cholesterol is synthesized in the liver, and a lesser amount comes from diet. Isolated high triglyceride levels are most often due to the individual not fasting at the time of blood collection.

Low density lipoprotein (LDL) is a synthesized cholesterol-triglyceride-containing particle that transports cholesterol from the liver to the peripheral tissues. High LDL levels are associated with increased cardiovascular risk. While direct methods for the measurement of LDL are available, they are expensive. For that reason, LDL concentration is not measured but rather calculated using the formula: $LDL = \text{total cholesterol} - \text{HDL} - (\text{triglycerides}/5)$. Normally, LDL cholesterol is the largest component of total cholesterol.

HDL is a lipoprotein particle that transports cholesterol from peripheral tissue back to the liver. Low HDL is a risk factor for the development of coronary disease. The lower cut-off value for normal HDL is often defined as 40 mg/dL. Females have higher average HDL values than males.³⁰ In both sexes, higher values can also be the result of heavy alcohol use or exercise. The total cholesterol to HDL ratio (cholesterol/HDL) is routinely reported, and underwriting guidelines will often use this ratio instead of total cholesterol and/or HDL to assess lipid risk.³¹

Additional risk markers include measurement of the protein part of the lipoprotein particles. These include measurement of lipoprotein Lp(a) (LDL), apolipoprotein A1 (HDL), and apolipoprotein B100 (LDL). In clinical trials, all have been reported to correlate with the risk of developing cardiovascular disease and with increasing mortality.³² While these tests are not performed routinely in the insurance industry, they do appear in laboratory reports in attending physician's statements.

Apolipoprotein E, specifically ApoE4, is a potential marker for risk of Alzheimer's disease. While this marker is not currently utilized in insurance testing, the presence of test results for ApoE in an attending physician's statement should be carefully reviewed for possible anti-selection risk.

Insulin resistance syndrome (or metabolic syndrome) is a problem with metabolism that has high cardiovascular mortality.³³ The syndrome is characterized by high normal to minor elevations of cholesterol, triglycerides, glucose, and high blood pressure with low HDL in the presence of obesity. Each separate test result can present only a small risk that falls below an underwriting threshold, but if three or more of the five factors are positive, there is a higher cardiovascular risk.

Brain Type Natriuretic Protein (BNP) Hormone and NT-ProBNP

This protein was originally isolated from pig brain and when injected into lab rats was found to cause diuresis, an increased rate of urine formation. More recently, it was discovered that the heart is the primary site of the synthesis of proBNP hormone, while the kidneys are the site of its biological action (diuresis). It is produced in response to increased stress on the heart muscle and/or heart failure. This test is used in hospital emergency rooms to identify heart failure in those with unexplained shortness of breath or chest pain.

NT-proBNP is an independent predictor of mortality risk. It can be abnormal when other markers of cardiovascular disease and risk factors (such as cholesterol and HDL) are normal. NT-proBNP levels are higher in females and in older individuals; therefore, age- and sex-adjusted normal reference ranges should be used.³⁴ In addition, for proposed insureds who self-report heart disease, NT-proBNP helps differentiate risk. NT-proBNP may be elevated in individuals with atrial fibrillation, valvular heart disease, heart failure or renal failure.

Kidney Function

The kidneys remove waste products, excess water, salts, and toxins from the blood. The glomeruli of the kidneys act as a selective mechanical filter, allowing the passage of small proteins and water-soluble substances into the urine. In a second step, the kidney tubules concentrate the

urine, returning most of the water, salts, and glucose to the blood, leaving behind mostly waste products in the urine. Blood levels of creatinine and blood urea nitrogen reflect the balance between their rates of production and removal by the kidneys.

Creatinine

Creatinine is the breakdown product of muscle creatine phosphate (an energy source for muscle contraction). Creatinine production is proportional to muscle mass and exhibits very little day-to-day variation in an individual. The serum concentration of creatinine is the balance between the rate of creatinine production and the rate of elimination by the kidneys.

Creatinine, therefore, serves as a measure of renal filtration and urine formation. It is also impacted by muscle mass so that the serum level is higher in males and at younger ages. Slightly increased values can also occur in those with diets very high in meat. Delays in centrifugation of the serum sample can also artificially elevate the creatinine value. In those cases, an “enzymatic” creatinine (not impacted by delay) or cystatin C test can be ordered.

With aging, kidney function decreases along with muscle mass, so that serum creatinine remains reasonably stable. Minor elevation of creatinine values can be caused by hemolysis of the sample (post-collection) and rarely by dietary supplements, including creatine. Fifty percent of kidney function can be lost before it is detectable as an elevation of BUN or creatinine.

BUN

Blood urea nitrogen (BUN) is a by-product from the breakdown of protein. Protein is constantly being produced in tissue and cells; it is also absorbed from the intestine as amino acids. The serum concentration of BUN is proportional to its rate of production minus the rate of renal removal. BUN goes up if food intake is high in protein; likewise, it goes down if there is low tissue protein synthesis or tissue breakdown. Decreased BUN levels occur as a result of a diet low in protein, pregnancy, or with severe liver disease. If elevated, it can be used in combination with creatinine to evaluate renal function, but it is subject to much more variation independent of kidney function.

Cystatin C

Cystatin C is a low molecular weight protein present in all nucleated cells of the body. It is freely filtered by the glomerular network of the kidney and is completely destroyed in the kidney's tubules. Serum levels vary little by sex, diet, or body mass but will increase with the normal age-related decline in renal function. Therefore, the normal range for cystatin C needs to be adjusted upward for older individuals. Due to the high cost of this test, it is most commonly used as a reflex test for samples with high serum creatinine values.

Estimated Glomerular Filtration Rate (eGFR)

The primary function of the kidney is to filter metabolites and waste products from the blood, concentrate the urine, and remove the waste from the body. The volume of blood that the kidney filters per minute is the glomerular filtration rate. The glomerular filtration rate (GFR) can be measured by the rate that an injected drug is cleared from the blood, but this type of invasive testing

is rarely done outside a research setting. The alternative is to estimate the rate with an equation that uses the serum creatinine and the individual's age and gender.

The estimated GFR (eGFR) is now routinely calculated on attending physician's statements (and on some insurance laboratory reports) if a laboratory test for creatinine is reported. The lower limit of normal is generally considered to be 60ml/min/1.73m². This last term is the average body surface area. If the eGFR is lower than 60ml/min, the individual is considered to have impaired renal function; the lower the value is, the more severe is the disease. The eGFR helps to correct for sex and body size (muscle mass) in determining risk, but if a single cut-off value is applied to all ages, the presence of renal insufficiency will be substantially over-estimated in older individuals.³⁵

Two formulas for eGFR - the Rule (or Mayo) formula and the CKD-EPI formula - are in common use, with the latter becoming the more common. They are equally predictive of mortality risk but generate substantially different eGFR values for many age-sex subgroups. Underwriting tables based on eGFR for one formula cannot be substituted for the other formula.³⁶ An eGFR can also be calculated based on cystatin C.

Albumin

Albumin, produced in the liver, is the most abundant protein in blood. Albumin is decreased in starvation, cirrhosis, and in the weight loss ("wasting" or "cachexia") that often accompanies cancer or HIV. These are all significant underwriting risks. High levels of albumin only indicate dehydration, but low levels indicate that the individual requires additional evaluation.³⁷ Even minor reductions of albumin at younger or older ages are cause for concern and should prompt careful review of weight loss, other laboratory test values, and medical histories.

Bilirubin

Bilirubin is a breakdown product of the heme component in hemoglobin. Heme is converted to bilirubin in the liver. A portion of bilirubin is excreted in the bile, so obstruction of the biliary tree can lead to increased serum concentrations. Increased serum bilirubin can be due to either liver disease or biliary obstruction. If it is an isolated finding, it is most often the result of a common (and completely benign) genetic variation (i.e., Gilbert's syndrome). Extra-hepatic causes include hemolytic anemia, ineffective red cell production, blood transfusion, and drug interference with transport of bilirubin to the liver. In most of these cases, the other liver enzymes are normal. The mortality risk associated with isolated, abnormal levels of bilirubin among insurance applicants is generally low. A detailed analysis has been published by the authors.³⁸

Globulin

Globulin is comprised of immune proteins such as immunoglobulins (antibodies). Rather than being directly measured, globulin level is calculated by subtracting the albumin from the total protein. Antibodies are a special class of proteins produced by the immune system that adhere to specific foreign substances (antigens). The foreign substance can be a virus, bacterium, allergen, or a new cancer cell. The immune system is capable of producing millions of different antibodies, which specifically target these foreign substances. High levels of immunoglobulin can indicate an

acute or chronic infection or inflammation, myeloma or other malignancy, or a recently cleared infection. Elevated globulin and a low albumin/globulin ratio are markers of increased mortality risk.³⁹

Myeloma is a cancer of certain white cells. It is characterized by high levels of a single specific antibody. Monoclonal and polyclonal gammopathies are evaluated in the laboratory using a process called electrophoresis that identifies the specific type of antibodies involved. Monoclonal gammopathies of undetermined significance (MGUS) were originally thought to be benign but are now considered to be a risk for progression to myeloma. Rates of progression approach 1-2% per year in the elderly.^{40,41}

Total Protein

Total protein is a measure of all the protein present in the serum minus the clotting factors. The importance of the total protein is that it allows for the calculation of the globulin fraction. Refer to the albumin and the globulin levels to assess risk. Electrophoresis of the serum separates the individual types of proteins depending on their charge and mass allowing quantitation of albumin, individual immunoglobulins, alpha-1-globulin, alpha-2-globulin, beta globulin and gamma globulin.

Uric Acid

Uric acid is a metabolic product from the building blocks of DNA and RNA. Plasma levels vary considerably, with males having higher values than females. High values are associated with renal disease, hypertension, gout, and use of thiazide diuretics. The independent predictive value of uric acid for mortality is uncertain.

Hematology

Whole blood can be examined to determine the number of cellular components present. This is not routinely done in insurance laboratories due to lack of stability of the sample. However, a hemoglobin value can be reliably determined on almost all insurance samples and is routinely ordered by some insurers at older ages. The complete blood count (CBC) includes red cell (erythrocyte) count, white cell (lymphocyte, macrophage, and granulocyte) count, platelet count, hematocrit (i.e., volume of red blood cells as a percentage of total blood volume) and hemoglobin in grams per deciliter.

Laboratories can also report red cell indices, which are measurements of the size and hemoglobin content of red cells, the morphology (i.e., size and shape) of the red cells, or a ‘differential’ which is the percentage of each white cell type, the absolute number of each type, and any unusual cells detected. It is important for the underwriter to note the absolute count on a differential because the relative number of cells present in whole blood can be normal, while the absolute count is abnormal. This occurs in anemia and in some hematological cancers. In older females and males of any age, low hemoglobin (or hematocrit), high reticulocytes (new red cells), and low red cell counts are particularly worrisome. High hemoglobin values can also indicate the presence of polycythemia vera and be associated with increased risk.⁴²

Tumor Markers

Prostate-Specific Antigen (PSA)

Prostate-specific antigen (PSA) is a protein produced in the prostate. Levels increase in cancer, benign prostatic hypertrophy (BPH), and inflammation (i.e., prostatitis). In serum, PSA is present in two identifiable forms - free and bound. Total PSA is the sum of the two. Mortality risk increases as the PSA level increases.⁴³

Total PSA is usually measured first. If the total exceeds 10 ng/ml, the individual is normally referred to his attending physician for additional testing because cancer may be present and because this level of PSA suggests any cancer that is present may have spread beyond the prostate gland. If the test gives an equivocal result (values of 4-10 ng/ml), cancer risk may be elevated. Some insurers request that the percentage of free PSA be determined; others simply use the total PSA level to reach a decision.

If the free PSA test is performed and the percentage is 25% or higher, cancer risk is lower. Only 26% of proposed insureds tested had free PSA percentages that high. The free PSA test appears potentially useful for risk discrimination only in the 50-59 age group who have PSA values between 4-10 ng/ml.⁴³ Post sample collection, free PSA continues to bind to alpha-2-macroglobulin, reducing the amount that the test can detect. The result is a mis-classification of risk due to a pretest artifact with a lower than expected amount of free PSA being reported.

In proposed insureds with a history of prostate carcinoma treated with radical prostatectomy or radiotherapy for cure, PSA values ≥ 0.2 ng/ml suggest incomplete removal of the cancer. Anti-androgen treatment with Lupron®, Casodex®, or Zytiga® suppresses tumor growth but does not completely block formation of PSA by the prostate. As a corollary, any PSA value < 0.2 ng/ml for a male should raise suspicion of prior treatment for prostate cancer. In the group with prostate cancer the velocity of PSA change (rate of change of the PSA concentration over time) is an important measure. When the post treatment PSA value is stable, the risk is low; when the sequential values increase, the risk of active disease is high.

Carcinoembryonic Antigen

Carcinoembryonic antigen (CEA) is produced in excess amounts by many solid tumors including gastrointestinal, lung, and breast cancers. In clinical practice, the test is used to follow patients after treatment if their tumor was initially associated with a CEA elevation. It is not used clinically for general screening for two reasons: there are a substantial number of false positives (at lower cut-off values) and if CEA is very high, no cure of any tumor found is generally possible. The fact that such tumors may not be treatable increases rather than decreases the potential value of the test for insurers. The test is used by some insurers for screening proposed insureds over age 50 and uses a much higher reference cut-off value to limit false positives.^{44,45}

Other Tumor Markers

In attending physician's statements, it is important to review tests used for cancer screening. These can include chest x-rays, genetic markers such as BRCA1 and BRCA2, and mammography. BRCA is a genetic marker associated with an increased risk for development of breast and ovarian cancer. It is used to identify individuals who may be at increased risk for cancer based on their family history. Other markers of interest include CA-19-9 for gastrointestinal cancer, alpha fetoprotein (AFP) for liver and germ cell cancer, and beta human chorionic gonadotropin (beta-hCG) for germ cell cancer. This list is not exhaustive since new markers are introduced constantly.

Genetic Testing

Genetic testing is becoming increasingly prevalent in clinical and non-clinical settings, although interpretation of results is difficult. Genetic tests for determination of the "risk of future disease," including the risk for developing Alzheimer's disease, Huntington's disease, various cancers, and cardiovascular disease are available. Genetic tests can be helpful in defining future risk in two distinct ways. They can reveal diseases that have 100% chance of occurring if the genetic test is positive. An example of this is Huntington's disease. They can also reveal diseases that have some probability of occurring if a particular gene is present. Examples of this include the current marker genes associated with cardiovascular disease.

Another current application is the genetic testing of tumor cells to determine the course of treatment and the probability of outcomes for various cancers. Genetic testing will become increasingly important so medical directors and underwriters will need to follow its development.

Currently no genetic test(s) are ordered by insurance companies, however, if they are reported in attending physician reports please carefully review the test result(s) and medical interpretation.

Epigenetic Testing

The field of epigenetics studies the effects of the chemical modification of DNA. Most studies thus far have looked at DNA methylation, one type of modification. DNA contains several million locations where a methyl group might be added to a cytosine residue (the C in the DNA 'ATCG' code). Some of these locations tend to accumulate or lose methyl groups with certain behaviors. Specifically, smoking or alcohol intake may alter the methylation levels in reasonably reliable ways. Since the science is still young, specific tests are still being worked out.

Scoring of Laboratory Test Results, Blood Pressure, Height and Weight

Insurance laboratories have recently introduced mortality risk scores into their laboratory reports. The scoring varies by laboratory but reflects the overall risk and/or the individual risk presented by each laboratory test and physical measurement result. These efforts take advantage of age-, sex- and condition-specific analysis, also accounting for the overlapping impact of various tests.^{46,47}

Note on Reference Ranges:

In this chapter, very few expected or reference range values are specified because:

1. Individual insurance companies can specify different cut-off values in their underwriting manuals. Guidelines change and values that are correct today can be different in the future.
2. Individual laboratory reference ranges can vary. For this reason the underwriter must use the reference range on the report that is being reviewed.

APPENDIX 1
(For student's information only; this material will not be tested.)

EXAMPLE OF A LABORATORY REPORT

LABORATORY XXX

(ILS.XYZ.XYZ)

DATE: XXX 11:56

Page: 1

NAME: XXXXXXXXXX	XYZ COMPANY	SAMPLE ID: XXXXXX04
DOB/AGE: 12/31/1950 (56 YRS)	XYZ REGION	SLIP ID: XXXXXX04
SSN: XXX-XX-XX04	MEDICAL DIRECTOR	DRWN: 10/04/2014 02:55
GENDER: MALE	POLICY/REF#: N/S	RCVD: 10/04/2014 2014
CITY: ANYTOWN	POLICY AMT: \$ 0	SENT: 10/23/2014 11:56
STATE/ZIP: KS	AGENCY: N/S	LAST FOOD: 12
HRS		
DL#/ST: XX04/KS	EXAMINER: N/S	URINE TEMP:N/S
INSURANCE TYPE: N/S		

RESULT/STATUS CUTOFF/EXPECTED VALUE

CHEMISTRIES-----

GLUCOSE	90	70-110 mg/dL	
FRUCTOSAMINE	1.65	1.20-2.10 mmol/L	
BLOOD UREA NITROGEN (BUN)	15	6-25 mg/dL	
CREATININE	1.05	0.60-1.50 mg/dL	
URIC ACID	6.2	4.0-8.5 mg/dL	
ALKALINE PHOSPHATASE	72	30-115 U/L	
TOTAL BILIRUBIN	0.65	0.10-1.20 mg/dL	
SGOT (AST)	378	HIGH	0-41 U/L
SGPT (ALT)	152	HIGH	0-45 U/L
SGOT/SGPT	2.48	HIGH	0.00-1.50
GAMMA GLUTAMYLTRANSFERASE	33	2-65 U/L	
TOTAL PROTEIN	7.2	6.0-8.5 g/dL	
ALBUMIN	4.2	3.0-5.5 g/dL	
GLOBULIN	2.8	1.0-4.6 g/dL	
CALCIUM	9.3	8.4-10.2 mg/dL	
LACTATE DEHYDROGENASE (LDH)	171	100-242 U/L	

CARDIAC RISK-----

CHOLESTEROL	290	HIGH	140-280 mg/dL
HIGH DENSITY LIPOPROTEIN (HDL)	41.0		25.0-75.0 mg/dL
LOW DENSITY LIPOPROTEIN (LDL)	210	HIGH	80-200 mg/dL
VERYLOW DENSITY LIPO. (VLDL)	22		5-40 mg/dL
TRIGLYCERIDES	105		10-200 mg/dL
CHOLESTEROL/HDL RATIO	7.07	HIGH	1.50-5.00
LDL/HDL RATIO	1.80		0.00-3.60

HIV SCREENING-----

-----HIV-1 EIA

NON-REACTIVE

NON-REACTIVE

URINALYSIS-----

URN SPECIFIC GRAVITY	1.030	1.003-1.035
URN CREATININE	155.0	10.0-300.0 mg%
URN GLUCOSE	0.00	0.00 g/dL
URN TOTAL PROTEIN	7.5	0.0-14.9 mg/dL
URN PROTEIN/CREATININE	0.04	0.00-0.20 g/gCREA
URN RED BLOOD COUNT	2	0-4 HPF
URN WHITE BLOOD COUNT	4	0-9 HPF
URN HYALINE CASTS	0	0 LPF
URN GRANULAR CASTS	0	0 LPF

DRUG SCREENING-----

-----COCAINE METABOLITES, URN	NEGATIVE	300 ng/mL
NICOTINE METABOLITES, URN	NEGATIVE	

< END OF REPORT >

APPENDIX 2
(For student's information only; this material will not be tested.)

SAMPLE APPLICANT TEST GUIDE

Sample ID: 0000000

NAME:	JANE P EXAMPLE1	COLLECTION DATE:	01/07/2014
BIRTH DATE:	05/26/1958 (54 YRS)	LAST FOOD:	3 HRS
GENDER	FEMALE		

CHEMISTRIES RESULTS

Determination	Your Result	Expected Range	Test Guide
GLUCOSE	60 LOW	70-110 mg/dL	Measures the blood sugar level. Elevations are indicative of diabetes.
FRUCTOSAMINE	1.53	1.20-1.70 mmol/L	Measures blood sugar concentrations over the preceding one to three weeks. Elevations are indicative of diabetes.
HEMOGLOBIN A1C	6.1 HIGH	3.0-6.0%	The A1C test may be used to screen for and diagnose diabetes in addition to monitoring the glucose control of diabetics over time. It provides an accurate long-term index (100-120 days) of the average blood glucose level. This test is not affected by short term variations such as food intake, exercise or stress.
BLOOD UREA NITROGEN (BUN)	11	6-25 mg/dL	BUN is a by-product of protein metabolism and is cleared by the kidneys. Elevations can result from any type of kidney disorder, strenuous exercise, or diuretic medications.
CREATININE	0.85	0.60-1.50 mg/dL	A by-product of muscle metabolism, also cleared by the kidneys. Elevations suggest kidney or muscular disorders. Protein diets may cause mild elevations.
URIC ACID	6.3	2.5-7.5 mg/dL	A by-product of protein metabolism. Elevations are generally associated with gout, but also may be due to kidney disease and other conditions. Asymptomatic elevations in otherwise healthy individuals are of little significance.
ALKALINE PHOSPHATASE	70	30-115 U/L	An enzyme found primarily in the bone and liver that may indicate bone, liver or kidney disorders. Generally higher in children than in adults because of its role in the bone making processes. Levels may be elevated at times of pregnancy.
TOTAL BILIRUBIN	0.6 LOW	0.10-1.20 mg/dL	A by-product of the breakdown of old red blood cells and is made into a water soluble form in the liver. Elevations may be due to anemia, chronic liver disease, and carcinoma.

Sample ID: 0000000			
NAME:	JANE P EXAMPLE1	COLLECTION DATE:	01/07/2014
BIRTH DATE:	05/26/1958 (54 YRS)	LAST FOOD:	3 HRS
GENDER	FEMALE		
CHEMISTRIES RESULTS (continued)			
Determination	Your Result	Expected Range	Test Guide
SGOT (AST)	15	12-36 U/L	Enzyme which has three main sources, skeletal muscle, heart muscle, and liver tissue. Elevations can be due to disease or trauma to the muscles, to heart damage, and to various liver diseases. SGOT may also be elevated in the presence of certain medications.
SGPT (ALT)	11	9-42 U/L	An enzyme present in many tissues including the liver. Elevations occur in acute viral hepatitis and other liver disorders. SGPT may also be elevated in the presence of certain medications.
GAMMA GLUTAMYLTRANSFERASE (GGT)	48	10-75 U/L	A liver enzyme that is present in various tissues. Elevations may indicate hepatitis, heavy alcohol consumption or the use of certain medications.
TOTAL PROTEIN	7.5	6.0-8.5 g/dL	Very low values may be associated with peripheral edema or malnutrition. High values may suggest dehydration, chronic inflammation.
ALBUMIN	4.3	3.6-5.2 g/dL	Higher values represent dehydration, while lower values are generally a result of renal or hepatic problems.
GLOBULIN	3.2	1.0-4.6 g/dL	High levels of globulin are found in severe liver disease, some infectious diseases and multiple myelomas.
CARDIAC RISK RESULTS			
Determination	Your Result	Expected Range	Test Guide
CHOLESTEROL	220	130-220 mg/dL	Cholesterol is a blood lipid (fat) which has a direct correlation with the chances of developing coronary heart disease. Elevated cholesterol levels can be hereditary or from excess dietary intake of cholesterol rich foods
HIGH DENSITY LIPOPROTEIN(HDL)	41.8	25.0—75.0 mg/dL	High density lipoproteins facilitate the transport of lipids (fats) to bodily tissues. HDL removes excess cholesterol from arteries, inhibiting the formation of atherosclerotic lesions. HDL can be increased by regular exercise, weight loss, smoking cessation and reduction of fat intake.
LOW DENSITY LIPOPROTEIN(LDL)	144	60-190 mg/dL	Low density lipoprotein is known as the "bad" cholesterol. High levels of LDL carry cholesterol through the blood, "painting" it on arteries in combination of calcium and plaque.

Sample ID: 0000000

NAME:	JANE P EXAMPLE1	COLLECTION DATE:	01/07/2014
BIRTH DATE:	05/26/1958 (54 YRS)	LAST FOOD:	3 HRS
GENDER	FEMALE		

CARDIAC RISK RESULTS (continued)

Determination	Your Result	Expected Range	Test Guide
TRIGLYCERIDES	168	10-200 mg/dL	A blood lipid (fat) derived primarily from carbohydrate intake. High levels may be associated with various disorders, including diabetes, alcohol abuse and pancreatitis.
CHOLESTEROL/HDL RATIO	5.2 HIGH	1.5-5.0	Cholesterol reading divided by the HDL reading. The lower the ratio, the lower the risk of coronary heart disease.
LDL/HDL RATIO	3.4	0.0-3.6	Low Density Lipoprotein divided by High Density Lipoprotein. The higher this ratio, the greater the risk for coronary atherosclerosis

URINALYSIS RESULTS

Determination	Your Result	Expected Range	Test Guide
URN SPECIFIC GRAVITY	1.030	1.003-1.035	Low specific gravity is characteristic of diabetes or tubular necrosis, while high values may occur with dehydration, congestive heart failure, kidney failure, liver failure or shock
URN CREATININE	157.0	10.0-300.0 mg%	Creatinine levels primarily measure renal function. Decreased levels may indicate impaired renal perfusion, urinary tract obstruction or kidney related disease.
URN GLUCOSE	0.00	0.00 g/dL	Sugar glucose in the urine. Presence is generally thought to be the result of diabetes.
URN TOTAL PROTEIN	110.0 HIGH	0.0-14.9 mg/dL	Albumin or white blood cells in the urine. Presence may indicate a kidney infection, prostate infection, vaginal infection or extreme muscular exertion.
MICROALBUMIN/CREATININE	468.78 HIGH	0.00-29.99 mg/gCREA	Microalbumin/creatinine ratio is used to predict the development of diabetic nephropathy (kidney failure) and its mortality risk in diabetes.
URN PROTEIN/CREATININE	0.70 HIGH	0.00-0.20 g/gCREA	Protein/Creatinine Ratio may help determine whether protein is elevated due to kidney disease or urine concentration.
URN MICROALBUMIN	73.6 HIGH	0.0-3.0 mg/dL	Microalbumin is used to predict the development of diabetic nephropathy (kidney failure) and its mortality risk in diabetes.

Sample ID: 0000000

NAME: JANE P EXAMPLE1 COLLECTION DATE: 01/07/2014
 BIRTH DATE: 05/26/1958 (54 YRS) LAST FOOD: 3 HRS
 GENDER FEMALE

URINALYSIS RESULTS (continued)

Determination	Your Result	Expected Range	Test Guide
URN RED BLOOD COUNT	0	0-5 HPF	Red blood cells in the urine. Presence can indicate diseases, structural abnormalities or injury to the kidneys, ureters, bladder, prostate or urethra.
URN WHITE BLOOD COUNT	0	0-9 HPF	Numerous white cells in the urine usually imply urinary tract inflammation such as cystitis or pyelonephritis. Renal infection is suggested by the presence of white cells and white cell casts.
URN HYALINE CASTS	0	0 LPF	Excessive numbers of casts are associated with renal disease.
URN GRANULAR CASTS	0	0 LPF	Excessive numbers of casts are associated with renal disease.
NICOTINE METABOLITES, URN	NEGATIVE	0.000-0.199 ug/mL	Nicotine in the urine indicates tobacco use of some type. Cutoff values have been established to differentiate smokers/tobacco users from non-tobacco users, including those non-smokers exposed through passive inhalation.

PHYSICAL MEASUREMENTS

Height: 5' 1" Blood Pressure Reading 1: 124/85 Pulse Reading 1: 60
 Weight: 177 Blood Pressure Reading 2: 128/85

The above results are provided to you for information purposes only. If you have any questions regarding your health, please consult with your personal physician. This report is not a substitute for medical care, and only your physician can diagnose a medical condition.

Legend: BDL-BELOW DETECTABLE LIMIT	QNS-QUANTITY NOT SUFFICIENT FOR ANALYSIS
NCAL-NOT CALCULATED	SNS-SAMPLE NOT SUBMITTED
NSA-NOT SUITABLE FOR ANALYSIS	TNP-TEST NOT PERFORMED
NVG-NOT VALID DUE TO GLYCOLYSIS	

Review Questions – ALU 101, Chapter 6

1. The measure of a test's ability to detect individuals who have disease is:
 1. sensitivity
 2. reliability
 3. specificity
 4. proficiency
 2. Elevations of both gamma-glutamyl transpeptidase (GGT) and alkaline phosphatase (AP) are associated with:
 1. pancreatitis
 2. osteomyelitis
 3. biliary obstruction
 4. osteoporosis
 3. A positive urine cotinine test result on an insurance exam can be caused by which of the following?
 - A. nicotine gum
 - B. cigar use
 - C. second hand smoke
- Answer Options:
1. A and B only are correct.
 2. A and C only are correct.
 3. B and C only are correct.
 4. A, B, and C are correct.
4. Discuss the differences between acute and chronic hepatitis, including causes, typical findings, and possible outcomes.
 5. Name the five serum enzymes that are used as indirect measures of liver pathology and diseases associated with their elevations.

6. Chronic hepatitis increases the risk of developing which of the following?

- A. fibrosis
- B. hepatocellular carcinoma
- C. Barrett's esophagus

Answer Options:

- 1. A only is correct.
- 2. A and B only are correct.
- 3. B and C only are correct.
- 4. A, B, and C are correct.

7. The presence of red blood cells in the urine is:

- 1. hematuria
- 2. glycosuria
- 3. proteinuria
- 4. albuminuria

8. Name two tests performed on blood that are useful in identifying impaired glucose tolerance or diabetes and discuss the efficacy of each.

9. Name four tests that can be performed on a urine sample and the value of each.

10. Identify two tumor marker tests that can be performed as part of an insurance exam and identify what disease implications might be suggested by each.

Answers and Sources of Review Questions

Review Question 1

Answer 1: sensitivity – page 2.

Review Question 2

Answer 3: biliary obstruction – page 17.

Review Question 3

Answer 1: A and B only are correct – page 13.

Review Question 4

Refer to page 15.

Review Question 5

Refer to page 17.

Review Question 6

Answer 2: A and B only are correct – page 15.

Review Question 7

Answer 1: hematuria – page 11.

Review Question 8

Refer to page 16.

Review Question 9

Refer to pages 10-13.

Review Question 10

Refer to pages 23-24.

CHAPTER 7

MOTOR VEHICLE RISK

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Revised 2020

MOTOR VEHICLE RISK

Introduction

One of the largest voluntary risks taken by the U.S. population is traveling by automobile. In recent years, traffic accidents ranked as the fourth leading cause of death in the United States overall, and the leading cause between the ages of 5 and 24 based on 2015 data.¹ Motor vehicle accidents cause nearly 33,000 deaths each year despite numerous advances in motor vehicle design and highway safety.²

The number of licensed drivers continues to increase with the growing population. In order to measure frequency of motor vehicle deaths more accurately, the National Highway Traffic Safety Administration (NHTSA) developed the ratio of fatalities per 100 million vehicle miles traveled. Over the past four decades deaths have declined steadily, from over 5 fatalities/100 million miles in 1968 to less than 1.1 deaths/100 million miles during the first half of 2017.²

Determining those most at risk for a fatal accident can permit appropriate pricing or avoidance of that risk to meet mortality and pricing expectations. The purpose of this chapter is to provide an understanding of the risks, explain pertinent terminology, and discuss the underwriting tools used for assessment.

Major Factors in Motor Vehicle Fatalities

The major causative factors associated with motor vehicle fatalities are speeding, running red lights, distracted driving, fatigue, and impaired driving. In the U.S., alcohol-related accidents represented approximately one-third of fatalities, resulting in nearly 10,500 deaths per year.³

Alcohol and Drug Use

Approximately 15,000 people are killed each year due to drunk and drugged driving, according to the NHTSA. Drugged driving is driving under the influence of any drug that acts on the brain to impair motor skills, reaction time, and judgment.

Physiological and Psychological Impact

Alcohol is quickly absorbed into the bloodstream. The body eliminates alcohol at a rate of approximately one ounce per hour, although individual variations exist.⁴ Because the body metabolizes alcohol at a fairly constant rate, ingesting alcohol at a rate higher than the rate of elimination results in a cumulative effect and an increasing blood alcohol concentration. The toxic effects of alcohol are magnified with higher concentration in blood levels, leading to a profound negative effect on driving skills.

Alcohol acts as a depressant on the central nervous system, causing drivers to misjudge capabilities. This includes the following effects:

1. reaction time – Reflexes can be dulled, decreasing the ability to react swiftly enough to situations.

2. vision – Eye muscles function more slowly. Eye movement and perception are altered, possibly resulting in blurred vision. Night vision and color perception are also impaired.
3. tracking – The ability to judge such things as the vehicle's position on the road, or the location of other vehicles, the center line, road signs can be affected.
4. concentration – Attention to driving may decrease. Drowsiness can occur.
5. comprehension – The depressant effect of alcohol hinders the ability to make rational decisions.
6. coordination – The mechanics of driving can be affected by reduced eye/hand/foot coordination.

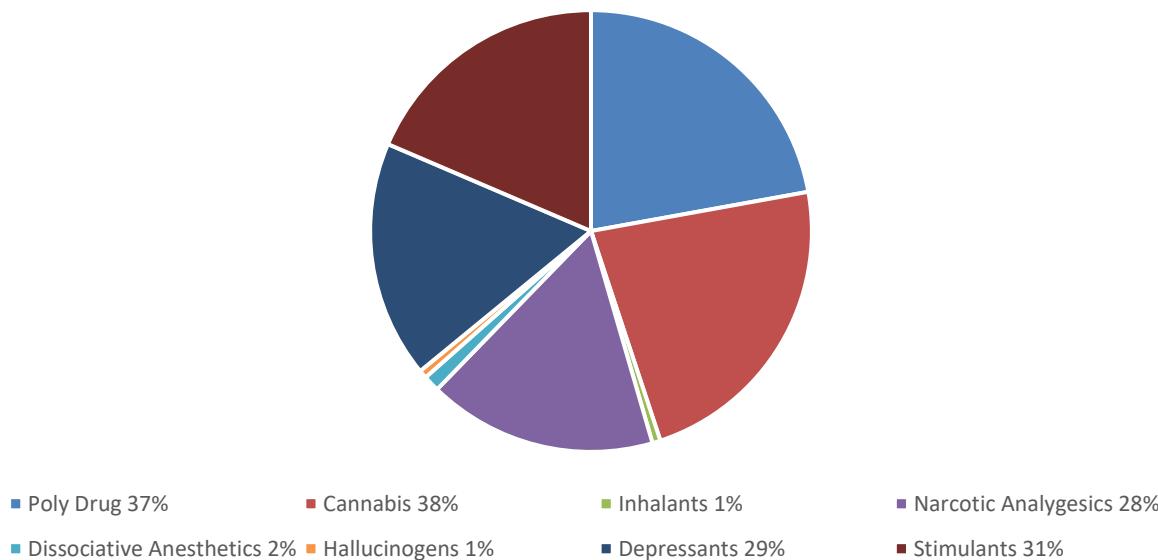
If alcohol is used in conjunction with other drugs (legal or illegal), the effects of both substances can be increased – a potentially deadly situation.

Drugged driving is driving under the influence of any drug that acts on the brain to impair motor skills, reaction time, and judgment. Drugs are used by approximately 10-22% of drivers involved in crashes, often in combination with alcohol. Research shows that driver impairment increases significantly when marijuana use is combined with alcohol.

In recent years, several U.S. states have taken action to legalize the use of marijuana for medical and recreational use, increasing concern of the risk of driving under the influence of marijuana. Use of marijuana and prescription drugs is increasingly prominent among drivers on America's roads, which raises a new safety challenge. Understanding the effects of drugs on driving is considerably more complicated than is the case for alcohol impairment. There are many potentially impairing drugs and the relationship between them and driving impairment is complex.

The NHTSA graph shows the 2017 distribution of drugs detected in law enforcement evaluations.

Confirmed Toxicology Results of Enforcement Evaluations 2017



Source: Sobriety Testing Resource Center

https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/13839-drugged_facts_flyer_101918_v8_002.pdf

Reported Drug Use Among Fatally Injured Drivers From 2008 to 2016.
Cannabinoid Use Nearly Doubled Between 2008 and 2016.

	Tested and Drug +	Tested Cannabinoid +
2008	27%	10%
2009	32%	11%
2010	33%	11%
2011	35%	11%
2012	37%	13%
2013	38%	14%
2014	38%	14%
2015	42%	16%
2016	42%	18%

https://www.safercar.gov/sites/safercar.dot.gov/files/documents/13839-drugged_facts_flyer_101918_v8_002.pdf
Fatality Analysis and Reporting system (FARS)

While a hand-held breath test can quickly determine ethanol in the breath, there is no instant test to check for marijuana intoxication. Standards for level of impairment and THC testing technologies are still in development in most jurisdictions where marijuana use is legalized.

Expanding legalization of medicinal and recreational use of marijuana requires much more research to build on these preliminary findings.

Legal Issues

Legal alcohol limits for DUI (driving under the influence; also known as DWI—driving while intoxicated or driving while impaired) are established and are used to test drivers suspected of driving while intoxicated. All 50 states and the District of Columbia have enacted per se laws, defining criminal penalties from driving with a blood alcohol concentration (BAC) at a minimum level (usually 0.08%).⁵

License suspension or revocation traditionally follows a conviction for alcohol-impaired driving. Under a procedure called administrative license suspension, driving privileges are suspended before conviction when a driver fails or refuses to take a chemical test.

Some DUI offenders are allowed to drive only if their vehicles have been equipped with an ignition interlock device, a court-mandated requirement for an alcohol conviction. The interlock device is a breath analyzer that will prevent the engine from starting if the device detects a blood alcohol content above the legal limit. In most states, repeat offenders may have to forfeit vehicles that are driven while the driver was impaired by alcohol.

Attendance at Alcohol/Drug Education Classes

Several states will remove or reduce a DUI violation if the offender attends classes for safety training or alcohol/drug awareness. For example, a DUI violation could be reduced to reckless driving or removed altogether following alcohol/drug education classes.

Speeding

Speeding is described as driving too fast for conditions or driving in excess of posted speed limits. One out of ten drivers regularly exceeds the speed limit by 11 or more miles per hour (mph), with drivers between ages 18 and 24 years showing the greatest propensity for speeding.⁶

Speed limits are determined in part based on highway sight distances. A straight, level highway has the highest speed limit potential. Speed limits are modified according to local geography, surface conditions, and traffic demands near population centers.

When a speeding vehicle approaches, other drivers may not be able to recognize or comprehend distances needed for a margin of safety. Speeding vehicles also take longer to stop. Excessive speeds in accidents cause reduced effectiveness of the safety features included in both vehicles and road design.

Statistics continue to show a relationship of excessive speed to an increased rate of accidents. In the U.S., 27% of all fatalities occurring in 2015 were speeding-related. The Insurance Institute for Highway Safety has studied the relationship of speeding, accidents, and fatalities. One of the landmark research findings concerned the 1995 repeal of the mandatory 55 mph speed limit and what happened in the following years. States that went back to higher speed limits recorded a 15% increase in fatalities on interstates and freeways. There was a 38% increase in fatalities in states that increased the speed limit from 55 to 75 mph.⁷

Motorcycles

There were less than 1.11 automobile deaths per 100 million miles traveled in the first half of 2015. In contrast, in the same time period there were approximately 23 motorcycle deaths per 100 million miles traveled, and fatalities reached 4,976. Motorcycle accidents accounted for 15% of all fatalities in 2015; however, motorcycles make up only 3% of all registered vehicles.⁸

According to the NHTSA, motorcyclists are 37 times more likely than automobile occupants to die in a crash, per vehicle mile traveled, and 9 times more likely to be injured. Motorcycles are the smallest vehicles on the road and provide virtually no protection in the event of a crash. Motorcyclists are at increased risk of injury and death from exposure, from not being easily visible to other drivers, and from inconsistency of helmet use. Only some states require helmet use, so motorcycle drivers and riders are exposed to head trauma and a greater likelihood of death.

Driver Characteristics

The General Motors Acceptance Company Insurance National Driver's Test found that nearly 36 million Americans, or about one in six drivers, would fail a state driver's test if they had to take one today. More than 5,000 licensed drivers between the ages of 16 and 65 were administered a 20-question written test designed to measure basic knowledge about traffic laws and safety.

According to the study, many drivers have difficulty with basic driving skills such as merging and interpreting road signs. One out of five drivers surveyed did not know that a pedestrian in a crosswalk has the right of way, and one out of three drivers admitted to accelerating through a yellow light at an intersection, even when pedestrians are present.

Young Drivers

As noted earlier, motor vehicle traffic crashes are the number one cause of death up to age 34. Teenage drivers have the highest crash risk due to inexperience and immaturity; moreover, many young drivers are at increased risk because of deficiencies in a variety of psychomotor, perceptual, and cognitive skills. Some young drivers intentionally increase their risk of collision when they are motivated by thrill-seeking or compromised by peer pressure. Lifestyle choices and inexperience often add to the mix and dramatically increase the crash risk of teen drivers.

Teens and other young people are over-represented in drunk driving accidents because they are inexperienced with alcohol, are more likely to use illegal drugs, and have a false sense of invincibility. In recent years, people ages 16 to 24 were involved in 28% of all alcohol-related driving accidents, although they make up only 14% of the U.S. population.¹¹ Young people are also over-represented in “drinking driver” injuries and deaths. Even when their blood alcohol content (BAC) is not high, young drinkers are involved in driving accidents at higher rates than older drivers with similar levels of blood alcohol.

Elderly Drivers

The elderly driving pool comprises 15% of all drivers, but overall this group drives only 7% of all vehicle miles each year. Since 2003, the population of older adults, defined as age 70 and older, has increased by 20% and the number of licensed drivers has increased by 21% to 32 million licensed older drivers in 2015.

Driving is an important issue for older adults. Getting an elderly driver to admit that it may be time to stop driving can be difficult. Driving represents freedom and independence, the ability to travel and do errands without relying on anyone else.⁹ The majority of Americans rely upon private automobiles for their transportation. Older adults who are forced to stop driving may rely more upon their families, reduce their social activities, and often become depressed.

Despite a moderate decline in mental, motor, optic, and auditory functions with aging, many older people drive safely. Driving performance is usually impaired only after a considerable loss of function since most driving patterns are learned and become second nature. In addition, individuals often regulate their own driving as they age; seniors drive fewer miles, shorter distances, less at night, and seldom in rush hour. There is consensus among traffic safety experts that older drivers should be kept on the road as long as they can drive safely. Most drivers monitor themselves and gradually limit or stop driving when they feel that a certain driving situation or driving in general is not safe.

However, some people fail to recognize declining abilities. Conditions such as dementia can make some drivers unable to evaluate their driving properly.

Elderly drivers have an increased death rate from accidents due to frailty. Older drivers have become a mortality risk concern because they are involved in more fatal car crashes per miles driven than any other age group, except teenagers. Drivers over the age of 75 also have more traffic violations and nonfatal collisions than younger drivers. Two of the most common violations, failure to yield the right of way and failure to obey a traffic sign, often lead to accidents at intersections where the older driver can fail to have a quick response, full peripheral vision, and appropriate interaction with other drivers.

As the elderly population increases in the next 20 years, older drivers are projected to be involved in up to 17% of all crashes and 25% of all fatalities.

Distracted Driving

Distracted driving can be anything that pulls attention away from driving, including cell phone use, texting while driving, eating, drinking, and using in-vehicle technologies and portable electronic devices. According to NHTSA data from 2012¹⁰, 10% of fatal crashes and 18% of injury crashes were distraction-related. Forty-seven states and the District of Columbia ban text messaging for all drivers, while 14 states and the District of Columbia have handheld cell phone bans.¹¹

Young drivers using cell phones for verbal conversation or text messaging while driving have a five-fold increase in accidents compared to their peers who do not use cell phones while driving. About one in five young drivers think that texting makes no difference in their driving performance. An unsettling survey result showed 68% of young drivers ages 18 to 20 are willing to answer incoming phone calls on some, most, or all driving trips.¹²

A 1997 study published in *The New England Journal of Medicine*¹³ found that drivers using cell phones have up to a four-fold risk of having an accident. In other studies using driving simulators, drivers using cell phones were compared to drivers impaired by alcohol up to the limit of legal intoxication. Researchers confirmed cell phone users tune out visual and auditory cues needed for driving awareness. Reaction time and driving ability were similar to those with blood alcohol levels meeting the threshold for driving while impaired. According to research at Virginia Tech Transportation Institute from 2012, texting while driving increases the risk of having an accident by a factor of 23.¹⁴

Aggressive Driving

Aggressive driving is increasing on public highways due to increased traffic, increasing population densities, and longer commutes. People are pressed for time and slowed by congestion, which builds stress and results in more incidents of aggressive driving behavior. A 2006 survey of American Automobile Association members perceived aggressive and distracted drivers as a greater threat than drunk drivers. Aggressive driving violations can appear on the MVR as reckless or careless driving, depending on the jurisdiction.

Examples of aggressive driving are speeding while running red lights or stop signs, unsafe lane changes, passing on the shoulder, or following too closely. Aggressive behavior can also include harassment, intimidation, or intent to injure or obstruct other drivers. These actions can transition to road rage, which is a criminal offense defined as “an assault with a motor vehicle or other dangerous weapon by the operator or passenger of one motor vehicle on the operator or passengers of another motor vehicle or is caused by an incident that occurred on a roadway.”

Medical Conditions

Driving ability can be affected by medical conditions reducing alertness, strength, physical coordination, agility, judgment, attention, knowledge, or skill necessary to safely operate a motor vehicle.

Deciding which medical conditions can be acceptable is a matter of careful underwriting consideration.¹⁴

Such conditions can be static (i.e., unchanging), such as the residual effects of a single stroke. Driving can also be affected by chronic conditions, such as an uncontrolled seizure disorder or diabetes, or by progressive conditions that gradually deteriorate over time, such as Alzheimer's disease or other forms of dementia.

Alcohol and Drug Dependence

Alcohol or drug dependence that results in loss of control or compulsive behaviors can increase driving risk immeasurably. Stimulants, narcotics, marijuana, and LSD can significantly alter perception and increase the danger of driving under the influence.

Cardiac

Cardiovascular disease can affect driving safety if associated with coronary ischemia.

Many states have laws that preclude driving for a minimal period of time following implantation of a cardiac defibrillator. This is to ensure that programmed settings do not inappropriately generate a shock during driving, causing a loss of vehicle control.

Cerebrovascular Accident (CVA) or Transient Ischemic Attack (TIA)

The diagnosis of a CVA or TIA can lead to a temporary suspension period, requiring physician's clearance for authorization to resume driving.

Diabetes

Diabetic complications include musculoskeletal effects from peripheral neuropathy causing sensory deficits. A driver with peripheral neuropathy complications may not be able to fully sense foot pedal operation for maintaining vehicle control.

Psychiatric

Drivers with psychiatric impairments are also a prominent concern in risk assessment. Patients in an acute phase of a psychiatric condition such as a psychotic or bipolar disorder should not drive. Driving can resume when the attending physician feels confident the condition has stabilized.

Dementia in early stages should not impair driving significantly. Progressive dementia including Alzheimer's will eventually require a medical consideration for continued driving privileges. Although people with Alzheimer's disease do not have more car accidents than others during the first year after diagnosis, the risk of crashes more than doubles after the first year.¹⁴

Pulmonary

Chronic obstructive lung disease can present an extra risk, if associated with respiratory failure resulting in cognitive impairment due to generalized hypoxia.

Seizure Disorder

A seizure disorder that is poorly controlled, a history of loss of consciousness, and syncope are all serious medical conditions that should be of significant concern, even if the driver's license is not suspended for medical reasons. A driver with uncontrolled epilepsy is at risk for a motor vehicle accident, with resulting property damage, as well as injury or death to himself and others.

Many years ago, individuals with epilepsy were essentially banned from driving. With the development of effective antiepileptic drugs, and the recognition that many patients with epilepsy were well-controlled and therefore at low risk for seizures while driving, laws have been successively revised to relax this total restriction.

Sleep Disorders

Narcolepsy, sleep-disordered breathing, sleep apnea, and sleep deprivation are associated with daytime somnolence that can occur while driving a motor vehicle. Among individuals with sleep apnea, risk for impaired driving is highest among those with both severe excessive daytime sleepiness and a history of near accidents.

Results of a study published by the *Journal of the American Medical Association* indicated that a medical resident's alertness and driving skill deteriorated measurably after working overnight shifts in the hospital, coupled with working a month of 90-hour weeks. Accumulated fatigue negatively affected driving performance, which deteriorated to the performance equivalent of driving with a blood alcohol concentration of 0.04%. In the U.S., the NHTSA reported that drowsy driving accounted for 6,000 motor vehicle fatalities in 2016.¹⁵

Underwriting Tools

Application

The life insurance application provides the initial source of information related to driving concerns. Two or more admitted driving violations can signal a pattern that requires ordering an MVR to see whether additional violations are on the record.

Motor Vehicle Report (MVR)

An MVR from the driver's state motor vehicle department can be ordered as a routine requirement at pre-determined age and amount limits. Many underwriting systems can obtain an MVR within 24 hours after it is ordered. Information from an MVR can screen out driving behaviors to avoid early death claims, providing a valuable piece of the overall risk analysis.

Most infractions recorded on MVRs are self-explanatory. However, there are a number of alcohol-related terms that can appear, which are explained below.

Violation Terminology Associated with Alcohol or Drug Use

A broad range of alcohol-related violations are defined by jurisdictions. Many commonly appear as driving under the influence (DUI), or driving while intoxicated/impaired (DWI). The following citations are also associated with alcohol and drugs:

1. administrative per se – This occurs when the driver refuses to submit to testing of blood or urine for the presence of alcohol or drugs, or testing by a breathalyzer. This is a law that provides for an immediate driver's license suspension for alcohol-impaired drivers. It is also referred to as an “on-the-spot” license suspension law. Many jurisdictions require the department of motor vehicles (DMV) to suspend or revoke the driving privilege of persons who are arrested for driving with a blood alcohol concentration (BAC) of .08% or more, or who refuse a chemical test upon arrest.
2. interlock device – The interlock device is a court-mandated breathalyzer that is connected to the ignition of a motor vehicle. This was traditionally required for a repeat alcohol-related conviction, but recently it is being required for first time offenders in many states. The driver is required to use the interlock device before he is allowed to operate the vehicle. Typically, the interlock system is pre-set to lock the ignition of the vehicle if the analyzer detects a BAC of 0.02–0.04%, or a similar level well below the legal limit of intoxication (usually 0.08%). Any detected alcohol over the preset limit will lock the ignition of the vehicle.
3. implied consent – This violation also applies to drivers who refuse to submit to approved tests to determine intoxication. A person who has a license to drive a motor vehicle is deemed to have given his consent to chemical testing of his blood or breath for the purpose of determining the alcoholic content of his blood, if lawfully arrested for an offense allegedly committed.
4. conditional privilege – This is a temporary privilege to drive, pending a court hearing to address an alcohol- or drug-related violation.
5. zero tolerance law – Targeted to drivers younger than the legal drinking age, this violation applies even if a minimal level of alcohol is detected in the blood stream. It is illegal in every U. S. state for persons under the age of 21 to purchase and publicly possess alcoholic beverages. A zero tolerance law makes it illegal per se (i.e., in and of itself) for persons under the age of 21 to drive with any measurable amount of alcohol in their blood. Most jurisdictions have established lower blood alcohol concentration (BAC) levels for youthful drivers, typically .01% or .02% BAC for drivers under 21.

The zero tolerance law requires license suspension for one year for any driver under age 21 with a BAC of .01% or more, as measured by a preliminary alcohol screening test. A suspension would also apply for a young driver who refuses or fails to complete the test. Upon arrest or detention, the driver's license is immediately confiscated and an order of suspension or revocation is served.

Inspection Report or Telephone Interview (IR)

A proposed insured may be more candid answering questions about his driving history when the questions are posed by an anonymous telephone interviewer from an inspection company than when posed from the agent completing the life insurance application.

If serious or multiple violations are admitted during the course of questioning, obtaining an MVR can provide confirmation or additional violations to consider in evaluating the risk.

Attending Physician's Statement (APS)

Motor vehicle accidents can be mentioned in doctor's office visit notes and in reports of visits to the emergency room. The medical records can show blood chemistry abnormalities indicative of alcohol involvement or substance abuse. Medical records and lab findings provide clues to the extent of alcohol and drug use. The attending physician can also list injuries and rehabilitation plans for injuries sustained in accidents. All of this information is valuable in adding to the determination of risk from information provided on the motor vehicle record.

Underwriting a History of Driving Violations

It is important to review the pattern of violations to determine if the driving history reflects a random or occasional event or if the record points to a chronic behavior problem. Job instability, problems with family, immaturity, psychiatric issues, or substance abuse problems can all be associated with patterns of problem driving behavior.

Aviation and Avocation Risks

A consistent pattern of poor driving habits can extend to activities other than driving. Clues to immaturity, psychiatric problems, or substance abuse can be uncovered from discovery of driving violations such as multiple speeding tickets, reckless driving, and driving while impaired.

Flying an aircraft or ascending a cliff face during rock climbing demand a high level of concentration and specialized training to safely participate. Serious driving violations should be considered as a significant risk factor when judging acceptance of aviation and avocation risks.

An individual participating in multiple avocations can represent an excessive pattern of risk-taking behaviors. A chronic history of driving violations usually demonstrates disregard for safety, a poor characteristic for participation in any high-risk sport or occupation. The combination of thrill-seeking activities and hazardous driving evidence would likely compound the risk.

Suspended or Revoked Driver's License

If the proposed insured's license is currently suspended at the time of underwriting, the underwriter should review the reason for the suspension. If the license is suspended for moving violations, it presents a serious risk. A license revocation is usually associated with the more serious underwriting concerns of a recent alcohol-related violation or of a chronic pattern of driving violations.

A license suspension can also be applied for non-moving violations, including failure to document insurance coverage, failure to appear for a court hearing, or failure to pay child support in divorce matters. A driver's license can also be suspended for physical or mental conditions, associated with impairments believed to affect the ability to drive safely.

Driving While Suspended

Violations documenting this citation show a disregard for legal consequences designed to protect the public from the increased risk to society. Individuals cited with driving with a suspended license are more likely to be associated with unfavorable mortality and increased lapse potential.

Industry Research Studies

Industry studies have shown a link between all-cause mortality and motor vehicle violations.¹⁷ One of the suggestions arising from these studies indicated that extra mortality risk of individuals with adverse motor vehicle histories is probably better represented by a mortality multiple (i.e., table rating) rather than a temporary flat extra rating. This writer presumes the traditional underwriting approach of applying a temporary flat extra charge for a chronic pattern of driving risk is predicated on the assumption that only recent infractions matter. Since there is no guarantee that a proposed insured will improve upon his driving habits, a more cautious approach is to apply a table rating, or permanent flat extra rate. A table rating may be more appropriate if risk is considered to be variable at different ages and genders over time. Consideration of a permanent flat extra can be suggested if the risk is considered to be constant over time. Either approach would continue to generate premium until driving risk is re-considered in the future with documentation of interim driving habits.

Conclusion

Though automobile fatality trends continue to improve, the underwriter still needs to identify those individuals who are most at risk of an early death caused by traffic accidents. This can be done by utilizing the requirements in the underwriting process, particularly the evidence provided by the MVR.

The MVR is a low-cost mortality screen that does not inconvenience the proposed insured, and remains an efficient means of confirming driving history statements admitted on the application. The MVR provides a snapshot of driving history, but the evidence can be used to determine if increased risk is likely to extend from the pattern of recorded violations.

Driving criticism can provide clues requiring further investigation to develop a definitive underwriting action. When adverse findings are developed, attention should also focus on age, experience, financial status, job stability, lifestyle, medical history, any alcohol or drug use, and overall reputation for a comprehensive approach to determine the most accurate picture of risk.

Review Questions – ALU 101, Chapter 7

1. In the U.S., the primary cause of death for individuals between ages 5 to 24 is:
 1. suicide
 2. seizures
 3. diabetes
 4. motor vehicle accidents
2. All of the following statements regarding elderly drivers in the U.S. and Canada are correct EXCEPT:
 1. They represent an increasing segment of the driving population.
 2. Many elderly people drive safely.
 3. They are more likely to die in an auto accident than are teenage drivers.
 4. Dementia in early stages should not impair driving significantly.
3. Underwriting tools that can be used to evaluate an individual's driving record include which of the following?
 - A. attending physician's statement
 - B. application
 - C. personal history interview

Answer Options:

 1. B only is correct.
 2. A and C only are correct.
 3. B and C only are correct.
 4. A, B, and C are correct.
4. Infractions found in an MVR can include numerous alcohol-related or drug-related violations.
Name five of these violations.
5. Discuss the six effects alcohol has on an individual's ability to drive.

6. Which of the following statements regarding a driving under the influence (DUI) offense are correct?

- A. All offenders are equipped with an ignition interlock device.
- B. A conviction can be removed following alcohol education classes.
- C. Driving privileges are suspended when a driver refuses to take a chemical test.

