Module 9

9.1: Introduction to Specialty Medications

In general, **specialty medications** are high cost medications used for treating complex disease states. They can be challenging to both manufacture and administer, and they often require significant patient education and close monitoring to ensure their safe and appropriate use. Although specialty medications were once a very small piece of the pharmaceutical industry, there has been a significant change over the last 20 years and especially within the last decade. Specialty medications are now the fastest growing segment of the pharmaceutical industry. Common characteristics associated with specialty medications are listed in **Table 9.1**.

Table 9.1 Specialty Medication Characteristics

High Cost	Potential for limited or exclusive availability for distribution
Complex treatment regimen that require ongoing monitoring and patient education	Treat rare diseases
Special handling, storage, or delivery requirements	Treat diseases known to have long term or severe side effects or increased fatality
Biologically derived and available in injection, infusion, or oral form	Payers may define what they consider to be a specialty medication for reimbursement and contracting purposes.

With the increase in specialty medications over the last two decades, a whole new approach to dispensing these medications emerged called **specialty pharmacies**. Generally, specialty medications are not available at typical community pharmacies, so patients must obtain them through specialty pharmacies. There are many reasons for this: some practical, some financial, and some clinical. Traditional retail pharmacy is not designed to handle these complex, costly medications. First, the high cost alone, in many cases, would prohibit retail pharmacies from stocking the medication. Second, the often-busy nature of a retail pharmacy does not align itself well with being able to appropriately manage and support the needs of patients with complex disease states. For these reasons, the first specialty pharmacies began in the early 2000s. Specialty pharmacies are typically required, through their contract with health insurance companies, to meet unique requirements that are not part of their contracts with retail pharmacies. Examples of these requirements are listing in **Table 9.2.**

Table 9.2 Examples of Specialty Pharmacy Services

Coordinating care and facilitating the drug access	Case management- disease state management
Facilitating mail order delivery logistics	Product device training when applicable
Working with health insurance to determine coverage and help coordinate any requirements of the insurance company	Data management of technical and clinical patient care services.
Investigating patient assistance programs for patients without insurance or lack of coverage	Call center development

Patient Experience

A patient receiving a prescription for a specialty medication should be aware that the process for getting the medication is going to look different than the normal retail pharmacy experience. However, the system is designed so that the patient has the best chance of successfully obtaining and using the medication safely and appropriately. The prescription would first be sent to the specialty pharmacy. The specialty pharmacy then takes responsibility for making sure the patient gets the medication, understands the risks and benefits, is able to afford it, able to take it appropriately, and will follow through with any necessary monitoring. The patient may be connected with a case manager that will call them on a monthly basis to make sure there are no issues with the medications, check to see if they had any required monitoring

completed, provide any necessary education, and/or answer patient questions. Patient follow-up often happens every month prior to sending out the next months' worth of medications in order to minimize waste, ensure safety, and assess for efficacy. As specialty pharmacies are generally not local to the patient they are caring for, care and coordination are often provided telephonically. The process is centralized, and the medications are shipped to the patient's house or, in some cases, to the facility that will be administering the medications.

Brief Overview of Common Disease States Treated with Specialty Medications

Common disease states managed by specialty pharmacies include (1) oncology, (2) multiple sclerosis, (3) rheumatoid arthritis, (4) Crohn's disease, (5) hepatitis C, and (6) HIV/AIDs. This module with introduce some of the most commonly used specialty medications that most health care professionals would come into contact with, regardless of their specialty. Many of these conditions represent an entire specialty in medicine and are very complex. Therefore, for the purposes of this module, these conditions will be introduced briefly.

Oncology is the study and treatment of cancer. **Cancer** is a disease process that involves the development and proliferation of abnormal calls. Cancer cells are marked by both a structural change and a loss of function from the original healthy cell. They are often characterized by multiplying at a faster than normal rate. As this collection of abnormal cells, called a tumor, grows it can become life threatening as it deprives normal body cells of the nutrients they need to function.

