Risk Factors for Osteoporotic Fracture in the National Health and Nutrition Examination Survey

Background

Osteoporosis is a condition that causes bones to become thin and porous, decreasing bone strength and leading to increased risk of breaking a bone. The most common sites of osteoporotic fracture are the wrist, spine and hip. No single cause for osteoporosis has been identified.

Although low bone mass (or low bone density) plays an important role in determining a person's risk of osteoporosis, it is only one of many risk factors for osteoporotic fractures. Fracture risk results from a combination of bone-dependent and bone-independent factors. Age, gender, race, excessive weight loss, nutritional status, a history of fractures, and having a parent who fractured a hip all increase the risk of fracture independent of a person's bone mineral density (BMD), and individuals with more risk factors have a higher chance of suffering a fracture. For example, men and women who have the same bone density have about the same risk of a fracture, but overall women have more fractures because they have lower bone density. Persons of African ancestry have better bone density than other races; furthermore, at the same bone density they have about 30% fewer fractures. Asians have fewer fractures than Caucasians even though their bone density is lower. Other risk factors include high body mass index (BMI), large weight loss, long-term use of certain medications such as prednisone and cortisone, smoking, high alcohol consumption, and some chronic diseases.

The most widely recognized test for measuring BMD is a noninvasive technology known as dual-energy x-ray absorptiometry (DXA). This technique, which uses low levels of x rays, involves passing a scanner over the body. Bone density measurement by DXA at the hip and spine is generally considered the most reliable way to diagnose osteoporosis and predict fracture risk. DXA bone densitometry records the areal BMD (g/cm2), and is routinely measured at the lumbar spine (lower portion of the spine) for the vertebrae L1 to L4. For the hip, several regions may be studied including the femoral neck, trochanter and Ward's triangle. The results of DXA scans are usually interpreted using the World Health Organisation (WHO) definition of osteoporosis, which is a T-score less than -2.5. A T-score is computed by comparing the BMD measurement to a reference value.

Data Source

The National Health and Nutrition Examination Survey (NHANES) is a program of studies designed to assess the health and nutritional status of adults and children in the United States. The survey is unique in several countries in that it combines interviews and physical examinations and the data are made publicly available for analysis by researchers. NHANES is a major program of the National Center for Health Statistics (NCHS). NCHS is part of the Centers for Disease Control and Prevention (CDC) and has the responsibility for producing vital and health statistics for the Nation.

The NHANES program began in the early 1960s and has been conducted as a series of surveys focusing on different population groups or health topics. In 1999, the survey became a continuous program that has a changing focus on a variety of health and nutrition measurements to meet emerging needs. The survey examines a nationally representative sample of about 5,000 persons each year. These persons are located in counties across the country, 15 of which are visited each year.

The NHANES interview includes demographic, socioeconomic, dietary, and health-related questions. The examination component consists of medical, dental, and physiological measurements, as well as laboratory tests administered by highly trained medical personnel.

Findings from this survey can be used to determine the prevalence of major diseases and risk factors for diseases. Information is used to assess nutritional status and its association with health promotion and disease prevention. NHANES findings are also the basis for national standards for such measurements as height, weight, and blood pressure. Data from this survey is used in epidemiological studies and health sciences research, which help develop sound public health policy, direct and design health programs and services, and expand health knowledge.

This case study uses data from the National Health and Nutrition Examination Survey, 2007-2008 (NHANES 2007-2008), in which 10,149 individuals of all ages were initially contacted for the survey and physical examination. Data were collected between January 2007 and December 2008.

Further information about the NHANES 2007-2008 program can be found at the following website: http://www.cdc.gov/nchs/nhanes/nhanes2007-2008/nhanes07_08.htm

Research Question:

What are the risk factors for osteoporotic fracture?

Objectives

The primary objective is to identify predictors of osteoporotic fracture (i.e., fractures of the hip, wrist, and spine) in men and women.

The secondary objectives include:

·   To determine which bone mineral density (BMD) measure(s) is(are) the best predictor of osteoporotic fracture after controlling for various non-BMD risk factors.

·   To determine which BMD measure(s) is(are) the best predictor of hip fracture after controlling for various non-BMD risk factors.

Variables:

Data are provided for 5,935 individuals who had a DXA scan. There are 54 variables in the dataset, which includes non-bone density risk factors, BMD measurements, and information about fractures of the hip, wrist, and spine. Survey weights and sampling unit information is also included.