Answer Options:

- 1. A and B only are correct.
- 2. A and C only are correct.
- 3. B and C only are correct.
- 4. A, B, and C are correct.

7. Which of the following disorders can affect driving ability?

- A. narcolepsy
- B. sleep apnea
- C. epilepsy

Answer Options:

- 1. A only is correct.
- 2. C is correct.
- 3. A and B only are correct.
- 4. A, B, and C are correct.

8. Describe the difference between aggressive driving and road rage.

9. Explain why a permanent flat extra or table rating may be a more appropriate rating strategy than a temporary flat extra for rating motor vehicle concerns.

10. Describe the effect distracted driving can have on an insured's mortality.

Answers and Sources of Review Questions

Review Question 1

Answer 4: motor vehicle accidents – page 1.

Review Question 2

Answer 3: They are more likely to die in an auto accident than are teenage drivers. – page 5.

Review Question 3

Answer 4: A, B, and C are correct – pages 8-9.

Review Question 4

Refer to page 9.

Review Question 5

Refer to pages 1-2.

Review Question 6

Answer 3: B and C only are correct – page 3.

Review Question 7

Answer 4: A, B, and C are correct – pages 7-8.

Review Question 8

Refer to page 6.

Review Question 9

Refer to page 11.

Review Question 10

Refer to page 6.

CHAPTER 8

INTRODUCTION TO FINANCIAL UNDERWRITING

RICHARD WEAVER, FALU, FLMI, CLU

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INTRODUCTION TO FINANCIAL UNDERWRITING

Why Financial Underwriting?

Life insurance can provide many financial benefits for policy owners and insureds. For example, the cash value in some life insurance policies can be borrowed against in the event of a financial crisis, and policy premiums can be paid in ways that reduce the income tax burden on the policy payor. However, for many policy owners, the most important benefit in owning life insurance comes from the death benefit payable to the policy beneficiaries.

Through the payment of a death benefit, life insurance is able to alleviate the hardship or financial loss caused by the death of the insured. This makes life insurance a very powerful financial planning tool. However, as with many other financial products, life insurance can be misused and is, therefore, carefully regulated by laws and business practices that safeguard both the general public and the insurance industry.

Before the Great Depression of the 1930s, financial underwriting in the United States was nonexistent and large amounts of life insurance were issued without question. However, after the 1929 stock market crash, insurance companies saw an enormous increase in death claims due to murder, accidents, and suicide. Claims analysis showed a direct relationship between poor mortality and applicants who paid out a relatively large percentage of their personal income in life insurance policy premiums. Many desperately poor people saw life insurance as the only solution to their financial problems and, by concealing the true motivation for their application, selected against the life insurer when seeking coverage. Because of this experience, the first financial guidelines for underwriting were developed. The term anti-selection has come to mean the tendency of individuals, who believe they have a greater than average likelihood of loss, to seek insurance protection to a greater extent than do those who believe they have an average or a less than average likelihood of loss.¹

Over time, it has come to be one of the principal responsibilities of the home office underwriter to understand the purpose of the insurance being applied for and the relationship between the need for insurance and the amount of coverage being requested. In doing this job well, home office underwriters protect both the insurance industry and the insurance buying public.

Insurable Interest and Insurable Value

One of the basic concepts of life insurance is that policy owners and beneficiaries should have an insurable interest in the insured life, which is to say they have a substantial financial interest in the continued life of the insured and would suffer a significant financial loss in the event of his or her death. Insurable interest also implies a degree of financial dependence on the part of the beneficiary towards the insured. Examples of such financial dependence include:

1. the relationship between young children and their parents
2. the relationship between a non-working spouse and the family breadwinner
3. a situation involving business owners who badly need the skills of their top salesperson to keep the company profitable.

Insurance that covers a nonexistent financial loss implies a lack of insurable interest on the part of the beneficiary. Such contracts are considered examples of wagering or gambling on the life of the insured since they allow the beneficiary to profit by the death of the insured instead of receiving a payment for the financial losses suffered.

The underwriter should carefully question the purpose of insurance when no obvious insurable interest exists. For instance, insurance for the benefit of a neighbor, a casual acquaintance, or a roommate requires some explanation. On the surface, there appears to be a lack of insurable interest on the part of the beneficiary towards the insured in each of these situations.

On the other hand, coverage in excess of the amount necessary to replace the financial loss suffered by the beneficiary involves an overstatement of the insurable value of the insured. The insurable value is a calculation of the financial losses and obligations created by the insured's death, and is used to determine an acceptable death benefit.

As an example of insurable value, let us look at a 38-year-old married man with three young children, who, with a business partner, owns a company. What possible reasons could he have to buy life insurance? They include the following:

1. to replace income that will be lost to his family
2. to pay funeral expenses
3. to pay for his children's education and any special needs they have
4. to pay off any debts he owes at the time of his death
5. to pay the estate taxes due at his death
6. to make a charitable bequest
7. to provide funds that allow his business partner to continue running the company
8. to provide funds for the company to purchase his business interests from his heirs.

All of these reasons can be valid and, added together, can comprise the total insurable value of this proposed insured. However, each individual reason requires the underwriter to take a different approach in assessing the appropriate death benefit. For this reason, it is important for underwriters to have a wide knowledge of financial underwriting topics and to keep themselves up-to-date on changes in financial planning techniques.

What are the consequences of ignoring insurable interest or exceeding the insurable value limits? In such cases, the policy beneficiary will likely receive a monetary windfall at the death of the insured. That might seem, at worst, like an unfortunate waste of money paid for unnecessary coverage. However, a substantial death benefit can serve as an incentive for homicide, suicide, or a fraudulent claim. Additionally, there can be legal consequences in certain instances that result in the policy contract being construed as void if insurable interest did not exist at inception of the policy.²

Claims involving homicide and suicide are especially tragic due to the consequences associated with the loss of life. However, these acts can also cause the insurance industry incalculable harm by putting the insurance company (along with the underwriter) squarely in the public eye as

providing the motivating factor in the death of the insured. Insurance companies have been sued for providing a motive for murder or suicide by issuing a policy.³

Fortunately, the insurance industry is not entirely defenseless in dealing with claims involving homicide and suicide. Laws and contract language prevent would-be murderers and suicide victims from successfully making a claim. In the United States, life insurance is regulated by individual states, so there is no uniform law covering insurable interest or insurable value. However, the common law⁴ of the courts “does not and cannot sanction any scheme which has as its purpose the certain infliction of death for . . . financial gain.”⁵ This is the so-called “slayer’s rule” that prevents beneficiaries and their heirs or representatives from profiting from murder. Individual states have amended this common law with “slayer’s statutes” that expand upon the rule and address unique situations, such as what to do if the beneficiary/murderer is a minor, or insane, or kills in self-defense.

In addition, U.S. life insurance policies contain a “suicide clause” that disallows a claim in the event of a suicide for up to two years after the contract is put in force. (Note that some states only allow for a one-year suicide clause.) Suicide clauses prevent claims by individuals who purchase insurance with the intention of killing themselves immediately after the contract goes into effect. If a suicide takes place after the exclusion period, however, the claim is valid.

Fraudulent claims involve a misrepresentation of information relating to the insurability of the insured person or a falsification of the death of the insured. These claims can take up an enormous amount of time and expend valuable company resources investigating and litigating.

The “contestable clause” in life insurance contracts helps prevent claims due to a deliberate misstatement of information on the application. In the first two years a contract is in force, a misrepresentation of material underwriting information in the application voids the contract and prevents payment of the claim. After two years, the contract becomes contestable and a misrepresentation is no longer grounds to deny a claim.

Personal Insurance

Income Replacement Insurance

Personal life insurance indemnifies and protects the financial relationship between the insured and his or her family and individual heirs. The policy benefit can be used to provide for the ongoing needs of dependents, as well as supplying cash that can cover immediate post-death expenses such as funerals, medical bills, and death taxes.

One common reason for purchasing life insurance is income replacement. The death benefit from an income replacement policy replaces the income stream of the decedent and is often purchased by young to middle-aged individuals with large, ongoing family expenses.

Multiple of Income Method

Income replacement sales are often justified using the multiple of income method, in which the maximum death benefit is a multiple of the insured’s income. The multiple of income method

produces a death benefit that provides the proposed insured's family a replacement of income that the proposed insured would have otherwise earned if not for his premature death. The multiple of income method has a number of advantages and disadvantages:

Advantages of the multiple of income method are that it is:

1. easy to use
2. useful in simple sales situations.

Disadvantages of the multiple of income method are that it does not account for:

1. the age of the surviving spouse
2. the existence of another family wage earner
3. the number of dependents
4. the number of years for which income may be needed
5. any changes in government benefits
6. monetary inflation
7. income growth.

Example: A 40-year-old accountant makes \$50,000 annually. Insurance company guidelines indicate that, for his age, the maximum multiple of income he could qualify for is 20 times income. Accordingly, using the multiple of income method, the maximum amount he qualifies for is 20 times \$50,000 or \$1,000,000.

Human Life Value Method

Another method of computing income replacement insurance utilizes the concept of human life value, which is a measurement of the earnings potential of the insured's life. Ideally, income replacement insurance using the human life value concept should produce a death benefit equal to the current value of the insured's future earnings. The methodology of the human life value concept is somewhat more sophisticated than the multiple of salary approach and takes into account more factors. These include:

1. actual after-tax earnings
2. projected rate of earnings growth
3. expected length of career
4. discount rate for future earnings.⁶

Using these four factors, an insurance benefit can be computed that will equal the present value of the insured's potential earnings for the rest of his or her career.

Example: Mrs. A is a 35-year-old computer programmer. Her after-tax earnings are \$42,000 annually. She anticipates a 5% raise next year. Inflation is expected to be 3% per year. How much insurance must she buy to cover her income needs for just next year? Mrs. A's income next year will be 5% higher than this year. $\$42,000 \times 1.05 = \$44,100$. Inflation will discount next year's income by 3%, which means that, in today's dollars, Mrs. A will get 97% of \$44,100

$(\$44,100 \times .97)$ or $\$42,777$. To cover her income needs for next year, Mrs. A needs to buy $\$42,777$ of life insurance today.

Of course, this is a very simple example of the computations necessary to produce an appropriate death benefit using the human life value approach, since most individuals buying insurance want to cover more than a single year of income replacement. Software programs and computation tables allow insurance providers to compute the human life value of proposed insureds with many years left to their careers before retirement.

Needs Analysis Method

Lastly, income replacement needs can be computed using a needs analysis approach. This method, as part of a more comprehensive financial planning program, identifies the specific lump sum and income needs of the beneficiaries and translates them into a proposed death benefit. The emphasis in the needs analysis approach is not so much on the replacement of the insured's income as it is on satisfying the expenses that will be incurred by the beneficiaries. These lump sum and income requirements produce a death benefit with the following characteristics:

1. provides a somewhat larger benefit in the period immediately following the death of the insured to offset additional expenses
2. satisfies the normal living expenses of surviving dependents
3. provides a long-term income for the retired surviving spouse and/or disabled family member(s), if any.

Example: Mr. B is married with two children. The financial needs at his death are comprised of the following items:

Pay off the mortgage	\$125,000
Cover funeral expenses	\$ 20,000
Emergency fund	\$ 20,000
College fund for children	\$ 75,000
Fund for children's living expenses	\$580,000
Fund for surviving spouse	<u>\$650,000</u>
Total insurance needs	\$1,470,000

Choice of Method

Of the three means of providing income replacement through life insurance, which is the best? Each approach has its strengths and weaknesses, primarily in terms of the complexity of each method, its ease of use, and the accuracy of the results.

1. The multiple of income method is simple but may not be very accurate because it does not adjust to reflect individual circumstances.
2. The human life value approach is more sophisticated but relies on an estimate of the future inflation rate and expected increases in income. If these estimates are inaccurate, the insurance need could be underestimated or overestimated.

3. The needs analysis approach can be comprehensive in its scope but in complex financial planning situations can require an exhaustive amount of research and computation. Also, the needs analysis approach ignores family earnings and can produce an insurance amount based purely on need, not income, creating a situation where the insured is worth much more dead than alive.

All in all, each technique has its merits and every underwriting department will employ them according to the department's own underwriting philosophy.

Insuring the Non-Working Spouse

The non-working spouse presents a special challenge to the underwriter. Whereas the financial contributions of the working spouse are easy to identify, the non-working spouse provides services to the family that are not compensated financially. Because of this, it can be difficult to calculate the insurable value of the non-working spouse.

The needs analysis approach can be adapted to provide a solution to this problem. The services provided by the non-working spouse are quantified by estimating the cost of replacing these services with outside vendors. The total amount is the expense that will need to be funded for the family to replace the services of the non-working spouse. This amount can be substantial.

Example: Mrs. C is a non-working married female with four small children. She provides the following services to her household:

Services	Replacement Cost
1. Cooking	\$14,000/year
2. Home maintenance and repair	\$12,000/year
3. Childcare	\$40,000/year
4. Managing family finances	\$7,500/year
5. Transportation	<u>\$6,500/year</u>
Total	\$80,000/year

Assuming Mrs. C will have full responsibility for her children for at least the next six years, she qualifies for a maximum of \$480,000 (\$80,000 x 6), which will replace all the services she currently provides her family.

Another way of estimating the insurable value of the non-working spouse is to plan that the surviving spouse will stop working temporarily and assume all the responsibilities of the deceased spouse. In this case, the death benefit would amount to a sum equal to the income the wage-earning spouse will not collect.

Example: Mr. C works as an accountant and makes \$60,000/year. He and Mrs. C agree that, in the event of her death, he will quit work to take care of their four children for six years. As such, the family will need to replace Mr. C's income for 6 years, which requires an amount of \$360,000 (\$60,000 x 6). The total death benefit Mrs. C would qualify for under this scenario would be \$360,000.

It is important to note that these methods are not mutually exclusive. They can be combined to suit the desires and plans of the family, provided the total amount can be justified. Currently in the industry, many companies allow a non-working spouse to have a total amount of life insurance equal to the amount the working spouse has in force. Some companies limit the amount to a maximum dollar amount, such as \$5,000,000.

Juvenile Protection

Given that life insurance offsets the insured's financial obligations at death, there are very few reasons to consider a substantial policy on a child's life. From a purely financial standpoint, most children have a very low insurable value. Therefore, many life insurance contracts on children provide a very modest death benefit, mostly just enough to cover the costs of funeral expenses.

Sometimes, however, children are insured for larger sums in anticipation of their insurance needs as adults. This allows for the acquisition of life insurance at a very low cost during a time of life when most young people enjoy excellent health and insurability. Also, the cash value accumulation can be an attractive way to save for the child's college education or other future needs. Because the amount applied for can exceed the immediate insurable value of the child, situations like this require careful consideration and clear guidelines from underwriting department management.

Larger insurance contracts can be applied for on the children of wealthy families for straightforward estate planning reasons. These children can acquire a substantial estate of their very own early in life through inheritance or the practice of gifting. Gifting is a practice wherein wealthy elders seek to reduce the death tax due on their own estates by giving away money or property before they die. Currently, each U.S. citizen can give away up to \$15,000 per person each year without being subject to a gift tax. A husband and wife together can give \$30,000 annually to any child, grandchild, or anyone else they choose.⁷

Example: If a couple has four children and six grandchildren, they can gift a total \$300,000 (10 beneficiaries x \$30,000) per year, completely free of any taxes. This decreases the size of the couple's estate and lowers the amount of death taxes owed on their estate when they die.

In cases involving inheritance or gifting, larger amounts can be reasonable on children on a case-by-case basis, according to the estate planning philosophy and guidelines of the underwriting department. When insuring children, clear guidelines from underwriting management are essential.

Estate Planning

Over their lifetimes, individuals acquire assets that comprise their estate. At death, the estate of a U.S. citizen is evaluated by professionals such as attorneys, appraisers, and accountants. Then the estate is subjected to probate, a process by which a judge verifies the authenticity of the will and by which an executor (if there is a will) or a court appointed administrator (if there is not a will) manages and distributes the estate to the heirs of the deceased. A death tax or estate tax may have to be paid on the distribution of assets from larger estates.

Life insurance is commonly purchased for several reasons when addressing the needs of the estate planning process. The first is to offset probate costs, which are expenses paid by the estate to hire and retain the lawyers, accountants, and appraisers who work on the estate's valuation and legal representation. Generally, larger and more complex estates incur higher probate costs.

Life insurance can also be purchased in order to provide cash for use by the estate. This is appropriate in situations where the estate is composed of assets that cannot be easily or quickly sold (such as a company, for example). Instead of being forced to sell assets at a discount in order to pay for probate costs and death taxes, life insurance can provide immediate cash for these purposes. This allows the assets contained in the estate to remain in their original condition so they can be passed, intact, to the heirs of the deceased.

Finally, life insurance can be used to compensate the estate for the payment of estate taxes. In the U.S., these taxes can significantly deplete the value of the estate, significantly reducing the amount that is actually received by the heirs of the deceased. Life insurance can pay the tax and preserve the value of the estate.

The United States federal government has set a limit that differentiates larger taxable estates from smaller non-taxable estates.⁷ This limit is called the exclusion amount. The tax applies to the value of the estate in excess of the exclusion amount. The exclusion amount and the death tax rate changed each year according to the following schedule:

Year	Exclusion Amount	Tax Rate
2010	Repealed	
2011	\$5,000,000	35%
2012	\$5,120,000	35%
2013	\$5,250,000	40%
2014	\$5,340,000	40%
2015	\$5,430,000	40%
2016	\$5,450,000	40%
2017	\$5,490,000	40%
2018	\$11,200,000	40%
2019	\$11,400,000	40%

The estate tax was temporarily repealed during 2010 and then reinstated under the terms of the Tax Hike Prevention Act of 2010. The exclusion amount increases each year tied to an inflation formula. The tax bill passed in December 2017 allows for a 2018 federal estate tax individual exclusion amount of \$11,200,000. The maximum federal estate tax rate is 40%.

In Canada, there are no estate taxes. Instead, the deceased is deemed to have disposed of all property for its fair market value immediately before death and must pay capital gains taxes on his or her terminal income tax return. A capital gain can be defined as the difference between an asset's purchase price and selling price, when the selling price is greater. Fifty percent of the capital gain on estate assets will be included and taxed as part of the final income tax return of the deceased. Canadian federal income tax rates range from 15% to 29%. In Canada, life insurance can be purchased to offset the cost of the capital gains taxes.

Example: A Canadian citizen bought land for \$1,000,000 ten years ago. It is now worth \$2,500,000. If he dies, he will incur a capital gain of \$1,500,000 (\$2,500,000 minus \$1,000,000). Fifty percent of this capital gain will be taxed on his terminal income tax return (\$1,500,000 times .5 equals \$750,000). If his income tax rate is 29%, he will incur a tax liability of \$217,500 (\$750,000 times .29). A \$217,500 life insurance policy can pay this tax and preserve the value of his estate.

Charitable Gifting

Life insurance can allow people the opportunity to make a significant bequest to their favorite charity in a manner that is both convenient and relatively inexpensive. That said, however, charitable gifting can be one of the more difficult types of cases for an underwriter to evaluate. There are three important questions that must be satisfactorily answered when reviewing charitable gifting sales:

1. Is this a legitimate charity?
2. What is the relationship between the insured and the charity?
3. How much is an appropriate amount?

In its traditional legal definition, the word "charity" encompasses religion, education, assistance to the government, promotion of health, relief of poverty or distress, and other purposes that benefit the community, but not any individual. In the U.S., nonprofit organizations that are organized and operated to further one of these purposes will generally be recognized as charities, exempted from federal income tax, and eligible to receive tax-deductible charitable gifts under Section 501(c)(3) of the Internal Revenue Code. A section 501(c)(3) charity has satisfied the IRS as to its purpose and operating status and can generally be considered a legitimate charitable institution. A charity that does not meet these qualifications should be investigated in greater detail.

In dealing with the individual donor who wishes to name his or her preferred charity as the policy beneficiary, it is important to document to what degree the insured has been personally engaged with the organization. For example, an individual who has provided significant regular donations or volunteer work to a charity, or who has received a significant benefit from a charity, has the best reasons to purchase life insurance for charitable gifting.

If there is no discernable relationship between the proposed insured and the charitable organization, or if the death benefit applied for seems out of line with the proposed insured's personal finances, the motivation and purpose for such a gift must be questioned.

Example: Mr. D is an 81-year-old man living on Social Security benefits and a small pension. A \$1,000,000 application on his life, payable to the New Local Church, a non-503(c)(3) organization, has been submitted for consideration. Mr. D just joined this church last month after being solicited by the minister. Additional information to justify this case must be obtained.

Once the charity has been verified as legitimate, the question arises as to how much insurance can be justified. For those individuals who have been regular donors to the charity, a multiple of

their annual donations is a reasonable approach. The death benefit in this situation will serve to replace the missing donations caused by the premature death of the donor. Younger donors qualify for a higher multiple and older donors qualify for a smaller multiple. What multiple is selected is a matter to be decided upon by each underwriting department as a matter of underwriting policy.

Example: Mr. E (age 60) and his son (age 30) each contribute \$1,000 annually to a 505(c)(3) charity that helps abandoned animals. According to the guidelines available to the underwriter, Mr. E qualifies for a maximum of 10 x his donation (\$10,000) and his son qualifies for 20 x his donation (\$20,000).

A more difficult situation arises when dealing with people who volunteer their time or have received a benefit from the charity they wish to repay. In these cases, the underwriter has the option of requesting an explanation from the insured and/or the producer that explains and justifies the amount requested.

Example: Dr. F is a 45-year-old orthopedic surgeon who volunteers at a local hospital four weeks per year. The producer has submitted a cover letter stating that Dr. F earns \$5,000 per week when doing his regular job. The producer proposes to insure Dr. F for the value of his work for a 15-year period, producing a death benefit of \$300,000 (\$5,000 x 4 weeks x 15 years). This explanation transforms the doctor's volunteer time into an equivalent monetary donation that can then be insured in a manner similar to that of a cash donor.

Finally, substandard risks and very old individuals should be underwritten conservatively for charitable gifting plans. If it is not likely that charitable contributions would continue much into the future due to age or ill health, the use of insurance is inappropriate.

Business Insurance

Key Person Insurance

Business insurance covers the financial relationships that exist between business owners, employees, debtors, and creditors. One common reason for the purchase of life insurance in a business situation is to indemnify the company against the loss of an employee whose skills and contributions are critical to the firm. The underwriter should keep in mind that business owners are often also key employees.

When underwriting key person insurance, the underwriter faces two challenges. The first is qualifying the proposed insured as a key person. The second is quantifying the potential financial loss caused by his or her death.

It is tempting to believe that every business owner and every company employee is a key person – some are, but many are not. Underwriters should first determine whether the proposed insured meets the definition of a key person as defined in the Pension Protection Act of 2006⁸ that outlines industry best practices for COLI (corporate-owned life insurance). Assuming that test is met, additional consideration should be given by reviewing the proposed insured in light of the following factors:

1. age of the proposed insured – An older employee soon to retire may not qualify for much, if any, key person insurance.

Example: A 64-year-old vice president planning to retire and leave the company in eight months is not a candidate for key person insurance.

2. proposed insured's level of expertise – Higher levels of management or technical expertise or unique and special skills qualify a proposed insured more easily for key person insurance. A low level or entry-level employee doing unspecialized work probably will not qualify for any key person insurance.

Example: Ms. F has a PhD in chemistry and runs the research lab at a pharmaceutical company. Ms. G has a high-school degree and just joined the same company as an entry-level lab technician-in-training. Ms. F qualifies as a key person, while Ms. G is not a candidate for key person insurance.

3. business history of the proposed insured – An employee or business owner with a record of success, promotion, and achievement can readily qualify as a candidate for key person insurance. On the other hand, underwriters should be cautious if individuals have a history of business failure or bankruptcy or if they have little or no past experience in the career for which they are trying to qualify for key person coverage.

Example: Mr. I is a bakery delivery driver who wants to start a business that sells furniture. He is not a candidate for key person insurance.

4. stability of earnings over time – Companies with a history of stable business earnings make the calculation of a key person's value easier than those with an unstable history of business earnings. A very unstable pattern may not qualify the key person for any coverage.

Example: Mr. J sells roofing material. His company sales figures are stable and rising. Mr. K sells cement. His company sales are variable and most years he makes only a small profit. Of the two, Mr. J is the much better candidate for key person insurance.

5. number of key employees – The fewer the number of key employees, the more critical each one is.

Example: Mr. L is one of 6,500 similar accountants employed by General Industries, a multinational company employing 87,000 people worldwide. Mr. M is the only accountant at Websoft, a successful small software company that employs 25 people. Although they make the same salary and have the same title, Mr. M is very much a key person. Mr. L does not appear to be a key person.

6. business history of the company – A company with a successful business history is often supported by a cadre of competent managers and technical workers who qualify as key employees. On the other hand, it is inadvisable to insure the value of an employee whose contribution to a marginal or failing business is questionable.

Example: Mr. N is president of a 50-year-old company that manufactures engine components for automobiles. Under his direction, the company just started making components for a new brand of hybrid-electric engines. Company sales and profits are growing explosively. Mr. O is president of a 50-year-old company that manufactures vacuum tubes and has not upgraded its product line in decades. Mr. O has one remaining major client, the U.S. government, which needs these components for its antiquated air-traffic control system. This system's hardware has not been upgraded since the 1960s and is currently being phased out. Mr. N is very much a key person. Mr. O would have a difficult time qualifying as the same.

7. current financial picture – Regardless of the business history or stability of earnings, the current financial picture of the company should be favorable in order to justify key person coverage on business owners, managers, and technical workers.

Example: Mrs. P owns a wholesale beauty supply business. Her company's financial statement for this year shows profits of \$200,000 and a salary for Mrs. P of \$115,000. Ms. Q also owns a wholesale beauty supply business. Her financial statements this year show that her company lost \$60,000 and Ms. Q received a salary of \$20,000. Mrs. P qualifies as a key person, but Ms. Q does not appear to qualify.

Once the proposed insured is qualified as a key person, the underwriter can then verify how the amount applied for compares to the insurable value of the employee. There are two methods commonly used to compute this figure: a multiple-of-earnings factor or a business loss approach.

Multiple of Earnings Approach

The multiple of earnings approach is predicated on the idea that the insurable value of an employee is directly related to the income he or she receives. If the employee is truly key to the organization, his or her compensation should reflect this.

The amount applied for is typically a multiple of earnings, usually five to ten times earnings, but sometimes higher. The death benefit is used to:

1. Hire a replacement. The unexpected death of a key person can cause a company to offer a salary somewhat higher than normal to get a qualified replacement quickly.
2. Offset the cost of training the replacement employee. Depending on the position, this amount can be considerable.
3. Compensate the company for the financial losses created by the key person's death.

The multiple of salary used to calculate the key person need is often based on the importance of that individual to the organization and whether any unique factors allow for a larger-than-normal multiple. For example, a member of the senior sales staff who has critical relationships with customers could justify the use of a larger multiple than someone who works as manager of building maintenance. One has a direct and immediate impact on the company's profitability, the other does not.

Business Loss Approach

The business loss method is more specific than the multiple of earnings approach. It requires the computation of all business losses that would be associated with the death of the key employee that is equivalent to the insurable value of that individual.

Example: The loss of the comptroller at a bakery will necessitate hiring an outside firm for at least a year while a new comptroller is hired and trained. The cost to hire the services of an accounting firm for the bakery is \$150,000. The cost to hire and train a new comptroller is \$150,000. Business losses associated with the temporary disruption of the bakery's financial service department are estimated at \$200,000. Therefore, the insurable value of the bakery's comptroller totals \$500,000.

Creditor Insurance

As with other types of insurance sales, understanding the motivation for creditor insurance is critical to the underwriting process. Ideally, creditor insurance is designed to replace the funds the insured would have provided for the repayment of a loan, had he or she lived. Creditor insurance is not designed to act as a financial failsafe in the event that the business purpose for which the loan was taken out is unsuccessful. To that end, underwriting creditor insurance begins with:

1. understanding of the purpose of the loan
2. verifying the legitimacy of the lender
3. assessing the chances of success of the business purpose that the loan is funding
4. reviewing the business finances as well as the underlying assets that guarantee the loan to the lender.

Business owners, who can demonstrate that their companies are stable, well-funded, and profitable, are generally excellent insurance risks for creditor insurance. On the other hand, sometimes a loan's purpose is to bail out a troubled business, or funds are sought to establish a new company that has no other source of investment capital. Underwriters should review such cases carefully as they may not be good financial risks.

In particular, underwriters reviewing cases involving venture capitalists should note that these lenders specialize in borderline financial risks. Such loans can be speculative, especially if life insurance is required by the lender before the loan will be granted. This is a clue that the company can be under-capitalized and does not own enough assets to act as collateral for the loan.

Example: Dr. R is developing a new water filtration process. She has not yet completed research to prove the practicality of this new technique and has run out of funds. Her lenders, who are venture capitalists, require her to be insured for the entire loan amount. In this case, Dr. R is only in the preliminary research phase and has not developed even a prototype product, which might act as loan collateral. Her chances of success are not assured. Her financial statements show her close to bankruptcy. She is not a good candidate for creditor insurance.

In other instances, insurance companies are sometimes asked to insure loans that appear to be informal loan agreements between individuals. Because these arrangements are so open-ended, it is difficult to quantify and therefore accept the risk.

Example: Mr. S is getting a \$100,000 loan from an acquaintance, Mr. T, to start a used car sales company. Mr. T wants Mr. S covered for \$150,000, an amount that supposedly includes the interest due on the loan. No loan documents were submitted with the insurance application and the interest rate as well as the repayment plan is unknown. It is difficult to verify that this amount of insurance will provide appropriate coverage without further knowledge of the particulars of this loan arrangement. Copies of the loan agreement can help in this situation.

The full amount of the loan should rarely be covered by life insurance. Cutting back on the percentage of the loan amount to be insured motivates the lender to make sure that the debtor will be able to repay the loan through the course of normal business operations, or, failing that, through the sale of collateralized assets. In most cases, the amount of the loan covered is 60- 80%. Again, the policy on this is generally set by each company's underwriting department.

Finally, special care must be taken if there is a question about the health or insurability of the insured in a creditor insurance situation. Coverage for loans on highly impaired individuals may not be possible if it is more than likely that the proposed insured will die before the loan is repaid. This is also a form of speculative coverage.

Buy-Sell Insurance

Business owners are often faced with a problem when a significant part of their personal estate is made up of an interest in their own company. In many cases, the heirs are neither willing nor able to take over the management responsibilities for the business. In addition, the other business partners may not welcome an inexperienced associate into the ranks of management. In situations like this, buy-sell insurance allows the remaining business owners to purchase the business interest from the estate of the deceased. The result is that the company remains under the control and ownership of the remaining owners and the estate gets a cash equivalent, which can be of much more use to the heirs of the estate.

Example: Mr. U owns a dry-cleaning firm with three other partners. His wife is not involved with the business and his two children are only 3 and 5 years old. In the event of his death, a buy-sell policy will insure that his heirs receive the full value of his interest in the business in the form of cash, which can be used in any way to cover their immediate and future expenses.

Buy-sell insurance is purchased in association with a buy-sell agreement. The buy-sell agreement sets up a mandatory arrangement whereby the other business owners (or the company as a whole) agree to purchase or redeem the business interest from the estate. These agreements benefit both business owners and their heirs by:

1. providing an immediate market for the business interest
2. providing liquid funds for use by the estate
3. allowing for the continuance of the business

4. making the business more creditworthy to lenders, who value the continuity of the business.

Two types of buy-sell agreements commonly used are cross-purchase agreements and liquidation/stock redemption agreements. In cross-purchase agreements, each partner or stockholder is obligated to purchase buy-sell coverage on every other partner or stockholder. If one of the business owners dies, the insurance money buys his interest in the company from the estate and transfers it to the remaining owners. This works well in situations involving a small number of business owners. Liquidation or stock redemption agreements allow the company as a whole to purchase the business interest from the estate, and typically the stock is kept as inactive company “treasury” stock. As a result, the surviving owners automatically own a greater percentage of the active ownership shares remaining.

In underwriting buy-sell cases, it is critical to understand and verify the value of the business as a whole. In order to do this, a review of the buy-sell agreement and/or the financial statements of the company may be necessary. The buy-sell agreement will reveal the valuation formula used for the business, and the financial statements will provide the variables for the formula.

Example: Two individuals own a pet shop. Their buy-sell agreement says that the business will be valued at eight times net profit. The financial statements for the business show that the business net profit is \$75,000. The value of the business under the terms of this agreement is \$600,000 ($8 \times \$75,000$). If they are equal partners, their buy-sell policies should be for no more than \$300,000 each.

Occasionally, underwriters will come across cases where the relationship between the valuation formula in the buy-sell agreement and the value of the business is nonexistent or difficult to establish. Often this occurs when the buy-sell agreement gives a flat figure for the value of the ownership shares or the ultimate value of the business seems inconsistent with the company finances.

Example: Two individuals own a bookstore. Their buy-sell agreement stipulates that each of their 50% ownership shares in the store is worth \$600,000. The store's profits average \$8,500 annually. The net worth of the business in the company's financial statement is listed at \$50,000. Their income totals \$25,000 each. It is unlikely that such a modest business is worth, in total, \$1,200,000.

In situations where the amount applied for seems excessive, the underwriter can ask for an explanation, decrease the amount, or decide not to participate in the coverage.

Fringe Benefits

Fringe benefits can be defined as non-salary compensation for employees. Common fringe benefits include health insurance, a company car, a travel expense account, education expense coverage, and group life insurance. Individual life insurance can also be a fringe benefit, operating as part of a program to compensate and retain highly valued employees. These programs are often structured as deferred compensation plans or executive bonus plans.

Deferred compensation and executive bonus plans can fund life insurance policies and other employee benefits that form a valuable extra layer on top of the basic benefits package available to rank-and-file workers. These policies are usually permanent plans with large internal values that allow executives to accrue extra funds for retirement while at the same time providing a valuable insurance benefit. Although funds for these programs are funded with personal after-tax dollars, the internal policy values accumulate tax-free and the administrative cost and program management is assumed by the company. This makes a very attractive benefit for the employee.

From an underwriting perspective, these policies are often treated as part of the personal life insurance portfolio of the insured. While it is important to avoid over-insuring the proposed insured, it should be recognized that deferred compensation and executive-bonus plans are often made available to an entire class of employees. As such, the dangers of financial anti-selection on the part of any individual proposed insured are usually avoided.

Sources of Financial Data

Insurance Application

Financial underwriting begins with the application. From a description of the insured's occupation and age, the policy beneficiary, and basic financial data (often part of the application), the underwriter can begin assessing the case from the financial perspective. For many small to moderate sales (especially income replacement cases), this information is more than sufficient to justify or disqualify the amount.

Cover Letter

A good cover letter from the producer will assist in validating the sale and explaining the relevant details of the case. In many ways, the cover letter restates the line of reasoning used by the producer in convincing the client that this insurance was in his or her best interests.

Financial Statements

Larger, more complex estate planning cases and business insurance sales can require the review of personal and business financial statements. Although they can differ in format, both personal and business financial statements contain the same basic information, including:

1. total income received
2. expenses paid out
3. net income or profits (total income minus expenses equals net income or profits)
4. assets owned
5. liabilities or debts owed
6. net worth (assets minus liabilities equals net worth).

Items 1 to 3 comprise the income statement. Items 4 to 6 make up the balance statement or the balance sheet. Income statements answer the question "How much money did you make?" – usually over a specific time period such as one year. In lieu of an income statement, individuals

can submit income tax returns. Balance sheets answer the question “What do you own?” - at a given point in time.

Financial statement analysis is not always a simple, straightforward process. The practice of accounting is not a rigid mathematical profession but allows many options that enable accountants to portray the financial picture of an individual or business in the most favorable light. The complete study of financial statements is beyond the scope of this chapter. However, an accountant who is a certified public accountant (CPA) is required to abide by a standard of conduct and code of ethics. Financial statements produced by a CPA should be objective, reliable, and honest attempts to accurately represent the financial profile of an individual or organization.

Buy-Sell Agreement

As stated earlier, buy-sell cases can require the review of buy-sell agreements in order to find out the methodology behind the valuation of the company. Buy-sell agreements use either a fixed value for the business or a formula. Buy-sell agreements are important documents when reviewing large or complex buy-sell cases.

Inspection Report

The inspection report serves as an important check on financial information contained elsewhere in the application or financial statements. Not only can the proposed insured be asked to verify financial information previously submitted on the case, but secondary sources (e.g., banking references, business associates, accountants) can also be asked to confirm the finances of the proposed insured. As with other underwriting issues, the consistency of information is very important.

Conclusion

Underwriters are not usually trained to address the requirements of financial underwriting early in their careers. Small cases need very little financial underwriting and inexperienced underwriters start with small cases.

As a result, some underwriters can finish their initial training without dealing with financial issues in any depth. As underwriters progress to larger cases, the purpose of the sale and the justification of the amount of the application become more complex and dominant concerns - sometimes even eclipsing the mortality risk, which was the focus of the underwriter’s early training.

For this reason, underwriters who want to advance their careers should become familiar at the earliest possible opportunity with the basics of financial underwriting. Furthermore, they should seek additional opportunities whenever possible to upgrade and improve their knowledge. This chapter serves as a starting point. Financial underwriting knowledge is an important component in the prevention of financial anti-selection. The risks associated with overinsurance are as relevant today as they were in the 1930s.

Review Questions – ALU 101, Chapter 8

1. In Canada, life insurance can be purchased to offset which tax:
 1. property
 2. estate
 3. capital gains
 4. sales
 2. In the United States, life insurance is used in the estate planning process for all of the following reasons EXCEPT to:
 1. offset probate costs
 2. provide cash for use by the estate
 3. pay estate taxes
 4. replace key person income
 3. Which of the following statements regarding deferred compensation plans is/are correct?
 - A. They are in addition to the basic benefits available to all employees.
 - B. They allow executives to accrue extra funds for retirement.
 - C. They are usually permanent insurance plans with large internal values.
- Answer Options:
1. A only is correct
 2. B only is correct.
 3. B and C only are correct.
 4. A, B, and C are correct.
4. Explain three methods of calculating the amount of life insurance needed when considering income replacement and explain the advantages and disadvantages of each method.
 5. Describe sources of financial data an underwriter can request or receive to evaluate the amount of insurance being purchased.
 6. The type of business insurance that indemnifies a company against the loss of an employee whose skills are critical to the firm is:
 1. creditor
 2. cross-purchase
 3. income replacement
 4. key person

7. Methods of calculating income replacement for personal life insurance include which of the following?

- A. multiple of salary
- B. human life value
- C. needs analysis

Answer Options:

- 1. A and B only are correct
- 2. A and C only are correct.
- 3. B and C only are correct.
- 4. A, B, and C are correct.

8. Typical examples of insurable interest with regard to financial dependence include which of the following?

- A. the relationship between young children and their parents
- B. the relationship between a non-working spouse and the family breadwinner
- C. a situation involving business owners who require the skills of a top salesperson to keep the company profitable

Answer Options:

- 1. A and B only are correct
- 2. A and C only are correct.
- 3. B and C only are correct.
- 4. A, B, and C are correct.

9. In the United States, the limit that differentiates larger, taxable estates from smaller non-taxable estates is:

- 1. the exclusion amount
- 2. income tax
- 3. Tax Hike Prevention Act of 2010
- 4. capital gain

10. The human life value method takes into account all of the following EXCEPT:

- 1. actual after-tax earnings
- 2. projected rate of earnings growth
- 3. the potential for unemployment
- 4. discount rate for future earnings

Answers and Sources of Review Questions

Review Question 1

Answer 3: capital gains – page 8.

Review Question 2

Answer 4: replace key person income – page 8.

Review Question 3

Answer 4: A, B, and C are correct – page 16.

Review Question 4

Refer to pages 3-6. .

Review Question 5

Refer to pages 16-17.

Review Question 6

Answer 4: key person – page 10.

Review Question 7

Answer 4: A, B, and C are correct – pages 3-5.

Review Question 8

Answer 4: A, B, and C are correct – page 1.

Review Question 9

Answer 1: the exclusion amount – page 8.

Review Question 10

Answer 3: potential for unemployment – page 4.

CHAPTER 9

LIFE INSURANCE PRODUCTS, MARKETING, AND DISTRIBUTION

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LIFE INSURANCE PRODUCTS, MARKETING, AND DISTRIBUTION

LIFE INSURANCE PRODUCTS

As a legal and financial product, life insurance protects individuals, families, or businesses against the loss of economic value upon an insured's death. Further, life insurance in the U.S. and Canada is afforded special income tax treatment making it a desirable asset.

Customer Needs

The uses of life insurance and the motives to purchase it vary. Companies develop life insurance products to satisfy customer needs for money to be delivered in the future. Five general customer needs are:

1. to protect and/or replace economic value – Life insurance death benefit proceeds can replace lost income upon the death of an income earner. These proceeds can go to a family who has lost a breadwinner, to find a replacement for a key employee whose skills or knowledge contributed to a business' continued success, or upon death of an owner, to replace a business interest's value.
2. to pay off inevitable last expenses – Upon death, certain outstanding debts or obligations become due immediately, e.g., consumer credit card debt, personal loans, funeral expenses, expenses of a last illness, income taxes. With life insurance, the event that creates the need for money - death - creates the money to meet those needs.
3. to provide meaningful executive benefits – Often to retain extraordinary employees who contribute to the profitable existence of a business and to keep them satisfied, business owners offer life insurance designed to provide protection on a pre- and post-retirement basis, and/or to build tax-favored supplementary retirement income.
4. to transfer assets efficiently – Whether one needs to provide more cash to an executor to pay estate taxes, transfer a business interest among interested parties via a buy-sell agreement, preserve one's family legacy, or fund a favorite charity or institution, life insurance death benefits provide the most economical way to do so. In effect, an insured pays pennies today (the premium payments) to deliver dollars in the future.
5. to accumulate a tax-favored investment account – With the exception of most term insurance policies, the products discussed below develop a cash value account or savings portion. The cash value account represents a policyholder's equity interest, much like the equity that builds up when paying off a home mortgage. Customers appreciate that the cash values grow tax-deferred or without current income taxes. Loans against policy cash values can be made at low net rates generally unavailable in other financial vehicles. Except for contracts classified as modified endowment contracts (MEC), tax-free withdrawals up to the amount of premiums paid into the policy (or cost basis) can be made systematically to provide a stream of income.

As both a legal and financial product, a life insurance policy is a contract of promises. If the insured (or owner) continues to pay the required premiums, the insurance company promises to provide the death benefit to the insured's named beneficiary or to pay other living benefits to the insured, which are often attached as optional policy riders and often for a premium charge.

After discussing product development considerations briefly, this chapter will outline the types and general characteristics of life insurance products, selected key rider benefits sold in North America, and the marketing and distribution of these products.

Product Development

When an insurance company develops a new life insurance product, several factors are taken into consideration: pricing, underwriting, administration, and marketing. Here is an overview of the first three factors and considerations. Marketing will be discussed near the end of this chapter.

Pricing

As a function of product pricing, adequate premium levels sustain the company, providing a comfortable profit margin to allow growth and to weather economic business cycles or disasters. Premiums must be enough to cover each risk assumed, not only when underwritten, but for the length of the contract. The major components determining premiums are:

1. *Mortality* – Mortality costs represent the expected cost of paying the death benefit on the number of deaths within an insured group over a period of time. Actuaries determine this probability by analyzing data in standardized industry and government expectation of life tables (often comparing those to their own company's mortality data). Since longevity continues to improve – people are living longer – these mortality tables also change periodically, affecting pricing often by lowering the mortality charges, or cost of insurance. In contrast to an actuary's analysis of large numbers to determine mortality risk, an underwriter assesses mortality risk by focusing on individual risks.
2. *Expenses* – The expense component in premium pricing involves the cost to operate the company. This includes building overhead, equipment purchase and maintenance, employee salaries and benefits, agent commissions, marketing, and advertising. Companies also need to consider expected customer behavior. Some products, for example, permit the owner to vary the amount of premium payments over the life of the contract. The number and timing of contracts that are surrendered for their cash value or lapsed without value are also important considerations.
3. *Investments* – Assumptions are made about a reasonable rate of return that must be earned on all invested assets to ensure that money is available to pay future claims.
4. *Profit* – In pricing for premiums, actuaries seek a profit level often measured as a return on investment (ROI) or a return on equity (ROE), which the company requires to grow, to meet all promises made to policyholders, and to meet the needs of other stakeholders, e.g., those who own stock in the company. Profit is the expected earnings after all expenses are met and can be in the form of money saved through operating efficiently, gains in investment income over what was projected, or mortality improvements because fewer people died than were expected to die.

New Business and Underwriting

In many companies, an organized product development team, comprised of members from many affected areas of the company, meets to reach consensus on the best method to price, develop, implement, and promote the product quickly and effectively. While typically actuaries

and sales and marketing officers take the lead in product development, underwriters also have a significant role in the process. Their analysis involves addressing some of the following issues:

1. Does the application ask the right questions in a clear manner so that the proposed insured's expected mortality class can be determined?
2. If a new product requires information not currently asked on the application, have the appropriate questions been added to the application?
3. Is the product designed and priced to allow substandard risks the opportunity to purchase the product at a higher premium?
4. Does the product's introduction require a new underwriting class, and if so, what criteria will be used, and what underwriting information is necessary to assign an individual proposed insured that premium classification?
5. What are the proper underwriting age and death benefit amount limits to help reach the expected mortality assumptions?

Administration

Finally, there are many administrative issues that need to be addressed when a new product is developed. The information technology department needs to modify system software. Policyholder service needs to develop forms and procedures to administer the contract properly. The claims department may need to be involved, particularly in cases where there are new legislative mandates or new benefits that will require interpretation. In the U.S., the legal and compliance areas must prepare and file all policy forms, the pricing actuarial memorandum and, in many instances, copies of marketing materials. Some products even require the filing of prospectuses. In Canada, no filing of products or forms is required federally or provincially.

Product Types

In this overview of life insurance products, the following sections discuss the main forms sold in North America. First, the discussion will cover the two main traditional products – whole life and term insurance. The focus will then be on the interest-sensitive and universal life products (fixed and variable) that emerged in the early 1980s as a response to prevailing high interest and inflation rates, as well as the more recent advent of equity indexed universal life. Special need products, such as joint life that insures two lives (often in one policy contract) will be discussed next, and finally, two of the more common specialty market products: corporate and bank-owned life insurance.

Subsequently, a selection of optional riders, with both death and living benefits, will be discussed. Some contain both morbidity and mortality factors, and thus are underwritten as an extra risk, usually with a separate premium cost.

Traditional Products – Term Life Products

As the name implies, term life insurance products provide coverage for a defined period of time. Policy durations can be as short as one year or for periods of five, ten, fifteen, twenty years, or more. The term period can instead be specified to a certain age, such as the anniversary when

the insured is age 65 or 70. For the beneficiary to collect the death benefit, the insured must die within the term period while the policy remains in force.

Unlike whole life plans, term plans generally have no savings or cash value component. Thus, the premium rates per thousand of insurance are lower (i.e., more closely based on true mortality cost assumptions) than for whole life. Today, term insurance approaches a product bought as a “commodity,” or based on price alone. In large part this is due to the internet, which has given rise to numerous term insurance quote services. Some policyholders continuously shop for the lowest term life insurance rates; thus, higher than normal replacement and lapse rates characterize term life business.^{1,2} With term life insurance, the face amounts can remain level, decrease, or increase over time.

Level Term

Level term products maintain a constant death benefit during the in-force period. However, premiums can remain the same or increase if the product has multiple premium payment periods that change every one, five, or ten years. Usually upon an increase, the premium rate renews at the insured’s attained age. The level death benefit plan with guaranteed premiums has remained a widely sold term product for more than a decade.³

Decreasing Term

With decreasing term products, the face amount decreases on a specified schedule over the duration of the policy, but the premiums remain level. In effect, premiums are increasing as a reflection of increased mortality with age, even though the at-risk amount decreases. Often this product is sold to protect or repay a large amount of debt, such as a mortgage, that decreases over time. Unfortunately, the decreasing term schedule may not always follow the mortgage amortization pattern in all years, allowing a coverage protection gap – that is, less insurance in force than debt in one or more years.

Increasing Term

Increasing term products have a face amount that increases over the coverage period, often at a set percentage rate to reflect some form of inflation. Premiums will usually increase also. This product can be suitable for those who expect both their income and insurance needs to increase over time but are uncomfortable paying the higher premiums required for permanent insurance.

Two key features help make term life insurance valuable: *renewability* and *convertibility*. The renewability feature, found commonly in level term products, allows the policyholder to renew the coverage at the end of the initial period for one or more additional term periods without evidence of insurability. Renewal periods are limited and subject to an increase in premiums at attained age rates at the time of renewal. The higher premiums reflect both the increased mortality risk due to the insured’s age, and the increase in the number of individuals with impairments since the initial underwriting. Those with health impairments are more likely to renew coverage, causing anti-selection.

A convertibility feature provides the insured an important right, which is the ability to convert term insurance to a permanent policy within a certain period of time or by a certain age without evidence of insurability. Upon a conversion, the new permanent policy would be purchased at the attained age rate for that product but in the same rating class as the original policy. Many companies offer incentives to policyholders to convert early to a permanent product.

In Canada, there is a product called Term to 100. It is classified as a term insurance product, but in reality it is permanent, level premium, non-par, whole life insurance. The death benefit remains level throughout the life of the insured. There are no or relatively insignificant cash value benefits. These products were popular initially because they provided permanent insurance protection at a low cost. However, premium rates had to be increased considerably on new Term to 100 products, and their popularity has decreased. Based on 2007 LIMRA figures, Term to 100 represents less than two percent of all Canadian sales.

Traditional Products - Permanent Life Products

Life insurance that provides coverage for the insured's lifetime is considered permanent insurance. Traditionally, such products "matured" (the cash value equals the death benefit) when the insured reached the limiting age (between 95 and 121) used in the mortality table. These policies are referred to as whole life policies. Today most policies allow the owner to keep the coverage in force well beyond maturity.

Whole Life

With whole life, premiums are payable for the lifetime of the policy. Many companies stop collecting premiums at the maturing age. Premiums are calculated so that excess contributions above the anticipated cost for mortality are paid in the policy's early years, in order to cover the cost of mortality charges in the later years, when mortality assumptions are higher than the premiums collected. One exception is a modified whole life plan with premiums that gradually increase for a stated number of years.

As policyholders pay their premiums, the excess money not required to cover mortality or expenses accumulates at interest and is held in reserve. To the benefit of the policyholder, some of the reserve is available to him or her as a cash value. That cash value can be used as a source of emergency money. The cash value can be borrowed at a low net interest rate, or the policy can be used in a loan transaction as a source of collateral, or the policy can be surrendered for its cash value.

Different types of whole life plans are marketed based on the duration of the premium payments. Normally, a whole life policy requires continuous premium payments over the lifetime of the insured. Since this maximizes the number of payments, each premium will be lower than for types of whole life in which the policy coverage will last a lifetime, but the premium payment durations are abbreviated.

Besides meeting a particular need for the insurance coverage, one advantage in purchasing a whole life policy with a shorter or limited premium payment duration is that the policyholder has access to a large amount of cash value more quickly. From the company's perspective, with

limited pay plans, it is managing policies with a lower net amount at risk (death benefit face amount less cash value). Such policies are economical for the company to administer due to less premium administration. Below are a few types of abbreviated premium whole life plans.

Single premium whole life requires just one premium to fully pay up the policy. Naturally, since the premium is payable all at once, this creates the highest premium amount. Occasionally, this plan is used in the following situations:

1. One policy is replaced for another policy and the cash value from the prior fully pays for the new policy.
2. Planning for seniors is done to provide additional tax advantages as well as additional death benefits; for example, a low-yielding and currently taxable investment of another form, such as a certificate of deposit (CD), can be cashed in to provide a single premium payment for new life insurance coverage.
3. Grandparents may wish to gift a policy on the life of a grandchild.

Limited pay whole life coverage lasts for the whole of the insured's life, but premiums are required only for a certain stated number of years, such as 10 or 20 years, or to the anniversary when the insured is age 65. The limited pay plan can be used in a variety of sales applications when it is desirable for the policy to be paid up by some designated time or event, such as retirement.

Modified whole life products vary their face amount and/or premium payment structure over the life of the policy. A modified premium product can have premiums that grade up over time, or, in the case of some policies sold to juveniles, upon attaining a certain age (usually 18 or 21). When premiums level out in the future, perhaps in five or ten years, the premium will have increased to an amount higher than it would have been if the premiums had been those of a level, continuous pay whole life product at the beginning.

A modified coverage product has a face amount that changes. One type of plan has an increasing death benefit and is often sold on juveniles. Sometimes these policies are referred to as "jumping juvenile plans," because when an insured child reaches adulthood, the policy face amount increases – in some cases as much as five times. For example, a \$5,000 face amount modified whole life product bought at age one might "jump" to a \$25,000 whole life at age 21.

While less common in today's marketplace, some modified death benefit plans provide that a portion of death benefits actually decrease beginning in a certain number of years or at a certain age, such as age 65. These plans provide a larger amount of coverage during one's working years, and then the face amount is reduced at retirement, when presumably less life insurance would be needed. Premiums usually remain constant throughout the duration of the policy.

Modified premium or modified coverage whole life policies can be appropriate for juvenile proposed insureds and young insureds with the need for protection but whose budget is limited. These types of policies are also appropriate on the lives of owners of new businesses that are carrying a large debt load and who are reinvesting any business profits into the business' growth.

Traditional Products - Combination Products

Less common than straight term or whole life, many products exist that combine a base of whole life or permanent coverage with a large amount of term insurance. These products economically offer policyholders a large amount of protection and some cash value accumulation. Typically, portions of the term face amount can be converted periodically to permanent coverage to accommodate a policyholder's ability to pay more premiums or his desire to accumulate more cash value.

Interest Sensitive Products

In the late 1970s and the early 1980s, inflation and interest rates soared to unprecedented double-digit levels. In this atmosphere, some consumer attention was focused on the relatively low interest earnings credited to the net premiums making up whole life policy cash values. Some companies responded by judging traditional whole life products to be too inflexible in their premium and death benefit structure to retain their value under extraordinary inflationary times.

To offset inflexibility, to increase the interest crediting to cash values, and to restore policyholders' faith and confidence in life insurance, in the early 1980s, interest sensitive whole life and universal life products were developed. Interest sensitive products are considered permanent products because they build cash value. In addition, if the proper premium level is paid, they will last for the whole of life. However, the at-risk and savings components have been uncoupled to allow for maximum flexibility. Specifically, the four components of premiums mentioned earlier – expected mortality, investments, expenses, and profit – have been uncoupled. The popular universal life product best demonstrates this.⁴

Universal Life

Universal life is characterized by premium paying and death benefit flexibility. Within limits, a policyholder can pay a minimal premium, suspend premiums for a time, or even add excess premium into the policy, periodically or in a lump sum. Universal life policies typically have two, but sometimes three death benefit options:

1. level face amount
2. level face amount plus the amount of cash value at the time of death
3. level face amount plus premiums paid

Since the death benefit is higher for universal life that includes cash value or the premiums paid, the cost of insurance charges are higher than for universal life restricted to the initial level face amount. The policy face amount can be lowered or increased to meet future needs; however, increases are usually subject to evidence of insurability.

In universal life, a monthly charge is deducted from the policy's premium and/or cash value for the cost of insurance (COI), or expected mortality, and for the company's operating expenses and taxes. Net premiums are invested by the company and credited to the policy as cash values, subject

to an early withdrawal or surrender charge schedule. Cash values increase by net premium deposits and investment interest earned.

During the period from one deduction to the next, the policyholder is allowed to pay as little or as much premium as he or she wishes. There are minimums set that will keep the policy in force regardless of interest earnings, and maximum premium guidelines to keep the policy legally as life insurance rather than an investment (under which some tax advantages could be lost). Essentially, as long as the amount of cash value remains higher than the COI and expense charges, the policy will remain in force.

To the extent the policyholder pays less than the premium required to guarantee coverage for life, he or she shares in the risk with the company. However, policyholders seem willing to bear some risk. Universal life's flexibility has made it one of the dominant policy types being sold. A large amount of face amount and death benefit protection can be purchased for a variety of needs and planning scenarios for a reasonable, affordable premium.

A disadvantage of this product is that in order to keep premiums low, policyholders tend to rely on high interest earnings from company investments to keep cash values sufficiently high to keep the policy in force. However, business cycles affect investment earnings. If a universal life policy is not funded at a high enough premium level initially and continuously, it can lapse in the future. Insurance companies encourage funding at a targeted level to keep the policy in force as long as possible, so it can function as originally intended and can be in force when the insured dies.

Indeterminate Premium Whole Life

This product has both a minimum and a maximum premium rate. The policy is issued with premiums that reflect the minimum premium rate possible and rates that remain fixed for a stated period of time, such as one, three, or five years. After this initial period, the premium can increase (for all policies in the same class and plan) to counter increases in the company's expected mortality or operating expenses, or the company can choose to keep the premiums at the current level if expected mortality and operating expenses do not increase, or if these factors can be offset by income earned on the company's investments. However, at no time is the premium allowed to exceed the maximum premium rate stipulated in the policy.