Multiple Sclerosis (MS) is an often unpredictable, disabling disease of the central nervous system. It disrupts the flow of information both within the brain as well as between the brain and the body. Damage to the myelin coating around the nerve fibers in the CNS causes the nerve signals to be disrupted. This damage ultimately leads to the symptoms of MS that can vary between individuals with the disease. Some of the more common symptoms include fatigue, difficulty walking, numbness or tingling, stiffness in the limbs, weakness, vision problems, cognitive changes, pain, depression, and emotional changes.

Rheumatoid Arthritis (RA) is a chronic autoimmune disorder that causes inflammation and tissue damage in the joints. It is a very painful and (often) disabling disease. The common symptoms of RA include pain, stiffness, and reduced range of motion. Generally, the treatment would not start with a specialty medication. The initial medications fall under the class **disease modifying antirheumatic drug (DMARD)**. However, these are not always effective or in some instances, patients may no longer respond as they once did. In either case, a patient would be then switched to one of the specialty medications reviewed below.

Crohn's Disease is an inflammatory bowel disease caused by inflammation in the digestive tract which can lead to symptoms such as abdominal pain, severe diarrhea, fatigue, weight loss, and malnutrition. The inflammation can spread deep into the layers of the affected bowel tissues making the symptoms extremely painful and often hard to control.

Hepatitis C is a viral infection that causes liver inflammation which can sometimes lead to serious liver damage. The virus is spread through infected blood. There are often no symptoms associated with chronic hepatitis C until the virus damages the liver significantly enough. Symptoms of hepatitis C then include bleeding and bruising easily, fatigue, poor appetite, dark urine, swelling, weight loss, and confusion. Interestingly, acute hepatitis C often goes undiagnosed because of the lack of or self-limiting nature of the symptoms. Additionally, some people that contract hepatitis C never go on to develop chronic hepatitis C because their body is able to clear the virus on its own. However, those that do progress to chronic hepatitis C, will likely develop liver failure and need a liver transplant should they live long enough if the disease is left untreated. Recent treatments have made the possibility of a cure very likely with only three months of treatment.

HIV/AIDS is a notorious virus with incredible advancements in treatment over the last 30 years. HIV stands for human immunodeficiency virus and is the causative agent of acquired immunodeficiency syndrome (AIDS). The virus is spread through sexual contact, perinatally from an infected mother, or by injection into the blood. The typical course of the infection is characterized by an acute clinical illness that varies in presentation followed by a longer clinical latency.

People may go years without any symptoms. However, during this asymptomatic time, the virus is working in the body to destroy the immune system, specifically the CD4 Cells (T-cells). With the destruction of immune cells, the person is eventually no longer able to fight off pathogens (disease causing agents), a state referred to as being immunocompromised. When a pathogen is able to take advantage of the lowered immunity, it is called an opportunistic infection. At this point, the patient is generally considered to have AIDS. HIV/AIDS cannot be cured, but it can be controlled with antiretroviral therapy (ART).

9.2: Introduction to Immunomodulating Drugs

Over the last twenty years, medical technology has developed a new group of drugs that affect the immune system. Many of these drugs are synthesized through **recombinant DNA technology**, which is the process of joining DNA molecules from two different sources and inserting them into a host organism which then generates specific products for human use. These drugs are often referred to as **biologics** and are almost always considered specialty medications. They are in a large part responsible for the growth of the specialty pharmacy industry. Such drugs work by altering the body's response to diseases such as cancer, autoimmune, inflammatory and infectious diseases. Biologics can work either by enhancing or restricting the patient's natural immune response. To better understand how such medications work within the body, we will briefly cover the physiology of the immune system.

Immune Response Overview

One of the main functions of the immune system is to identify substances as being either foreign or of self. When bacteria or viruses enter the body, the immune system should recognize both as foreign and initiate an immune response to eliminate it from the body.

More specifically, there is **humoral immunity and cell-mediated immunity**.

Humoral immunity is defined as the immune response mediated by B-cells and the production of antibodies targeted against specific antigens. **B-cells** are leukocytes that develop into plasma cells and then produce antibodies that bind to and inactivate antigens. **Antibodies** are molecules that have the ability to bind to and inactivate antigen molecules through the formation of an antigen-antibody complex.