Name of Variable	Variable Description	Variable Values
SEQN	Unique ID number assigned to each sample person	Numeric value
ALQ101	Had at least 12 alcoholic drinks in the last year	1=yes; 2=no; 7=refused; 9=don't know

ALQ130	Average number of alcohol drinks/day in the last 12 months	numeric value with a maximum of 95; 777=refused; 999=don't know; .=missing
ALQ140Q	Number of days having 5+ drinks in the last 12 months	numeric value with a maximum of 365; 777=refused; 999=don't know; .=missing
BMXBMI	Body mass index	numeric value; .=missing
DBQ197	Past 30 day milk consumption	0=never; 1=rarely – less than once a week; 2=sometimes-once a week or more, but less than once a day; 3 = often-once a day or more; 4 = varied; 7 = refused; 9 = don't know; . = missing
DBQ229	Regular milk use 5 times per week	1= a regular milk drinker for most or all of my life, including childhood; 2= never been a regular milk drinker; 3= milk drinking has varied over my life-sometimes I've been a regular milk drinker; 7=refused; 9=don't know; .=missing
DIQ010	Doctor told you have diabetes	1=yes; 2=no; 3=borderline; 7=refused; 9=don't know; .=missing
DID040	Age when first told you have diabetes	numeric value from 1 to 80; 666=less than 1 year; 777=refused; 999=don't know; .=missing
DIQ220	When was diabetes diagnosed	1=3 months ago or less; 2=more than 3 months ago but not more than 6 months ago; 3=more than 6 months ago but not more than 9 months ago; 4= more than 9

		months ago but not more than 12 months ago, 5=more than 12 months ago;7=refused;9=don't know; .=missing
DXX0FBMD	Total femur BMD (g/cm^2)	numeric value; .=missing
DXXNKBMD	Femoral neck BMD (g/cm^2)	numeric value; .=missing
DXXTRBMD	Trochanter BMD (g/cm^2)	numeric value; .=missing
DXXINBMD	Intertrochanter BMD (g/cm^2)	numeric value; .=missing
DXXWDBMD	Ward's triangle BMD (g/cm^2)	numeric value; .=missing
DXXL1BMD	L1 BMD (g/cm^2)	numeric value; .=missing
DXXL2BMD	L2 BMD (g/cm^2)	numeric value; .=missing
DXXL3BMD	L3 BMD (g/cm^2)	numeric value; .=missing
DXXL4BMD	L4 BMD (g/cm^2)	numeric value; .=missing
DXXOSBMD	Total spine BMD (g/cm^2)	numeric value; .=missing
MCQ160A	Doctor ever said you have arthritis	1=yes; 2=no; 77777=refused; 99999=don't know; .=missing
MCQ180A	Age when told you had arthritis	numeric value from 1 to 80; 77777=refused; 99999=don't know; .=missing
MCQ190	Type of arthritis	1=rheumatoid arthritis; 2=osteoarthritis; 3=other arthritis; 7=refused; 9=don't know; .=missing

MCQ160C	Doctor ever said you had coronary heart disease	1=yes; 2=no; 7=refused; 9=don't know; .=missing
MCQ180C	Age when told you had coronary heart disease	numeric value from 1 to 80; 77777=refused; 99999=don't know; .=missing
MCQ160L	Ever told you had any liver condition	1=yes; 2=no; 77777=refused; 99999=don't know; .=missing
MCQ170L	Do you still have a liver condition	1=yes; 2=no; 77777=refused; 99999=don't know; .=missing
MCQ180L	Age when told you had a liver condition	numeric value from 1 to 80; 77777=refused; 99999=don't know; .=missing
OSQ010A	Broken or fractured hip	1=yes; 2=no; 7=refused; 9=don't know
OSQ010B	Broken or fractured wrist	1=yes; 2=no; 7=refused; 9=don't know
OSQ010C	Broken or fractured spine	1=yes; 2=no; 7=refused; 9=don't know
OSQ020A	Number of times broken/fractured hip	numeric value with a maximum of 5; 7777=refused; 9999=don't know; .=missing
OSQ020B	Number of times broken/fractured wrist	numeric value with a maximum of 7; 7777=refused; 9999=don't know; .=missing
OSQ020C	Number of times broken/fractured spine	numeric value with a maximum of 5; 7777=refused; 9999=don't know; .=missing
OSQ40AA	Under/over 50 when fractured hip first time	1=under 50; 2=50 or older; 7=refused; 9=don't know; .=missing

OSQ40BA	Under/over 50 when fractured wrist first time	1=under 50; 2=50 or older; 7=refused; 9=don't know; .=missing
OSQ40CA	Under/over 50 when fractured spine first time	1=under 50; 2=50 or older; 7=refused; 9=don't know; .=missing
OSQ070	Ever treated for osteoporosis	1=yes; 2=no; 7=refused; 9=don't know; .=missing
OSQ130	Ever taken prednisone or cortisone nearly every day for a month or longer	1=yes; 2=no; 7=refused; 9=don't know; .=missing
OSQ170	Did mother ever fracture a hip	1=yes; 2=no; 7=refused; 9=don't know; .=missing
OSQ200	Did father ever fracture a hip	1=yes; 2=no; 7=refused; 9=don't know; .=missing
RIAGENDR	Gender	1=male; 2=female; .=missing
RIDAGEYR	Age (in years)	numeric value with a maximum of 80; .=missing
RIDRETH1	Race/ethnicity	1=Mexican American; 2=Other Hispanic; 3=Non-Hispanic white; 4=Non-Hispanic black; 5=other race; .=missing
WHD020	Current self-report weight (pounds)	numeric value; 7777=refused; 9999=don't know; .=missing
WHD110	Self-reported weight 10 years ago	numeric value; 7777=refused; 9999=don't know; .=missing