Interest Sensitive Whole Life

This type of product originated in the 1980s. To develop and administer universal life required companies to invest in new hardware and software systems, so many companies in the 1980s opted to combine the best features of traditional whole life with the current interest rate crediting of universal life. Interest sensitive whole life retains the three guarantees of whole life: level premiums, death benefit, and cash value. However, any premium not required to meet the expected mortality or operating expenses becomes the policy cash value, and it is credited with a current interest rate. The excess cash value increases the face amount of the policy as additional death benefit, and the death benefit will continue to grow as long as the policyholder continues to pay premiums.

After several years, if the total cash value account is sufficient to continue to pay mortality and operating expense charges, premiums can be suspended for a time and possibly for the duration of the policy. Death benefits can level out or decrease when premiums are suspended because it is from the cash values that future premiums are deducted as they come due.

This policy is an excellent choice for people who want a permanent life insurance policy earning a current interest rate with the guarantees of traditional whole life. Initial premiums generally are higher than most universal life products but somewhat lower than traditional whole life.

Variable Life

Variable life products bring a new concept to the role of life insurance. For over 200 years, the traditional whole life concept was to shift all risk for mortality to the insurance company. With universal life, some risk, principally for interest earnings, was shifted to policyholders who preferred to pay lower premiums and assume the risk that their policies would remain in force.

Variable life takes risk-sharing one step further. Traditionally, insurance companies collected the premiums and invested safely, mostly in high grade bonds, for a reasonable rate of return consistent with the future claim obligations. However, with variable life products, investments are made into any of numerous stock, bond, or money market mutual funds. The policyholder chooses the type of equity subaccounts in which the company will invest the net premiums. Thus, the risk for all earnings in the policy account and the continuation of the policy face amount shifts squarely onto the policyholder.

During the sustained growth of the equities markets in the 1990s, for people who needed life insurance and who had the right risk tolerance and long time horizon, variable life became a major form of life insurance purchased.⁴ Cash values increase or decrease depending on investment fund performance. Since death benefit is also tied to fund performance, it will increase or decrease as well; however, the face amount is usually guaranteed to never go below the initial amount purchased.

In variable universal life, policyholders also have the same premium flexibility as universal life to pay a specified amount, to increase premiums within some upper limits, or even to suspend payments for a time. However, they need to ensure that enough cash value is present at any time to pay current monthly operating and mortality expenses.

The menu of funds available to policyholders ranges from conservative company accounts or money market and government issues, to a variety of bond funds and relatively stable, blue-chip large cap stock funds in the middle range, on to the more speculative and risky equities, such as international or low capitalized new business stocks. Funds are usually from large, well-known, and well-managed investment companies, perhaps with a mixture of the insurance company's own funds included.

In the United States, since the instruments in which policyholders invest are regulated by the Securities and Exchange Commission (SEC), which also governs the behavior of the Financial

Industry Regulatory Authority, Inc. (FINRA), agents must apply for special securities licenses to sell variable life as registered representatives.

Equity Indexed Universal Life

Equity indexed universal life (EIUL) products are yet another hybrid designed to benefit the policy owner when the financial markets are doing well and to provide protection when those same markets do poorly. In this case the policy cash value is tied to the performance of a specified financial index, such as the Standard and Poor's 500 Index. Typically, as the index rises and falls, the cash value receives a related crediting rate. To protect against market declines, most such products guarantee that the crediting rate will not drop below a specified minimum, which can be zero.

However, the risks are shared between the insurer and policy owner. The crediting rate is not equal to the rate of index growth, but rather a specified percentage of that, known as the participation rate.⁵ Thus, while the policy owner benefits from an advancing financial market, the insurer does as well, retaining the difference between the participation rate and actual rate of return in order to cover potential losses should the markets turn negative.

Unlike variable products, with which the policy owner suffers the full loss of a declining financial market, the guarantees in EIUL products protect against the worst-case scenario. However, the benefits of EIUL are not as great as the potential benefits that variable products have. As with most products whose performance is linked to the financial markets, an EIUL product is for an informed purchaser who understands both the risks and the rewards.

Joint Life Products

To allow more than one person to be insured under one policy, joint life products were developed. In most cases this is accomplished by issuing a permanent policy on a base insured and adding other insureds by policy rider. The chief advantage of joint life for the policyholder is that generally it is less expensive to buy one policy, rather than purchasing several policies, each of which can have its own policy or administrative fees. From the company's viewpoint, it is also less expensive to administer since other insureds covered are only charged a premium for expected mortality – in effect the riders provide term life coverage.

Riders can cover a spouse, children of the insured, or even business partners. Individuals covered are usually able to convert their coverage to a separate individual permanent policy. Joint life performs as if several policies are tied together that can be separated without disturbing the base policy coverage.

A first-to-die policy provides protection for an insured and spouse that pays the death benefit once, at the time the first person dies. It can be written as either permanent or term life insurance, and it offers the same benefit of reduced premiums since there is only one policy. This works well, for example, to pay off a large mortgage.

Both insureds are underwritten as though they were applying for separate policies, since the death benefit is payable at the death of either insured. Upon the first death, the surviving spouse

is given a period of time to purchase an individual policy for the same policy face amount (and current attained age) without evidence of insurability.

Last-to-die policies, often referred to as survivorship policies, are typically used for estate planning purposes to pay federal estate taxes due when the second spouse dies. Again, there is only one death benefit payable and that is at the second death.

Why would married couples with a sizable estate consider survivorship policies? Upon the first death, under current U.S. estate tax law and Canadian law, the surviving spouse can receive the entire estate free of estate taxes. The major estate tax penalties for property transfers occur upon the second death, when one passes assets on to the next generation.^{6,7}

Premiums for last-to-die products are lower than for first-to-die products. Premiums are calculated for the expected mortality with two lives instead of just one. One highly desirable feature for policyholders planning their estate is that, at least among the major competitors in this market, generally one of the insureds can be substandard or uninsurable under this scenario, usually with the provision that the second insured is relatively healthy.

Last-to-die policies present underwriters with a challenge. The relatively healthy spouse could predecease the uninsurable spouse. In this case, perhaps the premium charged would in hindsight prove inadequate for the risk assumed.

COLI/BOLI Products

COLI is an acronym for corporate-owned life insurance, and BOLI refers to bank-owned life insurance. Any of the normal portfolio permanent products can be used for COLI plans, but usually only those generating high cash values are favored. Carriers will sometimes develop special high cash value products that are priced to include the advantage of executive mortality and increased persistency that is typical of multi-life COLI/BOLI plans. COLI/BOLI products are not sold in Canada.

COLI cases involve multiple lives and substantial premiums on executives who are the proposed insureds. The purchase of this life insurance is often used to fund non-qualified deferred compensation plans, designed as 401K look-alike plans, supplemental employee retirement plans (SERPs) or other “non-qualified” deferred compensation plans (i.e., not subject to federal government registration and oversight) designed to build extra retirement income for highly compensated executives. Under normal “qualified” pension plans, highly compensated executives and business owners are limited in the contributions they can make yearly.

BOLI products are strictly single-premium permanent life policies developed by insurance companies to fund some type of employee benefit plan. To comply with state insurable interest guidelines, usually only highly compensated bank employees or bank officers are insured even though the underlying benefit that the insurance proceeds will fund can extend to a much larger employee group. They are administered separately following certain federal guidelines. Rules for BOLI must follow rigorous guidelines for bank solvency, which are established and audited by the Comptroller of the Currency in the United States Treasury.

In both COLI and BOLI, death benefits provide family income replacement protection in the event of death prior to retirement, but the emphasis generally is on rapid cash value accumulation to generate supplemental income upon retirement. In both instances, since multiple insureds are involved, non-traditional underwriting in the form of guaranteed issue (GI) or simplified issue (SI) has become the norm.⁸

Guaranteed issue means just what its name implies – all proposed insureds are accepted as a risk if they and the corporation can verify that they are actively at work at the time of application. It is a conditional guarantee, typically subject to both the active-at-work requirement and a provision that they have not been hospitalized or absent from work for a specified number of days (usually 3 to 5) due to illness or injury in the preceding 90 days. The products are priced for extra mortality. To qualify for guaranteed issue, a case must satisfy the insurance company's guidelines regarding minimum number of lives, minimum level of participation, and overall plan design.

If the case is ineligible for GI, then perhaps simplified issue underwriting will work. The SI underwriting process involves each proposed insured answering only a few medical questions and perhaps submitting a urine specimen and/or an abbreviated blood test. Typically, pricing anticipates extra mortality, resulting in acceptance or declination with no attending physician statement (APS) for past or current medical information is sought.

Optional Policy Rider Benefits

To create flexibility and choice, insurance companies develop and market new rider benefits to enhance and differentiate their coverage offerings. Some have limited use and specific sales concept applications, such as the estate tax protection rider. Often found on last-to-die policies, the estate tax protection rider provides for extra death benefits in the event an asset that had been gifted to another within three years of death reverts into a decedent's estate, creating additional estate settlement taxes.

Many optional rider benefits are too limited for discussion in this context. Underwriters should be knowledgeable of all riders offered in their company's portfolio, the sales applications of each, and the underwriting implications.

The following primary rider benefits have a fairly wide acceptance and can be attached to most product types. All have underwriting implications, and all but one – accelerated death benefits – generally require additional premium. The accelerated death benefit deserves a wider treatment, since it has become rapidly accepted as a “living” benefit, and because the benefits relate or correspond to conditions that trigger benefits for long-term care and critical illness insurance, which can be sold as separate types of insurance policies.

Waiver of Premium for Disability

This fundamental and valuable benefit “insures” the insurance policy against lapsing due to the insured's, or owner's, loss of income upon suffering a total and permanent or other covered disability defined in the policy rider. In such an event, usually after a specified number of months of continuing disability, premiums on the insurance policy are waived (credited by the company)

for the duration of the disability. Any cash values continue to grow as though the policyholder were continuing to pay premiums. Definitions of disability usually refer to one's own occupation for 24 months, then for any occupation for which the disabled insured might become rehabilitated or trained. However, variations can occur from company to company.

Because morbidity rather than mortality is involved for assessing whether to grant the waiver of premium, in addition to past medical history, underwriters must consider the proposed insured's occupation or avocation. Some occupations or avocations can require an extra premium due to the hazards involved, while others are denied the benefit altogether even though the base policy risk might be a standard issue.

Accidental Death Benefit (ADB)

This rider provides for additional indemnity or death benefits if the insured dies as a result of an accident. Often, this is referred to as "double indemnity." Passengers who die while on public transportation, such as a bus, train or airplane, can be entitled to additional indemnity. Usually there is an aggregate accidental death limit on any insured for all policies in all companies and on an individual policy. Underwriting considerations include certain lifestyle factors, such as excessive alcohol or drug use, or a poor driving record indicating a persistent pattern of speeding or accidents, and dangerous occupations and avocations.

The accidental death benefit can be issued standard, rated, or can be denied, depending on medical and non-medical factors. The underwriter must pay special attention to medical impairments that can put the proposed insured at an increased accident risk and recognize that the medical history combined with certain avocations can increase accident exposure.

Guaranteed Insurability Option (GIO)

GIO offers valuable protection for younger insureds in the ability to build a program of protection by allowing future purchases without evidence of insurability. At specified intervals, often of three years, until a designated age, insureds can purchase another policy, usually the same as the base policy. As an example, a common scenario is to offer six guaranteed purchase options for ages 25, 28, 31, 34, 37, and 40. Often, the next option can be moved forward upon marriage, or the birth or adoption of a child.

Young adults beginning careers or starting a family are typically the market for this rider, but many parents add this important benefit for an extra premium to policies written on their children (juveniles) to protect their right to purchase life insurance in the future. Options typically can be up to twice the face amount of the base policy, not to exceed a specified face amount per option. In addition to the base policy, underwriting assesses the total additional insurance coverage that could be added. Underwriting requirements can depend upon the total face amount that can ultimately be in force when the GIO elections are made. Typically, this benefit is not available on term life insurance.

Accelerated Death Benefits

This benefit was developed first in Canada in the mid-1980s. The accelerated death benefit (a separate rider or base policy provision) has rapidly become perceived as the most significant “living benefit” currently offered to policyholders by major insurers across North America. Generally offered to all permanent policyholders at no additional premium charge, the accelerated death benefit can be viewed as having morbidity and mortality aspects, with any extra “risk” generally priced within the policy.

How does this rider work? Under certain conditions, death benefits can be obtained prior to death via systematic advances treated as policy loans, payable over a specified period of time and capped at a set percentage of the face amount death benefits or a dollar limit.

Accelerated death benefits have proved so popular as a benefit that they continue to evolve. Initially, accelerated death benefits covered only terminal illnesses. Today, benefits can be accelerated for terminal illness, critical illness, or long-term care due to permanent confinement in a nursing facility or at home. Here are the general characteristics under the three definitions, or benefit-triggering events:

1. terminal illness – Benefits are accelerated if a physician certifies that the insured has a terminal illness and is expected to die, usually within twelve months or less. When approved under the terms of the rider, benefits can usually be paid out periodically to offset ongoing expenses of care for an end-stage illness.
2. critical illness – When critical illness is a trigger for accelerated death benefits under the contract or a separate rider, benefits are accelerated, or advanced, in a lump sum. Conditions or illnesses covered can include cancer, coronary artery bypass surgery, and stroke, for example. Benefits can be payable up to a certain percentage of cash values or capped at a certain dollar limit. Further, critical illness benefits can be limited to a one-time claim. Payments under this definition usually will reduce the ultimate remaining death benefits available for acceleration. Underwriters should be aware that stand-alone critical illness insurance products are on the market that have benefits and cover conditions more encompassing than an accelerated death benefit rider, such as discussed here.
3. long-term care – Modern accelerated death benefits include an option to provide for long-term care. In many respects, the definitions follow those found in a stand-alone, tax-qualified long-term care insurance policy.

Benefits generally can be triggered in two key ways: inability of the insured to perform any two of six activities of daily living (ADLs), i.e., eating, bathing, dressing, toileting, continence, and transferring, or being confined in a nursing home or similar facility, or even under professional home care, for a specified period of months.

Many of the appliances, machinery, or even home modifications that can be necessary to provide adequate care can be covered in some instances. The accelerated death benefit advances are usually paid monthly to offset the long-term care expenses, up to a specified period, such as 48 months. To assess the long-term care risk, the underwriter will pay close attention to disabling histories as opposed to those that primarily carry a mortality risk. As with the waiver riders, the

long-term care rider can be issued standard, issued with a rating, or be denied. An individual can be uninsurable for this rider while still being approved for a standard life insurance policy.

MARKETING

Successfully marketing a life insurance product relies on a variety of factors. Typically, life insurance companies focus on what their products offer, product competitiveness, advanced sales concepts, and underwriting niches. Successful marketing should also tie into and reinforce a company's overall brand. This section will break down some of the industry's marketing techniques and provide a better understanding of how and why companies choose to market their life insurance products in certain ways.

Product Marketing

Not surprisingly, insurance companies place a great deal of emphasis on promoting their products—their strengths, features, and benefits—to those who are interested in selling and purchasing life insurance. In the life insurance world, a new product is a significant event. Insurance carriers will use all marketing tools at their disposal to deliver the message about a new product. They also need to make sure they provide their distributors plenty of lead time to learn more about the product and run test illustrations before it is officially available for sale.

The marketing effort usually begins between 30 and 60 days prior to the launch date, with carriers focusing on disseminating information through a number of means, including (but not limited to): email communications, printed overview kits, teleconferences and meetings, as well as print and electronic advertising. Advertising is generally focused on trade publications and industry websites but can also include consumer advertising if the company feels the product is especially strong and they have a key marketing demographic they want to reach. The overall goal of this marketing effort is to raise awareness and create an excitement to sell the new product.

Repriced/revised products do not typically demand the same level of attention as new products but are still important areas of focus for marketers. This is especially true if the product changes are positive and result in improved features or competitiveness. A change that is especially beneficial can even command a level of promotion akin to that of a brand new product. However, it does not matter whether the change is positive, negative, or neutral—the company's marketing group still needs to get the word out about product changes, especially to those who sell the product.

Marketing Product Competitiveness

Insurance products are often designed in a way to ensure a company remains competitive in key ages and underwriting categories. The carrier anticipates a majority of their sales will come from these competitive “niches” which are typically based on market and sales data as well as independent and focus group research. Insurance carriers will also invest considerable time and resources to research and development in order to identify key target markets they believe will be most attracted to their life insurance product(s). This research is based on demographic, gender,

age, and socioeconomic data as well as psychographic (e.g., attitudes, value, or fears) reasons why an individual or group would be likely or less likely to purchase life insurance.

Even with this amount of attention to detail devoted to identifying potential target markets, the statistical realities of life insurance purchasers mean that companies often find themselves competing for the same pool of consumers. This, in turn, can lead to a seemingly revolving door of product repricings and revisions as companies compete with each other to ensure they stay competitive. It is important to keep in mind that in general, no company offers the most competitive prices across all product lines, and product features and benefits can be as important as competitiveness. In many cases, the least expensive product is not necessarily the best product to meet a client's needs.

Advanced Sales Concepts

Putting aside the never-ending struggle to remain competitive, companies are also increasingly offering additional sales concepts to those that sell their products. These so-called advanced sales concepts and marketing approaches serve to present life insurance as an important vehicle to solve more complex financial problems including estate planning, business continuation, and special needs planning. This new focus on advanced concepts is designed to show the flexibility and importance of life insurance and emphasize the fact that life insurance coverage should be a key part of a client's total financial portfolio.

Underwriting Marketing

Not to be ignored, underwriting is also a key focus for marketers. Since multiple carriers offer similar products at comparable prices, one of the key ways they can differentiate themselves is how they underwrite certain vocations, avocations, and medical conditions. Individual carriers will market their underwriting strengths through underwriting guidebooks, overviews, and frequent updates on any changes to ensure that their distribution partners know where their underwriting strengths or "niches" are. Successful marketing of underwriting niches should result in producers being aware of which risks a company underwrites competitively and wishes to solicit, and those risks where a company prefers to limit acceptance. Underwriting and marketing need to partner closely in this regard to create the appropriate balance between the acquisition of "niche driven" business and a company's risk tolerance as a whole.

Corporate Brand Marketing

Take a moment to think about how life insurance carriers market themselves. What comes to mind—colors, a logo, a memorable slogan? All of these identifiable characteristics come together to form a company's brand. A successful corporate brand will create a favorable impression in a customer's mind as well as improve their muscle memory so that when a person thinks of life insurance, they will think of Company X or Company Y.

Brand management is a key part of any successful marketing strategy. Good brand management marketing tells a compelling story and uses different avenues of reaching consumers to build off of one another. Presenting the company (to both end consumers and those that sell its

products) in a consistent way will help present a coherent company story, one that will hopefully resonate with the intended audience. It is often useful to review different companies' marketing material, to analyze how they present themselves, and how they manage and promote their brand. Over time, patterns and themes that each company uses frequently will often become discernible. How a company positions itself in the marketplace and what story they are trying to tell are critical components of successful brand management.

DISTRIBUTION

In addition to recognizing how and why companies market their insurance offerings the way they do, it is important to understand how these products are sold. Or, more to the point, *who* sells life insurance. The life insurance industry has many avenues or distribution channels through which its products are sold (e.g., captive agents, third party producers, banks) so that it can all seem a bit confusing and overwhelming. However, the key item to keep in mind is that no matter what the distribution model, the end goal is to sell life insurance protection to a consumer looking to protect his or her loved ones. These divergent approaches to distribution are employed by carriers to fully penetrate the marketplace and reach as many consumers as possible.

Captive or Career Agents

A captive agency force is comprised of individuals who are employees of a specific insurance carrier and exclusively sell the products offered by that carrier. Captive agents are the most straightforward and easy-to-understand life distribution channel. They serve as the traditional basis of what the population-at-large thinks of when they envision a life insurance salesperson. The use of captive agents varies widely across the life insurance industry. Some carriers rely exclusively on a large, nationwide agency pool to reach consumers while other carriers have no captive agents at all. Most insurance carriers have a captive agent pool that is somewhere in the middle—enough agents to give them a solid national or regional presence, but not large enough to exclusively rely on to ensure long-term profitability.

Independent Producers

Independent producers are individuals that are not aligned with one particular insurance carrier. First and foremost, these producers represent their client. They can pick and choose which carriers to sell based on product competitiveness, service, underwriting, and compensation rates. A growing force in life insurance for the past generation, this pool of independent financial professionals has enjoyed success because they offer the client something that the career agent cannot: the chance to quote a number of leading carriers to determine which carrier and policy offers the best product match at the most reasonable price. These independent producers often align with a *general agency* or *producer group* as a way to gain additional support and services to help ensure their practice is a success.

General Agency

A general agency is an insurance and financial services distribution organization that caters specifically to the independent producer audience. General agencies, or GAs as they are

commonly known, serve as a liaison between these independent producers and the life insurance carriers. GAs also provide additional levels of support to their pool of independent producers, including:

1. advanced sales specialists - provide expertise, support, and sales solutions for producers working on more complex life insurance cases
2. business case managers - help the producer take their life insurance case from start to finish or “quote to placement” – Case managers have extensive knowledge on how to best work with different carriers to get life cases placed successfully in the shortest amount of time possible. Producers also rely on these individuals to provide application status updates.
3. dedicated underwriting team - work with producers to ensure that the underwriting process runs smoothly and all required medical information and testing is conducted properly and in a timely fashion
4. back office support staff - help producers do the “leg work” involved with the life insurance application process – Back office support will help producers collect and compile applicant data, provide the relevant and state-specific forms and applications needed, and help schedule the necessary medical appointments.

Larger GAs can have a national presence while smaller organizations often choose to focus on a particular community. For a GA to be successful, it is imperative that they provide the necessary tools and a high level of support to ensure their producers are successful.

Producer Group

Producers groups are also comprised of independent producers and are created as a way to use the institutional strength of a larger organization to create a national presence that is seen as an attractive distribution partner to leading carriers. Producer groups typically are formed because their independent producer members:

1. are unhappy with their previous selling arrangement
2. are looking for a way to get increased compensation
3. want a stake of ownership/equity in the company for whom they are working
4. want a higher level of access to a wider range of life insurance carriers.

Like the GA structure, producer groups also provide their producers with additional levels of support including back office functions such as sales support, underwriting assessment, identification of carrier products, case design, and case management. The key difference between a producer group and a GA is that members of a producer group collectively own the group and, therefore, have a greater stake in the overall success or failure of the entire organization.

Personal Producing General Agent (PPGA)

A personal producing general agent is an individual that has been appointed by a carrier as a type of financial independent contractor. PPGAs can sell more than one carrier’s products and typically have contracts with a small pool of preferred carriers with whom they continue to place business.

Financial Institutions Channel

One of the newer distribution channels for life insurance, the financial institutions channel, is comprised of banks, wire houses (financial firms with multiple branches that offer teams of brokers with research and investment expertise to advise and conduct financial transactions for clients), and independent broker-dealers (brokers who can execute orders for their clients as well as conduct trades for their own accounts). These financial professionals are involved in a number of different financial services industries and have traditionally been focused on investment and wealth management. They have recently turned their attention to offering life insurance as a way to provide a more complete, totally diversified financial portfolio to their clients, while at the same time growing their business with their existing clientele. It is important to note that each financial institution has its own individual needs, requirements, and processes when it comes to marketing and selling a carrier's life insurance products. This understandably makes it more challenging for carriers to get their marketing messages through to those that have the ability to sell life insurance in these institutions. Because of this and the traditional resistance within these organizations to offer a complex product such as life insurance, carriers are still working on how best to successfully market to and sell life insurance through these distribution channels.

New Avenues for Distribution

Technological changes have greatly transformed all aspects of society in the past decade. The ubiquity of the internet, as well as the rise of smartphone technology and social media, have all profoundly changed the way individuals interact with each other. Because of this new technology, consumers today demand easy access to information and a certain level of sophisticated corporate engagement from all businesses, including the life insurance industry. Whether or not a company has a robust and dynamic approach to the latest social media trends, all life insurance companies have been touched in one way or another by the revolution of the information age.

A perfect example is the internet. While life insurance companies may have been hesitant to put too much information on a public website ten years ago, all major carriers today devote a great deal of time and attention to their corporate websites. This is because they correctly see a website as a way to market their company, explain their products, share knowledge, and locate new prospects. Some carriers even offer simplified-issue products for sale directly from the corporate website, a practice that would have been unthinkable ten years ago. While only some carriers currently participate in this type of direct distribution via online simplified-issue products, almost all carriers work with direct response GAs (DRGAs). Working with these DRGAs helps carriers service a segment of the population to whom price and convenience are the two most important factors in purchasing a life policy. DRGAs have created a successful business model by acting as online, multi-carrier quoting intermediaries between insurance carriers and the increasingly harried and technology savvy population that is looking for affordable term insurance and an uncomplicated insurance purchase process.

Technology does not slow down—think about how the life insurance distribution model may be different five, ten, or even twenty years from now. Chances are, long-standing accepted ways

of selling life insurance will be replaced or overshadowed by new approaches that embrace the internet, smartphone technology, or social media.

Conclusion

Marketing and distribution enjoy a symbiotic relationship that plays an essential part in the success of the life insurance industry. Good marketing will present a company's story, products, and underwriting in a way that is compelling, concise, and easy to understand. Successful distribution will review and use that marketing to find prospects throughout the country with the ultimate goal of successfully placing a life insurance policy.

Without marketing, all the distribution channels discussed would struggle to keep track of each carrier's products, underwriting approaches, and most recent updates. Without distribution to make the connections and present products and concepts, marketing is just words on a page. As a life insurance underwriter, it is important to understand how life insurance products are marketed and sold. Professional underwriters must have a thorough understanding of the products they are underwriting, partner interactively with their marketing colleagues, and demonstrate comprehension of the product's distribution channel. By doing all of this, they position underwriting as a competitive edge for their company and increase awareness of the importance and value of their profession.

Review Questions – ALU 101, Chapter 9

1. Universal life insurance is characterized by:
 1. guaranteed issue for applicants
 2. death benefit flexibility
 3. rigid premium payment schedule
 4. flexible mortality rates

2. Accelerated life insurance benefit payments can be paid if which of the following occurs?
 - A. a terminal illness
 - B. a need for long-term care
 - C. a critical illness

Answer Options:

 1. B only is correct.
 2. A and C only are correct.
 3. B and C only are correct.
 4. A, B, and C are correct.

3. Administrative considerations to be addressed during life insurance product development include all of the following EXCEPT:
 1. the creation of policy forms
 2. the determination of the mortality risk
 3. the implementation of policy holder services procedures
 4. the modification of system software

4. What are the different factors on which a successful marketing effort relies?

5. Briefly discuss the differences between a captive agency force and independent producers.

6. A policy benefit rider that generally does not require additional premium is the:
 1. accelerated death benefit
 2. waiver of premium benefit
 3. guaranteed insurability option (GIO)
 4. accidental death benefit (ADB)
 7. Major factors in determining life insurance premiums include which of the following?
 - A. mortality costs
 - B. accelerated benefits
 - C. return on investment
- Answer Options:
1. A and B only are correct.
 2. A and C only are correct.
 3. B and C only are correct.
 4. A, B, and C are correct.
8. List three optional policy rider benefits and briefly describe each.
 9. Describe the four major components determining product premium pricing.
 10. List three general customer needs fulfilled by the purchase of life insurance and briefly describe each.

Answers and Sources of Review Questions

Review Question 1

Answer 2: death benefit flexibility – page 7.

Review Question 2

Answer 4: A, B, and C are correct – page 134.

Review Question 3

Answer 2: determination of mortality risk – page 3.

Review Question 4

Refer to pages 14-16.

Review Question 5

Refer to page 17.

Review Question 6

Answer 1: accelerated death benefit – page 14,

Review Question 7

Answer 2: A and C only are correct – page 2.

Review Question 8

Refer to pages 12-14.

Review Question 9

Refer to page 2.

Review Question 10

Refer to page 1.

CHAPTER 10

CONTRACT LAW AND LEGAL FACTORS AFFECTING UNDERWRITING

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CONTRACT LAW AND LEGAL FACTORS AFFECTING UNDERWRITING

Introduction

A life insurance policy is a legal contract. Like other contracts, the agreement is legally enforceable in a court of law. The underwriter should be familiar with the following legal terms that relate to a legal contract:¹

1. *Contract* – A binding promise between two or more parties and/or an agreement enforceable by law.
2. *Formal Contract* – A contract that is binding because of the form of the instrument in which the promise is expressed.² Such instruments are binding contracts if they comply with the special requirements of the form. Examples of a formal contract are a check or loan agreement.
3. *Informal Contract* – A binding contract that creates certain legal duties because the parties have met requirements concerning the substance of the agreement rather than form. An insurance contract is an example of an informal contract. Other examples of informal contracts are leases and employment contracts.
4. *Bilateral Contract* – Both parties to the contract make legally enforceable promise(s).
5. *Unilateral Contract* – One party to the contract makes legally enforceable promise(s). A life insurance contract is a unilateral contract.
6. *Breach of Contract* – The failure of a party to perform according to the terms of a contract. A court remedy (i.e., a legal means of correcting a wrong) can be sought.
7. *Representation* – In insurance, a statement of facts made by an applicant upon which an insurer based its decision.
8. *Misrepresentation* – A statement of fact that is actually false.
9. *Material Misrepresentation* – A false statement of fact that is so substantial and important, that had the party to whom the statement was made known the statement was false, it would have caused that party not to enter into the contract. For example, a proposed insured does not disclose he regularly uses illegal substances.
10. *Reformation* – An action of the court by which a contract is revised to express the real agreement or original intent of the parties. For example, the insurance company discovers a policy was issued for \$100,000 instead of \$10,000 as applied for. Permission to correct the error must be requested by the insurer and granted by the policy owner before the contract can be changed.³
11. *Rescission* – A remedy in which a contract is voided because of a material misrepresentation.
12. *Waiver* – The giving up of a known right.
13. *Estop* – To prevent or preclude.
14. *Estopel* – The legal principle by which a party is prevented (estopped) from asserting a claim or right that is inconsistent with prior conduct on which another party detrimentally relied. For example, a producer informs a proposed insured it is not necessary to disclose certain medical history. The insurer would be estopped from asserting material misrepresentation or rescinding the contract because of the action of the producer.⁴
15. *Remedy* – A legal means of correcting a wrong.

16. *Punitive Damages* – Damages awarded to a plaintiff to punish the defendant.

17. *Agent* – A person who acts for another person or entity.

Life Insurance Contract

The life insurance contract is a binding promise enforceable by law. A promise is made by the insurance company, subject to conditions made by the applicant, creating a legal duty on the insurance company. Contracts created in which one party makes a promise, as in life insurance contracts, are called unilateral contracts. Since the life insurance contract is created by the parties meeting the requirements concerning the substance of the agreement, and not the form, it is an informal contract.⁵

The life insurance contract is an agreement enforceable by law. While the agreement is typically in the form of a policy, if both parties meet the requirements set forth, an insurance contract could be considered in effect even if no policy was issued.⁶

The life insurance contract usually includes the policy form, a copy of the application signed by the proposed insured and owner or applicant (if different from the proposed insured), any state approved questionnaires, and riders.

The applicant is required to sign the application. Each state has prescribed the legal contractual age. An application on an individual who is not of contractual age must be signed by that proposed insured's parent or legal guardian.

Requirements to Create a Contract

There are specific elements required to create an informal contract that is enforceable by law:⁷

1. *Offer* – An offer is a proposal by one party. The act of submitting an application for insurance with payment of the premium is an offer in exchange for a promise from the insurance company. The offeree can accept the offer, counter the offer, or reject the offer. If the initial premium does not accompany the application, the insurer can make an offer. Acceptance occurs in this situation when the policy owner pays the initial premium. When an insurer issues a policy other than applied for, that is considered to be a counteroffer. The policy owner must then accept the counteroffer before a legally enforceable contract is created.
2. *Acceptance* – This is the point at which an informal contract is created. Any words or actions on the part of the offeree indicating assent to the offer will constitute acceptance, as will performance of the act requested in an offer for a unilateral contract. Acceptance must be unconditional. If new conditions are imposed, it is a counteroffer, and not acceptance.⁸ Acceptance can be implied if there is an unreasonable delay on the insurer's part. If there is unreasonable delay, the courts of some states have imposed contract liability and some courts have imposed tort liability.
3. *Legally Adequate Consideration* – Life insurance contract consideration would be the value of money given in exchange for the promise.

4. *Competent Parties* – A person entering into a contract must have contractual capacity. This means he must be of legal age and without mental or other incapacity. A contract is considered void or voidable if contractual capacity was not present. A contract entered into with a minor can be voidable by the minor at any time. The insurer is considered a competent party if it is authorized in its charter to issue life insurance contracts and it is licensed in the state where the insurance is being sold.
5. *Form (or document)* – While there can be oral informal contracts, there are many complex terms in an insurance contract making it necessary for the policy owner to receive a written policy.
6. *Legal Agreement* – Any contract enforceable by law must be a legal agreement. Examples of illegal agreements are those that commit torts or crimes, that are against public policies, or that are considered wagering agreements.
7. *No Duress or Undue Influence* – Parties to an informal contract must be acting under their own will and not under the threat or pressure by another party to enter into the contract. Also, a person cannot misuse his position or dominance over another person to cause that other person to enter into a contract.

Governing Laws and Regulations

Insurance companies and their agents and brokers are governed by both state and federal laws. State laws regulate insurance contracts. In addition, insurance contracts that invest in securities must comply with federal and state securities laws as well as life insurance laws.

The life insurance contract is governed by contract rules and by rules specific to insurance policies. An insurer must be licensed in each state in which it does business. The contract language must be clear and without ambiguities. The language laws usually require policies to meet a reading ease test. In most states, the simplified language requirements are patterned from the National Association of Insurance Commissioners (NAIC) Life and Health Insurance Policy Language Simplification Model Act. This act prohibits print size that makes the contract difficult to read and specifies that the style and arrangement of the policy must be such that no portion is given undue prominence.

In Canada, life insurance contracts are regulated by provincial law and follow the Uniform Life Insurance Act drafted by the Conference of Commissioners on Uniformity of Legislation. Unlike the United States, policy forms do not have to be filed, except for those used with variable or equity product contracts.⁹

Information that is typed or handwritten in the life insurance contract will take precedence over the printed contract form. However, there are certain required policy provisions that cannot be changed by the applicant or the insurance company. These provisions will be discussed in the Contract Provisions section.

Further, in the United States and Canada, there are special insurance contract laws that prevent insurance contracts from being used for wagering purposes. For example, an unscrupulous person standing to gain from an insured life “may be tempted to implement the whims of chance in his favor.”¹⁰ Use of the concept of insurable interest in underwriting helps to reduce this problem.¹¹

There are laws that provide safeguards that premium collected will be applied to acceptable accounting and investment practices so the insurer will be able to honor claims as they are presented.

Fair claim practice laws are an example of the laws that regulate the claims practices of insurers. Such laws mandate that insurers promptly investigate and settle claims.

Insurance policies are intangible personal property with values that can be enforced by the courts. The policy owner holds all ownership rights to the policy, which includes the option to change or cancel the policy.

Temporary Life Insurance Contracts or Agreements

A premium receipt is issued when the initial premium is submitted with the application. There are different forms of premium receipts and the temporary coverage afforded under the receipts varies. The terms and limitations are outlined on the receipt form. The insurer will have no liability under the receipt coverage if there has been material misrepresentation on the part of the applicant.

Table 1. Conditional and Temporary Receipts.

Receipt	Description ¹²
Approval Premium Receipt	A <u>conditional</u> premium receipt. There is no coverage under this type of receipt until the insurer approves the risk. This type of receipt is rarely used because of the limited protection it provides to the applicant.
Insurability Premium Receipt	A <u>conditional</u> premium receipt. Coverage is provided under this form of receipt if the insurer determines the proposed insured was insurable at the time the receipt was issued.
Binding Premium Receipt (i.e., Temporary Insurance Receipt)	Temporary insurance becomes effective on the date the premium receipt is issued. The receipt is cancelled should the insurer find the proposed insured is uninsurable or upon issue of the policy. An abbreviated medical question is asked on the receipt.

A conditional premium receipt does not provide temporary life insurance unless certain conditions occur, whereas the temporary insurance or binding premium receipt is effective immediately on payment of the initial premium, without conditions.¹³

Premium receipts will typically extend a limited amount of coverage, such as a maximum specified amount of \$1,000,000. Age limits usually apply.

The binding premium receipt will specify when coverage under the receipt terminates. This will typically be after a period of time, such as 60 days, or when a policy is issued, or when the policy owner is notified the coverage is denied.

Conditional receipts have created legal challenges for insurers. Courts have interpreted them as if they were binding. This interpretation of the courts has been based on the ambiguity in the premium receipt and/or the doctrine that insurers must honor what an average person would believe, i.e., that there was temporary life insurance coverage immediately and that it was unconditional.¹⁴ For these reasons, binding receipts are becoming more commonly used today.

Contract Provisions and Statutory Requirements

The typical life insurance policy will have a face page that will contain the basic promise of the policy, signed by an officer of the company. The face page can include a description of the plan and describe the free-look provision. This will be followed by required (or standard) statutory provisions, optional policy provisions, and additional benefits or riders. A copy of the application will be included in the policy.

Required (or Standard) Statutory Policy Provisions

Any contract for life insurance must be approved in the state where it is being sold. There are certain provisions called required (or standard) statutory policy provisions that an insurer must include in a life insurance contract.

Entire Contract Provision

This provision specifies the policy and the application make the entire contract. The states vary in the exact language required in this provision. Most states require the application be attached to the policy to be part of the contract. It should be noted here that any form or application attached to the policy must be a form that is approved (or approved by deemer¹⁵) by the department of insurance in the state where the contract is being sold.

The entire contract provision has two purposes. First, it protects the policy owner. It prohibits the insurer from later adding agreements or conditions to the policy and, by attaching the application, the policy owner can review it for accuracy and can correct any errors that are found. Second, it protects the insurer. It includes the representations made by the applicant upon which the insurer relied in issuing the policy.¹⁶

In Canada, the entire contract provision states that the contract consists of the application, the policy, any document attached to the policy at issue, and any amendment to the contract in writing after the policy is issued. There is no general rule that the application be attached to the policy (except in Quebec), though most companies do so.¹⁷

Incontestable Provision

This provision provides that after a policy has been in force for a period of two years during the lifetime of the insured, the policy becomes incontestable – that is, the insurance company cannot contest the policy’s validity. This provision was created to ensure the public confidence that insurance companies would honor the long-term life insurance commitment. The two-year limitation does not apply to contestability based upon non-payment of premiums nor misstatement of age.¹⁸

The effective date of the contestable period is typically interpreted as the earlier of the date of issue or effective date of the policy. In certain states (Kansas, Kentucky, and West Virginia) where replacement of insurance is involved, coverage will be contestable only to the point it would have been on the replaced policy. This would not apply to any increase in amount or benefits on the new contract.¹⁹

If any medical or nonmedical history is admitted and not thoroughly investigated by the underwriter, the condition cannot be used to contest the policy. If, however, the information was not disclosed by the applicant, and it is determined the additional facts would have resulted in an adverse action, a claim in the contestable period can be contested by the insurer.

In recent years, the contestable period has even been interpreted by the courts to apply to fraud, limiting an insurer’s ability to rescind a policy in case of fraud to two years from the policy’s inception. Insurance companies may, however, be able to contest the contract where impersonation of the applicant was involved.²⁰

Most incontestable provisions state the policy can be contested by the insurer in the first two policy years, during the lifetime of the insured. This means the policy cannot become incontestable if the insured dies within the first two years the policy is in force. This is to prevent a beneficiary from delaying the submission of a claim until after the contestable period has expired.²¹

If a material misrepresentation is discovered while the insured is alive and the policy is in the contestable period, the insurer can pursue rescission and refund the premium. A misrepresentation is considered material if the underwriting action would have been different had the information now available been revealed at the time of application.²²

In Canada, the incontestable period is the same as in the United States. If there is a failure to disclose a material fact, the contract can be voided during the first two policy years. Unlike in the United States, however, a fraudulent statement can void a contract beyond the two-year period. This can apply even to misstatement of smoking history.²³

Misstatement of Age Provision

This provision covers the procedures for correcting an insured’s age that is innocently misstated. If the error is discovered after the death of the insured, the benefits of the policy will be adjusted according to what the premium paid would have purchased. If the error is found before death, an

ajustment can be made to either the benefit or the premium. If an insurer can prove fraud in the misstatement of the insured's age, benefits could be denied.²⁴

The same provisions exist in Canada. Canadian law does, however, address situations in which the contract would not have been issued had the correct age been known. When this occurs, the contract can be rescinded as long as the rescission is done while the insured is living and within 60 days after the insurer discovers the misstatement. This does not apply, however, to a contract that has been in force for five or more years (three years in Quebec).²⁵

Grace Period Provision

This provision defines the time beyond the premium due date in which the premium must be accepted by the insurer. Coverage continues during this period. If the premium is not paid, the policy will lapse and reinstatement will be required to continue the coverage. If the insured dies during the grace period, the premium that is due can be deducted from the benefit amount. Most life insurance policies have a 31-day grace period. If the last day of the grace period is a non-business day, the premium will usually be accepted on the following business day. Interest can be charged by the insurer on payments made in the grace period.²⁶

Reinstatement Provision

The reinstatement provision provides the insured with the requirements and the time period in which a policy can be put back in force after it has lapsed for nonpayment of premiums. Typically, a policy owner will be able to apply to reinstate a lapsed policy within three to five years of policy lapse. Evidence of insurability that is satisfactory to the insurer will be required. Typically, payment of all past due premium is required. (A specific contract's policy provisions should be referenced as some contracts cannot require payment of all past due premium.) Interest on the back premium can also be required. The reinstatement date, as held by most courts, is the date the policy owner meets the conditions for reinstatement.²⁷

Regarding the contestability of a reinstated policy, the majority of court decisions have ruled in favor of a new contestable period applicable only to the information provided on the reinstatement application. The period covered by the suicide provision, however, does not start anew.²⁸

Many companies have a period of time in which they will automatically reinstate a lapsed policy upon receipt of the past due premium. In these cases, the insurer assumes that there has been no significant change in medical history in contrast to those policies that have been lapsed for longer periods of time. Most companies do not allow reinstatement of a policy that has been surrendered.²⁹

Canadian law provides for the right to reinstate a policy for a minimum period of two years from the date of lapse. Past due premium and other indebtedness plus interest must be paid and evidence of insurability satisfactory to the insurer must be submitted. The contestable period will run anew with respect to any statements made in connection with the reinstatement as it does in the United States. In Canada, however, the suicide provision is renewed with reinstatement.³⁰

Dividend Provision (if applicable)

This provision mandates payment of dividends on participating policies and also describes available dividend options. State laws regarding the frequency of dividend payments and dividend options vary. The basic dividend options include: payment in cash, reduction of the current premium, purchase of paid-up additional coverage, purchase of one-year term (typically limited to an amount equal to the cash value), or holding the dividend to accumulate at interest.³¹

Nonforfeiture Provision/Guaranteed Policy Values

Because more premium is paid than is needed to meet the mortality cost in the early years of permanent life plans, state laws require that insurers provide cash surrender values. Should a policy terminate with cash value, the policy owner will be given the option to surrender the policy for cash, to purchase paid-up insurance for a reduced amount, or to purchase extended term insurance for the net face amount. These options are generally defined in the nonforfeiture or guaranteed policy value provisions.³²

The Canadian Uniform Life Insurance Act does not require insurers to give the insured the right to elect nonforfeiture benefits. However, on permanent policies, these options are generally included and are the same options as are available on policies in the United States. The Quebec Civil Code states that the benefits and dividends must be applied to any premium to keep the policy in force, unless otherwise stipulated.³³

Policy Loan Provision

The policy loan provision defines the right to borrow from the cash value of the policy and describes the impact of a policy loan on the policy proceeds, on the repayment of the loan, and on the policy loan interest. A policy loan is actually an advance of the cash surrender value or of the death benefit. Any outstanding loan amount will be deducted from the cash value should the policy owner surrender the policy. In the event of a death claim, the outstanding policy loan will be deducted from the death benefit.

The policy owner is not required to repay a policy loan or the policy loan interest. Any unpaid interest, however, will be added to the indebtedness on the contract. A policy will lapse if the total indebtedness exceeds the loan value.³⁴

Most policies include or give the policy owner the option to elect an automatic premium loan provision. Under this provision, an overdue premium automatically creates a loan on the policy, if there is sufficient loan value to pay the premium. The automatic premium loan provision can prevent an unintentional lapse of the policy.³⁵

Optional Policy Provisions

Optional policy provisions are not required by law but are commonly used by insurers.

Ownership Provision

The ownership provision describes the rights of the owner(s). These rights include the ability to change revocable beneficiaries, to access policy values, to obtain a policy loan, to make assignments, or to surrender the policy for its values.³⁶

The ownership provision in Canada is similar except it does not necessarily describe the procedure for transferring ownership. A Canadian insurer can include a provision stating the policy owner's rights cannot be assigned. Also in Canada, as in the United States, the owner's rights are limited when there is an irrevocable beneficiary named.³⁷

Assignment Provision

An assignment is the transfer of ownership rights to another person. A life insurance policy could be assigned as a gift, as a sale, or to secure a loan.³⁸

The assignment can be absolute, meaning the policy owner irrevocably transfers all policy rights. An absolute assignment can be used to gift or to sell the policy. Generally, an absolute assignment will not cancel an irrevocable beneficiary's rights unless the beneficiary consents. A revocable beneficiary can, of course, be changed by the new owner.³⁹

A collateral assignment could be done, utilizing the policy as collateral for a loan, with a financial institution. This type of assignment is temporary and the policy's ownership rights revert back to the policy owner upon repayment of the loan and the financial institution's release of the assignment. A policy collateral assignment clause will define the assignee's rights and the insurer's responsibility.

Under a collateral assignment, the policy owner retains policy rights to collect disability payments, to designate or to change the beneficiary, and to elect an optional mode of settlement. Some collateral assignment forms will have a signature line for the beneficiary to consent to the terms of the assignment. If, however, the beneficiary is irrevocable and that beneficiary does not consent to the collateral assignment, his rights are usually superior to the collateral assignee's rights.⁴⁰

The assignment provision in most contracts states the insurance company is not responsible to an assignee before the assignment is received in writing at its home office. In addition, the insurance company does not take responsibility for the validity of an assignment.⁴¹

Suicide Provision

This provision permits an insurer, under certain circumstances, to deny a claim that is the result of suicide. Most policies include a suicide provision. This provision will specify the period of time, typically one or two years, during which a suicide *will not* be a covered risk. Some states specify the maximum time period suicide can be excluded in the suicide provision. In the event of a suicide during this time, the insurer will refund the premiums paid but will not pay the policy

death benefit. The insurance company bears the burden of proof that the death was due to suicide.⁴²

Change of Plan Provision

In this provision, the insurer describes the options available to change the plan or the amount of insurance and the conditions and requirements to do so. This provision is to give the policy owner some flexibility should his insurance needs or financial situation change. This change of plan option can help the company retain business that otherwise may be replaced by coverage with another insurer. Depending on the type of plan change, evidence of insurability can be required, such as when the company's risk is increased or the premium is reduced.⁴³

Accelerated Benefits Provision

Also known as a living benefits provision, this provision defines the criteria that must be met for a payout of the death benefit while the insured is still alive. For example, the accelerated benefits provision can allow an election of payment of benefits upon the diagnosis of a terminal illness of the insured. The payment is typically a portion of the death benefit that can be paid in a lump sum or in level monthly payments. This advance of the death benefit reduces the amount payable at time of death.

Additional Benefits or Riders

An insurer can make additional benefits or riders available on the life insurance contract to distinguish it from the products of competitors. These benefits or riders are designed to meet a customer's individual needs.

Critical Illness

Critical illness coverage can be available as a stand-alone or as a policy rider on a life insurance policy. The policy contract will define the condition that must be present to qualify for the benefit. When critical illness coverage is included on a life insurance policy, proceeds are typically an accelerated payment of a portion of the death benefit.

Disability Waiver of Premium Benefits

There are different forms of disability waiver of premium benefits that can be offered with life insurance contracts. The basic purpose is to keep the policy in force, without the payment of premiums, during a period of disability of the insured. Premiums continue to be waived as long as the insured's disability continues.

Before benefits are payable, each form will require a period of permanent and total disability, although companies will differ in their definition of disability. "Permanent" is typically interpreted as a disability that will continue for an indefinite period of time. "Total" disability for this benefit is usually defined as the inability to work and earn an income. The majority of courts have interpreted this to mean a disability that prevents the insured from "performing the substantial and

material acts of his own occupation or of any other occupation for which the insured's experience, education, or training might fit him.”⁴⁴ There is usually a specified period of time in which the insured must be totally disabled before the benefit becomes payable. This period of time is commonly four or six months.⁴⁵

Most disability clauses will include impairments that are considered presumptive evidence of disability, regardless of the length of time they have been present, even if the insured is able to continue to work. Examples of presumptive disabilities are loss of sight, severance of hands or feet, loss of use of hands and feet, loss of speech, and loss of hearing.⁴⁶

The disability benefit can exclude some risks from coverage. These exclusions are usually related to self-inflicted injury and to war hazard. Companies can also have maximum limits for waiver benefits. The maximums can be based on the total amount of life insurance, the amount of annual premium to be waived, or a combination of these factors.⁴⁷

The premium for a disability waiver of premium rider is typically such that extensive underwriting is not reasonable. The underwriter will usually need to rely on the underwriting requirements obtained to assess the life risk. The disability waiver benefit can be issued standard, denied, or charged with an additional premium. It is not unusual for the life risk to be issued standard and the disability waiver benefit to be denied.

In the United States and Canada, an insurer can contest a disability waiver benefit claim for material misrepresentation at any time.

Accidental Death Benefit

The accidental death benefit provision provides an additional amount of insurance should the death of the insured occur by accident. Accidental death coverage can be provided as a benefit or rider to a life insurance contract. The amount of this benefit is typically equal to the amount of the death benefit.

There are two basic definitions of accidental death that have been used by insurers: *accidental means* in which the cause and result must be accidental, and *accidental result* where only the result must be accidental. Under the *accidental means* definition, it can be difficult to determine whether or not the death was accidental. An example is when an insured's death is due to an allergic reaction to prescribed medication. While taking the prescribed medication was not accidental, the death was. Because it is not always clear whether or not the death was accidental, most companies use the *accidental result* definition.⁴⁸

In an accidental death benefit dispute, it will be the responsibility of the plaintiff to prove the cause of death was an accident or by accidental means. If the insurer disputes the coverage, it may have to prove the death resulted from an activity not covered, such as participation in a felony.⁴⁹

Accidental death provisions typically will not cover death resulting from self-inflicted injury, participation in an assault or felony, descent from an aircraft, infection or disease, alcohol, drugs (unless administered by a licensed physician or taken as prescribed), and war or any act of war. There is usually a maximum age (such as 65) at which the accidental death benefit rider will terminate. In addition, companies sometimes include a clause that death must occur within a certain number of days following the injury.⁵⁰

Long-Term Care

This rider will provide the policy owner with monthly benefits usually allocated for nursing home care and home health care. The benefit will typically be an accelerated payment of a portion of the death benefit. To qualify, most long-term care (LTC) clauses will require that the insured be unable to perform two or more activities of daily living (ADLs).

Terminal Illness

Terminal illness is typically defined as an illness in which the individual is expected to die within 12 months of diagnosis. This benefit is available on most life insurance policies. It typically does not increase the cost of the insurance but does offer a benefit to the policy owner in the form of a pre-payment of a percentage of the death benefit, should the insured be diagnosed with a terminal illness. Most insurers require prognosis be made by a specialist in the field of the terminal illness. This benefit is different from a critical illness benefit which covers illness that is severe but from which one will likely recover.

Extended Maturity Option

At policy maturity, policy proceeds and any policy gain are paid to the policy owner, not the beneficiary. This option allows the policy owner to defer receiving the policy proceeds when the policy reaches maturity. The primary purpose for having this option is to avoid the taxable event that would occur upon receipt of the proceeds.⁵¹

Most extended maturity options used in today's contracts will extend the death benefit beyond the maturity date (typically age 100) if there is some cash value remaining. Less commonly, the cash value only is deferred.⁵²

Some companies will automatically include the extended maturity option in the contract. Others make it an optional benefit.

Term Riders on Permanent Plans

Term riders on permanent plans are an additional amount of protection on the insured. This rider offers the benefit of term rates. The rider will expire after a specified period of time or at a specified attained age. When the rider terminates, there is typically no cash value available on that portion of the policy.

Guaranteed Insurability Option

This benefit allows additional amounts of insurance to be purchased at certain times during the life of the contract. This optional benefit allows the policy owner to protect the future insurability of an insured. The option will typically specify the amount of additional coverage that can be purchased without evidence of insurability and the dates when the purchase can occur, to a maximum age. If the option is not exercised at any of the stated times, the opportunity is lost.

If a policy is on waiver for the insured's disability at the time the exercise of the guaranteed insurability option is available, there can be restrictions on this optional benefit.

Premium rates for the additional coverage will be based on attained age.⁵³ The suicide or contestable periods typically do not start anew but instead date back to the original policy issue date.

Change of (Substitution of) Insured Rider

This benefit permits the policy insured to be replaced by a new individual insured, subject to evidence of insurability and new underwriting. This rider is most often used on business policies, as it permits an employer to change the individual insured employee. This benefit can be useful in key person coverage situations. Incontestable and suicide provisions start anew.

Policy Limitations or Exclusions

A life insurance contract can include policy limitations or exclusions, distinct from those that apply to policy riders and benefits. The most common are the suicide exclusion, the war hazard exclusion, and the aviation hazard exclusion.

Suicide Exclusion

A suicide provision is an optional provision that is included in most life insurance contracts. It is covered in detail in the Optional Policy Provisions section. A typical suicide exclusion will read:

Suicide - If the insured dies by suicide, while sane or insane, within two years from the (date of issue), our liability will be limited to the amount of the premiums paid, less any indebtedness.⁵⁴

War Hazard Exclusion

If this exclusion is included, proceeds will not be payable if the insured dies as a result of war or an act of war or while in military service in time of war and as a result of military activities. This exclusion can make it possible for military personnel to obtain coverage for other causes of death that otherwise may not have been available. One-half of the states have statutes that allow insurers to include war hazard exclusions in their contracts.⁵⁵ Not all companies use a war exclusion.

Aviation Hazard Exclusion

This clause excludes coverage for certain aviation activities such as when the insured is a licensed private pilot. It will typically specify that the exclusion does not apply to fare-paying passengers on scheduled commercial flights. By having the exclusion as an option when issuing coverage, individuals are able to obtain coverage that may have otherwise been rated or denied.

LEGAL IMPLICATIONS

Incomplete or Missing Application Information

The underwriting process can affect the insurer's legal position if the insurer is brought to court as a result of the denial of coverage or benefits. It is important the underwriter review the application carefully, act promptly and accurately, and fully document the underwriting process.⁵⁶

The application typically consists of Parts I and II. Part I gathers personal data and coverage details. Part II of the application gathers the medical details on the application or medical exam. Some companies refer to the signature section, conditional or temporary receipt, and the agent's report as Part III of the application. Other companies do not consider a temporary receipt or the agent's report as part of the application. Underwriters are expected to examine all parts of the application and apply company guidelines and standards. It is at this point that the underwriter can need to request additional information to adequately and properly assess the risk.⁵⁷

Without a properly signed application, the form can be considered invalid and inadmissible as evidence. Most jurisdictions do not allow altering the application without the applicant's affirmation to the changes. Other jurisdictions will allow certain types of changes that follow the legally prescribed method of alteration.⁵⁸

After the policy is put in force, an insurer is estopped from gathering information that was missing or waived. Missing information, inconsistent history, or details that are not fully researched will waive a company's right to policy rescission or to denying a claim that is within the policy's contestable period.⁵⁹ (See Waiver and Estoppel, later in this chapter.)

Prompt handling of the application is important in helping the producer place the policy. Delays not only impede placement but can also result in contract or tort liability. Some courts have ruled that an unreasonable delay in acting on an application gives rise to an implied acceptance of the contract by the insurer. This court action imposes a contract liability on the insurance company. In some jurisdictions, an unreasonable delay can subject the insurer to tort damages for negligence and the insurer can be liable for the amount that would have been recoverable under the policy.⁶⁰

Documentation in an underwriting file is crucial in the event that the underwriter is called to testify about a specific underwriting decision. Documentation reinforces the actions taken; lack of documentation can leave the underwriter without any evidence upon which to base a justification about the risk classification decision. Because the entire file can be subpoenaed, the presence of derogatory comments could prove embarrassing and damaging and can also substantiate a claim that the insurer was not dealing in good faith.⁶¹

Policy Amendments and Endorsements

It is not unusual for a policy to be issued with an amendment or an endorsement. The form on which they are written must be a state-approved form if they are to form a part of the contract. Amendments and endorsements that are not attached to the policy are not enforceable as part of the

contract. Policy amendments and endorsements require the signature of the policy owner before they can legally be made part of the contract.

Typical uses for an amendment form would include clarification of unanswered application questions or application inconsistencies, verification of plan, and providing details of a policy rating or a denied benefit or rider.