Cell-mediated immunity which works in collaboration with humoral immunity, is the immune response mediated by T-cells. **T-cells** (T lymphocytes) are not involved in the production of antibodies but instead act through either direct cell-to-cell contact or through the production of cytokines. **Cytokines** are a generic term for non-antibody proteins released by specific cell populations (activated T-cells) upon contact with antigens. They act as intercellular mediators of an immune response. Of note, there are various subtypes of T-cells: (1) helper, (2) suppressor and (3) cytotoxic.

T helper cells are cells that promote the direct actions of numerous other cells associated with the immune system.

T suppressor cells regulate and limit the immune response, balancing the effect of T helper cells.

Cytotoxic T cells (natural killer cells) are differentiated T-cells that can recognize foreign antigens being presented on the surface of another cell. Once recognized, the cytotoxic T-cell then attacks and destroys the particular target cell.

The main types of biologics covered in this module are classified as immunomodulating drugs.

Immunomodulating drugs are defined as a subclass of biologics that specifically or nonspecifically enhance or reduce the immune response. The subclasses of immunomodulating drugs include (1) interferons, (2) monoclonal antibodies, (3) interleukin receptor antagonists and agonists and (4) other miscellaneous drugs. Since these drugs alter a patient's immune response, they are often used in cancer treatments because they are able to specifically target the cancer cells while leaving healthy cells alone. They are also commonly used to treat autoimmune and inflammatory conditions by interfering with a patient's overactive immune response in diseases like rheumatoid arthritis.

Select Immunomodulating Drugs

Interferons are proteins that have antitumor, antiviral, and immunomodulating properties. They are most commonly used in the treatment of certain cancers and viral infections. Interferons have three different effects on the immune system. (1) They can restore function if it is not working properly, (2) they can augment its function, or (3) they can inhibit its function. Inhibiting its function becomes important in autoimmune diseases because the immune system is not working properly.

Note: Due to the fact that most of these drugs are only available in a brand name option, clinicians generally refer to them by their brand name. It is recommended that the student be familiar with both the brand and generic name of the drugs covered in this module.

Example Interferon

Interferon beta-1a (Avonex or Rebif) is indicated to treat relapsing multiple sclerosis. It interacts with the specific cell receptors found on the surface of human cells. They have been shown to slow the progression of physical disability and decrease the frequency of clinical exacerbations.

Avonex is a once weekly intramuscular injection while Rebif is a three times per week subcutaneous injection. The most common adverse effects with interferons are flu-like symptoms such as fever, chills, malaise, myalgia, and fatigue.

Monoclonal Antibodies are becoming the drugs of choice for many diseases such as cancer, rheumatoid arthritis, Crohn's disease, multiple sclerosis, and organ transplant. In the treatment of cancer, they have an advantage over traditional chemotherapy medications in that they can specifically target cancer cells and leave healthy cells alone. These drugs are made using recombinant DNA technology making them extremely costly. Despite being more targeted than traditional cancer therapies, severe allergic inflammatory type infusion reactions can occur. Patients often need to be pre-medicated to reduce the incidence.

Example Monoclonal Antibodies

Adalimumab (Humira) acts on tumor necrosis factor (TNF), which is a naturally occurring cytokine involved in the normal inflammatory and immune response. Adalimumab works by preventing TNF molecules from binding to the TNF cell surface. It also works by impacting the typical inflammatory responses regulated by TNF. Although originally indicated for rheumatoid arthritis, it can also be used in Crohn's disease, ulcerative colitis, plaque psoriasis, and psoriatic arthritis. The most common adverse reactions are infections, injection site reactions, headache, and rash. **Infliximab (Remicade)** works very similarly to adalimumab, although it does carry a unique contraindication. Due to being shown to worsen heart failure, it should not be used in patients with class III or IV on the New York Heart Association Scale.

Bevacizumab (Avastin) works by binding to and inhibiting vascular endothelial growth factor, which is a protein that promotes the development of new blood vessels in both tumor and normal body tissues. It is indicated to treat metastatic colon cancer, rectal cancer, non-small-cell lung cancer, and malignant glioblastoma (type of brain cancer). Adverse effects include blood clots, GI issues, headache, dizziness, and weight loss.