Good Health Statement and Policy Delivery

Due to the length of the time a case can require in the underwriting process, an underwriter may want to request an insurability statement to be signed at policy delivery. This statement can serve to update a variety of insurability factors such as health, financial status, hazardous activities, or other insurance. The period of time to which it applies, in most instances, will be from the date of application or medical exam, whichever is later, to the date the policy is delivered and accepted.⁶²

Most applications and policies will state that coverage will not take effect unless the first full premium is paid and a policy is delivered while the insured is alive and there has been no material change in health since the signing of the application. There are different state interpretations of this. The majority of states interpret this to mean the insured must be in good health when the policy is delivered in order for the coverage to be in effect. A minority of states interpret this to mean there has been no change in the proposed insured's health after the date of application in order for the coverage to be in effect.⁶³

Underwriters will occasionally be asked by a producer if he should deliver a policy if the proposed insured has had a change in health or been involved in an accident of a serious nature. The answer depends on the wording on the application and in the policy and can require consultation with the legal department. Most often, producers are simply instructed not to deliver the policy if the proposed insured's health has changed.

Insurable Interest

An insurable interest among the owner, the insured, and the beneficiary must generally be present at the time of application. Insurable interest is the benefit or advantage from the continued life of the insured. The benefit or advantage can be a financial one, one of dependence, or one based on love or affection. The underwriter will need to understand the guidelines that apply when the applicant and the proposed insured are one and the same and how they differ when the applicant is other than the proposed insured. An insurer can be liable for tort damages for any resulting harm if a policy is issued when an insurable interest did not exist.

Insurable interest in one's own life

In most states, when the proposed insured and applicant are the same, he can name anyone as beneficiary. An insurable interest does not need to be present. In a few states, however, an insurable interest is required. The underwriter should refer to the state statute regarding insurable interest or discuss with his company's legal or compliance area when unsure.

Insurable interest in another person's life

An insurable interest, personal or business, must be present. A policy can be considered void without the consent of the person being insured under the policy.

Community property laws currently exist in Arizona, California, Idaho, Louisiana, Nevada, New Mexico, Texas, Washington, and Wisconsin. Alaska allows couples to opt into a community property arrangement. The U.S. territory of Puerto Rico is also a community property jurisdiction. In these states, each spouse has a one-half interest in property acquired during the marriage. There are some exceptions such as property received as a gift, as an inheritance, or under a will. The underwriter must be familiar with these laws and the impact to policy proceeds when the premium is paid with community funds. Spousal consent should be required when the named beneficiary is someone other than the insured's spouse.

It is common in estate planning to name a trust as the owner and beneficiary of the life insurance contract. Having the trust document in place prior to the application date excludes the life insurance policy from the insured's estate.

In Canada, insurable interest is handled in a similar manner. The Uniform Life Insurance Act outlines specific situations that constitute an insurable interest. If there is no insurable interest at the time of approval, the contract is void.⁶⁴

A person has an insurable interest on his own life or on the life of:

1. his child or grandchild
2. his spouse, civil union or domestic partner
3. any person upon whom he is wholly or in part dependent, or from whom he is receiving support or education
4. any person in which he has a pecuniary (financial) interest – Person includes firm, trust, corporation, and an unincorporated society or association. An employer has an insurable interest in the life of an officer of the company or a key individual.

Table 2. Examples of Insurable Interest.

Personal Insurance	Those closely related by blood or marriage. Included: spouse, civil union or domestic partner, children, parents, grandparents, grandchildren, brothers, sisters. Not included (unless there is a dependency or business relationship): aunts, uncles, cousins, stepchildren, stepparent. Trusts or charitable organizations as part of estate planning.
Business Insurance	Those with financial or business continuation interest. Included: key person, business partner, officers, stockholders, parties to buy-sell. Not included: all employees.

Creditor Insurance	Those who entered into a debt arrangement. The creditor can take out the policy on the debtor's life. Courts hold that proceeds in excess of the debt can be retained by the creditor. The debtor can take out coverage on his own life and name the creditor as the beneficiary or assignee. In this situation, a beneficiary to receive the proceeds that are in excess of the debt amount should be named.
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Rescission and Reformation

If an insurer uncovers material misrepresentation during the life of the insured and while a life insurance contract is within the contestable period, the insurer can pursue rescission. Rescission is a process of making the contract void from its beginning. The insurer will refund all premiums paid. If the policy owner does not agree with the rescission, the insurer can ask a court to issue a decree of rescission. If the material misrepresentation is discovered after the death of the insured and while the policy is in the contestable period, the insurer can deny the death claim.⁶⁵

Once the policy is beyond the contestable period, the rescission remedy is not available to the insurer. The validity of the representations made by the applicant cannot be questioned. However, there are exceptions to this. A policy can generally be cancelled after the contestable period if it has been determined by the insurer that there was fraudulent impersonation, lack of insurable interest, or if the policy was obtained with intent to murder the insured.⁶⁶

Reformation provides for the revision of the contract that reflects the original intent of the parties. An example would be a policy issued for \$200,000 instead of \$20,000 as requested. In this example, the insurer would request permission from the policy owner to correct this error. If the policy owner does not consent, a legal remedy of reformation through the courts can be necessary to revise the contract.⁶⁷

Other Legal Issues Affecting Underwriting

Agency Law

The fundamental rule of agency law is that acts of an agent, within the scope of the agent's power, are acts of the principal. An agent can subject the principal to contractual liability. Not all employees of an insurance company have the actual authority to bind a principal to a contract. If, however, a principal acts in a manner that would cause a third party to believe an agent has actual authority, the principal can be bound to the contract.

Knowledge of the agent is considered knowledge of the principal, according to general concepts of agency law. This knowledge of the agent can prevent an insurer from rescinding a contract or denying a claim for material misrepresentation. For example, if an agent knows the truth about a proposed insured's medical history but, without the proposed insured's knowledge, does not record it on the application, the majority of jurisdictions will bind the insurer because of the agent's knowledge. In the minority of states, however, contract law is interpreted to mean the policy owner, upon accepting the contract, knows and agrees with the contents of his statements in the contract.

In these states, the insurer could rescind the contract even though the agent had knowledge of the material misrepresentations.⁶⁸

In other examples, if an agent knows the signature on the application is not that of the applicant, the contract can be binding on the insurer. Also, if renewal premiums are paid to the agent with the apparent authority to collect the payment, the effect is the same as if the insurer received the premium.

If there is collusion between the applicant and the agent to defraud the insurer, courts will not allow the applicant or the beneficiary to benefit from the collusion. When this occurs, the “knowledge of the agent and/or knowledge of the principal” rule is not applicable.⁶⁹

Waiver and Estoppel

There are state rules governing waiver and estoppel. Actions by the insurance company, medical examiner, home office associate, or the agent can create a waiver or an estoppel.

Waiver

A waiver is the voluntary giving up of a right. An example would be the acceptance of an incomplete application. This could be either intentional or accidental on the part of the underwriter. The insurer’s acceptance of an incomplete application could waive its right to contest answers to other application questions. In this situation, the insurance company would be estopped from using the unanswered questions in the defense of material misrepresentation.⁷⁰

Another example of a waiver would be the extension of the grace period. By having a practice of accepting premium after the grace period, the insurer has waived its right to lapse the policy at the end of the grace period. If, however, the insurer notifies the policy owner it will no longer accept late payments, the risk of creating a waiver is reduced.⁷¹

Waivers are not always made by an oral statement. They can be written in the policy contract or in correspondence to the insured or even implied or inferred by the insurer’s words or conduct.⁷²

Estoppel

Estop means to prevent or preclude. Producers can create an estoppel on the insurance company by misleading the proposed insured, such as when the agent informs the applicant that it is not necessary to disclose complete medical history. When this occurs, the insurer is estopped from asserting a defense of material misrepresentation. If there is collusion between the agent and proposed insured/applicant, this same situation would likely not create an estoppel on the insurance company.⁷³

Conclusion

There are many factors the underwriter must consider when assessing a risk. The assessment must go beyond the medical and financial factors presented. The underwriter must consider the

legal requirements of the contract. Putting a policy in force with incomplete information, unapproved forms, or in the absence of an insurable interest can create legal ramifications and monetary losses for the company.

Riders and benefits can make a policy more attractive to the applicant. Underwriters must be cognizant that the applications they are reviewing can present more than just mortality risks, but morbidity risks as well.

It is of utmost importance that the underwriter be able to view the entire picture during the underwriting process. This ultimately includes understanding all risks associated with the policy and contract.

Review Questions – ALU 101, Chapter 10

1. Voiding a contract due to material misrepresentation is:
 1. reformation
 2. estoppel
 3. rescission
 4. waiver
 2. All of the following statements regarding the suicide provision are correct EXCEPT:
 1. The burden of proof that death was due to suicide is the responsibility of the beneficiary.
 2. Most life insurance policies include the provision.
 3. The insurer will refund all premiums paid if a claim is denied due to suicide.
 4. It specifies the period of time during which a suicide will not be a covered risk.
 3. Without a properly signed application, a life insurance contract can be considered to be which of the following?
 - A. invalid
 - B. inadmissible as evidence
 - C. material representation
- Answer Options:
1. A only is correct.
 2. A and B only are correct.
 3. B and C only are correct.
 4. A, B, and C are correct.
4. Give examples of beneficiary arrangements generally accepted as having insurable interest for personal and business insurance.
 5. Explain the purpose of the misstatement of age provision. If an error is found after death, what action is typically taken?

6. Purposes of the entire contract provision in a life insurance policy include which of the following?
- to protect the insurer from misrepresentations made by the applicant
 - to protect the named beneficiary by prohibiting a beneficiary change
 - to protect the policy owner by prohibiting the insurer from making changes to the policy
- Answer Options:
1. A only is correct
 2. B only is correct
 3. A and C are correct
 4. B and C are correct
7. To receive payment under most long-term care riders, an insured must be:
1. terminally ill
 2. confined to a nursing home for at least six months
 3. completely disabled
 4. unable to perform two or more activities of daily living (ADLs)
8. What are the three types of conditional or temporary premium receipts and how do they differ?
9. Other than a spouse or child, name at least three people who would have an insurable interest in an individual's life.
10. Discuss the legal challenges insurers face when using a conditional premium receipt in an effort to limit liability during underwriting.

Answers and Sources of Review Questions

Review Question 1

Answer 3: rescission – page 1.

Review Question 2

Answer 1: The burden of proof that death was due to suicide is the responsibility of the beneficiary – pages 9-10.

Review Question 3

Answer 2: A and B only are correct – page 14.

Review Question 4

Refer to pages 16-17.

Review Question 5

Refer to pages 6-7.

Review Question 6

Answer 3: A and C only are correct – page 5.

Review Question 7

Answer 4: unable to perform two or more activities of daily living (ADLs) – page 12.

Review Question 8

Refer to page 4.

Review Question 9

Refer to page 16.

Review Question 10

Refer to page 5.

CHAPTER 11

AVIATION

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AVIATION

Introduction

Due to the diverse nature of aviation activity and the specific risks associated with each type of flying, assessing the aviator for life insurance can be challenging for even the most experienced underwriter. Over one hundred years ago, Wilbur Wright said, “Carelessness and overconfidence are usually more dangerous than deliberately accepted risks.” This statement still holds true even with the advances in technology and safety that have occurred over the last century.

This chapter will cover several different aspects of underwriting the aviation risk. While it will touch briefly on commercial air carriers, the primary focus will be general aviation – the type of aviation the underwriter encounters most often. The underwriter is responsible for properly classifying the proposed insured by being both competitive in the marketplace and sound in his or her basic considerations.

This discussion will:

1. provide insight into pilot qualifications, including medical and pilot certification
2. review several different types of flying and the hazards inherent in each type
3. give an overview of accident causes and statistics
4. provide sources of information available to the underwriter.

Pilot Certification

The qualifications of the pilot are essential in the overall risk appraisal. This section covers the training and experience requirements for the various pilot certificates and ratings and explains the differences among them.

Certificates

No individual can act as a pilot-in-command of a civil aircraft of United States registry unless he has in his possession a valid pilot certificate. Among the various pilot certificates are:

1. student
2. recreational
3. sport
4. private
5. commercial
6. airline transport.

All certificates require that the applicant must read, speak, and understand the English language. The requirements are prescribed in the Federal Aviation Administration’s Part 61, Certification: Pilots, Flight Instructors, and Ground Instructors. With the exception of the student pilot certificate, all other certificates require aeronautical experience, a knowledge test, and a practical test.

In recent years, there has been a decline in the private pilot population. There are approximately 633,000 active pilot certificates in the United States.¹ Only pilots with current Federal Aviation Administration (FAA) medical certificates are included in this number. The vast majority are private pilot certified. However, certificate type cannot be used to determine the actual number of private pilots. Many pilots who fly for personal business or pleasure earn higher certification or ratings for personal achievement. The average age of active pilots is 45.

Student Pilot Certificate

In April of 2016 the FAA made changes to the how long the student pilot certificate is valid. Previously, the student pilot certificate was valid for 24 months for pilots age 40 and over. For pilots under the age of 40, the student pilot certificate was valid for 60 months. After April 1, 2016, student pilot certificates do not expire. The student pilot certificate will be surrendered and superseded upon successful completion of the higher level of certification. Student pilot certificates issued prior to April 2016 will expire according to their expiration date, either 24 or 60 months from the date of issuance. The minimum age is 16 and the student pilot must obtain a third class medical certificate from an FAA-designated aviation medical examiner (AME). With this certificate, the student pilot can only fly solo or with an instructor. He cannot fly with passengers.

Recreational Pilot Certificate

The recreational pilot certificate requires less training than the private pilot certificate. There are various restrictions. For example:

1. All flights must be within fifty nautical miles of the airport at which ground and flight instruction was received.
2. The pilot cannot carry more than one passenger in a light, single-engine aircraft with no more than four seats.
3. There are stricter visual flight rules and limitations than there are for the private pilot certificate.
4. The pilot may fly only in good, clear weather during daylight hours.

These limitations recognize the fact that the recreational pilot will be somewhat less proficient than the private pilot.

Sport Pilot Certificate

As of September 2004, the FAA finalized the regulations that create a new pilot category, the sport pilot certificate. Under these regulations, pilots seeking a sport pilot certificate are able to learn how to fly a variety of aircraft - including single-engine airplanes, gliders, powered parachutes, gyroplanes, weight-shift-control aircraft, airships, and balloons - in as little as 20 hours of flight instruction. Much like the recreational pilot certificate, there are numerous restrictions placed on the sport pilot certificate:

1. The pilot may not fly at night.
2. The pilot may not fly when the flight or surface visibility is less than three miles.

3. The pilot may not carry more than one passenger.
4. The pilot must fly an aircraft that meets the definition of a light-sport aircraft (the broad definition includes a single, non-turbine engine and fixed landing gear).
5. The pilot may not carry a passenger or property for compensation or hire (i.e., no commercial operations).

Private Pilot Certificate

The minimum age for an individual to obtain a private pilot certificate is 17. The private pilot must have logged at least 40 hours of flight time that includes a minimum of 20 hours of flight instruction from an authorized instructor and 10 or more hours of solo flight training. The private pilot certificate remains valid permanently without need for renewal. The private pilot must obtain, at a minimum, a third-class medical certificate from an FAA-designated aviation medical examiner (AME). The duration of the third-class medical certificate varies. Below age 40 the certificate is good for three years and at age 40 and over the certificate is good for two years.

Commercial Pilot Certificate

To become a professional pilot, an individual must obtain a commercial pilot certificate. This certification allows the pilot to carry passengers and/or cargo for compensation or hire. A commercial pilot cannot act as a pilot-in-command in the air carrier service (e.g., Delta, American, and United). The minimum age for a commercial pilot is 18 and the individual must have a minimum of 250 hours of flying time of which 100 hours must be as a pilot-in-command. Typically, only about 20% of all pilots certified under the commercial pilot certificate are actually employed as commercial pilots.² The commercial pilot must obtain a second-class medical certificate from an FAA-designated aviation medical examiner (AME), which is valid for one year.

Airline Transport Pilot Certificate

The airline transport pilot can act as a pilot-in-command of an aircraft in the air carrier service. The individual must be a minimum of age 23, and the certificate requires a minimum of 1,500 hours of total flight time as a pilot. The eligibility requirements state that the applicant “must be of good moral character.” The airline transport pilot must obtain a first-class medical certificate from an FAA-designated aviation medical examiner (AME), which is valid for six months. This certificate has the highest medical and aeronautical experience qualifications.

Often the airline transport certificate (ATP) is mistakenly thought of as a rating rather than a pilot certificate. Many existing aviation questionnaires mistakenly use the rating terminology.

Canadian Licenses and Permits

The various pilot licenses and permits that can be obtained in Canada are:

1. student
2. recreational
3. private

4. commercial
5. airline transport
6. balloon
7. glider
8. gyroplane
9. ultralight.

At the end of 2008, there were roughly 65,000 Canadian licenses and permits held.³ The minimum age for the student permit is 14, whereas the minimum age for the airline transport license is 21.

U.S. Ratings

In the United States, specific ratings can be acquired. Ratings are available for all pilot certificates except the student pilot. The word rating means that special conditions, privileges, or limitations exist. As with pilot certification, to be eligible for a rating, the individual must read, speak, write, and understand the English language.

These ratings include, but are not limited to:

1. aircraft category ratings (airplane, rotorcraft, glider)
2. airplane class ratings (single-engine land, multi-engine land, single-engine sea, and multi-engine sea)
3. rotorcraft class ratings (helicopter, gyroplane)
4. lighter than air class ratings (airship, balloon)
5. instrument flight rating (IFR).

Probably the most significant rating for the underwriter to understand is the instrument flight rating. This will become evident in the discussion on accident causes.

Most pilots are certified for visual flight rules (VFR), which govern the procedures for conducting flight under visual conditions. Visual meteorological conditions (VMC) are expressed in terms of visibility, distance from the clouds, and a cloud ceiling equal to or better than a specified minimum. Requirements for visual conditions are normally three-mile visibility and a 1,000 foot cloud ceiling.

With the instrument flight rating, a pilot is additionally qualified to take off, fly, and land the aircraft by means of the instruments. The instruments show the altitude, attitude (position of the airplane relative to the horizon – climbing, straight-and-level attitude), and operations of the aircraft when the pilot-in-command cannot see to take off, fly, or land.

In order to obtain the instrument flight rating the individual must:

1. hold at least a private pilot certificate
2. pass aeronautical experience requirements, including at least 50 hours as pilot-in-command and 40 hours of actual or simulated instrument time
3. pass a practical and a written exam.

Approximately 51% of the pilot population is instrument rated.⁴ This number includes all commercial and airline transport pilots where the instrument flight rating is a fundamental requirement of the certification.

One purpose of instrument training and maintaining instrument proficiency is to prevent a pilot from being misled by several types of hazardous illusions that are peculiar to flight. The sensory organs and motion sensing system can play tricks on a pilot. For example, the effect of the plane's G-force on the inner ear makes the pilot feel that he is perfectly level even if the plane is not. These illusions can lead to spatial disorientation or the inability to determine accurately the altitude or motion of the aircraft in relation to the earth's surface. The individual believes he is upright when, in fact, the aircraft is inverted, which can cause the plane to drop into an inescapable spin. Aviators refer to this as the *dead man spiral* or *graveyard spiral*.

IFR pilots must develop an absolute reliance on what the flight instruments are reporting, be familiar with the systems of the aircraft they fly, receive regular, recurrent training, and use sound judgment. With practice and experience, the IFR pilot can discount or overcome these false sensations.

Following the high-profile accidents of John F. Kennedy, Jr. and Governor Mel Carnahan of Missouri, the concept of spatial disorientation has received much attention. Spatial disorientation is often noted as the cause or contributing factor in accident statistics, both fatal and nonfatal. Roughly 90% of accidents involving spatial disorientation are fatal.⁵

U.S. Medical Certification

In order to exercise the privileges of an airman certificate, all pilots must possess a valid medical certificate. There are three classes of medical certificates issued by the Federal Aviation Administration (FAA): first, second, and third. In addition, an authorization for a special issuance of medical certificate (authorization) and statement of demonstrated ability (SODA) can be issued.

Each medical certificate class carries specific requirements. The requirements are discussed in the Federal Aviation Administration's Part 67, Medical Standards and Certification. Medical certificates are valid for periods of six months (first class – age 40 and over) to 60 months (third class - under age 40). Certain categories of aviation require specific certifications. For example, a key component of the new sport pilot certificate is the physical eligibility requirements. Sport pilots are permitted to fly with a valid driver's license in lieu of a medical certificate. However, if an individual has been denied a medical certificate in the past or has had his medical certification revoked or suspended, he cannot use a driver's license in lieu of the airman medical. Gliders, balloons, and ultralights do not require medical certification.

The first-class certificate is the highest level of medical certification and the most extensive. It requires a baseline electrocardiogram at age 35 and annually after age 40. The third-class certification is both the least comprehensive and the least restrictive.

An individual who meets the appropriate medical standards, based on a medical examination and an evaluation of his history and current condition, is entitled to a medical certificate without restrictions or limitations, other than prescribed limitations as to its duration.

Special Issuance and Exemptions

An authorization for a special issuance of medical certificate (authorization) is a medical certificate issued on a discretionary basis. An applicant for a medical certificate who is unable to meet the standards under the first-, second-, or third-class certification can be issued a medical certificate at the discretion of the Federal Air Surgeon. Disqualifying conditions include:

1. coronary artery disease, angina, myocardial infarction, valve replacement, and permanent pacemaker implantation
2. diabetes mellitus requiring medication
3. psychosis, bipolar disease, severe personality disorders
4. substance dependence or abuse
5. epilepsy, disturbance of consciousness.

Since procedures for granting special issuance or exemptions have always been available, failure to meet the standards has never been absolutely disqualifying. A special flight test, practical test, and medical evaluation can be conducted to determine if airman duties can be performed without endangering public safety. If this determination can be made, a medical certificate can be issued with appropriate safety limitations.

Statement of Demonstrated Ability (SODA)

A statement of demonstrated ability (SODA) can be issued to an individual who does not meet the published standards for medical certification. The SODA applies to individuals whose disqualifying condition(s) are static or non-progressive and who have been found capable of performing airman duties without endangering public safety. Some examples of these conditions are the loss of the use of an arm, a leg, or the sight in one eye.

While this process may seem simple, it is actually quite complex, especially for the first- and second-class certification. For example, if an individual has a history of coronary artery disease, myocardial infarction, or angina, the medical certificate is postponed or suspended for six months, much like an application might be for life insurance. At that point, the individual must undergo post-event or post-procedure evaluation including stress testing for third class certification. First- and second-class certification would require thallium exercise testing and certification or re-certification is unlikely without post-event or post-procedure angiography.

If a pilot with a valid medical certificate develops a disqualifying medical condition, the regulations state that the individual must report the condition and must not fly until the problem is resolved. Under the new regulations for the sport pilot certificate, a pilot with a disqualifying medical condition under the current medical certification process, who has never applied to the FAA for a medical certificate, can use a valid driver's license to serve as sufficient evidence of medical eligibility. This is receiving much attention from various organizations representing the interest of pilots and pilot safety.

At the time of application for a medical certificate, the individual authorizes the FAA to check his motor vehicle records. The FAA can deny the application or can suspend or revoke an airman certificate or rating if any individual has two or more alcohol-related motor vehicle convictions within a three-year period. This program was established in 1990 by an act of Congress. This rule requires pilots to report to the FAA all alcohol- or drug-related motor vehicle convictions or state

motor vehicle administrative actions. It facilitates the removal of those pilots who do not comply with certain safety regulations and assists in identifying those individuals who do not meet the medical standards.

In a typical year, the FAA will process close to a half-million medical certificates in three classes.⁶ Historically, approximately 99% of all applicants ultimately receive a medical certificate.⁷

FAA Exams - Underwriting Considerations

Evaluating a pilot's physical and mental health is an integral part of underwriting an aviation risk, although historically very few accidents involve pilot incapacitation. Decades of data show that medical incapacitation is a factor in an insignificant number of accidents. The odds of a pilot becoming incapacitated on any one flight are one in several million.

During the underwriting process, there is usually not a significant benefit in obtaining a copy of the FAA exam. However, if an underwriter has reason to think that the FAA is unaware of the disqualifying medical condition, ordering these records will reveal if they have been informed. Obviously, it might be quite convenient for a pilot to "forget" a significant medical condition that would deny him certification, even though the FAA rules state that it is the individual's responsibility to report this information.

Canadian Medical Certification

There are four classes of medical certificates issued by Transport Canada's Civil Aviation Medicine Branch (CAM): category 1, category 2, category 3, and category 4. The medical certificate required depends on the type of pilot license requested. Similar to the medical certification process in the United States, category 1 is the highest level of medical certification and the most stringent.

A Canadian aviation medical examiner (CAME) conducts the medical exam. This physician does not issue or deny the medical certificate. The medical exam is assessed by the regional aviation medical officer. When necessary, the regional aviation medical officer can require additional information from the attending physician (through the applicant) or further testing or examination by a specialist.

An applicant is granted the highest assessment possible based on the findings recorded on the Civil Aviation Medical Examination Report. If the applicant is found to be unfit, he has several options for appeal:

1. submit additional reports from civil aviation medical examiners, specialists, and/or lab reports to have the assessment reconsidered
2. request that all findings and reports be sent to the Aviation Medical Review Board for further consideration
3. appeal the decision to the Civil Aviation Tribunal.

Types of Aviation

United States civil aviation can be divided into two types: commercial air carriers and general aviation. Mortality can vary significantly by type of flying. Commercial air carriers include, but are not limited to, certified route air carriers, which include major airlines, air taxi, commuter air carriers, and supplemental air carriers.

General aviation is defined as the portion of civil aviation that encompasses all facets of aviation *except* air carriers. There are a wide variety of activities in general aviation including, but not limited to, recreational flying that typically characterizes this segment of aviation. General aviation includes:

1. private pleasure
2. corporate and individual business travel
3. training
4. aerial application
5. law enforcement and other work use.

The aircraft used in general aviation activities are as varied as the pilots and types of operations involved. Most recent numbers available from the General Aviation Manufacturers Association (2018) indicate there are roughly 212,000 active general aviation aircraft in the United States.⁸

Canadian civil aviation includes commercial, private, and state (government-owned) aviation.

Commercial Air Carriers

Overall, certified route air carriers have experienced very favorable accident records. Scheduled air carriers, which consist mainly of certified route air carriers, experience lower fatal accident rates than the nonscheduled carriers, which consist of mainly supplemental carriers and commercial operators of large aircraft.

Air taxi has been defined as an aircraft operator who conducts operations for hire or compensation (passenger or cargo), in accordance with Federal Aviation Regulation (FAR) Part 135, in an aircraft with 30 or fewer passenger seats and a payload capacity of 7,500 pounds or less. An air taxi operates on an on-demand basis and does not meet the “flight scheduled” qualifications of a commuter.

A *commuter* is an air carrier operating under the FAR Part 135 that carries passengers on at least five round trips per week, on at least one route between two or more points according to its published flight schedules that specify the times, days of the week, and places between which these flights are performed. As with air taxi, the aircraft that a commuter operates has 30 or fewer passenger seats and payload capacity of 7,500 pounds or less.

Air taxis and commuter air carriers (scheduled and nonscheduled) have experienced tremendous growth since the Airline Deregulation Act of 1978. The character of these carriers has also changed. The fleet now consists of larger and presumably safer aircraft. Many of the large air carriers have absorbed air taxi and commuter carriers into their own operations. For the first

several years after deregulation, the fatal accident rate was high for both the scheduled and nonscheduled carriers. However, in recent years, the scheduled air taxi and commuter fatal accident rate has approached the level of nonscheduled certified air carriers. On the other hand, while both the number of accidents and the accident rates for nonscheduled operations have declined over the last 10 years, the risk of an accident is over 10 times that of the scheduled air carriers.

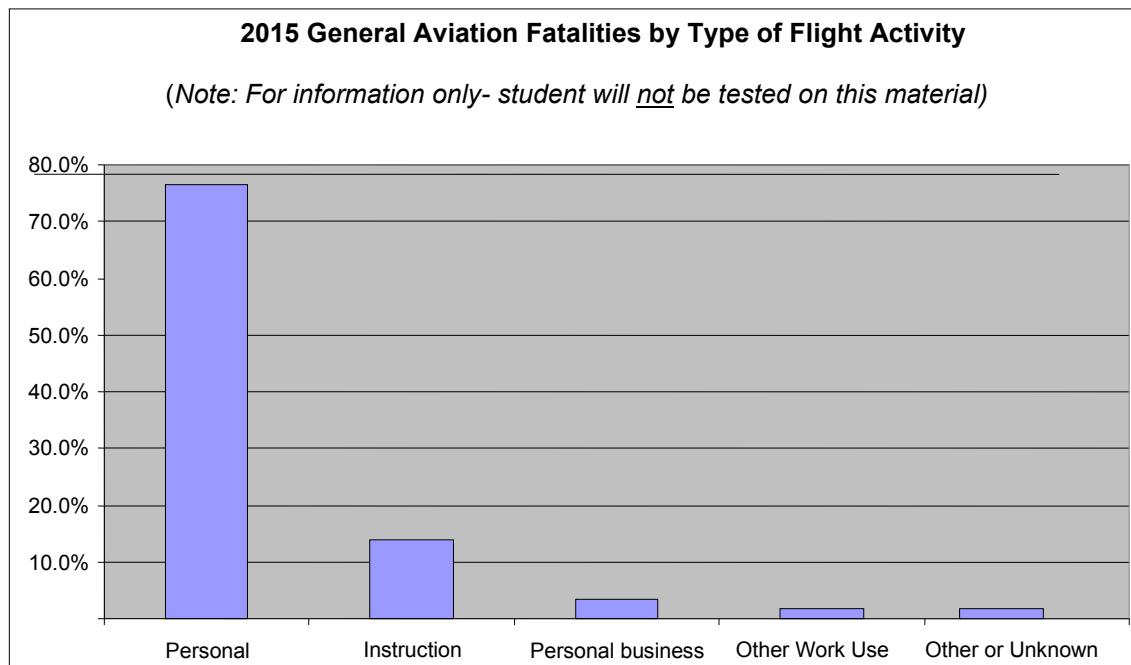
General Aviation

Personal Pleasure

Personal pleasure flying is by far the largest percentage of general aviation and continues to have the highest percentage of fatal accidents.

Business

Business flying (e.g., individuals, not professional pilots, flying themselves on business) has a significantly better safety record than personal flying. Discipline and controlled circumstances seem to make the difference. In 2015, business flights accounted for 2.8% of accidents and 3.1% of fatal accidents, while accounting for 10% of all general aviation flight hours.⁹



Flight Instruction and Student Pilots

Flight instruction makes up approximately 20% of all general aviation activity.¹⁰ It has a very low fatal accident rate with many instructional accidents being described as “fender-benders,” where the aircraft was damaged but serious injuries were avoided. On the other hand, flight instructors have much more exposure than do other pilots and many are involved in other types of aviation.

Student pilots demonstrate relatively favorable fatal accident rates. The risk does increase when these pilots obtain their private pilot certificate and begin operational flying due to two factors: increased exposure with an increase in the number of hours flown and lack of experience with adverse weather conditions.

Corporate/Executive

Corporate/executive flying, or the use of aircraft owned or leased and operated by a corporation or business firm for the transportation of personnel or cargo, has always had low fatality rates. This is probably due to superior equipment and the generally high skill level of these pilots. In 2015, there were a total of two accidents involving corporate/executive operations; with no reported fatalities.¹¹

Aerial Application/Crop Dusting

Agricultural pilots have been labeled the most skilled pilots in the world. They must often fly at low levels, concentrating not only on the task at hand, but also on avoiding trees, power lines, fences, and other obstacles. In addition, changing conditions can render the spraying of the same field an entirely different proposition from one hour to the next. Another factor to be taken into consideration is the possible long-term effects of the pilot’s exposure to the toxic agents that are sprayed on crops.

Aerial application accounted for the majority of commercial fixed-wing accidents and fatal accidents in 2015. Charter or cargo operations made up the remainder.

Bush Pilots

Bush pilots (i.e., pilots who fly in remote areas) have much higher fatal accident rates than pilots who fly in less remote areas. These pilots fly small airplanes to and from areas inaccessible to larger aircraft or by other means of transportation. The classic bush plane is capable of landing in short remote fields and can be equipped to carry large quantities of fuel for long distance flights. The bush pilot often encounters extreme weather conditions and treacherous terrain, including extensive deserts, tangled jungles, jagged mountains, or plains of ice.

The underwriter must take into consideration the mindset of the typical bush pilot. These adventurers are often the link to civilization for inhabitants of remote lands. For example, Alaska, with its large geographic area, is extraordinarily dependent on aviation. One out of every 58 Alaskans is a pilot and there are close to 300 commercial air carriers in the state.

In a state with few roads, planes carry everything from food to fuel to schoolchildren on a daily basis. Adverse weather, weather that can change quickly, rough terrain, and even active volcanoes can make safe flight operations in Alaska extremely challenging. In the past, the commercial aircraft accident rate in Alaska was three to four times that in the lower 48 states. However, a collaborative effort between government agencies called the Capstone Program has made remarkable strides in using new technologies to inform pilots of terrain, weather, and air traffic. Capstone makes use of global positioning systems, graphical and textual depictions of weather systems, and information broadcasting devices to keep pilots aware of conditions in their flight path. In 2005, for the first time, commercial airlines on scheduled routes in Alaska registered no fatalities. Other programs have been developed that target rural pilots and more isolated community airports, such as the FAA “Circle of Safety” program for bush pilots and passengers, and the FAA Safety Team (FAAST), which works on accident-related issues around the state.

Gliders

Glider flying is a unique area of aviation. A glider is a light, engineless aircraft designed to glide after being towed aloft or launched from a catapult. Without the assistance of power, a glider pilot must find rising air currents (i.e., lift) to increase flight time. Developing the skill to find lift can be very challenging because rising air currents are invisible and sometimes elusive. Learning about weather conditions and the nature of air movements helps glider pilots develop this skill.

The FAA regulates glider flying, and both the pilot and the aircraft must be certified. However, the FAA does not require a glider pilot to go through the medical certification process. Typically, there are very few fatalities involving glider operations.

Helicopters

Helicopters are used in general aviation for such activities as:

1. aerial application/crop dusting
2. observation
3. air medical
4. business
5. pleasure.

Helicopters are more difficult to maintain and are subject to more frequent mechanical failure than fixed-wing aircraft. For the years 2006-2015, the fatal accident rate for non-commercial helicopter operations has averaged 1.02 per 100,000 hours flown and 0.41 for commercial helicopter operations.¹² Although most fatal accidents are caused by pilot error, a number of accidents are due to mechanical failure. For underwriting purposes, these individuals are often evaluated as fixed-wing pilots.

Ultralights

Ultralights are light, one-person flying machines that operate under a completely different set of federal regulations than other aircraft. The Federal Aviation Regulations (FAR) that relate to ultralights are commonly called Part 103. These rules are very lenient compared to aircraft

regulations. Ultralights must be used for recreation or sport purposes only and do not need to have any U.S. or foreign airworthiness certificate. Ultralight crafts and their component parts and equipment are not required to meet the airworthiness certification standard specified for aircraft. Underwriting considerations include whether the ultralight is home-built, home-built from a kit, or factory assembled. Some ultralights come equipped with a ballistic recovery system, which includes a parachute that enables the entire aircraft to descend to the ground in the event of a structural failure.

Due to the nature of ultralight flying and the varying definitions of a pilot and aircraft, aviation exclusion riders are not thought to be applicable to ultralight flying.

Pilots and Experimental, Amateur-Built Aircraft

According to FAA registration information, the number of amateur-built aircraft has grown during the last 10 years. There are over 33,000 experimental, amateur-built aircraft currently licensed by the FAA.¹³ Experimental aircraft account for an estimated five percent of total general aviation fleet hours, but 25% of fatal accidents.

There are a disproportionate number of accidents during the first few hours of operation of these aircraft. Typically, 20% of all amateur-built aircraft accidents occur in the first two flights.¹⁴ This fact must be taken into consideration when reviewing accident statistics. As with production aircraft, the most common cause of fatal accidents in experimental, amateur-built aircraft is pilot error.

Some of these accidents were due to the pilot being unprepared or unfamiliar with the unique features of the aircraft. This is particularly important for initial flight-testing and landing accidents. However, most accidents were due to poor judgment on the part of the pilot and were not a result of these unique features.

As with factory-built aircraft, other causes of fatal accidents were unauthorized aerobatics, buzzing, improper loading, and taking off in non-airworthy aircraft. Mechanical or maintenance accidents accounted for 17% of all accidents in 2015.¹⁵

All experimental, amateur-built aircraft must be registered with the FAA. The FAA rules require a review of the building process by an FAA inspector, including scrutiny of records detailing when, where, and how the construction of the aircraft took place, along with supporting documents and photographs. If all is in order, a temporary airworthiness certificate is issued. Twenty-five to forty hours of flight testing in specified non-populated areas are required to make sure all components are operating properly. This testing can be done by the builder or by another pilot.

The Experimental Aircraft Association (EAA) recommends that the builder hire a pilot to complete the testing phase because flying skills can deteriorate during the building process, since the individual may not be using them. Pilots who are hired to do the testing are experienced at flying the specific design of aircraft and are more familiar with its peculiarities.

At the end of a satisfactory test period, a permanent airworthiness certificate is granted. These aircraft are subject to major condition inspections every 12 months, as are small factory-produced aircraft.

Underwriting assessment of a pilot who flies an experimental, amateur-built plane of any type should include an evaluation of:

1. the specific type of operations in which the pilot is involved – The materials and technology used in many of these experimental aircraft make them much lighter and faster than most production aircraft, making them ideal for certain types of risky operations (e.g., aerobatics, racing).
2. the pilot's experience level – This includes both overall experience and experience flying the specific aircraft in question.

The Experimental Aircraft Association flight advisor program offers information to help an individual assess the skills and experience it takes to fly a particular airplane. It is advisable for a pilot to acquire aircraft-specific training when transitioning to one of these airplanes. Limited time in a specific type of aircraft is often shown as a contributing factor in accidents; this is particularly important in these types of aircraft.

Obtaining the information needed to properly assess this risk can take some work on the part of the underwriter and the agent. However, it is an exercise that should provide many benefits from a mortality standpoint.

Accident Causes/Statistics

A multidisciplinary approach to aircraft accident investigation has become routine and is used in all major aircraft accidents. The investigation of the crash of a commercial airliner will trigger the marshalling of specialists from various fields – engineering, air traffic control, medical, and a human factor specialist.

The same types of resources are usually not expended on general aviation accidents, though general aviation produces the largest number of fatal accidents in the United States. The National Transportation Safety Board (NTSB) is responsible for determining the cause of an accident and for providing safety recommendations to the FAA or other entities as to how to avoid future accidents due to a specific cause. The FAA investigates all accidents or incidents to determine if any FAA regulation, policy, or standard has a defect or needs to be changed or modified.

The Canadian air transportation system is operated and regulated by Transport Canada and the Transportation Safety Board (TSB). They function in essentially the same capacity as the FAA and NTSB. The TSB is a separate branch from the other government agencies and departments. This independence allows it to be completely objective in arriving at its conclusions and recommendations.

Commercial Air Carriers

In the past several years there have been only a few fatal accidents on U.S. scheduled airlines. The odds of a fatality occurring during a commercial flight are in the millions, making airline flight one of the safest means of transportation in the world today. The chances of any passenger death in an airline accident are one in several million.¹⁶

In 2014, commercial airplanes in Canada were involved in 34 accidents; two of these were fatal.¹⁷ There were no fatal accidents involving airliners.

General Aviation

Typically, 75% of fatal accidents are attributed to action (or inaction) of the pilot.²⁰ Accidents involving pilot error can be described as skill errors versus decision errors.

Accident rates for general aviation have always been higher than commercial airline accident rates because general aviation operations involve risks not typically seen with airline operations. Examples of these risks include:

1. less regulation
2. wide variations in pilot certification levels
3. fewer cockpit resources (e.g., air carrier operations require at least two pilots, general aviation operations are predominantly flown by only one pilot).

Personal flying, which averages about 32% of general aviation activity, accounts for close to 85% of all fatal accidents.¹⁸ The fatal accident rate for general aviation has been relatively constant for the past several years. The majority of accidents in 2015 were due to the same causes, occurring at roughly the same rates, as those in the preceding several years. In 2015, the fatal accident rate for general aviation was 0.83 per 100,000 flight hours, a 3.6% increase over 2014.¹⁹

Typically, 75% of fatal accidents are attributed to action (or inaction) of the pilot.²⁰ Accidents involving pilot error can be described as skill errors versus decision errors.

The primary causes of fatal accidents across all classes of airplanes for 2015 were:

1. weather
2. maneuvering flight
3. descent/approach.

Weather-related accidents

Accidents in which aircraft are operated on visual flight rules into adverse weather conditions occur on a regular basis, resulting in a high number of fatalities each year.

1. Weather-related accidents are more likely to be fatal than accidents with any other cause; the majority of them involve fatalities (Of 38 weather-related accidents in 2015, 29 were fatal).²¹
2. Typically, more than half of all fatal weather-related accidents are due to “attempted VFR flight into instrument meteorological conditions (IMC).” VFR into IMC continues to be one of the most significant causes of fatal accidents.

Many pilots enter into operational flying with relatively little exposure to adverse weather conditions. During instruction, student pilots are flying, for the most part, in optimal conditions – daylight hours and good weather. The combination of darkness and adverse weather increases the

risk. The combination of night and IMC substantially increases the risk of a fatal accident, making it the most deadly general aviation environment.

Maneuvering accidents

Maneuvering flight remains another of the larger producers of fatal accidents and one of the most preventable. Typically, more than one-half of maneuvering flight accidents involve fatalities (Of 44 maneuvering accidents in 2015, 32 were fatal.)²² Some accidents occurred during legitimate activities such as aerial application, banner towing, and law enforcement. These operations require low, slow flight and a considerable amount of mission-related division of attention. The pilot is responsible for a task other than flying the aircraft. The most intense demands of the task at hand and of flying the aircraft can occur simultaneously, requiring extreme skill on the part of the pilot. Such accidents frequently involve collisions with terrain, wires, or trees.

It should be noted that close to 50% of maneuvering accidents occurred during flights described as personal, not work-related flights.²³ A few of these did involve inadvertent loss of control of the aircraft. However, many of these accidents happened while pilots were conducting unauthorized aerobatics, buzzing, or low-level flight. Due to the degree of recklessness in many of these accidents, it is difficult to term them accidents in the true sense. The AOPA Air Safety Foundation feels this recklessness is not the mark of a skilled pilot but of a potentially dead one, which has significant implications from an underwriting perspective.

Descent/approach accidents

Accidents resulting from mishandled approaches, although low in number, are fatal a significant percentage of the time. For the year 2015, 35% of all approach accidents (15 of 43) resulted in fatalities.²⁴ Studies conducted by NASA (the U.S. National Aeronautical and Space Agency) and the FAA have shown that the most demanding tasks – approach and landing – are sometimes performed when the pilot's ability to accomplish these complex tasks are significantly diminished.

Historically, one percent of general aviation accidents involve alcohol or drugs each year. In 2015, alcohol, illicit drugs, or unapproved prescription or over-the-counter medications were indicated in three accidents; two of which were fatal.²⁵ Fortunately, the number of accidents involving alcohol and drugs continues to be relatively low. However, it cannot be stressed enough that even small amounts of alcohol can have a profound effect on aviation safety. Alcohol and flying are a deadly combination. Flying an aircraft is a highly demanding cognitive and psychomotor task. Alcohol use impairs reaction time, reasoning, judgment, and memory. It would be wise to proceed with caution when underwriting a pilot whose records reveal any alcohol criticism.

Studies done in simulated experiments have shown smoking marijuana can cause significant performance decrements, leading to major pilot errors in previously practiced IFR approach and holding patterns. Caution should be exercised if there is any indication of drug use in an aviator applying for life insurance.

Military Aviation

Although limited information is available, the data clearly demonstrate that military aviation activity poses an extra mortality risk. As with other types of aviation, pilot error seems to be the primary cause of most fatal accidents.

There are several areas to consider when underwriting military pilots:

1. age – There is a correlation between younger military pilots and increased mortality – most likely a result of lower experience levels.
2. branch of service – Naval pilots encounter a higher risk in taking off and landing on aircraft carriers and flying over large bodies of water.
3. duty assignment – Fighter pilots, attack bombers, observation, and search/rescue pilots are exposed to more perilous missions than cargo pilots, for example.

As with all military personnel, there is always the potential for involvement in current and future military conflicts.

International Aviation

Aviation in some foreign countries presents its own set of concerns. These include:

1. lack of appropriate training and certification of pilots
2. substandard navigational equipment
3. lack of appropriate air traffic control
4. improper or lack of aircraft inspection and maintenance
5. unreliable weather forecasting and reporting
6. acts of terrorism
7. hazardous terrain not depicted on aeronautical charts.

The FAA does not regulate flights outside the United States borders and the NTSB maintains accident data only on U.S. registered aircraft. There are various organizations that compile data on international aviation. The International Civil Aviation Organization (ICAO) is the United Nations' technical agency for aviation, with the primary focus on scheduled air transport service. The International Aircraft Owners and Pilots Association (IAOPA) represents pilots and aircraft owners in over 50 nations, representing the interest of general aviation before international aviation organizations.

There is no international agency that tracks general aviation aircraft accident rates. While ICAO does compile statistics on scheduled air transport service, it does not maintain comprehensive general aviation accident data. Every two years, IAOPA requests accident information from its affiliates. However, many of the responses are of questionable accuracy and are often incomplete. In addition, reporting and the methodology used to report vary from one region to another, and many do not report at all. For all these reasons, it is difficult to glean any meaningful comparative accident rates.

From 2013 to 2017 the number of accidents annually in commercial scheduled flights worldwide has been stable, varying between 75 and 97 per year.²⁶ In 2017, there were 50 fatalities for scheduled commercial departures, which represents a substantial reduction from 182 in 2016, and the lowest level on the record of the past 10 years.²⁷ In 2017, there were 21 acts of unlawful interference, including one attack on aircraft in flight, one attack using aircraft as a weapon, one cyber-attack, two unlawful seizures, nine facility attacks and seven attacks classified as other.

General aviation is the largest segment of aviation worldwide. Approximately 446,000 aircraft and 1.3 million pilots are involved in these activities worldwide. Historically there have been roughly 10 accidents per 100,000 flight hours. Pilot error due to insufficient training, faulty judgment, lack of experience, or poor ground support is often listed as the principal cause.²⁸

Lower standards for aviation safety are common in Africa and Latin America compared to the United States and Canada. In Latin America, there are several areas of concern:

1. air traffic controllers who cannot speak English, the international language of aviation
2. radio malfunctions
3. poor weather reporting and forecasting
4. inadequate radar (90% of the region is uncovered)
5. rescue equipment that does not work.

All these factors make Latin America one of the world's least safe places to fly, second only to Africa. Latin America's rate of air accidents in which planes are damaged beyond repair – accidents that usually prove to be fatal – has been more than 11 times that of the United States and Canada.

It is important for the underwriter to recognize these concerns when evaluating an individual who engages in any type of international aviation activity. Appropriate questions to ask in addition to the traditional aviation risk profile include in what type of aviation the individual is engaged (e.g., general versus commercial) and where the individual is flying.

Aviation Safety Record

Typically, during the underwriting process, there is very little information regarding the proposed insured's aviation safety record. However, if there is a history of any past aviation accident, aviation violation, grounding, or license revocation, this information should be pursued to the fullest. Some examples of air safety violations include:

1. violation of air space regulation
2. landing without contacting the appropriate tower
3. using the wrong radio frequency
4. forgetting to put the landing gear down.

Several studies have shown that pilots who are involved in crashes are at an increased risk of involvement in future crashes and violations. Pilots with a history of aviation violations or prior crash history are a clearly identifiable high-risk group.

Sources of Information

There are several valuable sources of information to utilize when underwriting the aviation risk. These sources include:

1. application
2. aviation questionnaire
3. exam
4. inspection report
5. attending physician's statement
6. motor vehicle report.

The aviation questionnaire is probably the most valuable tool when evaluating this risk. A quality questionnaire can eliminate the need to request additional information during the underwriting process. It is important to capture the right kind of information that can be used to determine the appropriate underwriting action. Most companies base their rating schedules on total hours of experience and annual flying time, which are valid measurements of a pilot's total experience and anticipated exposure. A questionnaire should ask for this information and information about:

1. type of flying activity
2. total number of hours flown including total solo hours
3. total number of hours flown annually
4. pilot certificate and additional ratings held (specifically the instrument flight rating [IFR], including the total number of IFR hours and annual number of IFR hours)
5. any experimental aircraft flown
6. past aviation accidents or violations.

Typically, the aviation questionnaire will become a part of the final contract. The appendix provides an example of a typical aviation questionnaire.

The exam, inspection report, attending physician's statement, and motor vehicle report play an important role in underwriting this risk as well. They should disclose any significant medical history, verify the information on the application and aviation questionnaire, give insight into alcohol use, and reveal any adverse driving history.

In the past, it was unlikely that a copy of the FAA exam would be obtained for underwriting. However, there are circumstances under which these records should be obtained – especially if the pilot has any significant medical history. The reason for this is twofold: first, to verify that the proposed insured has admitted the history to the FAA and, secondly, to ensure there has been clearance for flight status.

Aviation Exclusion Rider

As an alternative to full aviation coverage, a policy can be issued with an aviation exclusion rider (AER). There are a variety of scenarios where an AER may be used:

1. The policy is rated for reasons other than the aviation risk.
2. The proposed insured has a significant history of alcohol abuse, drug abuse, or depression.
3. The proposed insured is elderly.

4. The proposed insured's future aviation activity is indefinite.
5. The extent of the potential aviation risk is unknown.
6. The proposed insured's ratable aviation activity has been terminated within the last year and he does not intend to engage in aviation activity in the future.

States differ in their view as to the validity of the AER. The underwriter must be familiar with not only his company's specific wording on the rider but also the insurance codes of each state to determine if the AER would be recognized at claim time. At the present time, the majority of states do permit provisions excluding or restricting coverage in the event of death as a result of aviation. However, it is usually the specific facts and circumstances of the individual case and review of case law that determines if the AER is upheld.

Special consideration should be taken with regard to aviation exclusion riders on survivorship coverage due to the complexity of these products. A consultation with the underwriter's legal department can benefit all parties involved if an AER is being considered.

Conclusion

As long as people continue to fly, there will be accidents. Many of these are just that – accidents. How a pilot will react in a particular situation and what the weather conditions will be when the proposed insured is flying are beyond the underwriter's control. The underwriter does control what is done with the information available at the time of underwriting. By examining the pilot's qualifications, experience, and exposure to risk, as well as any significant medical or non-medical concerns associated with aviation accidents, the underwriter has a strong starting point from which to classify these risks.

Appendix

Sample Aviation Questionnaire *(Students will not be tested on the questionnaire)*

Total hours as pilot/crew member _____ Total solo hours _____
Total hours in past 12 months _____ Estimated hours in next 12 months _____
Date of last flight ____ / ____ / ____

Certificate currently held: Student Recreational Sport Private
 Commercial Airline Transport

Do you hold a valid Instrument Flight Rating (IFR)? Yes No

Medical certificate held: Class I Class II Class III Date of last renewal: ____ / ____ / ____

Purpose of present and future flying: Private/Pleasure Commercial Military
 Business Instruction Other _____

Type of aircraft flown _____ Hours flown in that aircraft _____

Have you flown or do you contemplate flying Experimental/Amateur-built aircraft:

Yes No *If yes, complete the questions below*

Aircraft currently under construction? Yes No

If yes, contemplated date of completion: ____ / ____ / ____

If no, date of completion: ____ / ____ / ____

Testing phase complete? Yes No

If yes, date of completion: ____ / ____ / ____

If no, who is doing the testing phase? Self Hired pilot

Permanent Airworthiness Certificate received? Yes No

Provide details to any yes answer below:

Have you ever been involved in an aviation accident? Yes No

Have you ever had any aviation violations? Yes No

Have you ever been grounded or had your license revoked? Yes No

Have you ever flown or do you contemplate flying outside the United States? Yes No

If aviation activity requires an extra premium or aviation exclusion rider, which would you prefer?

Extra Premium Exclusion Rider

Review Questions – ALU 101, Chapter 11

1. The highest percentage of accidents in general aviation is attributed to:
 1. weather
 2. pilot error
 3. alcohol
 4. faulty equipment
 2. The scenarios in which an aviation exclusion rider (AER) can be used include all of the following EXCEPT:
 1. The proposed insured has a significant history of depression.
 2. The contract is written in a state that restricts the exclusion.
 3. The policy is rated for reasons other than aviation.
 4. The extent of the aviation risk is unknown.
 3. Which of the following statements regarding Canadian Aviation medical certificates are correct?
 - A. The examining physician issues them.
 - B. There are four classes.
 - C. Denials may be appealed to the Civil Aviation Tribunal.
- Answer Options:
1. B only is correct.
 2. A and C only are correct.
 3. B and C only are correct.
 4. A, B, and C are correct.
4. Describe sources of aviation information that can be obtained on the proposed insured at time of underwriting.
 5. Describe the meteorological conditions that must normally be present before a pilot with a visual flight rules (VFR) certificate can fly.

6. In the U.S., which of the following is required for all pilot certifications:
 1. practical test
 2. aeronautical experience
 3. knowledge test
 4. ability to understand the English language
7. To fly an aircraft in conditions in which a pilot is unable to see, the pilot must be certified for:
 1. visual flight rules
 2. aircraft category rating
 3. visual meteorological conditions
 4. instrument flight rating
8. Describe the risks associated with these specific types of aviation:
 - aerial application/crop dusting
 - bush pilots
 - helicopters
 - ultralights
 - international aviation.
9. List the three causes of fatal accidents across all classes of airplanes and identify those considered to be judgment failures.
10. Describe the roles of the National Transportation Safety Board (NTSB) and the Federal Aviation Administration (FAA) in investigating commercial versus general aviation accidents.

Answers and Sources of Review Questions

Review Question 1

Answer 2: pilot error – page 14.

Review Question 2

Answer 2: The contract is written in a state that restricts the exclusion – page 19.

Review Question 3

Answer 3: B and C only are correct – pages 7-8.

Review Question 4

Refer to pages 18-19.

Review Question 5

Refer to page 4.

Review Question 6

Answer 4: ability to understand the English language – page 1.

Review Question 7

Answer 4: instrument flight rating – pages 4-5.

Review Question 8

Refer to pages 10-11, and page 14.

Review Question 9

Refer to pages 13-14.

Review Question 10

Refer to pages 12-13.

CHAPTER 12

SELECTED AVOCATIONS, PROFESSIONAL SPORTS, AND OCCUPATIONS

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SELECTED AVOCATIONS, PROFESSIONAL SPORTS, AND OCCUPATIONS

Introduction

It is the responsibility of underwriters to assess the risk presented by each proposed insured from several different perspectives. While the majority of underwriting evidence pertains to the medical risk and overall health of the insurance candidate, there are also non-medical factors that must be evaluated to understand the entire risk profile. Two non-medical features that arise often are concerns over avocations and occupations. The principal risk associated with these features is accidental death. Assessing avocational and occupational risk requires the underwriter to be familiar with an entirely different body of knowledge than is used in medical underwriting.

Avocations - Basic Risk Factors/Risk Assessment

Underwriters assessing an avocation must take into account a number of factors that serve to define the risk associated with the avocation. They include the following:

1. training requirements – Some avocations require specialized training and certification. It can be extremely dangerous for anyone to practice an avocation without proper training and experience.
2. health/age/physical requirements – Many avocations demand that participants demonstrate a minimum level of physical conditioning for the safe practice of their sport. This can require no particular physical strength or flexibility beyond that of the average healthy adult, or it can require extreme strength and coordination. The underwriter should be aware of the physical requirements of a proposed insured's chosen avocation, and whether the proposed insured meets them. In addition, the physical demands of some avocations make them very dangerous for the very young or the elderly.
3. equipment requirements – Specialized equipment is sometimes necessary to safeguard the proposed insured from the risks of an avocation. Equipment failure can lead to injury or death.
4. level of expertise – Underwriters should understand the limits and abilities that pertain to different levels of expertise. Individuals with an advanced certification in a sport can be expected to attempt more challenging circumstances.
5. frequency – In general, more frequent participation in an avocation increases the risk. However, there is also a risk involved with very infrequent participation in an avocation since lack of practice weakens critical skills and safe habits.
6. location – Some avocations can involve a specific venue that brings with it hazards beyond that expected of the avocation itself. For example, some avocations (such as mountain climbing) can be practiced in areas or foreign countries where travel is hazardous and medical resources are scarce.
7. impact of multiple avocations and hazardous activities – Individuals who engage in multiple avocations or other hazardous activities, such as fast driving or drug use, can represent personalities who are “thrill seekers” and who crave excitement and danger. Such individuals can represent a higher mortality risk than the simple sum of their underwriting concerns would suggest.
8. mortality rates and causes – Underwriters should understand the reasons behind any excessive mortality rates associated with a specific avocation. Such an understanding will

allow them to justify their actions and discuss any underwriting decision more intelligently with proposed insureds and producers.