Natalizumab (Tysabri) is a humanized monoclonal antibody derived from murine myeloma cells. It works by binding to the alpha$_4$ subunit of **integrins**, which are proteins found on the surface of leukocytes. These proteins have been associated with the disease process of multiple sclerosis, although the exact mechanism is not completely understood. It is known that natalizumab inhibits the leukocyte adhesion that the alpha$_4$ protein subunits are involved. It is indicated to be used to treat multiple sclerosis (MS). There is a risk of a rare viral infection in the brain for patients on this medication. Therefore, in 2006 the FDA limited its distribution and patients must enroll in a specific program prior to being able to receive the drug. Less severe adverse effects include depression, fatigue, headache, GI issues, and lower respiratory tract infections.

Interleukins are a natural part of the immune system. They are actually classified as **lymphokines** because they are cytokines produced at least in part by lymphocytes. They are soluble proteins released from activated lymphocytes such

as natural killer cells. There are several different interleukins that have been identified, and each has different specific actions within the body. For example, interleukin-2 (IL-2) specifically is known to have anti-tumor actions.

Example Interleukins

Aldesleukin (IL-2) (Proleukin) is an interleukin-2 derivative and works indirectly to restore the immune response by binding to receptor sites on T-cells, stimulating them to multiply. One type of cell that results is called the lymphokine-activated killer (LAK) cell. **LAK cells** can recognize and destroy cancer cells while leaving other healthy cells alone. For this reason, Aldesleukin is specifically indicated for metastatic renal cell carcinoma (kidney cancer that has spread) and melanoma (skin cancer). Adverse events include severe toxicities, specifically **capillary leak syndrome**—the body's capillaries are no longer able to retain the substances that make up blood causing them to "leak" into the surrounding tissue. This results in severe fluid retention that can be life-threatening if not treated. The syndrome is reversible with the discontinuation of the drug. Other more typical adverse events include fever, chills, rash, fatigue, liver toxicity, muscle pain, and headache.

Anakinra (Kineret) is a recombinant form of human interleukin -1 (IL-1) receptor antagonist. It acts by inhibiting the binding of IL-1 to its many receptor sites throughout the body. Because this drug serves to block an immune process, it is effective in treating rheumatoid arthritis, which is a condition where the immune system is not functioning properly. Adverse events most commonly include injection site reactions, respiratory tract infections, and headache.

Miscellaneous

There are several immunomodulating drugs that work by various mechanisms but do not fall into one of the previous categories. Two of the more commonly used miscellaneous immunomodulators are covered below.

Example Drugs

Abatacept (Orencia) is a selective co-stimulation modulator indicated for the treatment of rheumatoid arthritis. It works by inhibiting T-cell activation. Common adverse effects include headaches, upper respiratory tract infections, and hypertension. It should not be combined with TNF blocking drugs like adalimumab and infliximab or with anakinra due to the increased risk of serious infection.

Etanercept (Enbrel) is a recombinant DNA-derived TNF-blocking drug. It works by binding to TNF and blocking its ability to bind to its target receptors on the cell surface. It is indicated to treat rheumatoid arthritis and plaque psoriasis. Common adverse effects include headache, injection site reactions, upper respiratory tract infections, dizziness, and weakness.

In general, these drugs are administered by injection although the exact route varies. See the summary chart (**Table 9.3)** of the immunomodulating drugs covered in this module for specifics on the route of administration.