Flat extras are the most common rating tool used in assessing the extra-premium risks associated with avocations and occupations. Flat extras are used in situations in which the risk associated with the impairment does not change with the age or gender of the proposed insured. By contrast, table ratings reflect a multiple of the expected mortality for the proposed insured, which increases with age and differs by gender. For example, a table rating of 150% increases the cost of insurance more for a 50-year-old overweight male than a 20-year-old overweight female. This is because, as a group, older men die at a higher rate than younger women, and obesity can accelerate that trend even more. However, if both individuals are completely healthy, the risks associated with scuba diving for a 20-year-old female and a 50-year-old male are basically the same, and the use of a flat extra, when a rating is necessary, makes the most sense.

Avocations - Underwriting Tools

Underwriters can be expected to gather information on avocations from a variety of sources. They include:

1. the application
2. avocation supplement/questionnaire
3. inspection report
4. underwriting manual
5. internet, specialty publications, government databases, trade journals, and other publications
6. attending physician statements (that can contain entries regarding injuries or comments regarding the avocation as a matter of medical record)
7. information from the producer/agent.

Underwater Diving/SCUBA

There are three types of diving encountered by underwriters: snorkeling, free diving, and scuba diving. Snorkeling, which is really surface swimming without much diving, is done with a mask, fins, and a snorkel. Snorkeling carries little or no extra risk and is extremely common.

Free diving is diving done without compressed air, using only a single breath. Some practitioners of free diving take the sport to a very advanced level, with competitions involving tremendous depth and endurance. Free divers with a Master certification can swim to a depth of almost 100 feet. Competitions involving divers with weights can reach depths of 230 feet. The principal risk in free diving is blackout and drowning. Free diving is relatively uncommon, but participants should be questioned closely about their participation in this high-risk avocation.

SCUBA stands for self-contained underwater breathing apparatus. It involves the use of specialized equipment designed to assist and enable the diver to remain submerged for long periods

of time. Like snorkeling, it is common, but can be a concern to underwriters because of the mortality risk.

Firm figures of scuba diving participation are difficult to come by, inasmuch as there is no single governing body for the sport (as is the case in many avocations), and much of the record-keeping is voluntary. The Sports and Fitness Industry Association survey estimated 3.1 million scuba diving participants in the United States in 2016.¹ There are an estimated 100,000-140,000 active scuba divers in Canada.²

It is difficult to determine valid estimates of risk using traditional methods. Fatality estimates approximate 16 per 100,000 divers annually.³ This varies depending on deaths per year against estimates of participation per year. Most studies of diver fatalities define a diver as someone *certified* as a diver. Some individuals scuba dive but have not been certified, while others are certified but rarely or never dive, while still others can hold as many as 25 advanced level certifications, with the result that such a diver could be treated statistically as 25 divers. Studies of risk usually do not distinguish a participant who dives once a year from divers who make several hundred dives per year.⁴

Because of the dangers inherent in this sport, scuba divers receive special training and certification from a recognized training program. There are many such programs, but major training centers in North America are run by the following organizations:

1. Professional Association of Diving Instructors (PADI) trains about two-thirds of the divers in North America⁵
2. National Association of Underwater Instructors (NAUI)
3. YMCA
4. Handicapped SCUBA Association (HSA)
5. International Association of Nitrox and Technical Divers.

The most common certifications held by amateur recreational divers are student diver, open water diver, and advanced open water diver. There are other advanced specialty certifications (examples: wreck diver, cave diver) that are less common and cover high-risk amateur diving and professional diving

Table 1. Risk characteristics of various diving activities.

Diving activity	Definition	Risk Characteristic
Recreational Scuba Diving	Open water diving	Depth of dive, experience level
Deep Dives: Recreation diving at depths of more than 100 ft.	Open water diving requiring additional training, additional certification, and which may require the use of mixed gases and specialized equipment *	Increased pressures of deep dives greatly diminishes diving time available, and requires stops for decompression risk on ascent

Cave diving	Entering into an enclosed, submerged cave.	Depth, darkness, overhead enclosure, disorientation, and loss of visibility from floating silt. Abrupt changes in conditions can result in panic and accelerated air consumption.
Wreck penetration	Entering into a submerged vessel and advancing through the interior spaces	Depth, darkness, getting lost or trapped in the interior spaces, loss of visibility due to floating silt and debris
Treasure or salvage	Searching the ocean floor or around /in wrecks for treasure or other valued material	Depth, loss of visibility from floating silt and debris, over-exertion.
Ice Diving	Diving through an access hole beneath a layer of ice.	Hypothermia, equipment malfunction, darkness, ability to find the access point at the end of the dive.
Night diving	Diving at night for a unique experience such as viewing nocturnal marine life	Depth, visibility, disorientation, navigation, need for enhanced buddy skills, reliance on light source
Spear fishing	Game fishing with a spear gun while diving	Injury from spears and marine life

*Rebreather equipment use:

A rebreather is a supplemental breathing apparatus that recycles a diver's exhaled breath to permit rebreathing of any residual oxygen with supplemental oxygen added to the mix to enable longer, deeper dives. However, rebreather equipment malfunction has been reported and associated with an increasing frequency of accidents and fatalities. The Divers Alert Network has labeled rebreather use as a high-risk diving activity.

Scuba diving is a popular recreational activity in which the vast majority of participants who are in good health do not require an extra rating. Other factors can introduce complexity in the underwriting evaluation, such as medical problems and specialty diving activities in higher risk environments of deeper dives, using mixed gases, and using rebreather equipment.⁶

The physical requirements for divers vary between organizations and courses, but in general, individuals contemplating taking up scuba diving should be able to swim 200 yards, open their eyes underwater, hold their breath, float for 10 minutes, and swim underwater for 15 yards.⁷ These requirements are not beyond the abilities of an average, healthy adult.

On the other hand, diving is not just a sport for the unimpaired. The HSA advises that handicapped divers can include divers with "paraplegia, quadriplegia, even the blind or those with high-functioning brain injuries."⁸ These are significant disabilities that require underwriters to examine handicapped scuba divers with great care and to evaluate the effect that any impairment can have on diving.

The Divers Alert Network (DAN), an international organization dedicated to diving safety, keeps records regarding accidents and fatalities that occur while diving. Data from 2015 suggests approximately 2 out of every 100,000 recreational divers in the U.S. die while scuba diving each year.⁹ The largest number of fatalities occurs among males, ages 50-59,¹⁰ with student, open water, or advanced open water certificates. In the U.S., the largest number of regional fatalities takes place in the southeast, with most diving deaths occurring in the ocean. The overwhelming majority of fatal diving accidents take place during recreational dives for pleasure purposes.

Many incidents involve decompression accidents, during which an ascending diver comes to the surface from a deep dive too quickly. Air saturates the body under the pressures of deep underwater diving. During ascent, air can suddenly erupt from the blood and body tissues and expand explosively in the chest, causing gas embolisms (i.e., bubbles in the bloodstream that block circulation) and pulmonary pneumothorax (i.e., lung collapse). Pneumothorax occurs because the abrupt change of air pressure upon ascending causes air blisters to develop on the surface of the lungs that then rupture, causing collapse of the lung.

Likewise, the abnormal saturation of nerve tissue at great depths with excessive amounts of oxygen, carbon dioxide, and nitrogen can have a toxic effect and impair judgment and reason. In a condition like nitrogen narcosis, divers who dive too deeply and stay down too long have been known to hallucinate, remove their breathing equipment, and drown.

Generally speaking, divers who descend to 100 feet or more require greater technical skills and special equipment to dive safely. Recreational divers who descend to depths beyond their technical training are sometimes called “rec-tech” divers and have poorer scuba safety records than fully trained divers. The physical effort of underwater diving can be considerable and can exacerbate the effects of cardiovascular and pulmonary disease. Common risk factors (i.e., *chronic* health disorders or habits) in people who die while diving include:

1. smoking (15% of all fatalities)
2. high blood pressure/heart disease (15% of all fatalities)
3. diabetes
4. allergies
5. asthma.

Other common chronic health disorders that contraindicate diving include:

1. anemia
2. stroke
3. depression/panic disorder
4. epilepsy
5. obesity
6. valvular heart disease.

The most common acute health conditions found in people who die while diving include:¹²

1. recent alcohol and drug use (10% of all fatalities)
2. recent orthopedic injury (8.5% of all fatalities)
3. hangover and seasickness.

Drowning is listed as the cause of death in more than 60% of fatal scuba diving accidents, frequently associated with the specific problems of running out of compressed air, entanglement (in fishing nets, rope or kelp), air embolism, narcosis, and panic. Air embolism, a common cause of diving fatalities, can result from rapid ascent due to panic, and the inability to free oneself from rope, nets or kelp can also be caused by a panic response. Diving authorities generally agree that panic behavior is responsible for many of the diving accidents and fatalities that occur in recreational scuba divers. (The presence of trait anxiety, which is an enduring feature of personality, can be a predictor of panic.¹³ Trait anxiety refers to a general level of stress that is characteristic of an individual.)

The increased risk that these medical conditions bring to underwriting a diver is significant and is compounded by the avocation. It is vitally important that the underwriter recognize them and their role when assessing the mortality risk.

Automotive Racing

Automotive racing is arguably the fastest-growing spectator sport in the United States and Canada. Organizations like NASCAR (the National Association for Stock Car Racing) report an increase in their fan base over the last decade in the tens of millions. Because of the sport's popularity, a multitude of professional and amateur classes have sprung up, catering to every style and economic class of participant, from the seasoned professional with corporate sponsorship to the entry-level amateur operating on a tiny budget.

There are dozens of sanctioning bodies in the sport of automotive racing. The following are major organizations operating on a national level:

1. Automobile Racing Club of America
2. INDYCAR
3. International Conference of Sports Car Clubs ICSCC
4. International Hot Rod Association
5. International Motor Sports Association
6. National Association for Stock Car Auto Racing
7. National Auto Sport Association
8. National Hot Rod Association
9. American Rally Association
10. Formula D
11. Sports Car Club of America
12. United States Auto Club
13. Southern California Timing Association
14. United States Hot Rod Association

Categories of Racing

1. single-seater racing – In single-seater (open wheel), the wheels are not covered, and the cars often have airfoil wings front and rear to produce downforce and enhance adhesion to the track. In Europe and Asia, open wheeled racing is commonly referred to as "Formula."
2. touring car racing – Touring car racing is a style of road racing that is run with production derived race cars.
3. production car racing – This type of racing is known in the U.S. as showroom stock and is an economical and rules-restricted version of touring car racing.
4. one-make, or single marque, championships – These races often employ production-based cars from a single manufacturer or even a single model from a manufacturer's range.
5. stock car racing – Primarily raced on oval tracks, stock cars resemble production cars but are, in fact, purpose-built racing machines that are designed to tight specifications.
6. rallying, or rally racing – Rally racing involves two classes of car. The modified Group A, but road legal, production-based cars and the Group N Production cars compete on (closed) public roads or off-road areas. They run on a point-to-point format where participants and their co-drivers "rally" to a set of points, leaving in regular intervals from start points.
7. targa – This is a tarmac-based road rally that is run all around the world.
8. drag racing – The objective is to complete a given straight-line distance, from a standing start, ahead of a vehicle in a parallel lane. This distance is traditionally $\frac{1}{4}$ mile (400 m).
9. sports car racing – Production versions of sports cars and/or grand tourers, and sports prototype cars compete within their respective classes on closed circuits. The races are often conducted over long distances, at least 1,000 km (621 mi), and cars are driven by teams of two or three drivers (and sometimes more in the U.S.), switching every few hours.
10. off-road racing – Various modified vehicles, including cars, compete in races through off-road environments. In North America, these races often take place in the desert.
11. kart racing – As an entry point for serious racers into the sport, kart racing, or karting, can be an economical way for amateurs to try racing.
12. historical racing – This type of racing only allows cars of a certain era to participate. The only modern equipment used is related to safety and timing. A historical event can be of various different motorsport disciplines.
13. land speed racing – the fastest form of racing in the world—This type of racing is done on salt flats and airstrips. The objective is to set the fastest speed over a predetermined distance, usually 1 mile. The fastest vehicles are streamliners, highly aerodynamic with an elongated low drag shape, which are capable of speeds in excess of 300 mph. Racing takes place in many classes, including regular street cars and motorcycles.
14. hill climbs – Vehicles race up a hill or mountain singly in an attempt to set the fastest time over the course. Sports cars and specialized formula-type cars are used in this event.

Training requirements vary for the different classes of automotive racing. Entry-level classifications require no training whatsoever. (Competitive go-kart races offer the youngest driver a chance to build his or her skills and feature drivers as young as 8 years old.) Other racing classes require years of experience in slower, less competitive and less risky vehicles in order to acquire the necessary skill to handle faster classes of race cars.

Mortality rates for auto racing are influenced by the following factors:

1. speed – the most important variable - By way of example, note that vintage racing typically involves racing antique cars under carefully controlled conditions designed not to tax the valuable and historic car excessively nor endanger the driver. Vintage racing is not commonly an underwriting concern. On the other hand, an International Racing League Indy car can accelerate from 0-100 mph (161 kph) in 4.2 seconds and reach speeds of 240 mph (388 kph).¹⁴
2. vehicle design and safety features – Safety features are highly variable, depending on class. However, even the least competitive of racing classes have basic safety features designed to avoid loss of vehicle control and fire. Most recently, incident data recorders, similar to those used on commercial airliners, have been installed on some cars in an attempt to learn more about the causal factors in racing accidents. Research into and the development of safety equipment is an ongoing process.¹³
3. fuel type – Fuels includes gasoline and other more unstable and flammable exotic fuels such as acetone, methanol, or nitromethane. As an example, the “flash point” of acetone (when it evaporates and can be ignited) is only -4 degrees Fahrenheit or -20 degrees Celsius. In addition, acetone burns much more readily than gasoline. Therefore, acetone can be termed both an unstable liquid fuel and highly flammable.
4. driver experience, age, and health – All can be risk factors.
5. track and track conditions – Rain can create particularly hazardous conditions at high speeds, as cars hydroplane on the water and lose traction and control.

The most common cause of death is collision with another racing participant or track structure. The deaths of several high-profile drivers have highlighted the need for continuous improvements in safety technology, including head restraints and other safety devices which the sanctioning authorities have begun to mandate.

In years 2012-2014, about two of every three deaths in U.S. auto racing occurred at short tracks (i.e., one-half mile or less), which have been slow to embrace changes that are saving lives in racing’s major leagues. Short tracks are also where most U.S. racing takes place. Most short-track owners have not mandated head-and-neck restraints or other safety features on cars. Since 1990, 53% of at least 523 racing deaths have been at short tracks. That number has climbed to about 70% since 2012. The number of racing deaths appears to have dropped from an average of more than 20 to about 15 over the past five full years.¹⁴

Motorcycle Racing

Motorcycle racing is one of the most exciting and dangerous of all motor sports. Spectator enthusiasm for the sport has grown with the increase in individual motorcycle ownership. In the U.S., motorcycle registrations increased to 8.4 million, a 100% increase between 2002 and 2017.¹⁵ Sports and media networks broadcast popular programming covering a wide spectrum of interest from international racing events to reality shows.

An increasing population of riders produces some enthusiasts who take their motorcycling hobby to the next level. Many riders enter racing events as amateurs, gain experience, and eventually enter professional driving events. An increasing number of racing participants have emerged as proposed insureds in the insurance population.

Motorcycle accidents frequently result in fatalities because the motorcycle rider is completely exposed to the consequences of a crash. Approximately 80% of reported motorcycle accidents result in injury or death; a comparable figure for automobile accidents is about 20%.¹⁶ Motorcycle racing has an increased potential for accidents since riders push the limits of control at maximum speeds in competitive traffic on challenging courses.

Motorcycles have powerful engines relative to their weight. Advanced engineering has provided continuous improvements in performance, designed to enable sudden acceleration and provide nimble handling. Motorcycle racing presents unique control challenges for participants, resulting from forces of sudden acceleration, deceleration, and braking. Sudden speed changes while cornering create simultaneous forces that make vehicle control difficult, leading to accidents.

Sanctioning bodies include: International Motorcycling Federation (FIM), which represents 98 national motorcycle associations, and the American Motorcycling Association (AMA).

There are two broad categories of events—tarmac (asphalt road surface) and off-road—each with several subgroups:

Types of Tarmac Racing

1. Road racing takes place on racing circuits or closed public roads.
2. Grand Prix includes three classes categorized by engine size (125-800cc). There have been 83 deaths over the past 20 years in grand prix events on the Isle of Man in Great Britain.¹⁷
3. Supersport and Superbike racing involves custom performance modified engines up to 1200 cc.
4. Endurance racing is racing to test durability of the motorcycles and endurance of the riders. Teams of riders cover maximum distances in a limited amount of time or to finish a distance in the shortest possible time. Track conditions change throughout the day, and fatigue becomes an additive factor of risk.
5. Drag racing and sprints occur on a racing venue where two participants line up at a dragstrip with a signaled starting line. Upon the starting signal, the riders accelerate down a straight, quarter-mile long paved track where their elapsed time and terminal speed are recorded.

Types of Off-Road Racing (dirt, sand, grass, or mud courses)

1. motocross (MX) – racing over dirt, sand, grass, or mud courses, which include jumps and variable terrain with engine sizes up to 250cc
2. supercross (SX) – indoor motocross, in stadiums and arenas
3. enduro and cross-country – off-road endurance events spanning several hours and taking place through wilderness areas; many times done in sections called stages, with a predetermined target time as the goal to achieve
4. hare scramble – variable duration and distance events over rugged terrain - Top performance awards go to those who maintain greatest average speed over the entire course.
5. freestyle motocross competition – Awards are based upon points for acrobatic ability including flips, jumps, and stunts. This is an important distinction from the generic motocross racing events noted previously.
6. cross-country events – Cross-country rally events use larger bikes than other off-road sports. Competition takes place over many days, travelling hundreds of miles off-road.

7. track racing – racing on an oval track; competition in teams or by individuals - Track racing can be held on a variety of different surfaces. Indoor short track courses can be on a concrete surface or dirt. Motorcycles race on an oval track or over a single jump with a right hand turn called a TT track. Ice racing is motorcycle racing on an ice covered oval 200-400 meters in length.
8. hill climbing – A single rider climbs a road going up a hill aiming for the fastest time and/or the farthest up the hill before ceasing forward motion.

Mortality rates are affected by the following risk factors:

1. speed – Injury severity increases with speed and motorcycle size.¹⁸
2. engine size
3. driver age/experience and health – Riders at ages 16-24 are over-represented in motorcycle deaths.
4. amateur or professional status
5. frequency of participation.

Extremes of risk can be estimated comparing off-road events at slower speeds (less than 75 mph) versus the high speed tarmac events. Underwriters should be cognizant of the limits, abilities, and maturity of participants.

Aerial Sports

Skydiving, paragliding, and hang gliding are three avocations in which the participant takes to the air with minimum equipment and without benefit of motorized support.

Skydiving

Skydiving or parachuting is defined as a sport utilizing a canopy that slows the descent of an individual who has jumped from a plane, a tall structure (e.g., a tower or bridge), or a natural formation (e.g., a cliff).

B.A.S.E. jumping is parachute jumping from natural formations or artificial structures. B.A.S.E. stands for building, antenna, span, and earth. B.A.S.E. jumps are considerably more risky than jumps from an airplane because B.A.S.E. jumps take place at much lower heights. This requires specialized training and equipment that allows for the quick deployment of the parachute and almost immediate preparation for landing. For example, a B.A.S.E. jump from a 500-foot cliff would include a parachute glide of only 10-15 seconds before landing. In contrast, many parachute jumpers from an airplane enjoy a 3-4 minute glide to the ground, with much more time to select a landing site and prepare for touchdown.

For most skydivers, regardless of where they jump, the thrill of the sport comes before the parachute is deployed, when the diver is still in freefall. Typical altitudes for skydivers jumping from an airplane range from 7,500 to 15,000 feet (2,300 to 4,600 meters) above ground level, yielding a freefall time of between 40 and 85 seconds.

The major sanctioning body for parachuting in the U.S. is the United States Parachuting Association (USPA). In Canada, it is the Canadian Sport Parachuting Association (CSPA). There

are approximately 400 training centers in the U.S. and 55 centers in Canada. Skydivers are trained by using:

1. classroom techniques
2. tandem training – in which students jump while harnessed to an instructor
3. static line training - a low altitude jump in which the main canopy is automatically deployed by a "static line" attached to the aircraft
4. instructor assisted deployment (IAD) – pilot chute deployed by instructor or student upon exiting a plane
5. accelerated free fall (AFF) training – which allows for more extensive ground training and the assistance of two jump masters who accompany the student during his or her first jump
6. vertical wind tunnel training – practice in basic free fall control and maneuvering.

The membership survey of the USPA conducted in 2017 counted 38,000 skydivers, the vast majority of them male (85%) and under the age of 40 (72%).¹⁹ However, underwriters should be aware of organizations like Parachutists Over Phorty Society (POPS), Skydivers Over Sixty (SOS), and Jumpers Over Seventy (JOS) that provide support to older jumpers. In Canada, the CSPA is made up of 55 clubs and member groups comprised of approximately 2,000 individuals.

There are over 300,000 people who skydive in the United States every year, making over 3 million jumps.²⁰ There were 21 fatalities in 2017.

Most people who experience parachuting make only a few jumps or only one jump, often in the setting of a tandem jump or as students. Student jumps have been highly refined, and fatalities are very rare.

Skydiver deaths average approximately 22 per year, which is a rate of 0.0065 fatalities per 1,000 jumps. Skydiving mortality is attributable mostly to poor judgment on the part of the jumper and inadequate equipment preparation and maintenance. Fatalities are due to the following causes:

1. collisions (15%)
2. improper landing technique (31%)
3. parachute not deployed or deployed at an inadequate altitude (9%)
4. main parachute malfunction (30%)
5. reserve parachute malfunction (5%)
6. other (10%).²¹

Hang Gliding and Paragliding

A hang glider is a non-motorized foot-launched wing with a rigid frame. A paraglider is a non-motorized foot-launched inflatable wing that maintains its shape through air pressure alone. Unlike parachutes, both are capable of soaring, which is the ability to achieve lift through the use of updrafts. Hang gliders are faster than paragliders and can cover more distance. Paragliders are slower but capable of tighter turns and will stay aloft in lighter wind and updraft conditions.

There are no exceptional physical demands placed on the hang glider or paraglider pilot. For foot-launching a hang glider, the basic requirement is the ability to lift and balance the 45 to 70 pound (20 - 32 kilograms) glider, and run down a slope with it at a moderate to fast jogging speed.

Paraglider pilots should be strong enough to hike uphill with about 25 pounds (11 kilograms) of gear and be capable of managing their wing in light to moderate breezes. This said, however, hang gliding and paragliding require the active skills of an unimpaired pilot during all phases of flight. Any medical condition that might interfere with the pilot's ability to physically handle his craft is a cause for concern.

In both the United States and Canada certifications that range from student or novice through master are available from the United States Hang Gliding & Paragliding Association (USHPA) and the Hang Gliding and Paragliding Association of Canada (HPAC). Designations are awarded through the completion of classroom instruction, supervised flights, accumulated airtime, written examinations, and flight tests. Most designations come with a recommended set of operating limits such as maximum wind speed and air turbulence and altitude limits. Master level pilots have no recommended operating limits on their class.

In 2014, HPAC reported a membership of 715. In the United States, the 2014 USHPA membership census totaled 10,845. The number of hang glider pilots is in a steady decline in the United States (2.8% loss/year average over the last decade) due to safety concerns and a perception that the sport is practiced only by older pilots. On the other hand, the number of paragliders more than tripled between 1992 and 2002 (increasing from 1,316 to 4,640).

Hang Gliding Mortality

There are 8-11 hang gliding fatalities per year in the United States and Canada, averaging 1 death per 1000 participants. The average mortality rate for hang gliding in any given year is 1 in 560 flights. HPAC accident statistics indicate the most frequent mishap experienced by hang glider pilots is collisions with trees, power lines, and other structures. In addition, the most dangerous phase of flight is while the pilot is attempting to land. Note that for both hang gliding and paragliding, pilot error is the principal cause of most fatalities and accidents.

Paragliding Mortality

The USHPA and HPAC report an average of four paraglider fatalities per year, or 1.37 per 1000 participants. USHPA reports that the most common contributing factor to paragliding accidents is flying too close to the ground and collision.

Mountain Climbing

Mountain climbing is a general phrase that encompasses outdoor activities ranging from an afternoon spent trail hiking to the ascent of Mt. Everest. It includes the following activities:

1. trail hiking
2. rock climbing – climbing natural stone features
3. ice climbing – climbing frozen water features
4. buildering – A twist on the rock climbing term “bouldering,” buildering is climbing a building.
5. mountaineering – involves climbing on rock, snow, and ice in an alpine environment.

Trail hiking is usually very low-risk, as is indoor climbing, which involves a safe training venue for climbers looking to practice their skills. Buildering is relatively rare but can be as dangerous as mountaineering, and can be illegal if the climber does not get permission to climb and is trespassing. The greatest underwriting concerns are with rock climbing and ice climbing, which are both relatively common and can be hazardous avocations.

Rock climbing can be broken down into the following categories:

1. top roping – involves attaching a rope to the climber at one end, passing through an anchor at the top of the route, and back down to a climbing partner (belayer) at the other end or the base of the route. The climber usually will not fall more than a short distance since the belayer's responsibility is to minimize slack in the rope and arrest any fall of the climber.
2. rappelling – also known as abseiling - involves a controlled descent down a cliff face or a steep slope using a friction device with a rope anchored at the top of the route.
3. bouldering – a style of climbing performed on boulders at a maximum height of 10-16 feet above the ground, utilizing a protective crash pad for safety.
4. traditional climbing – utilizes varied protective equipment that is designed to guard the climber from falls. The climber ascends without the use of aid equipment or mechanical devices.
5. sport climbing – uses a very limited and minimal selection of protective hardware to prevent falls on routes, modified with the protection of anchors, permanently bolted into the rock, to which a safety line is attached. No equipment is used to assist in the ascent. Sport climbing allows the climber to concentrate on technique and the execution of difficult and challenging climbing maneuvers.
6. aid climbing – includes the use of equipment to pull or stand on to assist in the ascent, as well as to protect from falls. Aid climbing is reserved for the most technically challenging and dangerous climbs.
7. big-wall climbing – climbing on large vertical rock walls that can take several days to complete - requires special techniques such as aid climbing, and the use of portaledges (portable ledges hung from the rock face, allowing climbers to rest, prepare meals and sleep).
8. free climbing – makes use of natural hand and foot holds only. No protective hardware is used at all.
9. free soloing – free climbing alone. A misstep while free soloing carries the greatest chance of death as there is neither safety equipment involved nor any companion who can render assistance.

Given the rigors of climbing, participants are often in above-average physical condition. It is important to note that even mildly deconditioned individuals can easily exceed their abilities in mountain climbing, and thus endanger themselves.

There is no sanctioning body for North American mountain climbing, although there are many schools, clubs, and guide companies. According to the Outdoor Industry Association, there are four million climbers in the United States and Canada. However, the American Alpine Club and the Alpine Club of Canada, which are the major national organizations supporting this sport in North America, give a much lower estimate of 200,000-300,000 participants.²²

Mountain Climbing Mortality

The American Alpine Club and the Alpine Club of Canada publish an annual analysis of accident and fatality statistics. On average and as a group, climbers can expect to experience 26 fatalities per year in the United States and six fatalities per year in Canada. The most common types of terrain for accidents are rock, snow, and ice, in that order. The most common immediate cause of death is a slip, a fall, or the impact of an icefall or rockslide. The most common contributory causes of death include:

1. climbing without a safety rope
2. climber exceeds his or her abilities
3. inadequate equipment or clothing
4. inadequate or no use of fall protection hardware.

Mountain climbing accidents occur most frequently in the United States in the Pacific Northwest, Northern Atlantic region, California, and Colorado. In Canada, most accidents occur in Alberta and British Columbia.²⁷

Snow Sports

Snow sports are very popular in Canada and certain parts of the United States. Some activities, including heli-skiing and cat or back country skiing, are hazardous and involve mortality risk that should concern the underwriter.

Heli-skiing

Heli-skiing is a form of extreme skiing that involves being dropped at or near the top of a mountain by a helicopter. It is often described as the ultimate in extreme adrenalin sports and is gaining in popularity. There are many heli-ski operators now in existence that range from daily operations catering to the novice heli-skier to multi day operations that cater to the experienced heli-skier who wants to ski in remote locations in wilder conditions. An underwriter assessing a heli-skiing risk should first ask about the location of the heli-skiing activity and the extent of the trip. The main risk associated with heli-skiing is not the helicopter ride but the risk of avalanche during descent down the mountain.

Cat Skiing

Cat skiing or back country skiing involves being taken to remote locations by a snowcat for the purpose of skiing in locations not accessible by the ordinary skiing enthusiast. Cat skiing is attracting a growing number of people due to its relaxed nature and ability to access incredible terrain in powder snow conditions. As with heli-skiing, the main hazard is risk of avalanche.

Avalanches cause a number of fatalities every year. Canadian statistics show that there have been 1,645 people caught in 1,120 avalanches in the 20-year period from 1 October 1984 through 30 September 2003. There have been 230 fatalities in this time period or an average of 11 per year. The typical accident victims are males in their twenties, and most are killed during back country skiing adventures. Other noteworthy items concerning avalanche fatalities are:

1. Most occur when the weather is good and the skies are clear.
2. Most are triggered by the victims or members of the same party.
3. Most avalanches start at or above tree line.

In cases where cause of death is known, 68% are due to asphyxiation and 32% are due to trauma.

Contributing factors to avalanche accidents include:

1. lack of trip preparation – Good trip preparation involves seeking information from maps, guidebooks, information centers, and from people who have been to the area.
2. failure to gather snow stability information prior to traveling into avalanche terrain
3. poor preparation for search and rescue operations – Probes, shovels, and transceivers are all important for an efficient search by surviving members of an accident party.
4. human factors – Such as travel in informal groups without a designated leader, attempts to reach certain landmarks without attention to unfavorable conditions, and entering gullies or large slopes that are at increased risk for avalanche.

As with most hazardous sports, it is wise to underwrite the participant in the extreme snow skiing activity as well as the sport itself.

PROFESSIONAL SPORTS

The United States Department of Labor keeps statistics on employment; it reports for 2016 that there were 11,800 professional athletes in the United States.²⁴ No comparable statistics are available for Canada.

Occupational fatalities among pro athletes are relatively rare. However, professional athletes are continually associated in the press with risky behaviors, such as drug use, alcohol use, and violence. In "Pros and Cons: The Criminals Who Play in the NFL," authors Jeff Benedict and Don Yaeger found that 20% of the 500 players surveyed for the 1996-97 season had been charged with a serious crime such as rape, weapons violations, driving under the influence of alcohol, or drug-related offenses.²⁵ However, these behaviors do not necessarily translate to adverse mortality.

Lincoln National Life produced an analysis of pro athlete mortality that revealed an overall mortality rate of 86%, compared to standard mortality of 100%. Details of the information analysis included:

1. There are more violent deaths, most commonly auto accidents, but also drowning, homicides, and commercial airline crashes.
2. Death rates were not increased for athletic "superstars," but were similar to all professional athletes, regardless of their level of skill.
3. Most deaths occurred off-season.

A majority of studies report superior lifespan longevity outcomes for elite athletes, particularly those in endurance and mixed sports, when compared to the general population.²⁶

National Football League player mortality also compared favorably with that of the U.S. population with a reduced (SMR 0.53, 95% confidence interval [CI] 0.48-0.59). However, the neurodegenerative mortality of this group is found to be three times higher than that of the general U.S. population.²⁷

The fact remains that the highly publicized deaths of some prominent sports figures, coupled with the risky and/or illegal behavior of other athletes, makes risk assessment a real challenge. Fortunately for underwriters, however, many athletes lead a life as public as that of any Hollywood star. A review of public records, a motor vehicle report, and an internet search can reveal a pattern of behavior that puts the athlete at risk for an early claim.

As a class, the mortality concerns for professional athletes can be sufficient cause for some insurers to:

1. limit the amount of coverage available to any athlete
2. bar pro athletes from the preferred risk class, even if the athlete meets all the preferred underwriting criteria
3. seek reinsurance support in underwriting professional athletes.

Finally, if an insurance company insures all the members of a particular sports team, that team represents a catastrophic accidental risk to the insurer. This risk occurs because many pro teams travel and live together, and an accident such as a plane crash or a hotel fire can result in a large total claim amount at one time. This catastrophic risk is sometimes dealt with by:

1. limiting the amount of insurance available to any single athlete
2. limiting the aggregate amount of insurance available to any single team
3. setting up special reinsurance arrangements, which protect against claims in excess of a certain size.

OCCUPATIONS

Basic Risk Factors and Underwriting Tools

Like avocations, occupational fatalities can occur in situations where an individual is required to execute his or her skills in a hazardous environment. The risk again is primarily that of accidental death. The occupational mortality hazard is related to several risk factors:

1. special job requirements and skills
2. environment and environmental exposure (e.g., nuclear power plant, a construction site, an underground mine)
3. equipment and tools (e.g., a welding torch, a truck, a computer)
4. materials (e.g., wood, dynamite, paper)
5. physical requirements
6. location (e.g., city, state, province, country).

As noted in the discussion of avocations, proposed insureds with an extra mortality risk are usually assessed a flat extra premium.

Sources of information for occupational risks are the same as those for avocations:

1. application
2. inspection
3. attending physician's statement (APS)
4. underwriting manual
5. information from the producer
6. internet, specialty publications, government databases, trade journals and other publications.

Military Occupations

Overall, the United States' active military population numbers approximately 2,875,000 in 2017.²⁶ Canada's armed forces total 65,000 active duty and 22,000 reserves.²⁶ Determining the mortality risk for military personnel involves consideration of the following criteria:

1. degree of exposure to wartime activities (e.g., front-line infantry vs. administrative bureaucrat)
2. hazardous job/accidental risk (e.g., special operations, aviation, explosives technician)
3. degree of foreign risk
4. health problems

From 2001-2017, there were over 2,300 fatalities with continuing operations in Afghanistan. In the last three years, combat deaths have diminished to approximately 20 per year.²⁶ There were a total of 159 Canadian military deaths in Afghanistan over the period 2002-2015.²⁷

Civilian Occupations

In 2016, there were 852 occupational deaths per year in Canada²⁸ and 4,836 in the United States.²⁹ Hazardous civilian occupations expose employees to situations where the risk of accidental death is high. The top three most common job accidents leading to death in the United States, according to the Bureau of Labor, are:³⁷

1. vehicular accidents (highway collisions, overturned or jack-knifed truck, and employees struck by a vehicle)
2. employees struck by a falling object
3. assaults and violence.

In Canada, the top three causes of occupational death are:³⁸

1. exposure to a harmful substance (such as coal dust or asbestos)
2. vehicular accidents
3. employees struck by a falling object.

Males are much more likely to be killed on the job than females. Ninety-two percent of all workplace fatalities are male in the United States and 96% in Canada. Females who die on the job are more likely to die from homicide than any other cause.^{39,40}

Table 1. The three most hazardous occupations in the United States.

United States		
	Logging	135.9 fatalities per 100,000 full time workers
	Fishermen	86 fatalities/100,000full time workers
	Pilots	55 fatalities/100,000 full time workers

For 2016, Statistics Canada found the highest risk for fatalities in occupational subspecialties within forestry, fishing, and aviation.

- Chainsaw and skidder operators: 81.7 per 100,000
- Fishing vessel deckhands: 77 per 100,000
- Air pilots, flight engineers, and flying instructors: 69.1 per 100,000.³⁰

Internet Resources for the Underwriter on Avocations and Occupational Risks

Professional Association of Diving Instructors (PADI)	www.padi.com/scuba/
Divers Alert Network (DAN)	www.diversalertnetwork.org
Automobile Racing Club of America (ARCA)	www.arcaracing.com
Canadian Association for Stock Car Racing (CASCAR)	http://racereview.com/cascar.htm
International Motor Sports Association (IMSA)	https://www.imsa.com/
National Association for Stock Car Racing (NASCAR)	www.nascar.com
National Hot Rod Association (NHRA)	www.nhra.com
Sports Car Club of America (SCCA)	www.scca.org
United States Auto Club (USAC)	www.usacracing.com
United States Parachuting Association (USPA)	www.uspa.org
Canadian Sports Parachuting Association (CSPA)	www.cspa.ca
United States Hang Gliding & Paragliding Association (USHPA)	www.ushpa.aero
Hang Gliding and Paragliding Association) of Canada (HPAC)	www.hpac.ca/pub/
American Alpine Club	www.americanalpineclub.org

Alpine Club of Canada	<u>www.alpineclubofcanada.ca</u>
United States Department of Labor	<u>www.dol.gov</u>
Statistics Canada	<u>www.statcan.gc.ca</u>
Canadian Avalanche Association	<u>www.avalanche.ca</u>

Review Questions, ALU 101, Chapter 12

1. Mortality rates in auto racing are most influenced by:
 1. type of fuel
 2. driver's experience
 3. rate of speed
 4. track conditions
2. In the U.S., the three most common occupational accidents leading to death include all of the following EXCEPT:
 1. assaults and violence
 2. electrocution
 3. vehicular accidents
 4. struck by a falling object
3. Insurers manage the mortality risk of professional athletes by doing which of the following?
 - A. limiting the issue age
 - B. seeking reinsurance support
 - C. limiting the amount of coverage

Answer Options:

1. B only is correct
2. A and C only are correct.
3. B and C only are correct.
4. B and C only are correct.

4. Describe the factors underwriters must consider when assessing an avocation.
5. List the different rock climbing categories.

6. Flat extra ratings are typically used when assessing which of the following risks?

- A. morbid obesity
- B. scuba diving
- C. underground mining

Answer options:

- 1. A only is correct.
- 2. B only is correct.
- 3. B and C only are correct.
- 4. A, B, and C are correct.

7. When assessing avocation and occupation for life insurance, the primary concern is:

- 1. residency
 - 2. morbidity
 - 3. overinsurance
 - 4. accidental death
8. Discuss the four most common causes of mortality while mountain climbing.
9. Describe the physical requirements required before learning to scuba dive.
10. List three categories of automotive racing and describe each.

Answers and Sources of Review Questions

Review Question 1

Answer 3: rate of speed – pages 7-8.

Review Question 2

Answer 2: electrocution – page 18.

Review Question 3

Answer 3: B and C only are correct – page 15.

Review Question 4

Refer to pages 1-2.

Review Question 5

Refer to page 13.

Review Question 6

Answer 3: B and C only are correct – page 2.

Review Question 7

Answer 4: accidental death – page 1.

Review Question 8

Refer to pages 13-14.

Review Question 9

Refer to page 4.

Review Question 10

Refer to page 7.

CHAPTER 13

INTERNATIONAL RISK

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INTERNATIONAL RISK

Introduction

International risk is a hot topic since foreign travel is rapidly increasing and violent incidents abroad are reported more frequently and often in sensational terms. A leading U.S. business magazine publishes an annual list of “most dangerous destinations” and in their accompanying article warned “before you plan on visiting any of these places, get a life insurance policy.”¹ However, some U.S. states limit an insurance company’s right to underwrite foreign travel risk. A balance is needed between overestimating and underestimating foreign risk.

It is increasingly common to receive life insurance applications on individuals born in or residing in foreign countries, or on individuals traveling abroad. The underwriter has the following choices: ignore international risk, decline most foreign travel and residence, or try to rationally assess the degree of risk involved in travel and residence abroad.

For the purpose of this chapter, “foreign” is defined as outside of the United States or Canada since a person residing in or traveling outside of these two countries can present an additional element of mortality risk.

Why Foreign Residence and Travel Matter

There are a number of factors a life insurance underwriter should consider when evaluating foreign residence or travel. Some of these include:

1. life expectancy – A 2018 report of life expectancy by country lists Monaco and Japan with average life expectancies of 89.40 and 85.50 years, respectively, while in contrast, Lesotho and Afghanistan have averages of 53.00 and 52.10 years.²
2. violence – Some individuals are targeted because of their nationality, race, religion, or occupation.
3. accidental death rates – which vary widely by country
4. murder rates – These differ significantly from nation to nation and are so high in some countries that even short visits should be considered dangerous.
5. deaths as a result of military conflict
6. infectious disease death rates - which vary greatly by country
7. infant mortality rates and maternal mortality rates – which are dramatically different internationally and substantially affect overall life expectancy
8. number of physicians per capita by country - Physicians are scarce in many countries.

(Charts in the appendix to this chapter illustrate how several of these mortality factors differ by country.)

The U.S. State Department publishes a report entitled “U.S. Citizen Deaths from Non-natural Causes, by Foreign Country.” This document, covering a specific period of time, lists U.S. citizen deaths abroad by such causes as drowning accident, homicide, motor vehicle accident,

drug-related, terrorist attack, or other accident. The study shows that some specific countries have a disproportionate number of reported non-natural deaths of American citizens.

Dramatic differences can be observed in fatal disease rates (especially HIV/AIDS) from country to country. The high HIV infection rates in many countries have caused sharp declines in overall life expectancies. The HIV/AIDS prevalence in the adult population is highest in Eswatini (27.30%) and in Lesotho (23.60%). In contrast, the rate in Germany is 0.10%. Other deadly diseases, such as tuberculosis and malaria, have mortality effects, especially in tropical regions. For example, in 2008 the Democratic Republic of Congo's infectious and parasitic disease mortality rate was extremely high at 687.4 per 100,000 people, which accounted for 441,700 deaths that single year. In contrast, that same year the United Kingdom had an infectious and parasitic disease mortality rate of only 13.4 per 100,000 resulting in 8,200 deaths.

Table 1. Infectious and Parasitic Disease Mortality.

Country	Death rate per 100,000 population	Total Fatalities in 2008
Australia	10.0	2,100
United Kingdom	13.4	8,200
Germany	15.9	13,100
United States	22.8	71,200
Canada	37.0	12,300
India	181.9	2,149,100
Haiti	299.7	29,600
Nigeria	568.7	860,000
Dem Rep Congo	687.4	441,700
Malawi	744.4	106,800

Source: WHO 2008

There are foreign risk factors for which there are good country-specific data and statistics to help classify the level of risk. For example, the following chart taken from the CIA's The World Factbook, contrasts the differences in life expectancy that exist among countries:

Table 2. Life Expectancy at Birth.

Rank	Highest 10	Years	Rank	Lowest 10	Years
1	Monaco	89.40	223	Afghanistan	52.10
2	Japan	85.50	222	Zambia	53.00
3	Singapore	85.50	221	Lesotho	53.00
4	Macau	84.60	220	Somalia	53.20
5	San Marino	83.40	219	Central African Republic	53.30
7	Iceland	83.10	218	Mozambique	54.10
8	Andorra	82.90	217	Uganda	56.30
9	Guernsey	82.70	216	Niger	56.30
10	Israel	82.70	215	Eswatini	57.20

In addition to country-specific risks, there is the risk of long-distance travel itself. If an individual has a serious medical condition, extensive travel can compound that risk. The stress and strain of foreign travel can exacerbate medical impairments, while prompt access to high quality medical care is often unavailable when one is in transit and can be unavailable upon arrival. For example, increased incidence of pulmonary embolism has been reported at airports among those who have disembarked from international flights. After sitting for long periods of time during flights, passengers can develop blood clots that can have fatal consequences.³

Finally, it is important to consider foreign travel due to its sheer volume alone. International travel is no longer for the privileged few. In 2018 alone, approximately 1.407 billion individuals traveled outside of their own country. About 51% of this total consisted of travel to European countries.

Foreign Risk Consideration – Living Abroad

Every country is unique with its own singular attributes and risks. The longer one lives in a country, the greater his or her exposure is to the risks of that country. For insurance companies, there is a need to classify mortality risks in foreign countries by comparing them to proven actuarial tables such as those that exist for insured lives in the United States and Canada. A country could be judged by its reputation, the popular media image, or other preconceptions, but none of those methods would be entirely accurate, equitable, or consistent.

There are many characteristics of a nation that can affect the life expectancy of its residents. All of these should be taken into consideration in reviewing any foreign risk situation.

A country's political situation impacts mortality. This includes factors such as the levels of violence, corruption, terrorism, guerrilla movements, and military conflict in the country. A study of "Major Episodes of Political Violence 1946 – 2012" estimates that over one million individuals

died from such violence during those years in each of the following countries: Cambodia, Congo-Kinshasa, Sudan, Afghanistan, and Angola.⁴ Many other countries have experienced similar great losses, such as Syria during its lengthy civil war that began in 2011.

Cultural and ethnic differences should be considered when living abroad. Lack of familiarity with one's surroundings or local customs can make a person conspicuous and exposed to dangers that locals know to avoid. In many countries people have been attacked simply because they are perceived to be of a different nationality, race, or religion. Those in certain occupations, such as missionaries, government officials, journalists, and judicial personnel, have been singled out for violence in some countries. A tragic example of heightened job-related mortality risk is the 68 journalists killed in Syria covering the civil war there from November 2011 to December 2013.⁵ In 2013, at least 95 journalists and news media workers were reported killed worldwide, with Syria, Iraq, and Egypt topping the list in numbers.⁵

Social and economic conditions in a country affect safety, stability, and general well-being. Citizens of countries with wide-scale poverty usually have the shortest life expectancies. Another issue impacting mortality is the existence of sharp socio-economic divisions. Such divisions foster class hatred, instability, crime, and outbreaks of violence, which decrease the likelihood that circumstances will improve. In addition, some nations seem prone to boom-or-bust economies and frequent recessions and depressions. Financial crises in recent years have brought about dramatic plunges in living standards in some countries.

The quality and extent of infrastructure and transportation systems impact mortality as well. National transportation systems vary in their ability to provide safe, dependable, and easily accessible transportation to their citizens and visitors. Unavailability of reliable transport could be dangerous in cases of medical emergency.

Some countries have high rates of fatal motor vehicle accidents. A 2016 report indicates Sweden, United Kingdom, and Netherlands have among the lowest rates of 2.8 to 3.8 deaths per 100,000, the United States had 12.4 deaths per 100,000, and Thailand had 32.7 deaths per 100,000.⁶

Table 3. Road Traffic Mortality (annual number of deaths per 100,000 population).

Country	Road Traffic Mortality	Country	Road Traffic Mortality
Dominican Rep	34.6	Russia	18.0
Thailand	32.7	Mexico	13.1
Rwanda	29.7	United States	12.4
Saudi Arabia	28.8	Canada	5.8

Belize	28.3	Belgium	5.8
Kenya	27.8	Italy	5.6
South Africa	25.9	Australia	5.6
India	22.6	Japan	4.1
Iran	20.5	Germany	4.1
Brazil	19.7	Netherlands	3.8
Morocco	19.6	United Kingdom	3.1
China	18.2	Sweden	2.8

Source: WHO, Global Status on Road Safety 2016

An important component of mortality risk assessment in a particular country is the percentage of the population that has access to adequate medical care. The WHO ranks the world's health systems by countries from best to worst⁸ (Appendix 5). This ranking is based on how well a nation does on average in providing for the health care of its citizens. Not surprisingly, there is a high correlation between the quality of a country's health care system and the life expectancy of its people. For example, the United States ranks 37th in health care system and 45th in life expectancy. However, Japan ranks tenth in health care and second in life expectancy. The U.S. has excellent standards of medical care for its insured population, but its health care ranking is diminished by the more than 32 million of its citizens without health insurance. In fact, most of the countries ranking highest in health care system and life expectancy are those that have a national program of universal health care in effect.

The quality of national medical care is also affected by issues such as whether medical centers have sufficient medical supplies, staff, modern equipment, and a reliable source of electricity. In some countries, needles are in such short supply that they are reused, increasing the risk of the transmission of diseases, especially HIV/AIDS. The blood supply in some nations is not properly screened to prevent transfusion-based disease transmission. Immunization programs for preventable disease are lacking in some countries.

Population density can affect the well-being of the people living in the region. Overcrowding exposes individuals to more human-borne diseases and to stress. On the other hand, a remote location with few people means urgent medical care can be unavailable if needed.

The local environment, including air and water pollution, levels of toxic emissions, and the availability of clean water, plays a role in causing regional mortality differences. Toxic emissions have demonstrated widespread deadly effects in some places, while the ability to provide adequate clean water to people has reached the critical point in many locales.⁹ When assessing life expectancy abroad, one should account for unequal levels of hygiene, sanitation, cleanliness, and proper food preparation and storage.

Climate and altitude changes can also impact a person's health. The transition from sea level to high altitude or from temperate climate to tropical environment can be harmful to some people, especially those with serious pre-existing medical impairments.

Although natural disasters are difficult to predict, they often occur repeatedly in certain locations. Some areas are prone to flooding or drought, which can have devastating consequences for their residents or visitors. It is estimated that over one million people in Africa died as the result of drought and famine in the 1980s. Earthquakes are widespread and frequently happen with little or no warning. The massive underwater earthquake of December 2004 off the coast of Sumatra with resulting tsunamis tragically demonstrated how swift, deadly, and wide-ranging such an event can be. The January 2010 Haiti earthquake is estimated to have caused 316,000 deaths. The impact of the 2017 hurricanes in the Caribbean region demonstrates that even though the immediate death toll may be relatively low, the long-term effect on life expectancy and quality of life will likely be significant. People living near volcanoes are also at risk, although their chances of being forewarned of danger are greater than is the case for most other natural disasters.

Underwriting Foreign Risk

To begin the process of international underwriting, it is necessary to determine the proposed insured's citizenship, visa status, and any expected foreign travel or residence. If the person is not a citizen of the country in which he or she resides, he or she is considered a foreign national.

The proposed insured's place of birth as listed on the application can provide information about citizenship. A person born in the United States is almost always a U.S. citizen by place of birth.

Underwriting foreign residence and travel risk can be made easier with use of a well-designed foreign risk questionnaire. In most states, this can be made a supplement to the insurance application. The questionnaire should include questions about:

1. citizenship
2. visa type
3. anticipated foreign travel or residence in the next 24 months
4. specific countries, as well as destinations within the country
5. duration, dates, and purpose of travel.

The underwriter should be aware that a number of U.S. states have passed legislation, issued a directive, or considered action to restrict or prevent underwriting of foreign travel.

Categories of Foreign Risks

Foreign National Living in the United States or Canada

In the U.S., those who qualify for legal permanent residence are issued immigrant visas (i.e., green cards). A green card holder (i.e., permanent resident card holder) has the legal right to

work and reside permanently in the United States and has almost all the same privileges and rights as a U.S. citizen. Therefore, for most practical purposes, it makes sense to consider the green card holder in the same manner as a U.S. citizen when considering international risk. A typical green card is valid for 10 years. A conditional green card is usually valid for 2 years and not renewable. The landed immigrant in Canada can be considered the equivalent of a United States green card holder.

For non-United States citizens, the recommended way of obtaining legal permanent U.S. residence status is by applying for an immigrant visa at a U.S. embassy or consulate. Preference is given to:

1. visa applicants who have close family members who are U.S. citizens, especially parents, spouses, children, or siblings
2. workers with special occupations that are needed in the country—These individuals can also receive preference when it comes to the issuance of immigrant visas.
3. individuals engaged to American citizens—They can apply to enter the United States with a K1 fiancé visa. If the marriage is determined to be legitimate, it is usually a straightforward process for the K1 visa holder to obtain a U.S. permanent resident card.

In Canada, the rules and regulations for landed immigrant status are outlined in the Canadian Immigration and Refugee Protection Act. This Act sets forth three basic classes of admissible immigrants - family class, convention refugees, and economic class.

1. family class—Anyone who is at least age 18 and is a Canadian citizen or permanent resident can sponsor certain close relatives under the family class. Such relatives include: spouse, common-law partner, child (by birth or adoption), parent, or other prescribed family member as specified in the Act.
2. convention refugees—Convention refugees are persons who, by reason of well-founded fear of persecution, for reasons of race, religion, nationality, political opinion, or membership in a particular social group, are unable or unwilling to return to their home country. Additionally, any person in similar circumstances to a convention refugee can be allowed to immigrate to Canada, taking into account Canada's humanitarian treatment with respect to the displaced and the persecuted.
3. economic class—Any person can be allowed to immigrate to Canada based on his or her ability to become economically established in Canada. The economic class includes the following basic categories: skilled workers, investors, entrepreneurs, and self-employed persons. Individuals applying for entry to Canada via the economic class are assessed based on a point system that allots points for criteria such as education, proficiency in English or French languages, work experience, age, arranged employment, net worth, and adaptability.

A foreign national cannot enter Canada without first obtaining a visa. Then that individual must pass an examination to determine whether he/she has the right to enter and remain in Canada. To pass this examination, the foreign national must meet selection criteria, provide bona fide documents such as a passport, and must not be inadmissible. A foreign national could be deemed to be inadmissible for criminality reasons, health reasons, financial reasons, or due to misrepresentation on application forms.

For those residents in the United States who do not qualify for legal permanent residence status, non-immigrant visas are issued. It is important to establish the specific type of visa the person possesses. Some of the most common U.S. temporary non-immigrant visas are H1B, L1, E1, F1, and B1/B2. (Additional visas listed in Appendix 4)

There are certain types of U.S. non-immigrant visas that authorize employment in the U.S. and are almost as favorable as a green card from the standpoint of foreign risk. They are:

1. the H1B work authorization visa given to those with special technical skills or distinguished merit
2. the L1 intracompany transferee visa for employees of multinational companies who have been transferred from a foreign branch to work at the American branch of their companies
3. the E1 treaty trader and E2 treaty investor visas.

These three classes of visas have characteristics that tend to engender strong ties to the United States in the visa holder. Each visa allows the recipient to work or conduct business and to reside for long periods of time in the U.S. A high percentage of these visas are eventually converted into legal permanent residence status and U.S. citizenship.

An EAC is an Employment Authorization Card issued by the US government and is one way to prove that a person is allowed to work in the U.S. for a specific time period. If a person has a green card or a work visa, they do not need to apply for an EAC. The EAC is usually valid for 1-2 years and is renewable.

For underwriting purposes, a proposed insured with only a student (F1) or visitor visa (B1/B2) is probably best regarded as a resident of his or her country of citizenship. Holders of these latter visas are not legally allowed to work in the United States and are expected to return to their countries of origin after a temporary stay. If a non-citizen is working and being paid in his or her country of residence, it is crucial to make sure that person holds a visa that legally authorizes employment in that country.

In Canada, foreign nationals can qualify for a temporary resident permit for the following reasons:

1. business visitor—an individual who seeks to engage in international business activities without directly entering the Canadian labor market
2. worker class—an individual who seeks to hold temporary employment in Canada and has received a work permit
3. student class—an individual who seeks to study in Canada and has received a student permit
4. visitor class—an individual who seeks to stay in Canada for a temporary period as a visitor and promises not to work or study in Canada.

A foreign national with a temporary resident permit must leave Canada at the end of the temporary period unless an application is submitted and approved to extend the permit.

Non-U.S. citizens living in the United States can present special risks. Those with poor English language comprehension or unfamiliarity with surroundings and customs can encounter extra hazards. It can be difficult to obtain reliable information on an application if the proposed insured speaks no English. There is an additional concern about the proposed insured's understanding of what he is signing when a life insurance application is being taken out on his life, perhaps by a son or daughter. One should also be aware of the greater incidence of some diseases, such as hepatitis B, in the population of those born and raised in certain countries. Therefore, a proposed insured who has resided in one of those areas has a higher risk of having a disease endemic to that area.

Foreign Travel

Since foreign residence is a greater risk factor than foreign travel, it is important to distinguish between the two.

1. Travel of three months or less per year outside of the United States or Canada can be considered foreign travel.
2. Living abroad longer than six months a year should be classified as foreign residence.
3. A period of three to six months abroad per year defies clear definition but can be considered to represent an intermediate level of risk.

In addition to the destination, the stated purpose of foreign travel can be critical. A missionary or war correspondent represents a far different risk than the typical vacation or business traveler. Another area of concern is those cases that have the appearance of trip insurance, since these policies tend to be higher risk cases with short persistency. Engaging in aviation or dangerous sports abroad compounds the overall risk.

To assess the foreign travel risks of U.S. citizens, green card holders, Canadian citizens, and Canadian landed immigrants, it helps to review key information sources to determine the positive (low risk) factors of foreign travel and the negative (high risk) ones.

Underwriting Foreign Risk

Key information sources include:

1. application: place of birth, type of visa, address/residence, foreign travel questions
2. foreign travel questionnaire: citizenship; visa type; anticipated foreign travel; list of specific countries to be visited; and duration, dates, and purpose of travel
3. inspection reports, telephone interviews, separate letter describing travel
4. official documents: copy of passport, green card, U.S. visa, EAD, other U.S. government issued documents on residential status
5. APS medical records (e.g., inoculations for travel, illnesses acquired abroad, mention of frequent travel or foreign residence).

Positive factors include:

1. A short duration of travel is more favorable than a longer duration.
2. Travel is not immediate; it will occur 60 days or more in the future.
3. Only major urban areas will be visited.
4. The purpose for travel is either vacation/holiday, business, or visiting relatives.

5. The proposed insured is between the ages of 18-70 years old.
6. The application is for a permanent or level term plan.
7. The proposed insured is in good health.
8. Lodgings are at a hotel or a relative's home.
9. The country of destination is considered relatively safe.