Table 9.3 Summary of Select Immunomodulating Drugs Including Route of Administration

Drug Name (Trade name)	Drug Class	Indications	Route of Administration and Typical Frequency
Interferon beta-1a (Avonex or Rebif)	Immunomodulator	Multiple Sclerosis	Avonex- Intramuscular (IM) once a week Rebif- subcutaneous (SC) injection three times per week
Adalimumab (Humira)	Anti-TNF monoclonal antibody	Rheumatoid arthritis (RA), Crohn's disease, ulcerative colitis	SC injection every other week
Infliximab (Remicade)	Anti-TNF monoclonal antibody	Ankylosing spondylitis, Crohn's disease, RA	IV infusion every 6-8 weeks once stable
Bevacizumab (Avastin)	Anti-human vascular endothelial growth factor	Metastatic colorectal cancer	IV infusion every 14 days
Natalizumab (Tysabri)	Anti-alpha$_4$ integrin subunit MAB	Multiple Sclerosis	IV infusion every four weeks
Aldesleukin (IL-2) (Proleukin)	Human recombinant IL-2 analogue	Metastatic renal cell carcinoma or melanoma	IV infusion every 8 hours (14 doses) hold dose for 9 days then repeat once
Anakinra (Kineret)	IL-1 receptor antagonist	RA	Daily subcutaneous injection
Abatacept (Orencia)	Selective costimulation modulator	RA	IV infusion every four weeks
Etanercept (Enbrel)	TNF receptor antagonist	RA	Subcutaneous injection every week

9.3: Antivirals & Antiretroviral Therapy

Antivirals for the Treatment of Hepatitis C

There have been major advancements in the treatment of hepatitis C in the last 5 years. Prior to these new medications, the treatment for hepatitis C included interferon and a drug called ribavirin. Ribavirin did not target the virus itself but rather helped to enhance the immune system with the hope that the body would then be able to fight off the virus. The cure rates were low while the side effects were high; so many people did not even attempt treatment. Over time, the likely outcome for these patients (if they lived long enough) was the need for a liver transplant. With the development of a new class of antiviral medication that targets the hepatitis C virus specifically, the likelihood of a cure is now close to 96%. One of the best aspects of the new treatments is the short duration. In fact, patients may only need to be treated for 8-12 weeks. This represents a significant improvement from traditional treatment that lasted anywhere from 24-48 weeks and had a 50% success rate at best. The new treatments available are considered "direct acting" antiviral medications. In simple terms, they interfere with the proteins that help the virus grow and spread. Two of the more common options are introduced below.

Ledipasvir/sofosbuvir (Harvoni) was the pill that launched this radical change in the treatment of Hepatitis C. In general, the side effects are mild, and the cure rate is high. The price tag is also high at about $95,000 for a 12-week treatment course.

Ombitasvir/paritaprevir/ritonavir with dasabuvir (Viekira Pak) has two separate pills. In general, the side effects are mild with the exception of some cases of serious liver injury, mostly seen in patients with underlying advanced liver disease. Of note, ritonavir is a protease inhibitor (see section below on HIV) with no activity against hepatitis C. It is a potent inhibitor of CYP 3A4 enzymes within the liver and is used to increase the concentrations of paritaprevir. The cost is also high at about $84,000 for a 12-week treatment course.

Antiretroviral Therapy (ART)

A full review of ART is beyond the scope of this course. This module will simply introduce the main classes of antiretrovirals and provide a basic understanding of the pharmacologic treatment of HIV. There have been many great advancements in the treatment of HIV since it was first identified in the early 1980s. Due to the high cost of most HIV medications and the importance of compliance, HIV medications are almost always considered specialty medications. HIV is unique from other viruses because it mutates rapidly which leads to drug resistance. When this happens, the drugs are no longer effective against the virus. In order to better understand the different classes of antiretrovirals, HIV as a virus needs to be reviewed in a bit more detail.

HIV

HIV is a retrovirus. As such, HIV contains the enzyme reverse transcriptase which coverts its RNA genome into DNA. The viral DNA can then be integrated into the host cell's DNA where it will be replicated alongside the host DNA. Thus, the virus 'tricks' the host into replicating its viral genome which then leads to the production of the viral proteins required to assemble new viruses. HIV specifically targets macrophages and helper T-cells, effectively compromising the immune system of the host. Once HIV has control of the cell, it often begins producing more HIV that can go out and infect more host cells. Over time, the patient becomes more and more **immunosuppressed,** meaning that the body's ability to fight infection has been compromised. Once the patient begins developing multiple opportunistic infections because of the depletion in lymphocytes (T-cells), they are said to have AIDS. Importantly, once a patient is infected with HIV, they have it for life. There is no cure. The medications are simply used to help control the virus and prevent it from propagating further to hopefully delay the onset of AIDS.

HIV treatment should always include more than one mechanism of action. Monotherapy cannot counter the development of drug resistance, and a missed dose can quickly lead to a poor outcome. The current treatment strategy is referred to as **HAART (highly active antiretroviral therapy)**. HAART consists of three antiretrovirals taken in combination. This increases the effectiveness of the regimen by presenting the virus with multiple obstacles to try and overcome.

Note: The effects of the HIV virus and the counter effects of the antiretrovirals can get very technical very quickly and again is really beyond the scope of this course.

Basic concepts of virus propagation will be introduced in order to have a working understanding of these drugs. As mentioned above, in order to multiply, viruses must be able to enter the cell nucleus and integrate with the host DNA. They first enter the cell by attaching to the outer cell membrane. Thus, this initial attachment is a potential site of action for drug therapy. The second thing that must happen is the virus needs to be able to take over the process of DNA transcription so that the host cell is now ultimately producing progeny virus to be sent out to infect more cells. This is another site of action for drug therapy—the drugs target the process of transcription. When the host cell is successfully producing the virus, it also must be able to expel the virus out of the cell (**egress**) and into circulation in order to find another host cell to infect. Inhibiting egress is another potential site of action for drug therapy.

The most common combination therapy to start with is a triple cocktail that combines two **nucleoside-analogue reverse transcriptase (NRTIs)** and one **nonnucleoside reverse transcriptase inhibitor (NNRTI)**, or one protease inhibitor. Fortunately, there are now combination tablets that have all three of these medications in a single dose. New advancements are continually being made in the area of HIV research. This module will introduce five primary drug classes used in the treatment of HIV.

Fusion Inhibitors work by preventing the complete fusion of HIV to the host cell. Therefore, penetration of the virus into the host cell is blocked as are any subsequent steps. However, fusion inhibitors are not 100% effective. For this reason, additional strategies are used to combat the virus.

Nucleoside-analogue reverse transcriptase inhibitors (NRTIs) are part of the recommended HAART regimen. Nucleosides are the fundamental building blocks of RNA and DNA. The NRTIs work by incorporating themselves into the

DNA and inhibiting the reverse transcriptase and synthesis of new viruses. This, in turn, decreases viral replication and the infection is reduced.

Nonnucleoside reverse transcriptase inhibitors (NNRTIs) are also part of the recommended HAART regimen. NNRTIs work by directly binding to the enzyme reverse transcriptase found within HIV, thus blocking its ability to take over the transcription process of the host cell.

Integrase Inhibitors work by blocking the enzyme integrase which is essential for the virus to be able to enter the host cell nucleus and begin incorporating its viral DNA into the host cells' DNA.

Protease Inhibitors are the third option for the recommended HAART regimen. As their name indicates they work by inhibiting protease, an enzyme essential for the final assembly of the new virus. The new virus is thus unable to be released into circulation to find a new host cell.

Table 9.4 below provides an overview of specific select antiretroviral medications.

Table 9.4 Examples of Antiretrovirals

Drug Class	**Example Drug(s)**
NRTI	Zidovudine (Retrovir) Tenofovir (Viread) Emtricitibine (Emtriva) Lamivudine (Epivir)
NNRTI	Efavirenz (Sustiva) Rilpivirine (Edurant) Nevirapine (Viramune)
Protease Inhibitor	Atazanavir (Reyataz) Darunavir (Prezista) Ritonavir (Norvir)
Integrase Inhibitor	Dolutegravir (Tivicay) Raltegravir (Isentress)
Fusion Inhibitors	Enfuvirtide (Fuzeon)

HAART requires multiple medications in order for the best chance of controlling the virus. Many of the above medications are available in combination pills in order to make the dosing regimen simpler. Adherence to these medications is critical to increase effectiveness and avoid or at least delay the development of drug resistance. Some of the common combination tablets are listed below **in Table 9.5.**