Negative factors include:

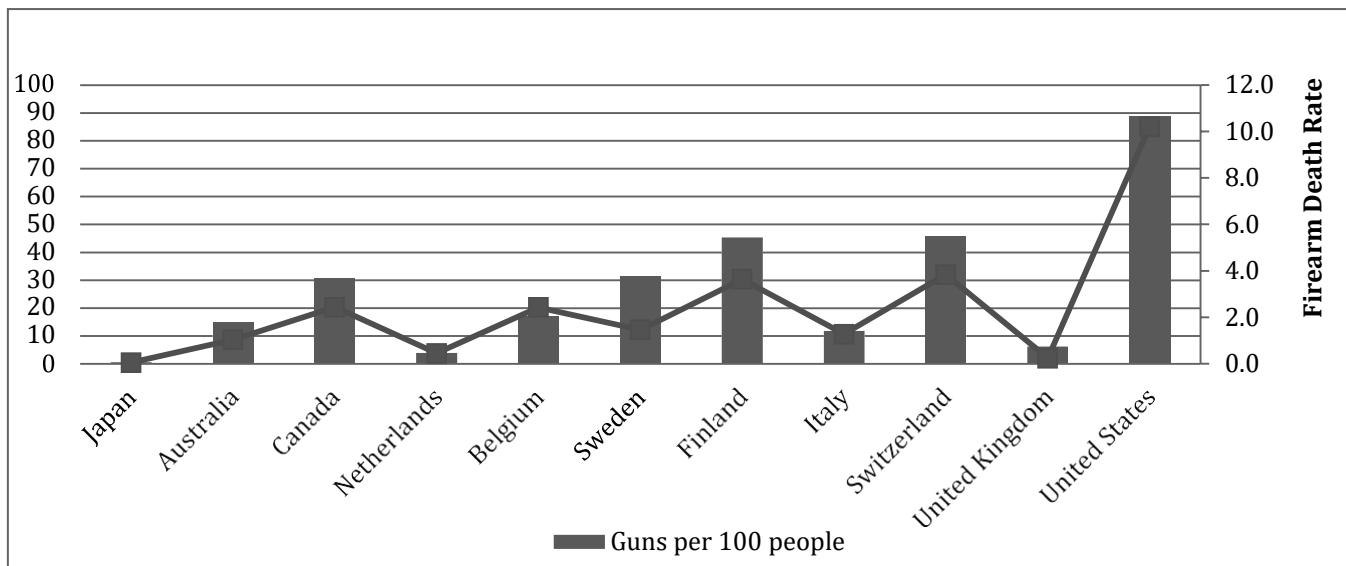
1. The longer the travel duration is, the higher the potential risk.
2. The anticipated travel is soon – within 60 days of application, or the proposed insured has already departed on the trip.
3. Travel is outside of urban areas to remote locations.
4. The purpose of travel is in the capacity of foreign journalist, politician, public figure, government official, missionary, or relief worker.
5. The proposed insured's age is less than 18 or greater than 70 years old.
6. The application is for an annual renewable term or a short-term plan.
7. The amount of coverage requested appears excessive.
8. Hazardous activities are engaged in abroad, such as mountain climbing, scuba diving, extreme sports, private aviation, or car racing.
9. The quality and type of lodging is uncertain.
10. The destination is to one or more high-risk countries.
11. The proposed insured has serious preexisting health concerns.
12. Minimum premium payment (e.g., one month) made or selected.

Dramatizing the concerns about medically impaired travelers is a study of overseas deaths of U.S. citizen travelers for years 1975 and 1984.¹⁰ Cardiovascular events (including myocardial infarctions and cerebrovascular accidents) accounted for 49% of these deaths. The study found the second leading cause of death among this traveling group to be injuries. A major component of these trauma deaths were motor vehicle accidents.

In 2005 a study focused on tourist injuries in the European Union. Approximately 300 million tourists visit the European Union countries annually. An estimated 3,800 of those tourists die from injuries each year, accounting for up to 30% of annual European Union tourist fatalities. Closer examination of those injury deaths reveals 2,900 caused by road traffic accidents, 340 by drowning, and 280 related to mountain activities. Overall tourist injury mortality was 4.6 times greater than resident injury mortality.¹¹

A review of injury mortality should not overlook the major factor that firearms represent in many societies. A 2013 research article in the American Journal of Medicine found a strong positive correlation between guns per capita and firearm-related mortality rate. As illustrated on the chart below, Japan with 0.6 guns per hundred people had a firearm death rate of only 0.06 per 100,000 people. The U.S., at the opposite extreme with 88.8 guns per hundred people - almost as many guns as people - had a firearm death rate of 10.20 per 100,000 or 170 times higher than Japan's firearm death rate. The U.S. had 33,594 total firearm deaths in year 2014 alone.

Figure 1. Gun Ownership and Firearm Fatalities.



Country	Guns per 100 people	Total firearm-related deaths per 100,000 population
Japan	0.6	0.06
Australia	15.0	1.04
Canada	30.8	2.44
Netherlands	3.9	0.46
Belgium	17.2	2.43
Sweden	31.6	1.47
Finland	45.3	3.64
Italy	11.9	1.28
Switzerland	45.7	3.84
United Kingdom	6.2	0.25
United States	88.8	10.20

Sources: The American Journal of Medicine, “Gun Ownership and Firearm-related Deaths,” October 2013.

Foreign Residence

For the purpose of risk assessment by U.S. or Canadian life insurers, foreign residence can be defined as living outside the United States or Canada for greater than six months per year. Also

included in this category is the foreign national, either living in his or her own country or in another country outside the United States and Canada.

Foreign residence matters more than travel because the individual is exposed for much longer periods of time to the risks of the country of residence. One cannot assume that American and Canadian mortality tables will apply to people living in foreign countries, especially long-term foreign residents. When underwriting a foreign resident, one is guided primarily by the overall risk category the insurance company's international underwriting guidelines assign to the specific country.

In addition to the considerations of that country's mortality rate and other factors such as those listed in the foreign travel section, there are a number of processing, administrative, and underwriting issues that can be concerns when assessing foreign residence cases.

Processing and administering insurance applications from abroad is challenging due to several issues specific to doing business in other countries. The insurance application and the exam must be completed in a language that both the proposed insured and the underwriter understand. The exams and lab tests should be completed at facilities approved by the insurance company and with providers who are accurate, professional, and reputable.

Obtaining physicians' statements (or medical records) from other countries has its difficulties:

1. If the medical records are in a foreign language, one must consider the cost and accuracy of using a translation service. Otherwise, the insurance company must consider whether it is cost-effective to have employees who can read medical records in the required foreign language.
2. Processing time and bureaucratic impediments increase when records must cross international borders.
3. There is a vast disparity in the accuracy and completeness of records from one country to another. Many of the attending physician statements from some countries consist of a simple one-paragraph statement in which the physician, who has seen the patient for years, asserts the proposed insured is in "perfect" health.

Legal issues must be considered with international underwriting. The company must be legally allowed to conduct business in the foreign countries in which it is operating. Laws vary by country so it is important to be familiar and in compliance with applicable laws. It is perilous for legal and other reasons to conduct business in a country that is not recognized diplomatically by the insurance company's country of domicile.

Another concern internationally is the extent of corruption and fraud in a country. In some places, it is easy to obtain fraudulent documents or to bribe an official to falsify records. This type of misrepresentation is especially difficult to detect for someone unfamiliar with the country or its language. The organization Transparency International publishes an annual report, "Corruption Perceptions Index," that ranks 182 countries according to its assessment of the level of corruption in those countries.

Premium payments on a foreign-held insurance policy should be made only in a designated, stable, hard currency. To avoid the possibilities of money laundering or frequent policy lapses, the insurer should know the source of premium payments and establish a reliable method of payment.

A final administrative consideration is potential insurance claims submitted from abroad. The distance, expense, unfamiliarity, legal issues, and language problems of conducting claims investigations in specific countries are concerns. There are some nations in the world in which it is extremely difficult, if not impossible, to carry out a proper claims investigation.

Underwriting Considerations

Once the underwriter knows the proposed insured's citizenship, visa, and expected foreign residence or travel plans, a reasonable assessment of foreign risk can be made. After gathering the pertinent details, the underwriter can weigh the positive versus the negative aspects of the case. A strong predominance of positive factors could indicate a low mortality risk, while too many negative factors could signal a high mortality risk.

Conclusion

There are some important conclusions to be drawn about underwriting international risks. Countries differ in many ways, so it cannot be assumed that what applies to one's home country will also apply abroad. The nation in which a person lives is vitally important. The life expectancy by country chart found in Appendix 2 illustrates that fact. Long-term residence abroad is much more significant than short-term foreign travel. The risk of most short-term foreign travel probably appears much greater than it actually is. Although short-term foreign travel is usually low risk, certain types of foreign travel are extremely dangerous. Travel to a combat zone, for example, is dangerous. The more informed and educated the underwriter is about the international scene, the more likely he or she will make good and rational decisions when faced with the foreign risk application. There is a growing need to distinguish the real risk of foreign travel and residence, from that which is merely imagined.

Appendix 1
(For student's information only; this material will not be tested.)

Valuable Sources for International Information

U.S. State Department Travel Warning – www.travel.state.gov

USCIS (US Visa Information) - www.uscis.gov

Foreign Affairs Canada – www.international.gc.ca

Australian Department of Foreign Affairs & Trade - www.dfat.gov.au/

British Foreign Office – www.fco.gov.uk

BBC Country Profiles – www.bbc.co.uk – then type “Country Profiles” in the Search box

News Services – www.reuters.com, www.un.org/News, www.bloomberg.com

CNN.Com International - <http://edition.cnn.com/>

CDC Health Information for International Travel - www.cdc.gov/travel

WHO (World Health Organization) - www.who.int

United Nations Human Development Reports - www.undp.org

CIA World Factbook - <https://www.cia.gov/library/publications/the-world-factbook/index.html>

Appendix 2
(For student's information only; this material will not be tested.)

Life Expectancy at Birth*

Rank	Country	Years	Rank	Country	Years
1	Monaco	89.40	31	Belgium	81.20
2	Japan	85.50	32	Slovenia	81.20
3	Singapore	85.50	33	Finland	81.10
4	Macau	84.60	34	Denmark	81.00
5	San Marino	83.40	35	Ireland	81.00
6	Hong Kong	83.10	36	Puerto Rico	81.00
7	Iceland	83.10	37	Germany	80.90
8	Andorra	82.90	38	Portugal	80.90
9	Guernsey	82.70	39	United Kingdom	80.90
10	Israel	82.70	40	Greece	80.80
11	Malta	82.70	41	Saint Pierre and Miquelon	80.70
12	Switzerland	82.70	42	Faroe Islands	80.60
13	Korea, South	82.50	43	Taiwan	80.40
14	Australia	82.40	44	Turks and Caicos Islands	80.10
15	Italy	82.40	45	United States	80.10
16	Luxembourg	82.40	46	Wallis and Futuna	80.00
17	Sweden	82.20	47	Saint Helena, Ascension, and Tristan da Cunha	79.80
18	Canada	82.00	48	Gibraltar	79.70
19	France	82.00	49	Virgin Islands	79.50
20	Jersey	82.00	50	Bahrain	79.10
21	Liechtenstein	82.00	51	Chile	79.10
22	Norway	82.00	52	Cyprus	79.00
23	Spain	81.80	53	Qatar	79.00
24	Austria	81.70	54	British Virgin Islands	78.90
25	Anguilla	81.60	55	Costa Rica	78.90
26	Bermuda	81.50	56	Cuba	78.90
27	Netherlands	81.50	57	Czechia	78.90
28	Cayman Islands	81.40	58	Panama	78.90
29	Isle of Man	81.40	59	United Arab Emirates	78.70
30	New Zealand	81.40	60	Albania	78.60

Rank	Country	Years	Rank	Country	Years
61	Curacao	78.60	94	Maldives	76.00
62	Sint Maarten	78.50	95	Mauritius	76.00
63	Kuwait	78.30	96	Macedonia	75.90
64	Saint Lucia	78.10	97	Oman	75.90
65	New Caledonia	78.00	98	Serbia	75.90
66	Lebanon	77.90	99	Tunisia	75.90
67	Poland	77.90	100	China	75.80
68	Paraguay	77.60	101	Saint Vincent and the Grenadines	75.80
69	Uruguay	77.60	102	Solomon Islands	75.80
70	Argentina	77.50	103	Barbados	75.70
71	Brunei	77.50	104	Saudi Arabia	75.70
72	French Polynesia	77.50	105	Northern Mariana Islands	75.60
73	Dominica	77.40	106	Romania	75.60
74	Slovakia	77.40	107	Malaysia	75.40
75	Morocco	77.30	108	West Bank	75.40
76	Algeria	77.20	109	Turkey	75.30
77	Aruba	77.10	110	Lithuania	75.20
78	Bosnia and Herzegovina	77.10	111	Seychelles	75.20
79	Ecuador	77.10	112	Syria	75.20
80	Sri Lanka	77.10	113	Armenia	75.10
81	Estonia	77.00	114	El Salvador	75.10
82	Antigua and Barbuda	76.90	115	Thailand	75.10
83	Libya	76.90	116	Jordan	75.00
84	Georgia	76.60	117	Iraq	74.90
85	Tonga	76.60	118	Latvia	74.90
86	Guam	76.40	119	Bulgaria	74.80
87	Croatia	76.30	120	Grenada	74.80
88	Hungary	76.30	121	Montserrat	74.80
89	Mexico	76.30	122	Belize	74.70
90	Colombia	76.20	123	Jamaica	74.50
91	Cook Islands	76.20	124	Gaza Strip	74.40
92	Saint Kitts and Nevis	76.20	125	Brazil	74.30
93	Venezuela	76.20	126	Uzbekistan	74.30

Rank	Country	Years	Rank	Country	Years
127	Iran	74.20	160	Mongolia	70.20
128	Peru	74.20	161	Bolivia	69.80
129	Samoa	74.20	162	Philippines	69.60
130	Vanuatu	74.00	163	India	69.10
131	American Samoa	73.90	164	Guyana	68.90
132	Vietnam	73.90	165	Timor-Leste	68.70
133	Bangladesh	73.70	166	Burma	68.60
134	Nicaragua	73.70	167	Pakistan	68.40
135	Marshall Islands	73.60	168	Tajikistan	68.40
136	Palau	73.60	169	Gabon	68.00
137	Micronesia, Federated States of	73.40	170	Nauru	67.80
138	Trinidad and Tobago	73.40	171	Papua New Guinea	67.50
139	Belarus	73.20	172	Ghana	67.40
140	Egypt	73.20	173	Tuvalu	67.20
141	Fiji	73.20	174	Kiribati	66.90
142	Indonesia	73.20	175	Madagascar	66.60
143	Azerbaijan	73.00	176	Yemen	66.20
144	Bahamas, The	72.90	177	Sudan	65.80
145	Greenland	72.90	178	Togo	65.80
146	Suriname	72.80	179	Sao Tome and Principe	65.70
147	Cabo Verde	72.70	180	Eritrea	65.60
148	Ukraine	72.40	181	Gambia, The	65.40
149	Guatemala	71.80	182	Cambodia	65.20
150	Kazakhstan	71.40	183	Equatorial Guinea	65.00
151	Dominican Republic	71.30	184	Laos	65.00
152	Honduras	71.30	185	Comoros	64.90
153	Moldova	71.30	186	Haiti	64.60
154	Nepal	71.30	187	Kenya	64.60
155	Russia	71.30	188	Rwanda	64.50
156	Kyrgyzstan	71.20	189	Namibia	64.40
157	Bhutan	71.10	190	South Africa	64.10
158	Korea, North	71.00	191	Djibouti	64.00
159	Turkmenistan	70.70	192	Botswana	63.80

Rank	Country	Years
193	Liberia	63.80
194	Mauritania	63.80
195	Western Sahara	63.80
196	Tanzania	63.10
197	Ethiopia	63.00
198	Benin	62.70
199	Senegal	62.50
200	Malawi	62.20
201	Guinea	62.10
202	Burkina Faso	61.80
203	Burundi	61.40
204	Guinea-Bissau	61.40
205	Zimbabwe	61.10
206	Mali	60.80
207	Angola	60.60
208	Congo, Republic of the	60.30
209	Cote d'Ivoire	60.10
210	Cameroon	59.40
211	Nigeria	59.30
212	Sierra Leone	59.00
213	Congo, Democratic Republic of the	58.10
214	Chad	57.50
215	Eswatini	57.20
216	Niger	56.30
217	Uganda	56.30
218	Mozambique	54.10
219	Central African Republic	53.30
220	Somalia	53.20
221	Lesotho	53.00
222	Zambia	53.00
223	Afghanistan	52.10

*Selections Taken from CIA – The World Factbook; estimates for 2018.
<https://www.cia.gov/library/publications/the-world-factbook/fields/355rank.html>

Maternal Mortality Rate (number of maternal deaths per 100,000 live births)

Country	Deaths	Country	Deaths
Poland	2.0	South Sudan	1,150
Norway	2.0	Chad	1,140
Italy	2.0	Sierra Leone	1,120
Belarus	2.0	Nigeria	917
United Arab Emirates	3.0	Central African Republic	829
Israel	3.0	Somalia	829
Greece	3.0	Mauritania	766

Australia 6.0

Canada 10.0

USA 19.0

Source: CIA World Fact book 2017.

Infant Mortality Rate (deaths before age one per 1,000 live births)

Country	Deaths	Country	Deaths
Slovenia	1.60	Afghanistan	108.5
Monaco	1.80	Somalia	93.0
Japan	2.00	South Sudan	90.4
Iceland	2.10	Central African Republic	84.3

USA 5.70 (55th) *Source: CIA World Fact book 2018 est.*

Intentional Homicide Rates (per 100,000 population)

Country	Murder Rates	Country	Murder Rates
El Salvador	61.8	Czech Republic	0.6
Jamaica	57.0	Cyprus	0.6
Honduras	41.7	China	0.6
Belize	37.9	Oman	0.5
South Africa	35.9	Norway	0.5
Bahamas	30.9	Switzerland	0.5
Brazil	30.5	United Arab Emirates	0.5
St. Lucia	29.6	Indonesia	0.4
Guatemala	26.1	Macao	0.3
Dominica	25.7	Luxembourg	0.3
Colombia	24.9	Hong Kong	0.3
Mexico	24.8	Singapore	0.2
Puerto Rico	18.5	Japan	0.2

USA: 5.3

Source: The World Bank 2017

El Salvador	61.8	Czech Republic	0.6
Jamaica	57.0	Cyprus	0.6
Honduras	41.7	China	0.6
Belize	37.9	Oman	0.5
South Africa	35.9	Norway	0.5
Bahamas	30.9	Switzerland	0.5
Brazil	30.5	United Arab Emirates	0.5

St. Lucia	29.6	Indonesia	0.4
Guatemala	26.1	Macao	0.3
Dominica	25.7	Luxembourg	0.3
Colombia	24.9	Hong Kong	0.3
Mexico	24.8	Singapore	0.2
Puerto Rico	18.5	Japan	0.2

USA: 5.3

Source: The World Bank 2017

Physician Density

The availability of physician care is an indicator of the quality of a country's healthcare system. The number of physicians per 1,000 population was provided by The World Factbook. The most recent year of data available is as of 2018.

<u>Physicians/1,000 population – top 5 countries</u>			<u>Physicians/1,000 population – bottom 5 countries</u>		
1	Cuba	8.19	194	Tanzania	0.04
2	Monaco	6.56	195	Liberia	0.04
3	San Marino	6.15	196	Sierra Leone	0.03
4	Sweden	5.40	197	Somalia	0.02
5	Austria	5.14	198	Malawi	0.02

The United States physician density is 2.59 per 1,000 population and ranks 56 of the 198 countries. (Cuba has 819 physicians per 100,000 people while Malawi has only 2 physicians per 100,000 people)

Source:

<https://www.cia.gov/library/publications/resources/the-world-factbook/fields/359.html>

Appendix 3
(For student's information only; this material will not be tested.)

HIV/AIDS - Adult Prevalence Rate.*

<u>Rank/Country</u>	<u>Prevalence Rate in %</u>
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1. Eswatini	27.3
2. Lesotho	23.6
3. South Africa	20.4
4. Botswana	20.3
5. Zimbabwe	12.7
6. Mozambique	12.6
7. Namibia	11.8
8. Zambia	11.3
9. Malawi	9.2
10. Equatorial Guinea	7.1
20. Rwanda	2.5
30. Barbados	1.5
40. Mauritius	1.3
50. Dominican Republic	0.9
57. Eritrea	0.7
63. Saint Lucia	0.6
73. Saint Kitts and Nevis	0.5
75. Colombia	0.4
79. Georgia	0.4
83. Malaysia	0.4
87. France	0.3
90. Laos	0.3
94. Peru	0.3
96. Vietnam	0.3
104. Libya	0.2
109. Nicaragua	0.2

* Selections Taken from CIA – The World Factbook 2016-2018 est

<https://www.cia.gov/library/publications/resources/the-world-factbook/fields/363rank.html>

Occupational Accident Fatality Rate (per 100,000 workers)

Country	Rate	Country	Rate
United Kingdom	0.8	Vietnam	27.0
Netherlands	1.5	Bangladesh	26.4
France	3.0	Egypt	24.0
Australia	3.2	Philippines	20.0
Japan	3.2	South Africa	19.2
Germany	3.6	Malaysia	18.3
United States	5.2	Mexico	15.9
Canada	6.4	U.A.E.	15.9
Italy	6.9	India	11.5
Poland	10.0	China	10.5

Source: Global Estimates of Accidents. Tampere University of Technology (Finland) 2005

2015: USA 3.4 4,836 total fatalities: 93% male, 7% female

Hours worked: male 57%, female 43%

Source: U.S. Bureau of Labor Statistics 2015

Appendix 4
(For student's information only; this material will not be tested.)

United States Immigration Classifications and Visa Categories.

Nonimmigrant Classifications and Visas	
Foreign Government Officials	
A-1	Ambassador, public minister, career, diplomatic or consular officer, and members of immediate family
A-2	Other foreign government official or employee, and members of immediate family
A-3	Attendant, servant, or personal employee of A-1 and A-2, and members of immediate family
Visitors	
B-1	Temporary visitor for business
B-2	Temporary visitor for pleasure
	Visa Waiver Program
Aliens in Transit	
C-1	Alien in transit directly through U.S.
C-1D	Combined transit and crewman visa
C-2	Alien in transit to UN headquarters district under Section 11.(3),(4), or (5) of the Headquarters Agreement
C-3	Foreign government official, members of immediate family, attendant, servant, or personal employee, in transit
C-4	Transit without Visa, see TWOV
Crewmen	
D-1	Crewmember departing on same vessel of arrival
D-2	Crewmember departing by means other than vessel of arrival
Treaty Traders and Treaty Investors	
E-1	Treaty Trader, spouse and children
E-2	Treaty Investor, spouse and children
E-2c	Long term foreign investor in the CNMI
E-3	Treaty traders and investors: Australian Free Trade Agreement
Eb5	Immigrant investor program
Academic Students	
F-1	Academic Student
F-2	Spouse or child of F-1

	For Foreign Medical Graduates (see individual categories H-1B, J-1, O-1, TN, E-2)
	Foreign Government Officials to International Organizations
G-1	Principal resident representative of recognized foreign member government to international organization, and members of immediate family
G-2	Other representative of recognized foreign member government to international organization, and members of immediate family
G-3	Representative of non-recognized or nonmember government to international organization, and members of immediate family
G-4	International organization officer or employee, and members of immediate family
G-5	Attendant, servant, or personal employee of G-1, G-2, G-3, G-4, or members of immediate family
	Temporary Workers
H-1B	Specialty Occupations, DOD workers, fashion models
H-1C	Nurses going to work for up to three years in health professional shortage areas
H-2A	Temporary Agricultural Worker
H-2B	Temporary worker: skilled and unskilled
H-3	Trainee
H-4	Spouse or child of H-1, H-2, H-3
	Foreign Media Representatives
I	Visas for foreign media representatives
	Exchange Visitors
J-1	Visas for exchange visitors
J-2	Spouse or child of J-1
	Fiancé(e) of U.S. Citizen
K-1	Fiancé(e)
K-2	Minor child of K-1
K-3	Spouse of a U.S. Citizen (LIFE Act)
K-4	Child of K-3 (LIFE Act)
	Intracompany Transferee
L-1A	Executive, managerial
L-1B	Specialized knowledge
L-2	Spouse or child of L-1
	Vocational and Language Students
M-1	Vocational student or other nonacademic student
M-2	Spouse or child of M-1

N-8	Parent of alien classified SK-3 "Special Immigrant"
N-9	Child of N-8, SK-1, SK-2, or SK-4 "Special Immigrant"
	North American Free Trade Agreement (NAFTA) – (see TN)
	<u>North Atlantic Treaty Organization (NATO)</u>
NATO-1	Principal Permanent Representative of Member State to NATO and resident members of official staff or immediate family
NATO-2	Other representatives of member State; Dependents of Member of a Force entering in accordance of NATO Status-of-Forces agreement; Members of such a Force if issued visas
NATO-3	Official clerical staff accompanying Representative of Member State to NATO or immediate family
NATO-4	Official of NATO other than those qualified as NATO-1 and immediate family
NATO-5	Expert other than NATO officials qualified under NATO-4, employed on behalf of NATO and immediate family
NATO-6	Member of civilian component who is either accompanying a Force entering in accordance with the provisions of the NATO Status-of-Forces agreement; attached to an Allied headquarters under the protocol on the Status of International Military headquarters set up pursuant to the North Atlantic Treaty; and their dependents
NATO-7	Servant or personal employee of NATO-1, NATO-2, NATO-3, NATO-4, NATO-5, NATO-6, or immediate family
	Workers with Extraordinary Abilities
O-1	Extraordinary ability in Sciences, Arts, Education, Business, or Athletics
O-2	Alien's (support) accompanying O-1
O-3	Spouse or child of O-1 or O-2
	Athletes and Entertainers
P-1	Individual or team athletes; Entertainment groups
P-2	Artists and entertainers in reciprocal Exchange programs
P-3	Artists and entertainers in culturally unique programs
P-4	Spouse or child of P-1, P-2, or P-3
	International Cultural Exchange Visitors
Q-1	International cultural exchange visitors
Q-2	Irish Peace Process Cultural and Training Program (Walsh Visas)
Q-3	Spouse or child of Q-2
	Religious Workers
R-1	Religious workers
R-2	Spouse or child of R-1

Witness or Informant	
S-5	Informant of criminal organization information
S-6	Informant of terrorism information
S-7	Spouse, child or parent of S-5 or S-6
Victims of a Severe Form of Trafficking in Persons	
T-1	Victim of a severe form of trafficking in persons
T-2	Spouse of T-1
T-3	Child of T-1
T-4	Parent of T-1 (if T-1 victim is under 21 years of age)
<i>North American Free Trade Agreement (NAFTA)</i>	
TN	Trade visas for Canadians and Mexicans
TD	Spouse or child accompanying TN
Transit Without Visa	
TWOV	Passenger
TWOV	Crew
Victims of Certain Crimes	
U-1	Victim of Certain Criminal Activity
U-2	Spouse of U-1
U-3	Child of U-1
U-4	Parent of U-1 (if U-1 victim is under 21 years of age)
Certain Second Preference Beneficiaries	
V-1	Spouse of an LPR who is the principal beneficiary of a family-based petition (Form I-130) which was filed prior to December 21, 2001, and has been pending for at least three years
V-2	Child of an LPR who is the principal beneficiary of a family-based visa petition (Form I-130) that was filed prior to December 21, 2001, and has been pending for at least three years
V-3	The derivative child of a V-1 or V-2
	Humanitarian Parole
TPS	Temporary Protected Status

For comprehensive US visa information, please see the US State Department's travel website on visas at <https://travel.state.gov/content/travel/en/us-visas.html>

Appendix 5
(For student's information only; this material will not be tested.)

Ranking of World Health Systems.*

<u>Rank/Country</u>	<u>Rank/Country</u>
1. France	104. Armenia
2. Italy	108. Syria
3. San Marino	111. Ecuador
4. Andorra	112. India
5. Malta	115. El Salvador
6. Singapore	120. Yemen
7. Spain	122. Pakistan
8. Oman	125. Brazil
9. Austria	129. Peru
10. Japan	130. Russia
14. Greece	134. Sudan
18. United Kingdom	138. Haiti
20. Switzerland	140. Kenya
22. Colombia	144. China
25. Germany	149. Uganda
28. Israel	153. Turkmenistan
30. Canada	155. Zimbabwe
33. Chile	160. Vietnam
37. United States	163. Mali
39. Cuba	165. Laos
46. Barbados	167. North Korea
49. Malaysia	169. Botswana
53. Jamaica	171. Equatorial Guinea
55. Albania	174. Cambodia
58. South Korea	175. South Africa
60. Philippines	177. Swaziland
63. Egypt	180. Ethiopia
65. Uruguay	181. Angola
67. Trinidad and Tobago	182. Zambia
71. Nicaragua	183. Lesotho
75. Argentina	184. Mozambique
78. Guatemala	185. Malawi
83. Jordan	186. Liberia
88. Bangladesh	187. Nigeria
92. Indonesia	188. Democratic Republic of the Congo
95. Panama	189. Central African Republic
99. Romania	190. Myanmar

* Selections Taken from WHO World Health Report in
2000 <http://www.photius.com/rankings/healthranks.html>

Review Questions - ALU 101, Chapter 13

1. In Canada, an immigrant who qualifies for legal permanent residence is a:
 1. convention refugee
 2. C1 visa holder
 3. landed immigrant
 4. foreign national
 2. All of the following are factors to consider when underwriting foreign risk EXCEPT:
 1. visa type
 2. driving record
 3. citizenship
 4. anticipated travel
 3. Preference for a U.S. immigrant visa is given to which of the following?
 - A. individuals engaged to U.S. citizens
 - B. workers with special occupations that are needed in the U.S.
 - C. parents of U.S. citizens
- Answer Options:
1. A only is correct.
 2. C only is correct.
 3. B and C only are correct.
 4. A, B, and C are correct.
4. List five factors that underwriters should consider when evaluating foreign residence and travel.
 5. Describe five positive and five negative risk factors that affect foreign travel underwriting.

6. Prolonged airplane travel increases the risk of:
 1. asthma
 2. pulmonary embolism
 3. dementia
 4. food poisoning
7. Favorable factors in underwriting applications involving foreign travel include all of the following EXCEPT:
 1. only major urban areas are visited during travel
 2. travel is not immediate
 3. the purpose of the travel is for vacation
 4. trips are of a long duration
8. What are the difficulties associated with obtaining medical records from a foreign country?
9. Describe the difference between foreign residence and foreign travel, and how the destination plays into an underwriting action.
10. Describe risks that can be associated with living abroad.

Answers and Sources of Review Questions

Review Question 1

Answer 3: landed immigrant – page 7.

Review Question 2

Answer 2: driving record – page 6.

Review Question 3

Answer 4: A, B, and C are correct – page 7.

Review Question 4

Refer to page 1.

Review Question 5

Refer to pages 9-10.

Review Question 6

Answer 2: pulmonary embolism – page 3.

Review Question 7

Answer 4: trips are of a long duration – pages 9-10.

Review Question 8

Refer to page 12.

Review Question 9

Refer to page 9.

Review Question 10

Refer to pages 3-6.

CHAPTER 14

INSURANCE REGULATION, BASIC COMPLIANCE, AND MIB

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INSURANCE REGULATION, BASIC COMPLIANCE, AND MIB

Introduction

The life insurance industry is heavily regulated to ensure both appropriate market conduct and financial solvency. The regulations regarding market conduct will have the most direct impact on the life insurance underwriter since market conduct regulations address discriminatory issues and privacy practices.

Maintaining the public's confidence that the proceeds of an insurance policy will be paid is one of the more important reasons that the government regulates the financial solvency of the life insurance industry. The decisions made today may not impact the final transaction, the payment of the death claim, until many years have passed. The regulation of the insurance industry helps protect the consumer from decisions against the general public interest. An example of such a concern would be the failure of life insurance companies during the junk bonds era. Many people lost their policy cash values when companies became insolvent in the early 1990s due to losses from investments in high risk bonds and policyholder requests for surrenders.

In Canada, the insurance industry is considered one of the four pillars of the financial sector along with banks, trust companies, and investment dealers. The industry is regulated by the state/provincial and federal governments of both the United States and Canada.

Insurance Regulation

An insurance company is subject to the laws and regulations of any state or province in which it does business. Uniformity is obtained through the efforts of associations in the United States and Canada—the National Association of Insurance Commissioners (NAIC) and the Canadian Life and Health Insurance Association (CLHIA), respectively. In addition, each state or province will have a commissioner, often known as the Office of the Superintendent of Insurance, responsible for the regulation and auditing of the companies. The Superintendents of the Canadian provinces and territories along with the federal government comprise the Canadian Council of Insurance Regulators (CCIR). They work to make recommendations on regulatory issues to promote consistency throughout the industry. The Uniform Life Insurance Act is an example of a model law developed by the CCIR. This model law provides for standard policy provisions in life and annuity contracts and has been adopted by all of the common law provinces with minor variations. Quebec has developed its own regulations, which are similar.

U.S. Regulation

In the United States, the insurance industry is regulated at both the federal and state levels. A few important court rulings shaped how the life insurance industry is regulated today. The first such court ruling was Paul vs. Virginia (1869). In this case, an agent questioned the authority of the states to require licensing of agents. The court ruled that insurance was not commerce and, therefore, not subject to federal regulations, which gave the states the authority to regulate the life insurance industry. In 1944, in the United States vs. South-Eastern Underwriters Association decision, the courts stated that insurance was, in fact, subject to federal regulation. Based on the

conflicting rulings, the federal government, in the McCarran–Ferguson Act of 1945, stated that if a state's regulation is adequate, then the state would be able to regulate the life insurance industry. If state regulation is felt to be inadequate or not in the public's interest, then Congress can enact regulatory legislation.¹

There are other federal regulations that affect the life insurance industry. The Employee Retirement Income Security Act of 1974 (ERISA) regulates how the life insurance industry handles public retirement plans. In addition, ERISA also regulates how individual companies provide benefits to their employees. This act also encompasses the Health Insurance Portability and Accountability Act of 1996 (HIPAA), which will be discussed later in the chapter.

The Fair Credit Reporting Act of 1970 has impacted how the insurance industry obtains the information necessary to underwrite life insurance applications. The Securities and Exchange Commission (SEC) along with the Financial Industry Regulatory Authority (FINRA-formerly the NASD) governs the sale and advertising of variable securities. FINRA Rule 2210 requires companies to file all variable life advertisements and sales literature prior to first use or publication. Advertisements must not reduce the importance of the life insurance portion of the policy when discussing the tax deferral and investment benefits.

In the United States, regulation of the life insurance industry does vary by state to some degree. Each state has its own insurance commissioner. A company wanting to do business in a particular state must comply with the regulations of that state. The NAIC works to promote uniformity in state regulation through the development of Model Laws. Model Laws are not actual laws, but they provide the states with working documents on which they can pattern their individual state's regulations.

An insurance company must have approval from the state insurance department prior to selling a product. Each state will have requirements that must be met to receive approval. The rates, applications, and policy contracts are just a few of the items that can be reviewed by the states. In some states, certain products can be marketed upon filing under a file-and-use program, which allows specific types of insurance to be marketed if they meet minimum guidelines for rates, rules, and forms.

In an effort to standardize the approval of life insurance, annuity, disability income, and long-term care products, the NAIC has created the Interstate Insurance Product Compact Model Law. This model law provides for uniform standards among the states. The NAIC is also working on a uniform electronic filing process model, System for Electronic Rate and Form Filing (SERFF), which helps to improve the efficiency of filing in multiple states. As of February 1, 2004, all 50 states, the District of Columbia, and Puerto Rico were able to accept filings through SERFF.²

In the U.S., a company is subject to financial audits by any state in which it is licensed to verify that the required policy reserves are being held. In addition to the auditing of financials, each state will also require the insurance company to belong to its guaranty association. For policyholders living in that state, a guaranty association helps to cover losses to some extent if a company has financial difficulties. For example, the limits for the Ohio Life and Health Insurance Guaranty

Association as of November 2017 are \$300,000 for death benefit and \$100,000 for cash surrender values.³

The NAIC's Financial Regulation Standards and Accreditation Program is designed to review the solvency regulation of the states. It works to monitor the states solvency laws and examination process. The program has overseen the adoption of laws and regulations in all 50 states and the District of Columbia to bring them in compliance with the NAIC standards.⁴ The NAIC is divided into four zones. Each zone is responsible for auditing companies domiciled in its area. If a company's premium in a particular state outside of its zone is large enough, that zone can send an examiner during an audit.

Canadian Regulation

Unlike companies in the United States, life insurance companies in Canada can be regulated at either the federal or provincial level. The Insurance Companies Act is the primary legislation, which governs insurance companies and fraternal benefit societies in Canada.

Currently over 90% of companies are regulated by the Canadian federal government. The provinces reserve the right to regulate; however, most accept the federal regulations. The province of Quebec is regulated by the Quebec civil code that came into effect in 1999.

The Office of the Superintendent of Financial Institutions (OSFI) is responsible for the supervision of the company's financial condition and general compliance. OSFI measures the financial condition of life insurance companies by comparing the total capital of the company to the minimum continuing capital and surplus requirements (MCCSR). The MCCSR determines the amount of capital a company must have on its balance sheet. This capital is in addition to the policyholder reserves. The purpose of the capital requirement is to ensure the company is financially stable in the event of unexpected experience, such as larger than expected claims or asset defaults. The MCCSR ratio looks at the ratio of the company's total capital to the MCCSR. If a company's ratio falls below 120%, the company must submit a plan to detail how additional capital will be obtained.

Assuris (formerly known as the Canadian Life and Health Insurance Compensation Corporation or Comp Corp) is similar to the Guaranty Associations of the United States. Assuris is operated by CLHIA and helps provide uniformity and guidelines in the development of regulations. Assuris was established to provide policyholders in Canada with protection against a loss of benefits if a company were to become insolvent. Assuris guarantees benefits up to established maximum benefit levels. The current maximum for individual death benefit as of November 2017 is \$200,000 or 85% of promised death benefit and \$60,000 or 85% of the savings/cash surrender value of policies.⁵

The financial condition of most life insurance companies in Canada is regulated by the Federal Government OSFI and inspected for soundness and financial safety. The Inspector General of Financial Institutions reviews those companies doing business in Quebec. Provincial governments will regulate agents' conduct and licensing along with contractual matters. They also handle reviews of complaints.

Basic Compliance

Illustrations

Those who have been around the life insurance industry for a few years will remember the vanishing premium policy. This policy type projected cash values to levels at which the owner would no longer be required to pay premiums. A drop in interest rates left many owners with policies that would lapse unless additional premium payments were made. As a result, the NAIC developed the Model Law on Illustrations. While this model does not prohibit the sale of vanishing premium policies, it does provide for disclosures during the sale. The purpose of the Model Law on Illustrations is to provide standards to be followed to protect proposed insureds. The standardized format promotes education through the use of disclosures and allows for side-by-side comparisons. At this time, the Model Law on Illustrations does not apply to variable business, group contracts, credit life insurance, or benefits below \$10,000. The Model Law on Illustrations has been adopted, with some variations, in the majority of states and required in all states by some companies. The Model Law requires that the illustration include the following information:

1. name of insurer
2. name and business address of the producer
3. name, age, and sex of the proposed insured
4. underwriting or rating classification
5. generic name of the policy, company product name (if different), and form number
6. initial death benefit
7. dividend option election or application of non-guaranteed elements.

The CLHIA also approved Guideline No. 6 or Guideline for Life Insurance Illustrations in 1996, which was later amended in 1999 and 2005. CLHIA G6 incorporates two of the eight components of the consumer code of ethics “to advertise products and services clearly and straightforwardly, and to avoid practices that might mislead or deceive, to ensure that illustrations of prices, values and benefits are clear and fair, and contain appropriate disclosure of amounts that are not guaranteed.”⁶ Similar to the NAIC model law, the G6 sets standards for use in preparing life insurance illustrations and informing the insured or proposed insured about the features of the policy. The illustration must be in consumer-friendly terminology and understandable by a reasonable consumer. The illustration should include the following information:

1. date the illustration was prepared
2. name of the person for whom it was prepared
3. name of the insurer
4. producer’s name - for proposed insurance illustrations
5. age, gender, rate basis (e.g., standard, preferred, rated)
6. page number with total number of pages shown on each page
7. guaranteed vs. non-guaranteed values or features clearly stated

8. those factors that could influence the results for illustrated amounts not guaranteed and at least two scenarios of illustrated results
9. the earliest period that cash surrender values and/or policy dividends would be available.

Replacements

Another practice that has been under scrutiny is the replacement of in force life insurance policies. *Churning* is the replacement of the same company's policies while *twisting* describes the replacement of policies of another company, both done to increase a producer's commissions with limited, if any, benefit to the insured.

Of course, a replacement can be in the insured's best interest due to reduced insurance costs, better rate classification, or additional policy benefits not previously available. More often, however, a replacement will have higher insurance costs due to current age or change in health. In addition, in most states the contestable and suicide periods will start anew and the contract will have new commission/policy expenses.

United States Replacement Law

As stated earlier, NAIC Model Laws over the years have helped to create uniformity within the insurance industry in the United States. Some of these laws were developed in response to abuses that were occurring within the insurance industry. One such Model Law is the NAIC Model Replacement Regulation, which defines a replacement as "a transaction in which a new policy or contract is to be purchased, and it is known or should be known to the proposing producer, or to the insurer if there is no producer, that by reason of the transaction, an existing policy or contract has been or is to be:

1. lapsed, forfeited, surrendered, or partially surrendered, assigned to the replacing insurer, or otherwise terminated
2. converted to reduced paid-up insurance, continued as extended term insurance, or otherwise reduced in value by the use of nonforfeiture benefits or other policy values
3. amended so as to effect either a reduction in benefits or in the term for which coverage would otherwise remain in force or for which benefits would be paid
4. reissued with any reduction in cash value
5. used in a financed purchase."⁷

In many states, the following are exempt from replacement regulations: credit life insurance, group life or annuities, replacement under a binding or conditional receipt, contractual change or conversion privilege, policies or contracts used with a pension, profit-sharing, or other plan that would qualify for tax deductibility of premium, non-convertible term coverage that will expire in five years, a policy paid by an employer or association, and structured settlements.

The Model Replacement Regulation requires the producer to have the applicant sign a statement as to whether a replacement of a life policy or annuity is involved. The agent is also required to sign as to his/her knowledge of replacement. If a replacement is involved, the agent must have the applicant read and sign a notice of replacement. A copy of this notice along with all sales literature

used in the sale must be given to the applicant. A form is required that lists all existing life insurance and annuities. A copy of the forms and sales material should be submitted along with the application.

In addition to the states' requirements, FINRA provides additional requirements to review the suitability of a replacement. The replacing insurance company must notify the existing insurer of a possible replacement. To this notice the replacing company will attach copies of the replacement forms and illustration with policy summaries. One of the first states to adopt this model law with some changes was New York. As of December 2015, 42 states and Puerto Rico have approved in some form the most current of the Model Replacement Law (2000).

Canadian Replacement Law

In Canada, the replacement regulations are similar to those in the United States and are covered under the provincial insurance acts. The definition of a replacement of a life insurance contract is "a transaction in which life insurance is to be purchased in a single contract or in more than one related contract by a person from an insurer and, as a consequence of the transaction, any existing contracts of life insurance have been or are to be:

1. rescinded, lapsed, or surrendered
2. changed to paid up insurance or continued as extended term insurance, or under automatic premium loan
3. changed in any other manner to effect a reduction of benefits in a contract of life insurance
4. changed so that cash values in excess of 50% of the tabular cash value of any contract of life insurance are released
5. subjected to substantial borrowing of any policy loan values whether in a single loan or under a schedule of borrowing over a period of time whereby an amount in excess of 50% of the tabular cash value is borrowed on one or more contracts of life insurance."⁸

Exemptions include execution of a contractual conversion privilege and a contract that is replaced by an annuity or by group insurance.

The agent is expected to make every reasonable effort to maintain the existing policy if replacement could be detrimental to the policyowner or to have the existing policy amended or changed to another contract by the same insurer. The agent must obtain a signed statement with every application attesting to whether or not replacement is intended. If a replacement is intended, the following procedures must be followed:

1. Before taking a new application, the agent should present and review a completed disclosure statement and obtain the applicant's signature attesting to receipt of the disclosure.
2. Upon taking an application where replacement is intended, every agent must, within three working days of the application, forward to every insurer whose contract is intended to be replaced a fully completed copy of the disclosure statement that was presented and signed by the applicant and provide to every insurer that has been requested to issue a new

contract a fully completed copy of the disclosure along with a copy of all written proposals presented to the applicant.

3. The agent must deliver the new life insurance contract(s) as soon as practical.

The life insurance company is responsible for verifying that the agent has complied with the requirements of this regulation, maintaining copies of all material that was received from the producer, and issuing all new contracts as soon as possible. In addition, a life insurance company must provide the agent who is replacing its contracts with the information necessary to complete the disclosure form. An applicant can withdraw his application for life insurance within 20 days and receive a complete refund of premium deposit or payment, unless the application is for a single premium contract. The return on a single premium contract will depend on the stated rate of interest or a stated group of assets or both. In that case, the refund shall be adjusted to reflect the change in the capital value of the contract.⁹

In Quebec, the replacement regulation does not require the completion of the disclosure form; however, the agent must notify the proposed insured in written detail of the advantages and disadvantages of the replacement. The agent must also notify the proposed insurer in writing of the intent to replace an existing contract, the reasons for the replacement, and descriptions of the insurance contracts. The proposed insured and existing company must receive a copy of this notice.

In Saskatchewan, as a result of the privacy regulation, an applicant can decide not to share the information required by signing a waiver form.

Privacy – United States

Privacy is a growing concern within the life insurance industry. Privacy concerns not only relate to disclosure but also to reporting, requesting, and accepting money during the course of business.

The Health Insurance Portability and Accountability Act of 1996 (HIPAA), while not specific to the life insurance industry, has impacted the process of obtaining attending physicians' reports. Effective April 14, 2003, HIPAA required insurers to redesign authorization forms to include all of the following:

1. a description of the information to be used or disclosed
2. the name of the covered entity, or class of entities or persons, authorized to use or disclose the Protected Health Information (PHI)
3. the name of recipient of the use or disclosure
4. an expiration date and time period or event
5. a description of each purpose of the requested use or disclosure
6. a signature and date
7. additional required statements:
 - a. the right to revoke the authorization in writing
 - b. the ability or inability to condition treatment, payment, enrollment, or eligibility for benefits on the authorization

- c. whether information disclosed pursuant to the authorization is subject to redisclosure and no longer protected by federal privacy laws.

HIPAA regulates any information collected including demographic information that could be individually identifiable health information, such as information that:

1. relates to an individual's physical and mental health
2. is a provision of health care to an individual
3. pertains to the payment of health care to an individual
4. provides the ability to identify the individual
5. is created or received by a covered entity
6. identifies an individual
7. it is reasonable to believe that the individual could be identified by the information provided.

Also, as part of HIPAA, health (but not life) insurance companies are required to designate privacy officers, provide employees with privacy training, and establish business agreements with those with whom the company does business.

The Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009 strengthened HIPAA through expanded notification requirements and penalties for failing to comply. The Act expands notification requirements in the event of a breach of information to records providers and non-HIPAA business associates. Possible penalties have increased to \$1.5 million dollars, strengthening the enforcement of the notification procedures.

Privacy concerns are responsible for many of the regulations that will affect an underwriter during his career. One of the first to have an impact was the Fair Credit Reporting Act of 1970 (FCRA), which became effective April 25, 1971. The FCRA was designed to protect consumers and to ensure accuracy of consumer reports. Information from consumer reporting agencies (CRA) can include credit history, medical conditions, driving records, criminal records, and hazardous sports. The FCRA defines medical information as "information or data, whether oral or recorded, in any form or medium, created by or derived from a health care provider or the consumer, that relates to the past, present, or future physical, mental, or behavioral health or condition of an individual...."¹⁰ A credit bureau is an example of a CRA. Consumer reports have limited permissible purposes and one such purpose is using the information in the underwriting of insurance.

Amendments to the FCRA, which began in September of 1997, provide for increased obligations of United States insurance companies regarding usage of consumer reports. Insurance company must obtain authorization prior to requesting information from a consumer reporting agency. Most life insurance applications will include this authorization above the applicant's signature.

If an adverse action is taken based on the information obtained in a consumer report, the insurance company must provide the name, address, and telephone number of the consumer reporting agency in its adverse action notice. An adverse action as defined by the Federal Trade

Commission is “a denial or cancellation of, an increase in any charge for, or a reduction or other adverse or unfavorable change in terms of coverage or amount of, any insurance, existing or applied for, in connection with the underwriting of insurance.”¹¹ The adverse action notice must provide a statement that the consumer reporting agency did not make the adverse decision and would not be able to provide the specific reason for the adverse action. The notice must also provide information regarding the individual’s right to dispute the accuracy of the information disclosed in the consumer report and ability to get a free consumer report within 60 days.

This notice is not required to be in writing, but most companies will provide the consumer with a letter. A notice should be made even if the information from the consumer reporting agency was only a part of the decision to rate or decline the application.

The Fair and Accurate Credit Transactions Act of 2003 (FACTA) provided additional provisions to FCRA regarding identity theft, consumer access to credit information, limits on the use and sharing of medical information in the financial system, and financial literacy and education improvement. Of note, this federal act included a permanent state law preemption prohibiting the states from enacting laws contrary to the FCRA.

Another piece of legislation that is having an impact on the insurance industry is the Gramm-Leach-Bliley Act (GLB) that was enacted by Congress on November 12, 1999 and enforced on July 1, 2001. The GLB requires financial institutions, which includes insurance companies, to establish privacy policies to protect the security and confidentiality of the non-public personal information of its customers. Non-public personal information as defined by GLB is personally identifiable financial information that:

1. was provided by a consumer to a financial institution
2. resulted from any transaction with the consumer or any service performed for the consumer
3. was otherwise obtained by the financial institution.

Non-public personal information includes social security numbers, addresses, health information, driving records, and financial assets, which almost always would be obtained during the underwriting process.

Privacy policies, in addition to insuring the security and confidentiality of the records, should be established to protect the unauthorized use or disclosure of the information. GLB requires companies to inform a customer at the beginning of a relationship (i.e., issuance of a contract) of its privacy policy and, at a minimum, annually thereafter. Enforcement of privacy regulations can be by either the federal or state authorities. GLB prohibits a company from disclosing non-public personal information to a nonaffiliated third party without first disclosing to the customer that the information will be disclosed and explaining to the customer how they can direct that the information not be disclosed. In response to the GLB Act, the NAIC drafted a model law, Privacy of Consumer Financial and Health Information Regulation, to help clarify many of the rules as it relates to insurance companies.

Privacy – Canada

For most of the Canadian provinces, privacy laws fall under the Personal Information Protection and Electronic Documents Act (PIPEDA) and the Privacy Act. Some provinces such as British Columbia, Alberta, and Quebec have enacted their own privacy legislation, but it is very similar in content and intent to the PIPEDA legislation.

PIPEDA, which took effect beginning in 2001 and was fully in effect January 1, 2004, places privacy restrictions on the private sector. PIPEDA requires organizations to obtain an individual's consent prior to the collection, use, or disclosure of an individual's personal information. By definition in the Act: "Personal information includes any factual or subjective information, recorded or not, about an identifiable individual."¹² This includes information in any form such as:

1. age, name, weight, height, address
2. medical records
3. ID numbers, income, ethnic origin, or blood type
4. marital status, religion, and education.

The Act was in part based on the Canadian Standards Association and its ten principles:

1. accountability – A company and its employees are responsible for the information under its control.
2. identifying purposes – The reason for collection of personal information must be identified.
3. consent – Individuals must understand and consent to the collection, use, and disclosure of personal information.
4. limiting collection – A company can only collect information that it truly needs for the purposes stated.
5. limiting use, disclosure, and retention – Information can only be used for reasons stated in disclosure forms, it cannot be disclosed to anyone not identified in disclosure forms, and it only can be retained for as long as it is required.
6. accuracy – Personal information must be complete, accurate, and up-to-date.
7. safeguards – Personal information must be safeguarded (e.g. locking computer terminals if away from desk).
8. openness – Policies and practices must be available to individuals upon request.
9. individual access – Individuals can view their files, with some limitations.
10. recourse – The company is required to investigate and respond to all inquiries and complaints.

In June of 2015, the Canadian Parliament amended PIPEDA with the Canada Digital Privacy Act of 2015 (DPA) (aka Senate Bill S-4). The DPA will be enacted by the end of 2017, and the key provisions of the Act are as follows:

1. graduated consent standard, which requires forms to be understood by an individual to whom the consent is directed

2. introduces additional exceptions to consent/knowledge requirements when information is used in the normal course of business transactions
3. introduces new mandatory data breach notification requirements
4. introduces expansion of the Business Contact exemption excluded from PIPEDA
5. enhances the powers of the Canadian Privacy Commissioner.

Further, information in the file must be made available upon request. If the information is incorrect or not authorized, the individual has the right to request the information be deleted. The DPA also provides requirements as to how information should be stored, how it can be used, and how information can be disclosed. Disclosure of this information can only be made upon the consent of the person covered, for a specific reason, and within a set time frame. Increased penalties of up to \$100,000 and cyber related risks such as breach notifications are further defined in the DPA.

The Consumer Reporting Act covers how consumer reports can be used by insurance companies in underwriting and claims. The Consumer Reporting Act contains limitations as to what can be included in the reports and how the information can be used. The Act sets standards for authorization to obtain and disclose information. It states that the authorization must be “set forth in type not less than ten point in size above the signature,”¹³ and that the user of the information must inform the person of an adverse action.

Additional Regulations

USA PATRIOT Act

As a result of the events of September 11, 2001, several federal regulations were put in place. The Uniting and Strengthening America by Providing Appropriate Tools Required to Intercept and Obstruct Terrorism Act of 2001 or USA PATRIOT Act is intended to help combat terrorism through increased scrutiny of financial transactions. It was signed into law October 26, 2001. A part of the USA PATRIOT Act is the Money Laundering Abatement and Financial Anti-Terrorism Act of 2001 (MLAA), which extended the previous Bank Secrecy Act to cover insurance companies.

The USA PATRIOT Act requires financial institutions to set up anti-money laundering programs and put into place procedures for training and auditing the program. In a life insurance environment, money laundering can involve taking money that was generated illegally, using it to purchase insurance, and later re-acquiring the money, now legitimized, through policy loans. It can also be thought of as using clean money to finance terrorism. By putting money into legitimate business, it is blended in and then reintroduced into the economy as clean money. Companies are required to file suspicious activity reports (SARs) with the Financial Crimes Enforcement Network (FinCEN) for all suspicious financial transactions of \$5,000 or more. FinCEN consists of 21 U.S. regulatory and law enforcement agencies that work to support law enforcement and provide inter-agency cooperation.

Examples of suspicious activities that an underwriter might see are:

1. a non-scheduled payment over \$5,000 made by cash, cashier's check, or money order
2. large payments that would exceed the 7702 or modified endowment contract (MEC) guidelines, requiring a refund of the premium
3. life insurance applications with foreign ownership or proposed insureds without appropriate documentation allowing them to reside in the United States
4. a request for a free look or cancellation with the owner residing outside of the U.S.

These are just a few of the possible situations an underwriter might see. Many more could occur during policy administration with payments, loans, or surrenders, for example.

When some provisions of the USA PATRIOT Act expired in 2015, the USA Freedom Act of 2015 was signed into law. The Act extended the provisions until 2019 and also limited the amount of information that could be obtained. In addition, it provided for changes in reporting government requests for information to the public.

In addition to FinCEN, the Office of Foreign Assets Control (OFAC) is part of the United States Treasury that enforces economic sanctions and embargo programs. OFAC does not allow transactions with specially designated nationals (SDN). Examples of SDN that might be seen during underwriting would be proposed insureds, owners, or beneficiaries living in certain countries such as Cuba. MIB, Inc. has established coding to help insurance companies check for proposed insureds that have been designated as SDNs. Insurance companies are blocked from issuing policies on those designated as SDNs, and OFAC supersedes all insurance regulations, both federal and state, under the President's exercise of foreign affairs and national emergency powers. Each company should have procedures for handling these regulations.

Customer Identification Program

The Customer Identification Program (CIP) pertains to the sale of variable products in the United States. CIP requires that the identity of the customer be verified and documented when a new account is opened. In addition, it requires that the sale of variable products must be suitable for the proposed insured, since the cash value and death benefit can fluctuate with the performance of the accounts chosen. The customer should be able to afford the product, be able to assume the investment risk, and understand market implications. In addition to review by the agent, the broker dealer is responsible for suitability reviews of all sales. FINRA Rule 2310 adds that the representative must demonstrate "grounds for believing that the recommendation is suitable for such customer upon the basis of facts...disclosed by such customer as to his security holdings and as to his financial situation and needs...."¹⁴ The sale of variable products to the elderly has recently been in the spotlight, and model regulations are being developed to address this issue.

Additional Regulations

The American Council of Life Insurance (ACLI) created the Insurance Marketplace Standard Association (IMSA) to promote ethical market conduct of life insurance companies. Life

insurance companies can submit to an examination to gain membership into IMSA. IMSA can assist companies in developing compliance programs. Member companies can use their IMSA membership in advertising. Strong voluntary participation in IMSA can help protect the industry against future market conduct legislation. In October of 2010 IMSA became The Compliance and Ethics Forum for Life Insurers (CEFLI).

Regulation has been proposed or adopted that will have an impact on the insurance industry. The Sarbanes-Oxley Act of 2002 was designed to protect shareholders from inaccurate financial reporting by corporations. The Act is limited to companies that are publicly traded and is comprised of 11 titles whose purpose is to develop and enhance financial reporting of corporations. The NAIC has responded to the Sarbanes-Oxley Act with the proposed Model Regulation Requiring Annual Audited Financial Reports. The NAIC regulation would require the annual examination of a company's financial statements by certified public accountants. The NAIC model regulation would cover all insurance companies even if they are not publicly traded.

The Interstate Insurance Product Regulation Compact was developed to provide uniform product filing standards. As of November 2017, 43 states and Puerto Rico have enacted this regulation and an additional three states are considering adoption.

The FTC created the Do Not Call registry as part of the Telemarketing Sales Rule, which was effective in 2003. The Do Not Call registry requires telemarketers to "scrub" or compare their call lists with a list of individuals who have requested that they not be called by telemarketers. Insurance companies will still be allowed to complete inspections as the lists do not prohibit calls when there is a business relationship. However, agents who solicit business by telephone must ensure that their call lists do not have any numbers listed on the registry.

MIB Group, Inc. ("MIB")

Like laws, regulations, and insurance regulators, MIB has a widespread impact on the entire life insurance industry and its operations, as well as on the individuals who apply for life insurance coverage. Operating since 1902, MIB is a membership corporation, sometimes described as an "information exchange." MIB is owned by its member insurance companies and was once known as "Medical Information Bureau." Although MIB's official name changed in 1978 when it incorporated, it is still frequently identified as "Medical Information Bureau."

MIB operates as a "nationwide specialty consumer reporting agency" that is governed by the federal Fair Credit Reporting Act (FCRA). Under FCRA, MIB provides "consumer reports," but its reports are not considered *credit* reports because they are not used to evaluate credit risk. MIB's primary mission is to detect and deter fraud in the application process for life, health, disability income, critical illness, and long-term care insurance. MIB's "Checking Service" protects insurers from attempts to conceal, omit, or misrepresent information material to the sound and equitable underwriting of these types of individually underwritten insurance.

MIB is subject to a complex web of federal, state, provincial, and Canadian laws addressing the privacy of individually identifiable information (information that is associated with individuals) and imposing numerous consumer protections. In addition to FCRA, MIB is subject

to certain privacy and security obligations under HIPAA as a Business Associate of members providing health insurance and under PIPEDA in Canada.

Under MIB's bylaws, to be eligible for membership in MIB, the business entity must be organized as an insurance company conducting life or health business, duly licensed and in good standing with appropriate regulating authorities, have a medical director who is a qualified physician in good repute at its domicile, and follow specific rules governing the confidentiality and use of MIB information. MIB is composed of nearly 400 life and health companies throughout Canada and the United States.

To ensure consumer protection, MIB requires its members to provide a self-audit report on an annual basis and to allow an audit of pre-selected files every three years. When the audit findings are less than satisfactory, a follow-up audit is promptly scheduled to ensure that remedial action is taken. Under the MIB company visit program, MIB furnishes education and guidance regarding MIB rules and procedures and ensures compliance.

MIB Reports

MIB has very specific prerequisites for searching its "Checking Service" database. A basic requirement is that a member must have a current application for insurance and an authorization, signed by the proposed insured, expressly naming MIB as an information source. The authorization should elicit the proposed insured's affirmative consent to the insurer's search of MIB as well as his or her consent to report personal information to MIB. The member company is required to furnish each individual proposed insured with a Pre-Notice, describing MIB, its services, and the right to request and arrange disclosure in keeping with FCRA requirements. The notice includes contact information so that a consumer can obtain a copy of his or her MIB Consumer File, if any, or to seek a correction if they feel the information is inaccurate.

Only authorized medical, underwriting, and claims personnel of a member company can have access to MIB record information. When a member receives information through MIB, it must be held in such a manner that will maintain its confidential character. The information must not be released by a member to non-member companies, sales agents/insurance producers, credit or consumer reporting agencies, or governmental agencies without a court order or authorization from the consumer. MIB removes information reported by member insurance companies from a consumer's MIB file after seven years in order to comply with the prohibition in the FCRA against reporting obsolete information.

If an MIB Consumer File exists for an individual, the information is returned in coded form ("MIB codes") to the MIB member company (an "MIB report"). For decades, MIB codes have been protected by MIB and Members as a valuable trade secret. An underwriter compares the content of an MIB report with the information that the proposed insured supplied. If an inconsistency exists, depending on how significant, the underwriter may need to investigate further. The Guide to Investigation, included in the MIB Primer, is available to member companies and provides many detailed suggestions and guidelines on how to proceed in this situation.

If the attempt to reconcile an inconsistency proves futile, then the underwriter can contact the reporting company through MIB with a Request for Details. The original reporting company, in turn, contacts the requesting company with the information that triggered the coded report. The amount and content of information furnished in answer to a request for details is at the discretion of the reporting member. Making underwriting decisions on the sole basis of a reported code is expressly prohibited under the MIB General Rules. Underwriters must do the necessary research to find out the specifics of the condition that was reported.

Reporting Underwriting Information to MIB

Member companies have the responsibility of reporting to MIB a brief, coded report of conditions and findings significant to a proposed insured's mortality or morbidity developed during their underwriting. Members are authorized to make such reports to MIB under the terms of the MIB Authorization, which is bolstered by the Pre-Notice.

Reportable information includes those impairments listed in the MIB coding manual that are received from medical records, third party data sources, government records, or from the proposed insured during the application process. Over the years, the manual has been updated with new medical concerns, findings, and terminology. Among the most commonly reported conditions are build, hypertension, diabetes, and test results. Non-medical codes can alert the underwriter to possible overinsurance, criminal activity, adverse driving record, hazardous sports, and aviation activity. MIB members do not report their final underwriting decision to MIB.

In order to attain a more thorough understanding of MIB principles and procedures, MIB provides the MIB Primer, which includes General Rules, a Guide to Investigation, Internal Procedural Rules, and Group Rules and Reinsurance Rules.

Post-Notice

An MIB member must notify a proposed insured with what is referred to as a Post-Notice whenever the member received any information from MIB pertaining to the proposed insured, the information received from MIB resulted in further investigation of the proposed insured's insurability, and the application for insurance was rated or declined in whole or in part because of information obtained from that investigation. If a member makes an adverse underwriting decision requiring it to provide a Post-Notice, then the consumer is allowed to obtain an additional free disclosure of his or her MIB Consumer File in accordance with the NAIC Information and Privacy Protection Model Act, the FCRA, and other laws that require that insurers must explain the basis for any adverse decision.

Other MIB Services

In addition to the basic inquiry or Checking Service described above, a number of other MIB services assist with risk selection and offer protective value during the application process, as well as after issue is completed.

Plan-F (Follow-Up) Service provides follow-up reports when another member reports a code on the same individual after the initial inquiry. When this happens, a new report is automatically sent to the member who made the initial inquiry, alerting the underwriter to possible fraud or omission on the original application. Such an alert can lead a member to contest or rescind a contract when the contents of the follow-up report may have led to a different underwriting decision.

The *Insurance Activity Index* (IAI) tracks the dates of MIB inquiries and returns a report that identifies other members that have made an inquiry on an individual during the prior two years. This information alerts an underwriter to potential misrepresentation or anti-selection by highlighting application activity, which can reflect an attempt to over-insure or to avoid requirements by splitting coverage across several different companies.

The *Disability Insurance Record Service* (DIRS) is a shared database of individuals who have applied for disability income insurance. This service provides a report that identifies other members who may have underwritten disability income insurance on a proposed insured within the last five years.

By reducing the incidence of application fraud and misrepresentation, MIB enables more equitable pricing of insurance products by its member companies. This helps foster the public's confidence by providing assurance that the industry's products are sold in an honest marketplace. Exposure to fraud is an industry-wide problem, which requires an industry-wide-solution. That is precisely why the industry formed MIB and why the industry continues to support it today.

Conclusion

Changing regulations and public opinions will always impact underwriters by affecting the way they are able to obtain and use information to properly classify the proposed insured. Regulations can limit what they are able to request and what physicians are able to release. In the United States, there is discussion regarding a Federal Charter to help create more uniformity within the insurance industry. The NAIC has responded with the Alliance for Sound State Uniform Regulatory Efficiency (ASSURE) to maintain current state regulation and promote uniformity. Underwriters must be aware of the changing regulatory environment as it impacts risk assessment and the gathering of underwriting information.

Review Questions -- ALU 101, Chapter 14

1. The National Association of Insurance Commissioners (NAIC) works to promote uniformity in state regulation through the development of:
 1. audit guidelines
 2. model laws
 3. white papers
 4. surplus requirements
 2. In the U.S., a Health Insurance Portability and Accountability Act (HIPAA) authorization must include all of the following EXCEPT:
 1. an expiration date
 2. the purpose of disclosure
 3. the plan of insurance
 4. the signature of the proposed insured
 3. In the U.S., which of the following statements regarding life insurance regulation is/are correct?
 - A. Each state has its own insurance commissioner.
 - B. Approval from the federal insurance department is required prior to selling a life insurance product.
 - C. Variation by state is common.
- Answer Options:
1. A only is correct.
 2. A and C only are correct.
 3. B and C only are correct.
 4. A, B, and C are correct.
4. Compare and contrast guaranty associations and Assuris.
 5. Explain the importance of the MIB in fraud protection and how that benefits the consumer.

6. Information reported to the MIB includes which of the following?

- A. aviation activities
- B. medical conditions
- C. underwriting decision

Answer options:

- 1. A and B only are correct
- 2. A and C only are correct
- 3. B and C only are correct
- 4. A, B, and C are correct

7. In Canada, the organization responsible for supervising the financial condition of all life insurance companies is the:

- 1. National Association of Insurance Commissioners (NAIC)
- 2. Office of the Superintendent of Financial Institutions (OSFI)
- 3. Canadian Standards Association (CSA)
- 4. Insurance Marketplace Standard Association (IMSA)

8. How does the Employee Retirement Income Security Act (ERISA) of 1974 affect life insurance carriers?

9. Name at least three pieces of information the Health Insurance Portability and Accountability Act (HIPAA) considers identifiable health information.

10. The USA PATRIOT Act requires financial institutions (which includes insurers) to do what?

Answers and Sources of Review Questions

Review Question 1

Answer 2: model laws – page 2.

Review Question 2

Answer 3: the plan of insurance – page 7.

Review Question 3

Answer 2: A and C only are correct – page 2.

Review Question 4

Refer to pages 2-3.

Review Question 5

Refer to page 13.

Review Question 6

Answer 1: A and B only are correct – page 15.

Review Question 7

Answer 2: Office of the Superintendent of Financial Institutions (OSFI) – page 3.

Review Question 8

Refer to page 2.

Review Question 9

Refer to page 8.

Review Question 10

Refer to page 11.

CHAPTER 15

UNDERWRITING ALCOHOL AND SUBSTANCE USE DISORDERS

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Revised 2020

UNDERWRITING ALCOHOL AND SUBSTANCE USE DISORDERS

Introduction

“The use of chemicals to alter thinking and feeling is as old as humanity itself, and alcohol was probably one of the first substances used.”¹ Anthropological studies, archeological data, and historical records all document the pervasive use of alcohol and other psychoactive substances throughout the history of the world. The type of substances used depended on availability, cost, and ease of administration. These same influences affect the trends seen today.

The National Survey on Drug Use and Health (NSDUH) is sponsored annually by the Substance Abuse and Mental Health Services Administration (SAMHSA), a division of the Department of Health and Human Services (DHHS).² It is the primary source of statistical information on the use of illicit drugs, alcohol use, substance use disorders (SUDs) and mental health issues for those age 12 or older in the civilian, noninstitutionalized population of the United States. The 2016 NSDUH data are the most recent data available.

Overall, the survey found that an estimated 20.1 million people age 12 or older had a substance use disorder (SUD) related to their use of alcohol or illicit drugs in the past year, including 15.1 million people who had an alcohol use disorder and 7.4 million people who had an illicit drug use disorder. In 2016, 28.6 million people reported that they had used an illicit drug in the past 30 days (about 1 in 10 Americans overall). Compared to 2015, there has been a slight decrease in the overall numbers.

The purpose of this chapter is to provide an overview of the physiological and psychological effects of substance abuse and the associated mortality implications.

Definitions

In May 2013, the American Psychiatric Association (APA) published the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-V), which included significant changes to substance-related disorders and alcoholism.⁴ The DSM-V removed the distinction between “abuse” and “dependence” and integrated them into substance use disorder measured on a continuum from mild to severe.

Two groups of substance-related disorders are defined as:

1. substance use disorders
2. substance-induced disorders.

Substance use disorders are patterns of symptoms resulting from the use of a substance that the individual continues to take, despite experiencing problems as a result. Substance-induced

disorders include intoxication, withdrawal, and substance-induced mental disorders (e.g., depressive, psychotic, bipolar, anxiety, sleep, neurocognitive, sexual dysfunction, delirium).

The presence and severity of substance use disorders are determined using the following 11 criteria:

1. The substance is often taken in larger amounts or over a longer period than was intended.
2. There is a persistent desire or unsuccessful effort to cut down or control use.
3. A great deal of time is spent in activities necessary to obtain, use, or recover from the effects of the substance.
4. Craving or a strong desire or urge to use the substance is present.
5. Recurrent use, resulting in a failure to fulfill major role obligations at work, school, or home occurs.
6. Continued use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of the substance is present.
7. Important social, occupational, or recreational activities are given up or reduced because of use.
8. Recurrent use in situations in which it is physically hazardous occurs.
9. Use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the substance.
10. The presence of tolerance, as defined by either of the following: a need for markedly increased amounts of the substance to achieve intoxication or desired effect, or a markedly diminished effect with continued use of the same amount of the substance.
11. Occurrence of withdrawal, as manifested by either of the following: the characteristic withdrawal syndrome from the substance, or the substance, or closely related substance, is taken to relieve or avoid withdrawal symptoms.

The severity of the substance use disorder is based on the number of criteria met:

1. mild: the presence of 2-3 criteria
2. moderate: the presence of 4-5 criteria
3. severe: the presence of 6 or more criteria.

Alcohol Use Disorders

In 2010, the annual cost associated with alcohol use disorders in the United States was approximately \$249 billion.⁵ This included costs associated with treatment, productivity losses due to alcohol-related morbidity and mortality, and costs due to the effects of violence and risk-taking behavior. Binge drinking was responsible for 77% of these costs.⁶

A study recently published by the Centers for Disease Control and Prevention (CDC) reported that there were 88,000 alcohol-attributable deaths in the U.S. (27.9/100,000 population) and 2.5 million (831.6/100,000) years of potential life lost due to alcohol use.⁷ The National Institute on Alcohol Abuse and Alcoholism (NIAAA) reported that, in 2014, alcohol-impaired driving fatalities—defined as a fatality in a crash involving a driver or motorcycle operator with a blood alcohol concentration (BAC) of 0.08g/dL or greater—accounted for 9,967 deaths, or 31% of

overall driving fatalities.⁸ Alcohol-related deaths are the third leading cause of preventable deaths in the U.S., exceeded only by tobacco use and obesity. According to a study published in 2007 in *The Archives of General Psychiatry*, 30% of U.S. adults have experienced alcohol abuse or dependence, and fewer are getting treatment for alcohol use disorders than in the past.

Metabolism of Alcohol

Alcohol is a general term that refers to a family of organic chemicals with common properties. Members of this family include ethanol, methanol, and isopropanol. Beverage alcohol is ethanol, which occurs naturally as a fermentation product of sugars and grains. It is a central nervous system (CNS) depressant. The degree to which central nervous system function is impaired is directly proportional to the concentration of alcohol in the blood.

When alcohol is ingested, approximately one-fourth is absorbed in the stomach and three-fourths is absorbed in the small intestine, where it rapidly enters the bloodstream. Cell membranes are very permeable to alcohol, which explains its wide range of effects on the body. The degree of these effects depends on:

1. the amount of alcohol consumed
2. the concentration of alcohol in the drink
3. the speed of consumption
4. the presence or absence of food in the stomach
5. level of hydration
6. body type.

In general, alcohol is metabolized at a fairly consistent rate of approximately 0.5 ounce/hour. Ninety-five percent of alcohol is metabolized in the liver; the remainder is excreted through urine, breath, sweat, feces, and saliva.

Although alcohol is a powerful CNS depressant, it actually has a biphasic effect; that is, at low concentrations, alcohol stimulates some nerve cells. As alcohol concentration increases, these same cells become suppressed, which accounts for the changes in symptoms that are observed.

Alcohol has historically been thought to have a generalized, nonspecific effect on all nerve cells, i.e., inhibiting their activity by disturbing the structure of the membrane that surrounds each cell. However, researchers have shown that alcohol has specific and significant effects on the function of at least two types of neuronal receptors—GABA (gamma-aminobutyric acid) receptors and glutamate receptors, particularly the NMDA (N-methyl-D-aspartate) receptor.

Normally, these two systems work together to maintain the balance between the inhibitory and excitatory activity in the brain. Alcohol increases the inhibitory activity of GABA receptors, which is responsible for its sedative effects. With chronic use of alcohol, the GABA system eventually becomes dependent on alcohol to function. At this point, if alcohol is withdrawn, the cells become hyper-excitable, leading to irritability, insomnia, hypertension, tachycardia, hallucinations, and seizures.

Alcohol decreases the excitatory activity of the NMDA receptor, which is involved in memory formation, complex thinking, and neuronal excitability. This inhibition leads to the memory deficits, impaired judgment, and sedative effects of alcohol. When alcohol is withdrawn after chronic use, the NMDA receptor becomes excessively excited, which can result in seizure activity and hypoxic damage.

Dopamine is a neurotransmitter that is thought to be the primary chemical messenger in the reward centers of the brain, which promote feelings of pleasure. It is also known to trigger the rewarding effects of such highly addictive drugs as cocaine and amphetamines.⁹ Alcohol increases the release of dopamine, activating these reward centers and providing the sensations of pleasure; however, this activity occurs while the concentration of alcohol in the blood is rising. Because this sensation declines when alcohol levels in the blood decline, it can cause continued drinking in an attempt to reclaim the feeling.

Epidemiology and Prevalence

According to the 2016 NSDUH data, 136.7 million Americans aged 12 or older reported current use of alcohol, including 65.3 million who reported binge alcohol use in the past month and 16.3 million who reported heavy alcohol use in the past month. Binge alcohol use is defined as 5 or more drinks (for males) or 4 or more drinks (for females) on the same occasion on at least 1 day in the past 30 days.²

Alcohol is the most common psychoactive substance used by older adults and the most common substance used by older adults entering substance abuse treatment.¹¹ A recent study published in the journal, *Drug and Alcohol Dependence*, reviewed the NSDUH data over the last 10 years and found a rising prevalence in alcohol abuse disorders, particularly binge drinking, among those over age 50.¹² One explanation for this is the aging of the baby boomer generation (persons born between 1946 and 1964), which has higher reported rates of substance use compared to any generation preceding it. Older adults are particularly vulnerable to complications from alcohol use due to the physiological changes inherent with aging such as, altered ability to metabolize alcohol, increasing chronic disease burden, and concurrent medication use.¹³ Higher quantities of alcohol use by older adults have been associated with a higher risk of adverse outcomes, complications in the management of chronic disease, functional impairment, injuries, and increased mortality risk.¹⁴

Researchers have been studying the potential factors that put some individuals at risk for alcohol dependence. While no single factor accounts for the abuse of a substance, several have been identified that are associated with increased risk of abuse and dependence.

Scientists have shown that alterations in the metabolism of alcohol, particularly with the ALDH enzyme, are associated with an increased risk of dependence. Serotonin dysfunction has also repeatedly been implicated as a predisposing factor for alcohol abuse.

Numerous studies have found that rates of alcoholism are substantially higher in relatives of alcoholics, with children of alcoholics demonstrating four to five times the risk of developing the

disorder.¹⁵ Based on these studies, certain traits have been identified that occur in families and can predispose a child to the disease. However, these studies have also found that the basis for alcoholism is only partly genetic.

What has become increasingly apparent is the association between alcohol abuse and drug abuse and between substance abuse and mental health disorders. The NSDUH data indicate that 8.2 million adults in the U.S. have both a mental health and substance use disorder.² These findings have been corroborated by several other major studies.

Although there are large differences in an individual's risk for alcohol abuse, continued exposure to large enough quantities of alcohol over time causes changes in the brain that can produce dependence.¹⁷ If all other factors are removed, the risk of an individual becoming dependent on alcohol increases dramatically with the consumption of more than three to four drinks per day.¹⁸ Another consistent finding is that those who report that they drink to self-medicate (for example, to reduce anxiety or emotional stress) are at increased risk of dependence.

Alcohol abuse has been under-reported in the elderly population. A study conducted by the Administration on Aging suggests that the prevalence of alcohol disorders in individuals over age 65 ranges from 2% to 20%, and that it is largely unrecognized.¹⁹ With the increased incidence of alcohol use disorders in the baby boomer population and the sheer size of that cohort, the prevalence of abuse in those over age 65 is likely to rise significantly over the next several years.

Medical Consequences of Alcohol Abuse and Dependence

The high permeability of cell membranes to alcohol helps account for the wide range of systemic effects seen as a result of chronic alcohol use. Some of the most affected systems include the liver, the gastrointestinal (GI) tract, and the cardiovascular, nervous, and immune systems.

Gastrointestinal Tract

Malnutrition is a common result of chronic alcohol intake and occurs for several reasons. The effects of alcohol on the CNS can cause appetite suppression. Alcoholics suffer from inflammation of the tongue and mouth, dental caries, and periodontitis, all of which further impair appetite. Malnutrition leads to vitamin deficiencies, which further promote oral inflammation.

Alcohol causes decreased peristalsis and decreased esophageal sphincter tone, which leads to reflux esophagitis. Chronic vomiting can lead to Mallory-Weiss syndrome, which is characterized by esophageal bleeding caused by a mucosal tear in the esophagus, as a result of repeated episodes of forceful vomiting or retching. Alcohol also decreases gastric emptying and increases gastric secretion, resulting in gastritis and gastrointestinal bleeding. Alcohol consumption impairs enzyme activity and absorption in the small intestine, including the absorption of folate, vitamin B12, thiamine, vitamin A, amino acids, and lipids. The most common cause of chronic pancreatitis is alcohol abuse and the risk of developing that disorder increases significantly with ingestion of 35 drinks or more per week.

Liver

The most common complications in the liver include:

1. hepatic steatosis, which occurs in 90% of heavy drinkers
2. alcoholic hepatitis (10-35%)
3. cirrhosis (10-20%).

There are several mechanisms that cause damage to the liver:

1. the production of acetaldehyde, free radicals, and cytokines as alcohol is metabolized
2. the enhanced passage of bacterial endotoxins through the intestinal wall in the presence of alcohol
3. alcohol-induced inflammation and cell death, which lead to scarring.²⁰

Although the reasons are not understood, females have a higher incidence of alcoholic hepatitis and cirrhosis than males.

Cardiovascular System

Despite the documented cardiovascular protective benefits of light to moderate alcohol intake, heavy intake is connected to an increased risk of cardiomyopathy, hypertension, and stroke. Heavy alcohol use has also been shown to be associated with atrial fibrillation, atrial flutter, supraventricular tachycardia, ventricular arrhythmias, and sudden death.

While the exact mechanism that produces cardiac damage as a result of alcohol is unknown, most evidence in the literature indicates that the effect of alcohol on the myocardium is a direct toxic result of ethanol or its metabolites, particularly acetaldehyde.²¹ Increased systemic blood pressure caused by heavy alcohol intake can further contribute to myocardial dysfunction.

Heavy alcohol intake is associated with increased risk of ischemic and hemorrhagic stroke due to several factors, which include alcohol-induced hypertension, coagulation disorders, atrial fibrillation, and reduction in cerebral blood flow due to vasoconstriction of cerebral blood vessels.

Nervous System

Damage to the central nervous system and peripheral nervous system occurs as a result of alcohol-induced alterations in neurotransmitter levels and neuronal cell membrane function. The frontal lobes of the brain contain most of the dopamine-sensitive neurons in the cerebral cortex and appear to be especially vulnerable to damage by alcohol. The frontal lobes are responsible for the executive functioning of the brain, including reasoning, judgment, emotion, and complex problem solving. The frontal lobe also plays a role in retaining long-term memories and new memory formation. Therefore, several areas of mental functioning can be compromised, including memory formation, abstract thinking, problem solving, attention, concentration, and perception of emotion.

One of the most frequent neurological consequences of chronic alcohol use is toxic polyneuropathy, which occurs as a result of a deficiency of thiamine and other B vitamins. Individuals with this complication will have distal sensory disturbances with pain, paresthesia, and numbness in a glove-and-stockings pattern; weakness and atrophy of distal muscles, primarily in the lower extremities; loss of tendon jerks; and autonomic dysfunction.

Immune System

Excessive alcohol intake can impair the immune system, increasing the risk of frequent and severe infections. The immune system damage occurs as a result of nutritional deficiencies, particularly protein deficiencies that, combined with liver damage, significantly inhibit the production of necessary immune system proteins. Also, alcohol impairs B-cell lymphocyte production and function. Alcohol increases hepatitis C virus replication, especially in the early stages and reduces the effectiveness of therapy. Individuals who abuse alcohol are also more likely to participate in behaviors that put them at risk of infection with human immunodeficiency virus (HIV).

Cancers

There is extensive evidence that alcohol increases the risk of some types of cancer. The International Agency for Research on Cancer (IARC) of the World Health Organization (WHO), has classified alcohol as a Group 1 carcinogen, which is defined as an agent (substance) that is carcinogenic to humans.²² Group 1 carcinogens also include agents on which evidence of carcinogenicity in humans is less than sufficient, but there is sufficient evidence of carcinogenicity in animals and strong evidence in exposed humans that the agent acts through a relevant mechanism of carcinogenicity.²³

Alcohol is most strongly associated with cancer of the oral cavity, pharynx, esophagus, and larynx. Statistically significant increases in risk also are found for cancers of the stomach, liver, female breast, and ovaries.²⁴ There is lack of medical consensus regarding alcohol consumption as a risk factor for colorectal cancer.

Alcohol is thought to act as a co-carcinogen by enhancing the carcinogenic effects of other chemicals and by stimulating tumor growth. Studies have suggested that acetaldehyde interferes with DNA replication and with the repair of damaged DNA. It is also thought to be responsible for stimulating tumor growth in cancers that are already present. Alcohol can also inactivate the tumor suppressor gene BRCA1 and increase estrogen responsiveness.

Treatment and Prognosis

Alcohol use disorder is a chronic illness, and the goal of treatment is abstinence. A better understanding of the pathophysiology of alcohol use disorders, the factors that increase the risk of abuse, and the significance of the effect of co-morbidities on alcohol abuse has led to a refinement of treatment methods, including a variety of options that meet individual needs.

Effectiveness of treatment depends on:

1. individual motivation
2. age at onset of abuse
3. duration and extent of abuse
4. compliance with treatment
5. successful treatment of co-morbid factors.

One of the most common forms of therapy is the psychosocial approach, the most well-known being Alcoholics Anonymous (AA). Based on the spiritual belief in a higher power, this system is built on a 12-step approach that uses psychosocial techniques such as rewards, social support networks, and role models to change behavior. As a result of the success of AA, other 12-step recovery programs have been developed, including Narcotics Anonymous (NA) and Cocaine Anonymous (CA).

Moderation programs such as Moderation Management do not mandate complete abstinence but allow low-risk drinking. While this type of program has had some success, the NIAAA has concluded that abstinence represents the most stable form of remission for most recovering alcoholics. However, abstinence alone is rarely successful.

Cognitive-behavioral therapy has been an important tool in treating alcohol use disorders, teaching the individual new skills for changing the drinking behavior. The advantage of this approach is that the associated mental health disorders can also be treated.

There are many medications that can also be prescribed as part of a treatment program; however, their success is highly dependent on patient compliance. These medications include:

1. disulfiram (Antabuse®), which prevents the elimination of acetaldehyde, leading to a range of significantly unpleasant effects including nausea, vomiting, flushing, sympathetic nervous system over activity, and palpitations with the ingestion of even small amounts of alcohol; the goal is to discourage use
2. naltrexone (Revia®), a competitive antagonist for opioid receptors, reduces the craving for alcohol
3. acamprosate (Campral®), which works by restoring the normal balance between neuronal excitation and inhibition that is altered by chronic alcohol use.

There are a few pharmacological treatments that remain without FDA approval (“off-label”) but have demonstrated some potential in reducing relapse to alcohol use. These include gabapentin, topiramate, valproate, levetiracetam and baclofen. While these medications require further study to determine their usefulness, they are sometimes being prescribed to treat alcohol use disorders.

Despite the advances in treatment, it is not uncommon for individuals with alcohol use disorders to go through several periods of alternating sobriety and relapse. A year after completing a rehab program, about one-third of those who completed a treatment program were sober, an additional 40% were substantially improved, but still drank heavily at times, and 25% had completely relapsed.

Underwriting Considerations

There are several challenges when trying to assess the presence and extent of alcohol use disorders. The underwriter is often faced with making a decision based on very limited and incomplete information.

One major challenge is that a proposed insured may not be candid about a present or past history of alcohol use on the application, inspection report, or alcohol questionnaire. Also, liver function test results are not reliable measures of alcohol use or liver function. In addition, it is cost-prohibitive to order attending physician statements (APS) on every proposed insured, and often the records do not specifically address alcohol use. Alcohol-dependent individuals frequently deny the extent of their drinking, even to their physicians. Therefore, unless an individual has become symptomatic, it is likely that the physician is not aware of the problem.

Because of these challenges, the underwriter must rely on small pieces of information that together either raise or reduce the suspicion of an alcohol use disorder. In the absence of a specific diagnosis, the following findings can be indicative of an alcohol use disorder:

1. history of depression or mood disorders
 - a. history of suicidal ideation
 - b. history of suicide attempts
2. significant personal or professional stressors
3. history of violence
4. history of another substance use disorder
5. adverse findings in motor vehicle records (MVR)
 - a. DUIs
 - b. excessive speeding
 - c. reckless driving
6. unstable employment record
 - a. frequent job changes
 - b. poor attendance
 - c. unexplained periods of unemployment
7. family history of alcohol abuse
8. easy access to alcohol
9. frequent falls or accidents
10. participation in high-risk behaviors or avocations
11. tobacco use (approximately 75% of alcohol users smoke cigarettes)
12. physical signs and symptoms and/or medical history
 - a. hypertension
 - b. gastrointestinal symptoms
 - c. enlarged or fatty liver
 - d. history of pancreatitis
 - e. insomnia
 - f. tremors/neuropathy
 - g. memory difficulties.

Laboratory Testing

Liver Enzymes

Aspartate aminotransferase (AST) and alanine aminotransferase (ALT) are hepatocellular enzymes that are released into the serum when liver cells are damaged. AST is also found in other tissue, including the brain, pancreas, kidney, lungs, and cardiac and skeletal muscle. ALT is found primarily in the liver and to a lesser extent in cardiac and skeletal muscle, making it a more specific marker for liver injury. However, AST is a more sensitive marker for alcohol use; an AST/ALT ratio greater than two is suspicious for alcohol-related liver disease.

Unfortunately, the degree of AST and ALT elevations do not correlate well with the presence or extent of alcohol-related liver disease. In fact, as liver disease becomes more severe and fibrotic changes occur, there are fewer healthy hepatocytes left to be damaged. Because these enzymes are released when injury occurs to hepatocytes, AST and ALT levels can return close to normal values during later stages of liver disease.

Gamma-glutamyl transpeptidase (GGT or GGTP) is a glycoprotein found in many tissues, including the liver. GGT has been found to be elevated in association with steady, heavy alcohol use over time; however, its sensitivity for detection is quite variable. In addition, other factors can cause GGT elevations, such as the use of some medications, including phenytoin (Dilantin®), phenobarbital, non-steroidal anti-inflammatory drugs (NSAIDs), and statin drugs. Because of these limitations, an isolated GGT elevation in the absence of any other evidence of significant alcohol use should not be used as a marker for abuse.

Mean Corpuscular Volume

Mean corpuscular volume (MCV) is a measure of the size of red blood cells. An elevated MCV represents macrocytosis or the presence of larger than normal red blood cells (RBCs). Macrocytosis is seen with B₁₂ and folate deficiencies, which interfere with normal RBC production and maturation.

Epidemiological studies have clearly shown a relationship between alcohol abuse and macrocytosis. Although the mechanism of this relationship is not known, it is thought that acetaldehyde plays a significant role in the reduction of serum folate levels, resulting in elevated MCV.

In general, the MCV is more significantly elevated in the presence of B₁₂ or folate deficiency; low-level elevations are more likely to be associated with alcohol-related abnormalities. Again, as an isolated finding, an elevated MCV should not be relied upon as an alcohol marker but should be considered in conjunction with other findings.

HDL Cholesterol

Low to moderate alcohol use raises HDL cholesterol, providing a cardio-protective benefit. However, excessive alcohol use increases HDL to levels outside normal range. The degree of elevation is related to the amount of alcohol consumed.

Triglycerides and Uric Acid

Excessive alcohol ingestion increases triglyceride levels due to fatty liver changes. Uric acid levels can also become elevated. It is thought that this occurs as a result of increased lactic acid production during the breakdown and excretion of alcohol, which is excreted from the kidneys. Lactic acid competes with uric acid for removal from the kidneys into the urine. It is also thought that increased levels of ethanol stimulate the body's production of uric acid.

Alcohol Markers

Carbohydrate-Deficient Transferrin

Transferrin is used for the transport of iron and is synthesized primarily in the liver. Carbohydrate-deficient transferrin (CDT) contains less than the normal number of carbohydrate groups than normal transferrin. The mechanism for CDT elevations is not thoroughly understood, but it is thought that alcohol either interferes with the addition of carbohydrate groups or stimulates their removal from transferrin. Studies have reported a high specificity for long-term alcohol consumption, but a relatively low sensitivity. Hence, CDT alone is not a suitable screening test; however a combination of CDT, GGT and MCV will improve the diagnostic value.^a

Alcohol Screening Tools

The CAGE Questionnaire is a simple screening test for alcohol abuse that consists of four questions. Two “yes” responses indicate the need for further investigation. The following questions are asked:

1. Have you ever felt you needed to **Cut** down on your drinking?
2. Have people **Annoyed** you by criticizing your drinking?
3. Have you ever felt **Guilty** about drinking?
4. Have you ever felt you needed a drink first thing in the morning (**Eye-opener**) to steady your nerves or to get rid of a hangover?

The Michigan Alcohol Screening Test (MAST) is one of the oldest and most accurate alcohol screening tests available. Developed in 1971, it is a 22-question test effective in identifying dependent drinkers with up to 98% accuracy. However, the length of the test makes it less convenient to administer and, because the questions focus on problems over the patient's lifetime, the test is less likely to detect early alcohol problems.

The Alcohol Use Disorders Identification Test (AUDIT) is a 10-question test developed by the World Health Organization (WHO) to determine if a person's alcohol consumption is harmful.

The test was designed to be used internationally and has been validated in six countries. As with the other screening tools, a high score warrants further investigation.

Mortality Implications of Alcohol Abuse and Dependence

Excessive alcohol consumption is associated with increased rates of death from cirrhosis, cardiovascular disorders, and cancers of the mouth, esophagus, pharynx, larynx, and liver. In addition, mortality from unintentional deaths as a result of motor vehicle accidents and high-risk behaviors is also increased.

According to the previously cited CDC study, there were almost 88,000 alcohol-attributed deaths per year with 2.5 million years of potential life lost due to excessive alcohol use between 2006 and 2010. Acute causes accounted for 49,544 of those deaths, while chronic causes were responsible for 38,253 deaths.²⁶ The leading chronic cause of alcohol-attributable deaths (AADs) was alcoholic liver disease, and the leading acute cause of AADs was injury from motor vehicle crashes. Almost three-quarters (72%) of AADs involved males, and 75% of the deaths among males involved those ages 35 or older.²⁷ All deaths from acute conditions were linked to binge drinking, defined as five or more drinks per occasion for males and four or more drinks per occasion for females.

Another study, conducted by the CDC in 2007, found that after a 20-year decline in total injury mortality rates, from 1999 to 2004 total injury mortality rates increased 5.5%.²⁸ Among persons ages 45-54, the unintentional injury rate increased 28%, largely as the result of an 87% increase in poisoning deaths. The suicide rate increased 19.5% during the same period.²⁹

In the elderly population (those over age 65), increased mortality was found to be the result of alcohol-induced cognitive disorders, accidental deaths due to injuries from falls, and unintentional poisoning due to medication-alcohol interactions.

Illegal Drug Use and Disorders

According to the National Institute on Drug Abuse (NIDA), drugs of abuse have been shown to alter gene expression and brain circuitry that, in turn, affect human behavior. Once addiction develops, these brain changes interfere with an individual's ability to make voluntary decisions, leading to compulsive drug craving, seeking, and use. The most recent NSDUH study estimated that 28.6 million Americans age 12 or older were current (i.e., within the past month) illicit drug users.³¹ This estimate represents 10.6% of the population ages 12 or older, an increase of 0.5% from 2015 and a significant increase in use from 7.9% in 2002.³² Illicit drugs include marijuana/hashish, cocaine (including crack), heroin, hallucinogens, inhalants, methamphetamine, as well as the misuse of psychotherapeutic drugs.³³

Marijuana continues to be the most commonly used illicit drug with current users (past month) totaling 24.0 million in 2016, followed by misusers of prescription pain relievers (3.3 million). According to a 2016 report published by the centers for Disease Control and Prevention (CDC), in 2014 there was an average of approximately 7,000 new users of marijuana each day.³⁴

Marijuana

Marijuana, also known as grass, pot, weed, herb, is the most commonly used illegal drug in the United States. It comes from the plant *Cannabis sativa*. The plant produces delta-9-tetrahydrocannabinol (THC), the active ingredient associated with intoxication. Marijuana resin, called hashish, contains an even higher concentration of THC. Concentrations of THC in marijuana plants have increased significantly over the last several years, with levels ranging from 4% to 25% in some specially grown plants, depending on growing climate and conditions, plant genetics, harvesting and processing, and the desire of small growers to maximize profits.³⁵

While THC is the most psychoactive component of marijuana, CBD, or cannabidiol, is not mind-altering. There are now firms that market CBD products to treat diseases or other therapeutic uses. Currently, CBD is not an ingredient being considered by the FDA under OTC (over the counter) drug review. Per the FDA, these products have not been proven to be safe or effective.^c

Marijuana can be smoked, brewed for liquid ingestion, added to food for oral ingestion, or taken as capsules. Smoking marijuana provides the most rapid absorption, with almost immediate effects that last approximately 2-3 hours. Oral ingestion results in slower onset of effects that persist 4-10 hours after ingestion. The duration of marijuana's effects depends on dose potency, administration route, any concurrent drug/alcohol use, and user tolerance.

Heavy marijuana use impairs an individual's ability to form memories, recall events, and shift attention from one thing to another. THC also disrupts coordination and balance by binding to receptors in the cerebellum and basal ganglia, which regulate balance, posture, coordination of movement, and reaction time. Studies show that approximately 6 to 11% of fatal accident victims test positive for THC.

Studies regarding mortality associated with marijuana use are limited and the results are often contradictory; however, known long-term effects of chronic marijuana use include:

1. lung disease, including bronchitis and squamous metaplasia of tracheobronchial epithelium
2. increased cancer risk due to the increased concentration of carcinogens in marijuana
3. development and/or progression of mental health disorders
4. possible cognitive impairments
5. increased risk of addiction/dependence
6. higher risk of multi-substance abuse
7. risk of lung toxicity with the use of vape pens

Marijuana users who have taken high doses of the drug can experience acute toxic psychosis, which includes hallucinations, delusions, and depersonalization. Long-term use increases the risk of chronic lung disease and cancers of the head, neck, and lungs.

Although the drug has been illegal under federal law in the United States since 1937, support for the legalization of marijuana for medical use has recently intensified. Marijuana is thought to be helpful in relieving neuropathic pain and spasticity due to neurological disorders, as an appetite stimulant for those with AIDS wasting syndrome, and for the control of nausea and vomiting associated with chemotherapy. It has also been found to help control seizures in those with epilepsy. There are currently four cannabinoid-based medications—dronabinol (Marinol®) and Syndros® for appetite stimulation, nabilone (Cesamet®) for chemotherapy-associated nausea, and most recently Epidiolex®, an anti-seizure drug purified from CBD—that are FDA-approved for medical marijuana use; however, the most common route of administration for medical marijuana is smoking.

As of 2019, marijuana remains classified as a Schedule 1 drug under the Federal Controlled Substances Act of 1970^c. Schedule 1 drugs are defined as having a high potential for abuse, no currently accepted medical use, and lack of accepted safety for use under medical supervision. However, as of June 2019, 33 states and the District of Columbia have statutes recognizing “medical marijuana,” 11 states have approved recreational marijuana, and 13 states have statutes recognizing cannabidiol (CBD) for medical use.^b Laws are continually evolving so consult federal, state, and local statutes for the most current information.

There are several issues to consider associated with medical marijuana use. Medical marijuana is not a first-line treatment for any disorder, so the severity of the underlying condition should be determined. Some states just require a prescription for medical marijuana use but allow the individual to obtain the drug from any source. Unless one of the FDA-approved medications is prescribed, there is no consistency in dosing, so health care providers are unable to measure the effectiveness of the dosing or treatment. Also, there is generally no required ongoing follow up with a health care provider therefore, the potential for marijuana and multi-substance abuse increases, as well as for drug overdose and motor vehicle accidents.

Synthetic Marijuana

These substances (also known as K2, Spice, Spike) are called “synthetic marijuana,” but they are not marijuana. Like THC, however, they bind to the same cannabinoid receptors in the brain and other organs. Research shows that these drugs affect the brain much more powerfully than marijuana, creating unpredictable, and in some cases, life-threatening effects including nausea, anxiety, paranoia, brain swelling, seizures, hallucinations, palpitations, and chest pain.^d

Cocaine

Cocaine, also known as crack, coke, snow, or rock, is derived from the coca plant of South America. It is an extremely addictive drug that can be smoked, injected, snorted, or swallowed. Desired effects include euphoria, with an increased level of energy and mental alertness. These effects appear almost immediately after a single dose and disappear within a few minutes or hours. The faster the absorption is, the more intense the high is; however, the faster the absorption is, the shorter the duration of action is.

The short-term physiological effects of cocaine include constricted blood vessels, dilated pupils, and increased temperature, heart rate, and blood pressure. Some of the most frequent complications of cocaine are:

1. cardiovascular effects, including arrhythmias and myocardial infarction
2. respiratory effects, including respiratory failure
3. neurological effects, including strokes, seizures, and headaches
4. gastrointestinal effects, including abdominal pain and nausea.

Sudden death can occur with first-time use, especially when injecting cocaine or smoking freebase, which is a pure form of cocaine that is derived from the removal of hydrochloride salt and cutting agents. Other adverse effects are associated with the particular route of administration of the drug.

Heroin

Heroin, also known as smack or horse, is administered by injection or inhalation. It is a highly addictive drug that quickly crosses the blood-brain barrier where it is converted to morphine and rapidly binds to opioid receptors. This produces a surge or “rush” of a pleasurable sensation. The rush is usually accompanied by a warm flushing of the skin, dry mouth, and clouded mental functioning. It can also cause severe respiratory depression. Fentanyl, a potent narcotic, can be combined with heroin, causing hypotension, severe respiratory depression, and coma.

Heroin use places users at significantly increased risk of many complications. The high-risk behaviors associated with heroin, such as sharing of equipment and high-risk sexual behavior, can lead to viral infections, including hepatitis B and C, and HIV. Users are also at risk of developing bacterial infections of the blood vessels and heart valves, abscesses, and other soft-tissue infections, as well as liver and kidney disease. Pneumonia and tuberculosis can result from the poor health conditions of the abuser as well as from depressed respiratory function.

Methamphetamine

Methamphetamine, also known as meth, crank, ice, speed, and crystal, is a man-made substance structurally similar to amphetamine and the neurotransmitter dopamine. It is a powerful stimulant that increases alertness, decreases appetite, and provides a sensation of pleasure. The drug can be injected, snorted, smoked, or ingested. In contrast to cocaine, which is quickly removed and almost completely metabolized in the body, methamphetamine has a much longer duration of action because the drug is present in the brain longer, producing a prolonged stimulant effect.

Long-term methamphetamine use has many negative consequences. Chronic users exhibit symptoms that include anxiety, confusion, insomnia, mood disturbances, and violent behavior. They can also display psychotic features, including paranoia, visual and auditory hallucinations, and delusions. Chronic use has been shown to cause severe structural and functional changes in the brain, particularly in areas associated with emotion and memory.

Methylenedioxymethamphetamine (MDMA)

Methylenedioxymethamphetamine (MDMA), also known as ecstasy, Adam, STP, or XTC, is a semi-synthetic stimulant and hallucinogen that is used to improve mood and maintain energy. It provides a distinct sense of euphoria, along with diminished feelings of fear and anxiety. MDMA also produces significant reductions in mental abilities, impairing memory and information-processing capabilities. These changes can last up to a week and perhaps longer in regular users. Other lingering effects include anxiety, restlessness, irritability, depression, impulsiveness, aggression, and sleep disturbances.

Phencyclidine (PCP)

PCP, developed in the 1950s as an intravenous surgical anesthetic, is classified as a dissociative anesthetic. Its trance-like sedative effect produces an “out-of-body” experience and sense of detachment from reality. Also known as angel dust, hog, embalming fluid, or superweed, it can be snorted, smoked, or swallowed. Even at small doses, the effects of PCP are unpredictable. It can cause rapid, shallow breathing, elevated blood pressure, tachycardia, and increased body temperature. More severe effects include severe hypertension, arrhythmias, nausea, blurred vision, dizziness, severe muscle contractions, seizures, coma, and death.

Ketamine

Ketamine, a dissociative anesthetic, was developed in 1963 to replace PCP and is used in human anesthesia and veterinary medicine. Also known as “K” or Special K, its chemical structure, mechanism of action, and effects are similar to those of PCP, but it is much less potent. Ketamine is odorless and tasteless, so it can be added to beverages without being detected, inducing amnesia. Because of these properties, the drug is sometimes used in the commission of sexual assaults.

Lysergic Acid Diethylamide (LSD)

Lysergic acid diethylamide (LSD) is a semi-synthetic hallucinogenic drug that is derived from rye fungus and is the most potent mood- and perception-altering drug known. LSD dramatically intensifies the senses and alters sensory perception. Physiologic effects include hypertension, tachycardia, dizziness, dry mouth, sweating, numbness, and tremors. Emotions can shift rapidly from fear and paranoia to euphoria. Hallucinations distort or transform shapes and movements. LSD users quickly develop a high degree of tolerance to the drug, but the tolerance dissipates quickly after cessation of use. The primary long-term effects of LSD are persistent psychosis and hallucinogen-persisting perception disorder (HPPD), more commonly referred to as “flashbacks.”

Underwriting Considerations

Because of the mortality risk associated with illicit drug use, as well as the high rate of relapse, there are several important factors to consider during the underwriting process. These include:

1. the drug(s) used
2. history of poly-substance use, including alcohol
3. use of prescription medications at risk of being abused (admitted use or discovered on prescription database search)
4. history of depression or other mood disorders
5. suicidal ideation or suicide attempts
6. duration of abuse
7. duration of abstinence
8. history and number of relapses
9. type of treatment and compliance with treatment
10. presence of ongoing support
11. history of high-risk behavior, accidents/falls, or violent behavior
12. adverse MVR findings (e.g., DUI, speeding, or reckless driving)
13. unstable employment record (poor attendance, unexplained periods of unemployment, frequent job changes)
14. positive findings on drug screening done as part of underwriting requirements.

Prescription Drug Abuse

In 2015 NSDUH adopted a revised definition of prescription drug misuse, which defined misuse as use in any way not directed by a doctor, including use without a prescription of one's own; use in greater amounts, more often, or longer than told to take a drug; or use in any other way not directed by a doctor. In 2016, an estimated 11.8 million people misused opioids in the past year, with 11.5 million pain reliever misusers.² NIDA reported that of those using psychotherapeutic drugs nonmedically, 5.2 million abused pain relievers, 1.8 million abused tranquilizers, 1.2 million abused stimulants, and 0.4 million abused sedatives.³⁹

The most commonly abused pain relievers are the opioid compounds, which include hydrocodone (Vicodin®), oxycodone (OxyContin®), morphine, fentanyl, and codeine. Benzodiazepines, particularly diazepam (Valium®) and alprazolam (Xanax®) are the most frequently abused tranquilizers and sedatives. In the category of prescription stimulants, dextroamphetamine (Adderall®, Dexedrine®) and methylphenidate (Concerta®, Ritalin®) are the drugs most likely to be abused.

This increased incidence of prescription drug abuse is a result of several factors, including:

1. the rising number of medicines being prescribed for a variety of health problems, including chronic pain syndrome, degenerative disc disease, neuropathy, fibromyalgia
2. the ease of obtaining these medicines online
3. inappropriate doctor-hopping and emergency room visits to obtain drugs
4. access by children and family members to the prescribed medicines of others in the household.

As a result of this increased use, and in combination with other substances of abuse, there has been an increase in total injury mortality, particularly among persons between the ages of 45 to 54, and those between the ages of 21 to 29.⁴⁰ According to the CDC, overdose deaths from opioids, including prescription opioids and heroin, have more than quadrupled since 1999. Deaths from drug overdose are up among both males and females, all races, and adults of nearly all ages.⁴¹ The National Vital Statistics Reports (NVSS), which provides final data for deaths in 2014, reported almost 52,000 deaths that occurred as a result of poisonings (26% of all injury deaths). Of these deaths, 80.9% were unintentional, 13.1% were suicides, and 5.8% were of undetermined intent. The age-adjusted death rate for unintentional poisoning has nearly tripled since 1999.⁴²

The other population at risk for prescription drug abuse is the elderly. One-third of all medications prescribed are for those ages 65 and older. Although this population has not been well studied, drugs for insomnia, anxiety disorders, and chronic pain are commonly prescribed.

Unintentional, inappropriate use of prescription drugs can occur due to impaired memory, poor understanding of dosing instructions, or adverse interactions with other prescription medications or alcohol. Increased sensitivity to or impaired excretion of these prescription drugs can lead to adverse effects. Increased mortality has been shown to be the result of cognitive impairments and injuries that occur in conjunction with the inappropriate use of these drugs.

Underwriting Considerations

Prescription drug abuse can be difficult for the underwriter to detect during the application process. These drugs are now widely prescribed for legitimate conditions and appropriately used by most people, making it challenging to determine when abuse is an issue. Records from prescription databases are useful for determining patterns of use, the number and type of drugs being prescribed, stability of use, and to ensure that prescriptions are not being obtained from more than one doctor. As these databases are more widely used, they will help determine the need for further investigation.

Medical records can also provide similar information, but only if the proposed insured provides the names of all physicians. Particularly with the treatment of chronic pain, the medical records often provide additional details that help determine the likelihood of abuse, including criticisms from the doctor, other substance or mental health disorders, the impact on employment and relationships, and changes in health.

Drug testing done for insurance purposes is not usually helpful in identifying the abuse of prescription drugs because detected levels can be due to appropriate use. However, the presence of positive alcohol markers or cocaine should significantly heighten suspicion of prescription substance abuse.

Treatment of Substance Use Disorders

Because of the changes that occur in the brain with chronic drug use, successful treatment of substance use disorders is extremely challenging. Drug rehabilitation is a long-term, multi-phase process that begins with detoxification and continues with ongoing therapy, support, and treatment of underlying mental health disorders.

Individuals who use illicit drugs have a much higher incidence of polysubstance dependence, which is defined by the DSM-IV as the use of at least three different types of substances used in the same 12-month period. An estimated 2.2 million persons in the US in 2016 reported that they had received treatment in the past year to reduce or stop illicit drug use, including prescription drug misuse, or for medical problems associated with illicit drug use.⁶

Traditional 12-step recovery programs such as Narcotics Anonymous (NA) and Cocaine Anonymous (CA) have been used successfully to treat drug abuse. Because these programs build on the tenets of AA, they are particularly effective in treating those with both drug and alcohol abuse disorders.

The relationship between chronic drug use and serious mental health disorders has been clearly established. According to NIDA, six out of ten people with a substance use disorder also suffer from another form of mental illness.⁴⁴ The most common disorders associated with chronic drug use include antisocial personality disorder, schizophrenia, bipolar disorder, major depressive disorder, attention deficit hyperactivity disorder (ADHD), generalized anxiety disorder, obsessive-compulsive disorder, and post-traumatic stress disorder (PTSD).

This co-morbidity of substance use and mental health disorders creates significant treatment challenges. Traditional methods have not proven successful and new methods are not yet accessible. Treatment of this group requires a dual approach that integrates detoxification of addictive substances with simultaneous identification and treatment of the mental health disorders. Unfortunately, this approach is relatively specialized, not readily available, and quite expensive.

Mortality and morbidity among drug addicts are high due to high rates of suicide attempts, consequences of high-risk behaviors, and unintentional deaths from overdose or injuries. In addition, because many of the abused drugs are illegal, there is also increased mortality risk due to criminal activity associated with the acquisition and use of these substances. There is a high incidence of relapse, particularly when multiple substances have been abused. Factors that influence treatment success:

1. duration of use
2. the drug(s) used
3. presence of poly-substance use
4. co-morbid mental health disorder
5. history of relapse
6. number of years drug-free
7. emotional/social support.

Review Questions – ALU 101, Chapter 15

1. All of the following statements regarding benefits from obtaining a prescription database during the underwriting process are correct EXCEPT:
 1. It can identify increased patterns of specific drug use.
 2. It can provide information about the number and type of drugs being prescribed.
 3. It can accurately identify all of the prescription drugs the proposed insured is using.
 4. It can alert the underwriter to multiple doctors prescribing similar medications.
2. Alcohol abuse is associated with elevation of all of the following blood tests EXCEPT:
 1. MCV
 2. HDL
 - 3.GGTP
 4. BUN
3. Complications of cocaine use include which of the following?
 - A. respiratory failure
 - B. seizures
 - C. arrhythmias

Answer Options: 1. B only is correct.

2. A and C only are correct.
3. B and C only are correct.
4. A, B, and C are correct.

4. Which factors significantly influence the success of treatment for drug addiction?
5. Why can it be difficult to detect prescription drug abuse during the underwriting process?

6. A need for markedly increased amounts of alcohol to achieve intoxication is:
1. dependence
 2. abuse
 3. withdrawal
 4. tolerance
7. All of the following are examples of commonly abused prescription medications EXCEPT:
1. stimulants
 2. benzodiazepines
 3. opioid compounds
 4. ACE inhibitors
8. What are the effects of heavy alcohol use on the cardiovascular system?
9. Describe the relationship between substance use disorder and other forms of mental illness.
10. What are the most common causes of mortality associated with the nonmedical use of prescription drugs?

Answers and Sources of Review Questions

Review Question 1

Answer 3: It can accurately identify all of the prescription drugs the proposed insured is using— page 18.

Review Question 2

Answer 4: BUN – pages 10-11.

Review Question 3

Answer 4: A, B, and C are correct - page 14.

Review Question 4

Refer to page 19.

Review Question 5

Refer to page 18.

Review Question 6

Answer 4: tolerance – page 2.

Review Question 7

Answer 4: ACE inhibitors – page 17.

Review Question 8

Refer to page 6.

Review Question 9

Refer to page 19.

Review Question 10

Refer to page 18.

ALU 101 Topic Index

References are listed as chapter.page, e.g. reference 11.12 is chapter 11, page 12.