Table 9.5 Examples of Combination Tablets for the Treatment of HIV

Drug name and components	**Drug classes**
Atripla (efavirenz/lamivudine/tenofovir)	NNRTI/NRTI/NRTI
Truvada (emtricitabine and tenofovir)	NRTI/NRTI
Complera (emtricitabine/rilpivirine/tenofovir)	NRTI/NNRTI/NRTI

The adverse effects associated with HIV medications are generally very drug-specific and beyond the scope of this module. However, most drugs tend to cause nausea and vomiting. More serious adverse events that need to be monitored for include renal toxicity and neutropenia. **Neutropenia** is a decrease in white blood cells, specifically neutrophils. This is especially concerning in patients that may already be immunocompromised. Patients will often require frequent blood counts to monitor for these more serious adverse events.

Problem Set

Question 1

List characteristics that typically describe a specialty drug.

High Cost	***Potential for limited or exclusive availability for distribution***
Complex treatment regimen that require ongoing monitoring and patient education	***Treat rare diseases***
Special handling, storage, or delivery requirements	***Treat diseases known t have long term or severe side effects or increased fatality***
Biologically derived and available in injection, infusion, or oral form	***Payers may define what they consider to be a specialty medication for reimbursement and contracting purposes.***

Question 2

List some common additional requirements that the specialty pharmacy must offer to patients in order to ensure that these high cost, potentially high adverse events medications are used safely and appropriately.

Coordinating care and facilitating the drug access	***Case management- disease state management***
Facilitating mail order delivery logistics	***Product device training when applicable***
Working with health insurance to determine coverage and help coordinate any requirements of the insurance company	***Data management of technical and clinical patient care services.***
Investigating patient assistance programs for patients without insurance or lack of coverage	***Call center development***

Question 3

Explain the process that a patient would need to follow in order to obtain one of these medications.

The prescription would first be sent to the specialty pharmacy. The specialty pharmacy then takes responsibility for making sure the patient gets the medication, understands the risks and benefits, is able to afford it, take it appropriately and follows through with any necessary monitoring. The patient may be connected with a case manager that will call them on a monthly basis to make sure there are no issues with the medications, check to see if they are had any required monitoring, provide any necessary education or answer patient questions. This often happens every month prior to sending out the next months' worth of medications to minimize waste, ensure safety, and assess for efficacy.

Question 4

List the most chronic disease states that are treated with specialty medications.

oncology, multiple sclerosis, rheumatoid arthritis, Crohn's disease, hepatitis C, and HIV/AIDs

Question 5

List a description of the basic disease process including common symptoms of following disease states: Rheumatoid arthritis, Multiple Sclerosis, Crohn's disease, Hepatitis C, and HIV

RA: is a chronic autoimmune disorder that causes inflammation and tissue damage in the joints. The common symptoms of RA include pain, stiffness, and reduced range of motion.

MS: It disrupts the flow of information within the brain and between the brain and the body. There is damage to the myelin coating around the nerve fibers in the CNS that cause the nerve signals to be disrupted. Some of the more common symptoms include Fatigue, difficulty walking, numbness or tingling, stiffness in the limbs, weakness, vision problems, cognitive changes, pain, depression and emotional changes.

Crohn's disease is an inflammatory bowel disease caused by inflammation in the digestive tract which can lead to symptoms such as abdominal pain, severe diarrhea, fatigue, weight loss, and malnutrition. The inflammation can spread deep into the layers of the affected bowel tissues making the symptoms extremely painful and often hard to control.

Hepatitis C: a viral infection that caused liver inflammation and sometimes leads to serious liver damage. The virus is spread through infected blood. There are often no symptoms with Chronic hepatitis C until the virus damages the liver significantly enough. Symptoms of hepatitis C then include bleeding and bruising easily, fatigue, poor appetite, dark urine, swelling, weight loss, confusion.

HIV is s retrovirus that attacks the body's immune system. The typical course of the infection is characterized by an acute clinical illness that varies in presentation followed by a longer clinical latency. People may go years without any symptoms. However, during this asymptomatic time the virus is working in the body to destroy the immune system, specifically the CD-4 Cells (T-cells). Over time the person is no longer able to fight off bacteria that generally do not cause infection called opportunistic infections.