- Abdominal diagnostic tests, 1.16–1.18
- Absolute assignment, 10.9
- Acamprosate (Campral®), 15.8
- Accelerated benefits provision, 10.10
- Accelerated death benefits, 9.14–9.15
- Acceptance, 10.2
- Accidental death benefit (ADB), 9.13, 10.11
- Acquired immunodeficiency syndrome (AIDS), testing for, 6.14–6.15
- Adderall® (dextroamphetamine), 15.17
- Adenocarcinoma, 4.6
- Adenoma, 4.6
- Administration, in product development, 9.3
- Administrative per se citation, 7.9
- Adrenergic neuron blocking agents, 2.14
- Aerial application, 11.10
- Aerial sports, 12.10–12.12
- Agency law, 10.17–10.18
- Agent, definition of, 10.1
- Air taxi, 11.8–11.9
- Airline transport pilot certificate, 11.3
- Alanine aminotransferase (ALT, SGPT), 6.17
 - in alcohol and drug use disorders, 15.10
- Albumin levels, 6.21
- Albuminuria, 6.11
- Alcohol
 - effects of, 7.1–7.2
 - legal limits of, 7.3
 - metabolism of, 15.3–15.4
- Alcohol abuse/alcohol use disorders, 6.18, 15.1, 15.2–15.4. *See also* Alcohol dependence
 - epidemiology and prevalence of, 15.4–15.5
 - laboratory tests for, 15.9–15.11
 - medical consequences of, 15.5–15.7
 - mortality implications of, 15.12
 - in motor vehicle fatalities, 7.1–7.2
 - review questions for, 15.20–15.22
 - screening tools for, 15.11–15.12
 - treatment and prognosis for, 15.7–15.8
 - underwriting considerations for, 15.8
- Alcohol dependence
 - affecting driving ability, 7.7
 - medical consequences of, 15.5–15.7
 - mortality implications of, 15.12
 - treatment and prognosis of, 15.7–15.8
- Alcohol/drug education classes, 7.3
- Alcohol markers, 6.18, 15.11
- Alcohol use, in teenage drivers, 7.5
- Alcohol Use Disorders Identification Test (AUDIT), 15.11–15.12
- Alcoholics Anonymous, 15.8
- ALDH enzyme, 15.4
- Aldomet® (methyldopa), 2.10
- Aliskiren (Tekturna®), 2.10
- Alkaline phosphatase (AP), 6.17, 6.18
- Alli® (orlistat), 2.4
- Alliance for Sound State Uniform Regulatory Efficiency (ASSURE), 14.16
- Alpha-1 adrenergic blockers, 2.14
- Alpha-blockers, 2.10
- Alpha-fetoprotein (AFP), 4.4, 6.24
- Alpine Club of Canada, 12.13
- Alprazolam (Xanax®), 15.17
- Altace® (ramipril), 2.9
- Alzheimer's disease, affecting driving ability, 7.7
- Ambulatory blood pressure monitoring, 2.8
- American Alpine Club, 12.13
- Amino acids, 6.2
- Amlodipine (Norvasc®), 2.9
- Amputations, diabetes-related, 3.5
- Aneurysm formation, 5.3
- Angina pectoris, 5.5–5.6, 5.9
- Angiography, 1.5–1.6
- Angiotensin-converting enzyme (ACE) inhibitors, 2.9, 2.15
 - with calcium-channel blockers, 2.15
 - with diuretics, 2.15
- Angiotensin II receptor blockers (ARBs), 2.9
 - with beta-blockers, 2.16
 - with calcium channel blockers, 2.16
 - with diuretics, 2.16
- Ankle-brachial index, decreased, 5.5
- Antabuse® (disulfiram), 15.8
- Antihypertensive medications, generic and trade names of, 2.14–2.16
- Anti-selection, 8.1
- Aortic sclerosis, 5.5
- Apnea-hypopnea index (AHI), 1.13
- Apnea index (AI), 1.13
- ApoE4, 6.19

ALU 101 Topic Index

References are listed as chapter.page, e.g. reference 11.12 is chapter 11, page 12.

- Apolipoprotein E, 6.19
- Applications
 - driving violations on, 7.8
 - financial data in, 8.16
 - incomplete or missing information in, 10.14
- Apresoline® (hydralazine), 2.10
- Aspartate aminotransferase (AST, SGOT), 6.17
 - in alcohol and drug use disorders, 15.10
- Aspirin, for CAD, 5.9
- Assets, efficient transfer of, 9.1
- Assignment provision, 10.9
- Assuris, 14.3
- Atenolol (Tenormin®), 2.9, 5.9
- Atherectomy, 5.9
- Atherosclerosis, 5.2–5.3
- Atherosclerotic lesions, 5.7–5.8
 - rupture of, 5.11
- Attending physician's statement (APS), 7.9
- Atypical hyperplasia, 4.3
- Automotive racing, 12.6
 - categories of, 12.7
 - mortality risk factors in, 12.8
 - sanctioning bodies for, 12.6
 - training requirements for, 12.7
- Avalanche fatalities, 12.14–12.15
- Aviation, 11.19. *See also* Pilots
 - accident causes and statistics in, 11.13–11.15
 - diverse nature of, 11.1
 - general, 11.8, 11.9–11.13
 - accident rates for, 11.14
 - descent/approach accidents in, 11.15
 - fatalities by type of, 11.9
 - maneuvering accidents in, 11.15
 - weather-related accidents in, 11.14–11.15
 - information sources on, 11.18
 - international, 11.16–11.17
 - military, 11.16
 - pilot certification for, 11.1–11.7
 - review questions on, 11.21–11.23
 - risks of, 7.10
 - safety record for, 11.17
 - types of, 11.8–11.13
- Aviation exclusion rider, 10.13, 11.18–11.19
- Aviation questionnaire, 11.18, 11.20
- Avocations. *See also specific avocations*
 - basic risk factors and assessment for, 12.1–12.2
 - internet resources for underwriting, 12.17–12.18
 - review questions for, 12.20–12.22
 - risks of, 7.10
 - underwriting tools for, 12.2
- Bank-owned life insurance (BOLI), 9.11–9.12
- Bariatric surgery, 2.4–2.6
- Barium enema, 1.16
- Barium swallow, 1.16
- Belviq® (lucaserin), 2.4
- Benign tumors, 4.1–4.2
- Benzodiazepines, 15.17
- Beta-1 blockers, selective, 2.14
- Beta-blockers, 2.9
 - with angiotensin II receptor blockers, 2.16
 - for CAD, 5.9
 - with diuretics, 2.16
 - non-selective, 2.14
- Bile duct disease tests, 1.18
- Biliopancreatic diversion, 2.5
 - with duodenal switch, 2.5
- Bilirubin levels, 6.21
- Binding premium receipt, 10.5
- Blood, substances in, 6.2–6.3
- Blood glucose monitors, 3.4
- Blood glucose test, 3.3
- Blood imaging, 1.18–1.19
- Blood pressure, 2.1, 2.7. *See also* Hypertension; Hypotension
 - high, 2.7–2.10
 - low, 2.10–2.11
 - measurement of, 2.8
 - underwriting for risks associated with, 2.11
- Blood samples, 6.1, 6.5
 - pre-test processing of, 6.6
- Blood urea nitrogen (BUN), 6.20
- Blood vessels, diagnostic tests for, 1.15–1.16
- Body habitus. *See* Build
- Body mass index (BMI), 2.1, 2.3
 - in adult overweight and obesity, 2.1–2.2
 - in childhood overweight and obesity, 2.2

ALU 101 Topic Index

References are listed as chapter.page, e.g. reference 11.12 is chapter 11, page 12.

- Bone marrow biopsy/aspiration, 1.18
- Bowel obstruction, 4.1
- Brachytherapy, 4.10
- Brain
 - benign tumors of, 4.1
 - diagnostic testing of, 1.6–1.8
- Brain natriuretic peptide (BNP), 5.8
- Brain type natriuretic protein (BNP) hormone, 6.19
- Brainstem auditory evoked response (BAER), 1.8
- BRCA1/BRCA2, 6.24
- Breach of contract, 10.1
- Breast imaging, 1.14
- Breathalyzer testing, 7.9
- Bronchoscopy, 1.12
- Build, 2.1
 - overweight and obese, 2.1–2.3
 - diagnostic tools for, 2.3
 - prognosis for, 2.6
 - treatment for, 2.3–2.6
- underweight, 2.6–2.7
 - underwriting for risks associated with, 2.11
- Bupropion, 2.4
- Bupropion/naltrexone combination (Contrave®), 2.4
- Bush pilots, 11.10–11.11
- Business flying, 11.9
- Business insurance, 10.16
 - buy-sell, 8.14–8.15
 - creditor, 8.13–8.14
 - fringe benefits, 8.15–8.16
 - key person, 8.10–8.13
- Business loss approach, 8.13
- Buy-sell agreements, financial data in, 8.17
- Buy-sell insurance, 8.14–8.15
- Byetta® (exenatide), 2.4
- CAGE Questionnaire, 15.11
- Calcium channel blockers, 2.9, 2.15
 - with ACE inhibitors, 2.15
 - with angiotensin II receptor blockers, 2.16
 - for CAD, 5.9
 - dihydropyridine, 2.15
- Campral® (acamprosate), 15.8
- Canadian Council of Insurance Regulators (CCIR), 14.1
- Canadian Life and Health Insurance Association (CLHIA)
 - G6 of, 14.4
 - regulations of, 14.1
- Canadian Uniform Life Insurance Act, 10.8
- Cancer, 4.1
 - active surveillance or monitoring of, 4.10
 - alcohol-related, 15.7
 - alternative and complementary therapies for, 4.11
 - biopsy of, 4.5
 - characteristics of, 4.2–4.3
 - common types of, 4.5–4.6
 - invasive, 4.3
 - microscopic findings in, 4.2
 - post-treatment follow-up for, 4.11
 - prognosis for, 4.12
 - progression to, 4.2–4.3
 - recurrence of, 4.11
 - review questions for, 4.13–4.15
 - screening for, 4.4
 - signs and symptoms of, 4.3–4.4
 - treatment of, 4.9–4.11
 - tumor markers for, 6.23–6.24
 - watchful waiting for, 4.11
- Cannabinoid-based medications, 15.14
- Captive agents, 9.17
- Carbohydrate-deficient transferrin (CDT), 6.18, 15.11
- Carbohydrates, 6.3
- Carcinoembryonic antigen (CEA), 4.4, 6.23
- Carcinoma, 4.5, 4.6
- Carcinoma in situ, 4.3
- Cardiac testing, 5.6–5.8
- Cardiomyopathy, alcohol-related, 15.6
- Cardiovascular diagnostic tests, 1.15–1.16
- Cardiovascular disease
 - affecting driving ability, 7.7
 - alcohol-related, 15.6
- Cardiovascular risk factors, 5.5
 - major, 5.3–5.5
- Cardizem® (diltiazem), 2.9
- Cardura® (doxazosin), 2.10
- Career agents, 9.17

ALU 101 Topic Index

References are listed as chapter.page, e.g. reference 11.12 is chapter 11, page 12.

- Carotid intimal-media thickness, increased, 5.5
- Casodex®, 6.23
- Cat skiing, 12.14–12.15
- Cell proliferation, 4.1
- Centrally-acting antihypertensive agents, 2.14
- Cerebral angiography, 1.7
- Cerebrovascular accidents (CVAs), 5.3, 7.7
- Cerebrovascular disease, diabetes-related, 3.5
- Cervical cancer, diagnostic testing for, 1.21
- Cesamet® (nabilone), 15.14
- Change of plan provision, 10.10
- Change (substitution) of insured rider, 10.13
- Charitable gifting, 8.9–8.10
- Chemotherapy, 4.10
- Chest diagnostic tests, 1.10–1.14
- Children, insurance on, 8.7
- Cholescintigraphy, 1.17
- Cholesterol. *See also* Lipoproteins
 - blood levels of, 6.18–6.19
 - mortality rates by total levels of, 6.6–6.8
 - mortality ratios by total levels of, 6.9
- Chronic obstructive lung disease, affecting driving ability, 7.7
- Churning, 14.5
- Circulatory system
 - anatomy and physiology of, 5.1–5.2
 - diagnostic tests for, 1.15–1.16
- Cirrhosis, alcohol-related, 15.6
- Cisternography, 1.8
- Civil aviation
 - Canadian, 11.8
 - U.S., 11.8–11.13
- Claims, involving homicide and suicide, 8.2–8.3
- Cocaine, 15.14–15.15
 - in oral fluid, 6.14
 - in urine tests, 6.12
- Cocaine Anonymous (CA), 15.8, 15.19
- Codeine, 15.17
- Cognitive-behavioral therapy, for alcohol use disorders, 15.8
- Collateral assignment, 10.9
- Collusion, 10.18
- Colon polyps, 4.1
- Colonoscopy, 1.17
 - routine, 4.4
- Colposcopy, 1.21
- Comedo necrosis, 4.9
- Commercial air carriers, 11.8–11.9
 - accidents on, 11.13–11.14
- Commercial pilot certificate, 11.3
- Community property laws, 10.16
- Commuter air carriers, 11.8–11.9
- Competent parties, 10.3
- Competitiveness, marketing, 9.15–9.16
- Compliance and Ethics Forum for Life Insurers (CEFLI), 14.13
- Computed tomographic hepatic angiography, 1.18
- Computed tomography (CT), 1.3–1.4
 - abdominal and pelvic, 1.17
 - cardiac, 5.8
 - for cardiovascular disease, 1.15
 - of chest, 1.11
 - electron beam (EBCT), 5.8
 - of kidneys, 1.19
- Computed tomography angiography (CTA), 1.5–1.6
 - for brain and nervous system, 1.7
- Concerta® (methylphenidate), 15.17
- Conditional premium receipts, 10.4–10.5
- Conditional privilege citation, 7.9
- Congestive heart failure, 5.10
- Connective tissue disease tests, 1.9
- Consumer Reporting Act, 14.11
- Contestable clause, 8.3
- Continuous Glucose Monitor (CGM), 3.4
- Contracts
 - additional benefits or riders in, 10.10–10.13
 - bilateral and unilateral, 10.1
 - definition of, 10.1, 10.2
 - formal and informal, 10.1
 - laws and regulations governing, 10.3–10.4
 - legal implications of, 10.14–10.19
 - limitations or exclusions in, 10.13
 - optional provisions of, 10.8–10.10
 - required (standard) provisions of, 10.5–10.8
 - requirements to create, 10.2–10.3
 - review questions for, 10.20–10.22

ALU 101 Topic Index

References are listed as chapter.page, e.g. reference 11.12 is chapter 11, page 12.

- temporary, 10.4–10.5
- terminology for, 10.1–10.2
- Contractual conversion privilege, 14.6
- Contrast agents, 1.2, 1.4
- Contrave® (bupropion/naltrexone combination), 2.4
- Convertibility, 9.4–9.5
- Coronary angiography, 5.7–5.8
- Coronary artery, 5.2
- Coronary artery bypass graft (CABG), 5.10
- Coronary artery disease (CAD), 5.1, 5.12
 - with diabetes, 3.5
 - diagnostic tests for, 1.15–1.16
 - pathophysiology of, 5.2–5.3
 - prognosis and underwriting considerations for, 5.10–5.11
 - review questions for, 5.13–5.15
 - risk factors for, 5.3–5.5
 - risk profiles for, 5.11
 - tests for, 5.6–5.8
 - treatment of, 5.9–5.10
- Coronary circulation, 5.2
- Coronary CT angiography (CCTA), 5.8
- Corporate brand marketing, 9.16–9.17
- Corporate/executive flying, 11.10
- Corporate-owned life insurance (COLI), 9.11–9.12
- Corruption Perceptions Index, 13.12
- Cotinine
 - in oral fluid, 6.14
 - in urine, 6.13
- Cozaar® (losartan), 2.9
- Creatinine
 - blood levels of, 6.20
 - urine levels of, 6.10
- Creditor insurance, 8.13–8.14, 10.17
- Critical illness coverage, 10.10
- Crop dusting, 11.10
- Cross-country racing, 12.9
- Customer Identification Program (CIP), 14.12
- Customer needs, 9.1–9.2
- Cut-offs, 6.2
 - values of, 6.6
- Cystatin C test, 6.20
- Cystoscopy, 1.19
- Death benefits, 8.1
 - in COLI and BOLI policies, 9.12
- Deferred compensation, 8.16
- Dementia, affecting driving ability, 7.7
- Dexedrine® (dextroamphetamine), 15.17
- Dextroamphetamine (Adderall®, Dexedrine®), 15.17
- Diabetes
 - affecting driving ability, 7.7
 - anatomy and physiology related to, 3.1
 - case study of, 3.8
 - complications of, 3.5–3.6
 - diagnostic tools for, 3.3
 - medications for, 3.9–3.10
 - prevalence and mortality/morbidity implications of, 3.6–3.7
 - review questions for, 3.11–3.13
 - treatment of, 3.3–3.5
 - type 1, 3.1–3.2
 - mortality and morbidity risk with, 3.7
 - risk factors for, 3.6
 - type 2, 3.2
 - mortality and morbidity risk with, 3.7
 - risk factors for, 3.6
 - types of, 3.1–3.3
- Diabetes mellitus, 3.1
 - as cardiovascular risk factor, 5.4–5.5
 - gestational, 3.2–3.3
 - non-insulin dependent or adult onset (type 2), 3.2
- Diabetic medications, 3.9–3.10
 - combination oral agents, 3.10
 - DPP-4 inhibitors, 3.9
 - hypoglycemic, 3.9
 - insulin, 3.9
 - non-insulin injectable, 3.9
 - sensitizers, 3.9
 - SGLT2 inhibitors, 3.9–3.10
 - starch blockers, 3.9
- Diagnostic imaging, 1.1–1.6
- Diagnostic tests
 - imaging, 1.1–1.6
 - invasive and non-invasive, 1.1
 - review questions for, 1.23–1.25
 - specialized, 1.6–1.22
- Diazepam (Valium®), 15.17

ALU 101 Topic Index

References are listed as chapter.page, e.g. reference 11.12 is chapter 11, page 12.

- Diethylpropion (Tenuate®), 2.4
- Diffusing capacity (DLCO), 1.13
- Digestive system diagnostic tests, 1.16–1.18
- Digital Privacy Act (DPA), 14.10–14.11
- Digital rectal exam (DRE), 1.22, 4.4
- Dihydropyridine calcium channel blockers, 2.15
- Diltiazem (Cardizem®), 2.9
- Diovan® (valsartan), 2.9
- Disability Insurance Record Service (DIRS), 14.16
- Disability waiver of premium benefits, 9.12–9.13, 10.10–10.11
- Distribution, 9.17–9.20
- Disulfiram (Antabuse®), 15.8
- Diuretics
 - with ACE inhibitors, 2.15
 - with angiotensin II receptor blockers, 2.16
 - with beta-blockers, 2.16
 - combination, 2.16
 - loop, 2.14
 - potassium-sparing, 2.14
 - thiazide, 2.9, 2.14
- Divers
 - decompression accidents in, 12.5
 - equipment for, 12.5
 - handicapped, 12.4
- Divers Alert Network (DAN), 12.5
- Dividend provision, 10.8
- Diving
 - free, 12.2
 - health disorders contraindicating, 12.5–12.6
 - risk characteristics for, 12.3–12.4
 - underwater, 12.2–12.6
- DNA mutations, 4.1, 4.7
- Do Not Call registry, 14.13
- Document, 10.3
- Doppler ultrasonography, 1.3
 - for vascular changes, 1.9
- Doxazosin (Cardura®), 2.10
- DPP-4 inhibitors, 3.9
- Drag racing, 12.9
- Dried blood spot (DBS), 6.5
- Driver characteristics, 7.4–7.6
- Driving
 - aggressive, 7.6
 - distracted, 7.6
 - medical conditions affecting, 7.6–7.8
 - Driving license suspension/revocation, 7.9, 7.10–7.11
 - Driving under the influence (DUI, DWI), 7.9
 - legal alcohol limits for, 7.3
 - Driving violations
 - alcohol- or drug-related, 7.9
 - underwriting history of, 7.10–7.11
 - Driving while suspended, 7.11
 - Dronabinol (Marinol®), 15.14
 - Drowning, 12.6
 - Drug dependence, affecting driving ability, 7.7
 - Drug screens, 6.12
 - Drug testing, for insurance, 11.18
 - Drug use/abuse. *See also* Illegal drug use/disorders; Prescription drug abuse; specific drugs
 - mental health disorders and, 15.19
 - mortality and morbidity rates with, 15.19
 - in motor vehicle fatalities, 7.2–7.3
 - Dual energy x-ray absorptiometry (DEXA) scan, 1.20
 - Duplex scan, 1.3
 - Dysfunction uterine bleeding (DUB), 1.21
 - Dysplasia, 4.3
 - Dysplastic nevus syndrome, 4.1
 - E-cigarettes, 6.13
 - Echocardiograms, 1.15–1.16, 5.7
 - Elderly drivers, 7.5–7.6
 - Electrocardiograms (EKGs), 1.15, 5.6
 - ambulatory, 1.16
 - Electroencephalography (EEG), 1.8
 - Electromyography (EMG), 1.8
 - Electron beam computed tomography (ultrafast CT scans), 1.4, 5.8
 - Electrophysiological (EP) mapping, 1.16
 - Employee Retirement Income Security Act of 1974 (ERISA), 14.2
 - Enalapril (Vasotec®), 2.9
 - Endocervical curettage, 1.21
 - Endocrine tumors, 4.2
 - Endometrial biopsy, 1.21
 - Endomyocardial biopsy, 1.16

ALU 101 Topic Index

References are listed as chapter.page, e.g. reference 11.12 is chapter 11, page 12.

- Endoscopic retrograde
cholangiopancreatography (ERCP),
1.18
- Endoscopic ultrasound (EUS), 1.18
- Endoscopy, 1.6, 1.17–1.18
- Entire contract provision, 10.5
- Enzymes, 6.2
- Epidiolex®, 15.14
- Epigenetic testing, 6.24
- Epilepsy, affecting driving ability, 7.8
- Equity indexed universal life (EIUL) products,
9.10
- Esophagogastroduodenoscopy, 1.17
- Estate planning insurance, 8.7–8.9
- Estate taxes, 8.8
- Estop, 10.1, 10.18
- Estoppel, 10.1, 10.18
- Ethical marketing, 14.12–14.13
- Evoked potentials, 1.8–1.9
- Exclusions, 10.13
- Executive benefits, 9.1
- Executive bonus plans, 8.16
- Exenatide (Byetta®), 2.4
- Exercise electrocardiogram, 5.6–5.7
- Exercise tolerance test, 5.6–5.7
- Expenses, in pricing, 9.2
- Experimental Aircraft Association (EAA),
11.12
- Experimental (amateur-built) aircraft, 11.12–
11.13
- Extended maturity option, 10.12
- External beam radiation, 4.10
- Eye tests, 1.9

- Fair and Accurate Credit Transactions Act
(FACTA), 14.9
- Fair claim practice laws, 10.4
- Fair Credit Reporting Act (FCRA), 14.2
amendments to, 14.8–14.9
defining medical information, 14.8
- Familial polyposis syndrome, 4.1
- Fasting blood glucose test, 3.3
- Fats, 6.3
- Fatty streaks, 5.3
- Fecal occult blood (FOB) test, 1.18
- Federal Aviation Administration (FAA)
exams of, 11.5, 11.7
Safety Team (FAAST), 11.11
- Federal Aviation Regulations (FAR)
Part 103, 11.11
Part 135, 11.8
- Federal Controlled Substances Act, 15.14
- Felodipine (Plendil®), 2.9
- Fentanyl, 15.17
- FEV₁/FVC ratio, 1.13
- Financial audits, 14.2
- Financial Crimes Enforcement Network
(FinCEN), 14.11–14.12
- Financial data, sources of, 8.16–8.17
- Financial Industry Regulatory Authority
(FINRA)
replacement regulation of, 14.6
Rule 2210 of, 14.2
Rule 2310 of, 14.12
- Financial institutions channel, 9.19
- Financial statements, 8.16–8.17
- Financial underwriting, 8.17
for business insurance, 8.10–8.16
data sources for, 8.16–8.17
insurable interest and value in, 8.1–8.3
for personal insurance, 8.3–8.10
purpose of, 8.1
review questions for, 8.18–8.20
- Fine needle aspirate (FNA)
for breast cancer, 1.14
for hormonal disorders, 1.10
- Flight instruction, 11.10
- Flight maneuvering accidents, 11.15
- Fluorescein angiography, 1.9
- Fluoroscopy, 1.1–1.2
- Fluoroscopy-guided percutaneous needle
aspiration, 1.11
- Fluoxetine, 2.4
- Forced expiratory volume at 1 second (FEV₁),
1.13
- Forced vital capacity (FVC), 1.12
- Foreign countries, life expectancies in at birth,
13.15–13.18
- Foreign nationals, in U.S. or Canada, 13.6–
13.8
- Foreign residence, 13.1–13.3
cultural and ethnic difference in, 13.4

ALU 101 Topic Index

References are listed as chapter.page, e.g. reference 11.12 is chapter 11, page 12.

- definition of, 13.11–13.12
- health systems in, 13.5
- infectious disease mortality and, 13.2
- information sources for, 13.14
- infrastructure and transportation systems of, 13.4
 - life expectancies and, 13.3
 - population density in, 13.5
 - review questions for, 13.30–13.32
 - risks of, 13.1, 13.3–13.6, 13.12–13.13
 - social and economic conditions in, 13.4
 - underwriting, 13.13
- Foreign risk
 - categories of, 13.6–13.9
 - underwriting, 13.6, 13.9–13.11
- Foreign travel
 - information sources for, 13.14
 - review questions for, 13.30–13.32
 - risk factors of, 13.1, 13.9
- Form, 10.3
- Fractional flow reserve (FFR), 5.8
- Fraud, in foreign countries, 13.12
- Fringe benefits, 8.15–8.16
- Fructosamine, 3.3, 6.16

- Gallbladder disorders, testing for, 1.17–1.18
- Gamma-glutamyl transpeptidase (GGT, GGTP), 6.17
 - in alcohol and drug use disorders, 15.10
- Gastric banding, 2.5
- Gastric bypass surgery, 2.5
- Gastric emptying, 1.17
- Gastroscopy, 1.17
- General agency, 9.17–9.18
- Genetic testing, 6.24
- Genitourinary disorders, diagnostic tests for, 1.19
- Gestational diabetes mellitus, 3.2–3.3
- Glandular disorder tests, 1.9–1.10
- Gliders, 11.11
- Globulin levels, 6.21–6.22
- Glomerular filtration rate (GFR), 6.10
 - estimated (eGFR), 6.20–6.21
- Glucophage® (metformin), 2.4
- Glucose, 3.1, 6.3
 - blood levels of, 6.16
 - impaired fasting (IFG), 3.2
 - urine levels of, 6.11
 - Glucose metabolism markers, 6.16–6.17
 - Glucose tolerance, impaired, 3.2
 - Glucose tolerance test, 3.2, 3.3
 - Glycohemoglobin test, 3.3
 - Glycolysis, 6.4
 - Good health statement, 10.15
 - Grace period provision, 10.7
 - Gramm-Leach-Bliley Act, 14.9
 - Guaiac test, 1.18
 - Guaranteed insurability option (GIO), 9.13, 10.12–10.13
 - Guaranteed issue (GI), 9.12
 - Guaranteed policy values, 10.8
 - Guaranty Associations, 14.2
 - Gun ownership and fatalities, by country, 13.11

 - Hang gliding, 12.11–12.12
 - fatalities in, 12.12
 - Hang Gliding and Paragliding Association of Canada (HPAC), 12.12
 - Health information, protected, 14.7–14.9
 - Health Information Technology for Economic and Clinical Health (HITECH) Act, 14.8
 - Health Insurance Portability and Accountability Act of 1996 (HIPAA), 14.2
 - privacy regulations of, 14.7–14.8
 - Heart
 - anatomy and physiology of, 5.1–5.2
 - benign tumors of, 4.1
 - Heart disease
 - with diabetes, 3.5
 - diagnostic tests for, 1.15–1.16
 - Helicopters, 11.11
 - Heli-skiing, 12.14
 - Hematology, 6.22
 - Hemoglobin, in urine, 6.11–6.12
 - Hemoglobin A1c (A1c test), 3.3, 6.16
 - Hemoglobin-associated acetaldehyde (HAA), 6.18
 - Hemolysis, 6.3
 - Hepatic angiography, 1.18

ALU 101 Topic Index

References are listed as chapter.page, e.g. reference 11.12 is chapter 11, page 12.

- Hepatic steatosis, 15.6
- Hepatitis
 - alcoholic, 15.6
 - serological testing for, 6.15–6.16
- Hepatitis B virus, 6.15
- Hepatitis C virus, 6.16
 - alcohol abuse and, 15.7
- Hepatocellular adenoma, 4.1
- Heroin, 15.16
- HIDA scan, 1.17
- HIV. *See* Human immunodeficiency virus (HIV) tests
 - (HIV) tests
- HMG CoA reductase inhibitors, 5.9
- Holter monitoring, 1.16
- Home blood pressure monitoring, 2.8
- Homicide exclusion, 8.3
- Homicide rates, by country, 13.20–13.21
- Hormonal disorder tests, 1.9–1.10
- Hormone therapy, for cancer, 4.10
- Human immunodeficiency virus (HIV)/AIDS prevalence, by country, 13.23
- Human immunodeficiency virus (HIV) tests
 - blood, 6.14–6.15
 - oral fluid, 6.14
- Human life value method, 8.4–8.5
- Human papilloma virus (HPV) testing, 1.21
- Hydralazine (Apresoline®), 2.10
- Hydrochlorothiazide, 2.9
- Hydrocodone (Vicodin®), 15.17
- Hyperglycemia, 3.1
- Hyperlipidemia, 5.4
- Hyperplasia, 4.3
- Hypertension, 2.7–2.8
 - alcohol-related, 15.6
 - as cardiovascular risk factor, 5.4
 - case study of, 2.12
 - classification of, 2.7–2.8
 - complications of, 2.10
 - diagnostic tools for, 2.8–2.9
 - lifestyle measures for, 2.9
 - medications for, 2.9–2.10
 - prognosis for, 2.10
- Hypoglycemia, diabetes-related, 3.5
- Hypoglycemic agents, 3.9
- Hypotension, 2.10–2.11
 - case study of, 2.13
- Hysterosalpingogram, 1.21
- Hysteroscopy, 1.21
- Hysterosonography, 1.21
- Hytrin® (terazosin), 2.10
- Illegal drug use/disorders, 15.12–15–16
- Illustrations
 - Model Law on, 14.4
 - regulation of, 14.4–14.5
- Immune system disorders, alcohol-related, 15.7
- Implied consent citation, 7.9
- Income replacement
 - human life value method for, 8.4–8.5
 - multiple of income method for, 8.3–8.4, 8.5
 - needs analysis method for, 8.5, 8.6
- Income replacement insurance, 8.3–8.6
- Income tax rates, Canadian, 8.8–8.9
- Incontestable provision, 10.6
- Independent producers, 9.17–9.18
- Indium scan, 1.18
- Infant mortality rates, by country, 13.19
- Infectious disease mortality, by country, 13.2
- Inspection reports (IRs), 7.9
 - financial data in, 8.17
- Instrument flight rating, 11.4–11.5
- Insulin
 - for diabetes, 3.4
 - intermediate or long-acting, 3.9
 - production of, 3.1
 - rapid or short acting, 3.9
- Insulin resistance syndrome (metabolic syndrome), 6.19
- Insurable interest, 8.1–8.3
 - in another person's life, 10.16
 - examples of, 10.16–10.17
 - in one's own life, 10.15
- Insurable value, 8.1–8.3
- Insurance Activity Index (IAI), 14.16
- Insurance Companies Act (Canada), 14.3
- Insurance Marketplace Standard Association (IMSA), 14.12–14.13
- Interest sensitive products, 9.7–9.10
- Interlock device, 7.9
- International Aircraft Owners and Pilots Association (IAOPA), 11.16

ALU 101 Topic Index

References are listed as chapter.page, e.g. reference 11.12 is chapter 11, page 12.

- International aviation, 11.16–11.17
- International Civil Aviation Organization (ICAO), 11.16
- International information sources, 13.14
- International risk, 13.1. *See also* Foreign residence; Foreign risk; Foreign travel mortality factors for by country, 13.15–13.29
 - review questions for, 13.30–13.32
- Internet, in product distribution, 9.19
- Interstate Insurance Product Compact Model Law, 14.2
- Interstate Insurance Product Regulation Compact, 14.13
- Intravenous pyelogram (IVP), 1.19
- Investments, in pricing, 9.2
- Ionamin® (phentermine), 2.4
- Jejunoileal bypass, 2.5
- Joint life products, 9.10–9.11
- Juvenile protection, 8.7
- Ketamine (Special K), 15.17
- Ketosis/ketoacidosis, 3.5
- Key person insurance, 8.10–8.12
 - business loss approach in, 8.13
 - multiple of earnings approach in, 8.12
- Kidney function tests, 6.19–6.20
- Kidneys, ultrasound and CT imaging of, 1.19
- KUB, 1.16
- Lab samples, pre-test processing of, 6.6
- Laboratory profile, typical, 6.9–6.10
- Laboratory report example, 6.26–6.27
- Laboratory test cut-offs, 6.2
- Laboratory tests, 6.1
 - for alcohol and drug use disorders, 15.10–15.11
 - blood, 6.14–6.22
 - epigenetic, 6.24
 - genetic, 6.24
 - interpreting results of, 6.6–6.9
 - oral fluid, 6.14
 - reference ranges in, 6.4
 - review questions for, 6.32–6.34
 - sample applicant test guide for, 6.28–6.31
- samples collected for, 6.5–6.6
- scoring results of, 6.24–6.25
- sensitivity and specificity of, 6.2
- terminology for, 6.1–6.4
- tumor markers, 6.23–6.24
- typical profile of, 6.9–6.10
- units of measure in, 6.4
- urine, 6.10–6.14
- Lactate dehydrogenase (LDH), 6.17
- Laparoscopic adjustable gastric band, 2.5
- Laparoscopic sleeve gastrectomy, 2.5
- Laparoscopy, 1.17
- Laryngoscopy, 1.11
- Last expenses, 9.1
- Laws, contract, 10.3–10.4
- Left ventricular ejection fraction (LVEF), 5.10
- Left ventricular hypertrophy (LVH), 5.5
- Legal agreement, 10.3
- Legal terms, in contract law, 10.1–10.2
- Legally adequate consideration, 10.2
- Leukemia, 4.5, 4.6
- Leukocyte esterase, 6.11–6.12
- Life and Health Insurance Policy Language Simplification Model Act, 10.3
- Life expectancies at birth, by country, 13.15–13.18
- Life insurance contract. *See* Contracts
- Life insurance products, 9.1
 - COLI/BOLI, 9.11–9.12
 - customer needs for, 9.1–9.2
 - development of, 9.2–9.3
 - distribution of, 9.17–9.20
 - interest-sensitive, 9.7–9.10
 - joint life, 9.10–9.11
 - marketing, 9.15–9.16
 - optional policy rider benefits in, 9.12–9.15
 - review questions for, 9.21–9.23
 - types of, 9.3–9.7
- Lipemia, 6.3
- Lipids, 6.3
 - in blood, 6.18–6.19
- Lipoproteins
 - high density (HDL), 6.18, 6.19
 - in alcohol and drug use disorders, 15.11
 - high levels of, 6.18
 - low density (LDL), 6.18, 6.19

ALU 101 Topic Index

References are listed as chapter.page, e.g. reference 11.12 is chapter 11, page 12.

- Liraglutide (Victoza®), 2.4
- Lisinopril (Prinivil®; Zestril®), 2.9
- Liver biopsy, 1.18
- Liver disease
 - with alcohol abuse, 15.6
 - testing for, 1.17–1.18
- Liver enzymes, 6.17–6.18
 - in alcohol and drug use disorders, 15.10
- Liver function, 6.17
- Living benefits provision, 10.10
- Loans, policy, 10.8
- Locaserin (Belviq®), 2.4
- Long-term care rider, 10.12
- Loop diuretics, 2.14
- Lopressor® (metoprolol), 2.9
- Losartan (Cozaar®), 2.9
- Lumbar puncture, 1.7–1.8
- Lumpectomy, 4.7
- Lung disorders, diagnostic tests for, 1.10–1.14
- Lupron®, 6.23
- Lymph nodes
 - enlarged, 1.19
 - staging of, 4.9
- Lymphoma, 4.5
- Lysergic acid diethylamide (LSD), 15.17
- Magnetic resonance angiography (MRA), 1.5–1.6
 - for brain and nervous system, 1.7
 - for cardiovascular disease, 1.15
- Magnetic resonance
 - cholangiopancreatography (MRCP), 1.18
- Magnetic resonance imaging (MRI), 1.4
 - breast, 1.14
 - cardiac, 5.7
- Malabsorptive surgery, 2.5–2.6
- Malnutrition, alcohol-related, 15.5
- Mammography, 1.14
- Marijuana, 15.13
 - legalization of, 15.14
 - long-term effects of, 15.13
 - medical use of, 7.2–7.3
 - synthetic, 15.14
- Marinol® (dronabinol), 15.14
- Marketing
 - of corporate brand, 9.16–9.17
 - ethical, 14.12–14.13
 - of life insurance products, 9.15
 - of product competitiveness, 9.15–9.16
 - underwriting, 9.16
- Material misrepresentation, 10.1, 10.4
- Maternal mortality rates, by country, 13.19
- McCarran-Ferguson Act, 14.2
- Mean corpuscular volume (MCV), 15.10
- Mediastinoscopy, 1.11
- Medical aviation certification
 - Canadian, 11.7
 - U.S., 11.5
 - special issuance and exemptions for, 11.6
 - statement of demonstrated ability (SODA), 11.6–11.7
- Medical records
 - for drug use information, 11.18
 - from foreign countries, 13.12
- Melanoma, 4.5, 4.6
 - biopsy for, 4.7
- Meningioma, 4.1
- Mental health disorders, chronic drug use and, 15.19
- Meridia® (sibutramine), 2.4
- Metabolic syndrome, 2.11, 3.2, 6.19
- Metastasis, staging of, 4.9
- Metformin (Glucophage®), 2.4
- Methamphetamine, 15.16
- Methyldopa (Aldomet®), 2.10
- Methylenedioxymethamphetamine (MDMA), 15.17
- Methylphenidate (Concerta®; Ritalin®), 15.17
- Metoprolol (Lopressor®; Toprol®), 2.9, 5.9
- MIB, 14.13–14.14
 - Post-Notice of, 14.15
 - reporting underwriting information to, 14.15
 - services of, 14.15–14.16
- MIB Reports, 14.14–14.15
- MIBG scan, 1.10
- Michigan Alcohol Screening Test (MAST), 15.11
- Microalbuminuria, 5.5

ALU 101 Topic Index

References are listed as chapter.page, e.g. reference 11.12 is chapter 11, page 12.

- Military aviation, 11.16
- Military occupations, 12.17
- Minimum continuing capital and surplus requirements (MCCSR), 14.3
- Misrepresentation, 10.1. *See also* Material misrepresentation
- Misstatement of age provision, 10.6–10.7
- Mitotic rate, 4.9
- Model Replacement Regulation, 14.5–14.6
- Moderation Management, 15.8
- Monoclonal gammopathy, 6.22
 - of undetermined significance (MGUS), 6.22
- Morphine, 15.17
- Mortality, in pricing, 9.2
- Motor cross racing, 12.9
- Motor vehicle fatalities
 - major factors in, 7.1–7.8
 - underwriting tools for, 7.8–7.10
- Motor vehicle report (MVR)
 - driving violation history in, 7.10–7.11
 - as underwriting tool, 7.8–7.9
- Motor vehicle risk, 7.1, 7.11
 - factors in, 7.1–7.8
 - review questions for, 7.12–7.14
 - underwriting tools for, 7.8–7.10
- Motor vehicle violations, mortality risk and, 7.11
- Motorcycle accidents, 12.9
- Motorcycle racing, 12.8–12.9
 - mortality rates for, 12.10
 - mortality risk factors in, 12.10
 - types of, 12.9–12.10
- Motorcycle-related fatalities, 7.4
- Mountain climbing, 12.12–12.14
 - fatalities of, 12.14
- Multiple of earnings approach, 8.12
- Multiple of income method, 8.3–8.4, 8.5
- Musculoskeletal disorder tests, 1.20
- Myelography, 1.8
- Myeloma, 6.22
- Myocardial infarction (MI), 5.6
- Myocardial perfusion imaging (MPI), 5.7
- Nabilone (Cesamet®), 15.14
- Nailfold microscopy, 1.9
- Naltrexone (Revia®), 15.8
- Narcolepsy, affecting driving ability, 7.8
- Narcotics Anonymous (NA), 15.8, 15.19
- National Association of Insurance Commissioners (NAIC)
 - Financial Regulation Standards and Accreditation Program of, 14.3
 - four zones of, 14.3
- Interstate Insurance Product Compact Model Law of, 14.2
- Life and Health Insurance Policy Language Simplification Model Act of, 10.3
- Model Laws of, 14.2
- Model Regulation Requiring Annual Audited Financial Reports of, 14.13
- Model Replacement Law of, 14.5–14.6
- Privacy of Consumer Financial and Health Information Regulation of, 14.9
- Privacy Protection Model Act of, 14.15
 - regulations of, 14.1
- National Institute on Alcohol Abuse and Alcoholism (NAAA), 15.2
- National Survey on Drug Use and Health (NSDUH), 15.1
- Natural disasters, 13.6
- Neck disorder testing, 1.10–1.14
- Needle aspiration biopsy, for cancer, 4.5
- Needs analysis method, 8.5, 8.6
- Nephropathy, diabetic, 3.5–3.6
- Nerve conduction studies, 1.20
- Nerve conduction velocity studies, 1.20
- Neurological disorders
 - alcohol-related, 15.6–15.7
 - diagnostic testing of, 1.6–1.9.
- Neuropathy, diabetic, 3.6
- Nicotine, in urine, 6.13
- Nifedipine, 5.9
- Nitrates, 5.9
- No duress or undue influence, 10.3
- Non-insulin injectables, 3.9
- Nonforfeiture provision, 10.8
- Non-working spouse insurance, 8.6–8.7
- Norvasc® (amlodipine), 2.9
- NT-proBNP, 6.19
- Nuclear medicine, 1.2

ALU 101 Topic Index

References are listed as chapter.page, e.g. reference 11.12 is chapter 11, page 12.

- Obesity
 - adult, 2.1–2.2
 - case study of, 2.11–2.12
 - childhood, 2.2–2.3
 - complications of, 2.6
 - diagnostic tools for, 2.3
 - lifestyle measures for, 2.3
 - medications for, 2.4
 - prognosis for, 2.6
 - surgery for, 2.4–2.6
 - treatment of, 2.3–2.6
 - underwriting considerations for, 2.11
- Occupational accident fatality rates, by country, 13.24
- Occupational risks, 12.17–12.18
- Occupations
 - civilian, 12.17
 - internet resources for underwriting, 12.17–12.18
 - military, 12.17
 - most hazardous, 12.17
 - review questions for, 12.20–12.22
 - risk factors and underwriting tools for, 12.16–12.17
- Off-road racing, 12.9–12.10
- Offer, 10.2
- Office of Foreign Assets Control (OFAC), 14.12
- Office of the Superintendent of Financial Institutions (OSFI), 14.3
- Open surgical biopsy/excisional biopsy, breast, 1.14
- Opioid compounds, 15.17
- Oral fluid, 6.5
 - pre-test processing of, 6.6
- Organ transplantation, for cancer, 4.10
- Orlistat (Xenical®; Alli®), 2.4
- Overweight
 - adult, 2.1–2.2
 - childhood, 2.2–2.3
 - complications of, 2.6
- Ownership provision, 10.9
- Oxycodone (OxyContin®), 15.17
- OxyContin® (oxycodone), 15.17
- Oxygen saturation, 1.12
- Pancreatic disease, testing for, 1.18
- Pancreatitis, alcohol-related, 15.5
- Papanicolaou (Pap) test, 1.21
- Paragliding, 12.11–12.12
 - fatalities in, 12.12
- Parotid sialography, 1.10
- Paul vs. Virginia, 14.1
- PCSK9 inhibitor antibodies, 5.9
- Percutaneous transhepatic cholangiography, 1.18
- Percutaneous transluminal coronary angioplasty (PTCA), 5.9
- Peripheral arterial disease (PAD), 5.3
 - with diabetes, 3.5
- Peristalsis, alcohol-related, 15.5
- Permanent life products, 9.5–9.6
- Peroral pneumocolon, 1.18
- Personal Information Protection and Electronic Documents Act (PIPEDA), 14.10
- Personal insurance, 10.16
 - charitable gifting, 8.9–8.10
 - in estate planning, 8.7–8.9
 - income replacement, 8.3–8.6
 - for juvenile protection, 8.7
 - for non-working spouse, 8.6–8.7
- Personal producing general agent (PPGA), 9.18
- pH monitoring, 1.17
- Phencyclidine (PCP), 15.17
- Phentermine (Suprenza®; Ionamin®), 2.4
- Pheochromocytoma diagnosis, 1.10
- Physician density, by country, 13.22
- Physician's statements, from foreign countries, 13.12
- Pilot certificates, 11.1–11.3
- Pilot licenses/permits, Canadian, 11.3–11.4
- Pilots
 - certification of, 11.1–11.7
 - military, 11.16
 - statement of demonstrated ability (SODA) of, 11.6–11.7
 - U.S. ratings of, 11.4–11.5
- Plan F (Follow-Up) Service, 14.16
- Plendil® (felodipine), 2.9
- Policy amendments, 10.14–10.15

ALU 101 Topic Index

References are listed as chapter.page, e.g. reference 11.12 is chapter 11, page 12.

- Policy delivery, insurability statement at, 10.15
- Policy endorsements, 10.14–10.15
- Policy loan provision, 10.8
- Polyclonal gammopathy, 6.22
- Polysomnography (sleep study), 1.13
- Positron emission tomography (PET) scans, 1.5, 1.11
 - for brain and nervous system, 1.7
- Postprandial lipemia, 6.3
- Postvoid residual (PVR) test, 1.22
- Potassium-sparing diuretics, 2.14
- Poverty, life insurance as solution to, 8.1
- Pramlintide (Symlin®), 2.4
- Pregnancy-related diabetes, 3.2–3.3
- Premium benefits, disability waiver of, 10.10–10.11
- Premium receipts
 - binding, 10.5
 - conditional and temporary, 10.4–10.5
- Premiums, pricing of, 9.2
- Prescription drug abuse, 15.16–15.17
 - treatment of, 15.17–15.19
 - underwriting considerations for, 15.17
- Pricing, of life insurance products, 9.2
- Prinivil® (lisinopril), 2.9
- Privacy Protection Model Act, 14.15
- Privacy regulation
 - In Canada, 14.10–14.11
 - in U.S., 14.7–14.9
- Private pilot certificate, 11.3
- Producer group, 9.18
- Professional athletes
 - lifespan longevity and mortality rates among, 12.15–12.16
 - risky behaviors of, 12.15
- Profit, in pricing, 9.2
- Propranolol, 5.9
- Prostate cancer
 - biopsy for, 4.7
 - screening for, 4.4
 - testing for, 6.23
- Prostate-specific antigen (PSA), 1.22, 4.4, 6.23
- Protein, 6.2–6.3
 - blood levels of, 6.22
- urine levels of, 6.11
- Proteinuria, 6.11
- Psychiatric impairments, affecting driving ability, 7.7
- Pulmonary angiography, 1.12
- Pulmonary circulation, 5.1
- Pulmonary disorders, affecting driving ability, 7.7
- Pulmonary function tests (PFTs), 1.12–1.13
- Punch biopsy, 4.7
- Punitive damages, 10.1
- Purified protein derivative (PPD) test, 1.13–1.14
- Quebec Civil Code, 10.8, 14.3
- Quebec replacement regulation, 14.7
- QYSMIA®, 2.4
- Radiation therapy, 4.10
- Radioactive iodine uptake (RAI), 1.9
- Radionuclide angiogram, 5.7
- Radionuclide studies
 - abdominal, 1.17
 - for cardiovascular disease, 1.15
- Ramipril (Altace®), 2.9
- Rappelling, 12.13
- Recreational pilot certificate, 11.2
- Reflux testing, 1.17
- Reformation, 10.1, 10.17
- Regulations, 14.1
 - Canadian, 14.3
 - compliance with, 14.4–14.11
 - governing contracts, 10.3–10.4
 - review questions for, 14.17–14.19
 - U.S., 14.1–14.3
- Reinstatement, contestability of, 10.7
- Reinstatement provision, 10.7
- Remedy, 10.1
- Renal biopsy, percutaneous, 1.19
- Renal failure, diabetes-related, 3.5
- Renal insufficiency, 5.5
- Renal scan, 1.19
- Renewability, 9.4–9.5
- Renin inhibitors, 2.10, 2.15
 - combination, 2.16
- Replacement law

ALU 101 Topic Index

References are listed as chapter.page, e.g. reference 11.12 is chapter 11, page 12.

- Canadian, 14.6–14.7
- U.S., 14.5–14.6
- Replacement regulation, 14.5
 - in Canada, 14.6–14.7
 - in U.S., 14.5–14.6
- Representation, 10.1
- Reproductive health tests, 1.21–1.22
- Rescission, 10.17
 - definition of, 10.1
- Restrictive surgery, for obesity, 2.5
- Retinopathy, diabetic, 3.5, 3.6
- Retrograde pyelogram, 1.19
- Revia® (naltrexone), 15.8
- Rider benefits, optional, 9.12–9.15
- Ritalin® (methylphenidate), 15.17
- Road traffic mortality rates, by country, 13.4–13.5
- Rock climbing, 12.12, 12.13
- Roux-en-Y gastric bypass, 2.5

- Sarbanes-Oxley Act, 14.13
- Sarcoma, 4.5
- Schirmer tear test, 1.9
- SCUBA diving, 12.2–12.6
 - certification for, 12.3
- Securities and Exchange Commission (SEC), 14.2
- Sedatives, 15.17
- Seizure disorders, affecting driving ability, 7.8
- Sensitivity, 6.2
- Sensitizers, diabetic, 3.9
- Sertraline, 2.4
- Serum, 6.1
 - lipemic, 6.3
 - proteins in, 6.3
- SGLT2 inhibitors, 3.9–3.10
- Sialography, 1.10
- Sibutramine (Meridia®), 2.4
- Simplified issue (SI), 9.12
- Single photon emission computed tomography (SPECT), 1.7
 - for cardiovascular disease, 1.15
 - gated, 5.7
- Single-premium permanent life policies, 9.11
- Sjogren's syndrome diagnosis, 1.10
- Skin biopsy, 1.9

- Skull, diagnostic testing of, 1.6–1.8
- Skydiving, 12.10–12.11
- Sleep apnea, 7.8
- Sleep disorders, affecting driving ability, 7.8
- Sleeve gastrectomy, 2.5
- Smoking, as cardiovascular risk factor, 5.4
- Snellen test, 1.9
- Snow sports, 12.14–12.15
- Somatosensory evoked potentials (SSEPs), 1.9
- Specificity, 6.2
- Speeding, 7.4
- Spinal cord, benign tumors of, 4.1
- Spiral (helical) scanners, 1.4
- Sport pilot certificate, 11.2–11.3
- Sports, professional, 12.15–12.16
- Spousal insurance, non-working, 8.6–8.7
- Sputum for analysis, 1.14
- Starch blockers, 3.9
- Statins, 5.9
- Stem cell transplantation, 4.10
- Stereotactic biopsy, breast, 1.14
- Stimulants, 15.17
- Stress testing, 1.15
- Stroke
 - alcohol-related, 15.6
 - diabetes-related, 3.5
- Student pilots, 11.10
 - certificate for, 11.2
- Substance Abuse and Mental Health Services Administration (SAMHSA), 15.1
- Substance-induced disorders, 15.1–15.2
- Substance-related disorders, 15.1–15.2
- Substance use disorders, 15.1–15.2. *See also*
 - Illegal drug use/disorders; Prescription drug abuse
 - criteria for, 15.2
 - review questions for, 15.20–15.22
 - treatment of, 15.17–15.19
- Suicide exclusion, 8.2–8.3, 10.13
- Suicide provision, 10.9–10.10
- Supplemental employee retirement plans (SERPs), 9.11
- Suprenza® (phentermine), 2.4
- Suspicious activity reports (SARs), 14.11–14.12
- Symlin® (pramlintide), 2.4

ALU 101 Topic Index

References are listed as chapter.page, e.g. reference 11.12 is chapter 11, page 12.

- Syncope, diagnostic testing for, 1.8
- Syndros®, 15.14
- System for Electronic Rate and Form Filing (SERFF), 14.2
- Systemic circulation, 5.1–5.2
- Tarmac racing, 12.9
- Tax-favored investment account, 9.1
- Taxation, estate planning and, 8.8–8.9
- Technetium scan, 1.9–1.10
- Technology, in product distribution, 9.19–9.20
- Teenage drivers, 7.5
- Tekturna® (aliskiren), 2.10
- Telemarketing Sales Rule, 14.13
- Telephone interview, as underwriting tool, 7.9
- Temporary agreements, 10.4–10.5
- Tenormin® (atenolol), 2.9
- Tenuate® (diethylpropion), 2.4
- Terazosin (Hytrin®), 2.10
- Term life products, 9.3–9.5
- Term riders on permanent plans, 10.12
- Terminal illness provision, 10.12
- Tetrahydrocannabinol (THC), 6.12, 15.13
- Thiazide diuretics, 2.9, 2.14
- Thoracentesis, 1.12
- Thyroglobulin antibody, 4.4
- Thyroid uptake and scans, 1.9–1.10
- Tilt table test, 1.8
- TNM staging system, 4.9
- Tonometry, 1.9
- Topiramate, 2.4
- Toprol® (metoprolol), 2.9
- Tourist injuries, 13.10
- Toxic polyneuropathy, alcohol-related, 15.7
- Track racing, 12.10
- Trail hiking, 12.13
- Tranquilizers, 15.17
- Transesophageal echo (TEE), 1.16
- Transient ischemic attack (TIA), 7.7
- Transrectal ultrasound (TRUS), 1.22
- Transthoracic echocardiography (TTE), 1.15–1.16
- Transvaginal ultrasound, 1.21
- Travel risks, 13.1–13.3
- Travelers, medically impaired, 13.10
- Triglycerides, 6.3
- in alcohol and drug use disorders, 15.11
- Trust, as insurance owner and beneficiary, 10.16
- Tuberculosis, 1.13–1.14
- Tumor cell DNA, 4.9
- Tumor markers, 4.4, 6.23–6.24
- Tumors. *See also* Cancer
 - benign
 - characteristics of, 4.3
 - by tissue of origin, 4.6
 - grades of, 4.7
 - malignant, 4.2, 4.3
 - by tissue of origin, 4.6
 - pathology report factors of, 4.9
 - staging of, 4.8–4.9, 4.9
- Twisting, 14.5
- Ultralights, 11.11–11.12
- Ultrasoundography, 1.2–1.3
 - abdominal, 1.16
 - of brain and nervous system, 1.7
 - of breast, 1.14
 - intravascular (IVUS), 5.8
 - of kidneys, 1.19
 - pelvic or transvaginal, 1.21
 - transrectal, 1.22
- Underweight, 2.6–2.7
 - case study of, 2.12–2.13
- Underwriters, in product development, 9.2–9.3
- Underwriting marketing, 9.16
- Uniform Life Insurance Act, 10.3
- United States Hang Gliding & Paragliding Association (USHPA), 12.12
- United States immigration classifications/visa categories, 13.25–13.28
- United States *vs.* South-Eastern Underwriters Association decision, 14.1–14.2
- Universal life products, 9.7–9.8
 - equity indexed, 9.10
- Unsealed source radiotherapy, 4.10
- Uric acid, 6.22
 - in alcohol and drug use disorders, 15.11
- Urinalysis, 6.10
 - for infections, 6.13
 - substances in, 6.11–6.13

ALU 101 Topic Index

References are listed as chapter.page, e.g. reference 11.12 is chapter 11, page 12.

- Urinary tract infections, 6.13, 6.14
- Urinary tract tests, 1.19
- Urine
 - casts in, 6.12
 - creatinine in, 6.10
 - glucose in, 6.11
 - hemoglobin in, 6.11–6.12
 - nicotine and cotinine in, 6.13
 - total protein in, 6.11
- Urine drug screens, 6.12
- Urine leukocyte esterase, 6.11–6.12
- Urine samples, 6.1, 6.5
 - pre-test processing of, 6.6
- Uroflowmetry, 1.22
- "U.S. Citizen Deaths from Non-natural Causes, by Foreign Country," 13.1–13.2
- USA Freedom Act of 2015, 14.12
- USA PATRIOT Act, 14.11–14.12
- Valium® (diazepam), 15.17
- Valsartan (Diovan®), 2.9
- Vaping, 6.13
- Variable life products, 9.9–9.10
- Variable securities, regulation of, 14.2
- Vascular invasion, 4.9
- Vascular tumors, 4.1
- Vasodilators, 2.10, 2.15
- Vasotec® (enalapril), 2.9
- Venipuncture, 6.5
- Ventilation/perfusion ratio (V/Q), 1.12
- Ventilation perfusion scan, 1.12
- Verapamil, 5.9
- Vertical banded gastroplasty, 2.5
- Vicodin® (hydrocodone), 15.17
- Victoza® (liraglutide), 2.4
- Video capsule endoscopy, 1.17
- Visual evoked potentials (VEPs), 1.8
- Visual flight rules (VFR) certification, 11.4
- Visual meteorological conditions (VMC)
 - certification, 11.4
- Waist circumference, 2.3
- Waist-hip ratio (WHR), 2.3
- Waiver, 10.1, 10.18
- Waiver of premium for disability, 9.12–9.13
- War hazard exclusion, 10.13
- Weather-related aviation accidents, 11.14–11.15
- Weight loss, unintentional, 2.7
- Weight-loss medications, 2.4
- Whole life policies, 9.5–9.6
 - indeterminate premium, 9.8
 - interest sensitive, 9.8–9.9
 - limited pay, 9.6
 - modified, 9.6
 - single premium, 9.6
- World health system rankings, 13.29
- X-rays, 1.1
 - chest, 1.10–1.11, 1.15
- Xanax® (alprazolam), 15.17
- Xenical® (orlistat), 2.4
- Zero tolerance law, 7.9
- Zestril® (lisinopril), 2.9
- Zonisamide, 2.4
- Zytiga®, 6.23