Question 6

Define the following terms related to the immune system: Humoral immunity, cell mediated immunity, Antibodies, T-cells and cytokines.

Humoral immunity is defined as the immune response mediated by B cells and the production of antibodies targeted against specific antigens.

Antibodies are molecules that have the ability to bind to and inactivate antigen molecules through the formation of an antigen-antibody complex.

Cell-mediated immunity which is the immune response mediated by T-cells.

T-cells or T lymphocytes are not involved in the production of antibodies but instead occur in different types of subtypes that act through direct cell to cell contact or through the production of cytokines.

Cytokines is a generic term for non-antibody proteins released by specific cell populations (activated T cells) on contact with antigens. They act as intercellular mediators of an immune response.

Question 7

Describe the impact on the immune system of the more common immunomodulating drugs such as: interferons, anti-TNF monoclonal antibodies, interleukins (specifically IL-2).

Interferons are proteins that have antitumor, antiviral, and immunomodulating properties. Interferons have three different effects on the immune system. They can restore function if it's not working properly, they can augment its function, or inhibit its function.

Interleukins are a natural part of the immune system. They are actually classified as lymphokines because they are cytokines produces at least in part by lymphocytes. Il-2 works by indirectly to restore immune response by binding to receptor sites on T-cells stimulating them to multiply. One type of cell that results is called the lymphokine-activated killer (LAK) cell. This LAK cell can recognize and destroy cancer cells while leaving other healthy cells alone

Anti-TNF Monoclonal antibodies acts on tumor necrosis factor (TNF), which is a naturally occurring cytokine that is involved in the normal inflammatory and immune response. they essentially work by preventing TNF molecules from binding to the TNF cell surface.

Question 8

List two of the new hepatitis C treatment options and describe how they improve previous treatment options.

Harvoni and Viekira Pak. With the development of a new class of antiviral medication that targets the hepatitis C virus specifically, the chance for a cure, is now close to 96%. Possibly the best part of this is that the treatment is not chronic. In fact, patients may only need to be treated for 8-12 weeks. Additionally, the side effects of these new drugs are minimal in comparison to the old treatment regimen of interferon.

Question 9

Explain what the HIV virus does once it enters the body.

HIV is a retrovirus. This means that it contains the enzyme reverse transcriptase. Essentially, this allows it to take over the process of DNA transcription (how cells multiply) once it enters the host cell. HIV specifically targets macrophages and helper T-cells effectively compromising the immune system of the host. Instead of producing cells that help fight infection, once the HIV has control of the cell, it actually begins producing more HIV that can go out and infect more host cells.

Question 10

Explain why it is not recommended to treat HIV with only one medication.

Monotherapy cannot counter the development of drug resistance and a missed dose can quickly lead to a poor outcome. The current treatment strategy is referred to as HAART (highly active antiretroviral therapy). HAART consists of three antiretrovirals taken in combination. This increases the effectiveness of the regimen by presenting the virus with multiple obstacle to try and overcome.

Question 11

List the primary antiretroviral classes covered in this module and provide a brief description at how they target the HIV virus.

Nucleoside-analogue reverse transcriptase (NRTIs). The NRTIs work by incorporating themselves into the DNA and inhibiting the reverse transcriptase and synthesis of new viruses. This in turn decreases viral replication and the infection is reduced.

Nonnucleoside reverse transcriptase inhibitors (NNRTIs). NNRTIs work by directly binding to the enzyme reverse transcriptase found within HIV virus thus blocking its ability to take over the transcription process of the host cell.

Protease Inhibitors. As their name indicates they work by inhibiting protease, an enzyme essential for the final assembly of the new virus. The new virus is thus unable to be released into circulation to find a new host cell.

Integrase Inhibitors work by blocking the enzyme integrase which is essential for the virus to be able to enter the host cell nucleus and begin incorporating into the transcription process.

Fusion Inhibitors work by preventing the complete fusion of HIV to the host cell. Therefore, the penetration into the host cell is blocked and it cannot take over the transcription process.