Chapter 5
Prevalence of Metabolic Syndrome in Subjects with Osteoarthritis Stratified by Age and Sex: A Cross Sectional Analysis in NHANES III

Ashish Joshi
Department of Information Systems, UMBC, USA

ABSTRACT
The aim of the study was to determine association between osteoarthritis and metabolic syndrome stratified by age and gender categories. A final sample of 16,149 US residents aged 17 years or older was analyzed using the database National Health and Nutrition Examination Survey (NAHNES III). Variables assessed include age, gender, race, education, poverty income ratio, body mass index, smoking history, metabolic syndrome and its risk components. Continuous and categorical variables were compared in the 2 groups using T and chi-square statistics as appropriate. Multivariate analysis was performed after adjusting for the potential confounders. Five percent subjects self-reported of having osteoarthritis. The prevalence of metabolic syndrome in subjects with osteoarthritis was 40% compared to 21% with no osteoarthritis. Subjects with osteoarthritis were significantly older; were females, non-Hispanic whites, less educated and had high prevalence of diabetes, hypertension and high cholesterol. Age, being female, higher education, being non-Hispanic White, absence of osteoporosis, and body mass index were significant predictors of osteoarthritis. Metabolic syndrome was a risk factor for osteoarthritis in males.

INTRODUCTION
Osteoarthritis (OA) is the most common type of arthritis affecting older people. OA affects different people differently. There are several risk factors associated with the development of OA. These include ethnicity, age, gender, genetic factors, bone density, nutritional factors, obesity, prior joint injuries and occupational factors. Obesity, hypertension, dyslipidemia, diabetes and insulin resistance tend to cluster into the so-called metabolic syndrome (MS). There are not
many studies that have explored the relationship between MS and OA. The motivation for the study was to determine if there was an increased risk of cardiovascular diseases in subjects with OA.

**Epidemiology of OA**

Osteoarthritis (OA) is the most prevalent form of arthritis and a major cause of disability in people aged 65 and older (Lawrence, 1998). Osteoarthritis is a clinical syndrome of joint pain and dysfunction caused by joint degeneration. Current estimates are that 27 million people in the United States have OA (Helmick, 2008) and this number is expected to reach 60 million by the year 2020 (CDC, 1996). Approximately 10-30% of those affected with OA in the United States have significant pain and disability (Garstang, 2006). It has been estimated that by the year 2020, 12 million Americans are estimated to have limitation in some aspect of function because of OA (CDC, 1996). OA symptoms typically begin after age 40 and progress slowly (Arthritis Foundation, 2008). OA typically affects only certain joints, such as the hips, hands, knees, low back and neck. After age 50, women are more affected by OA than men (Lawrence, 1998). Loss of joint function as a result of OA overall is a major cause of work disability and reduced quality of life (Arthritis Foundation, 2008). The CDC estimates that OA and related arthritic conditions cost the U.S. economy nearly $128 billion per year in direct medical care and indirect expenses, including lost wages and productivity (MMWR, 2007). The total annual cost of a person living with OA is approximately $5700 (Maetzel, 2004).

**Pathogenesis of OA**

The pathogenesis of OA is not fully understood, although multiple contributing factors are recognized including genetic, environmental, metabolic, and biomechanical factors (Kraus, 1997). Osteoarthritis can affect any synovial joint (Mandelbaum and Waddell, 2005). The normal joint is protected by biomechanical factors such as alignment and muscle strength, the lubrication provided by the synovial fluid, and the shock-absorbing function of bone and cartilage (Mandelbaum and Waddell, 2005). These functions get altered at both the macroscopic and cellular levels resulting in further joint destruction. It involves both destructive and reparative metabolic processes, with a variety of biochemical triggers in addition to mechanical injury of the joint (Mandelbaum and Waddell, 2005). The increased prevalence, chronic nature, lack of preventive services or cure of OA makes it a substantial economic burden for patients and healthcare systems (Brooks PM, 2006).

**Risk Factors of OA**

The risk factors can be divided into two major types including systemic factors (associated with the development of OA and local factors, (tend to result in abnormal biomechanical loading of affected joints) (Felson, 2004). The systemic factors include ethnicity, age, gender and hormonal status, genetic factors, bone density, nutritional factors, and other factors. Local biomechanical factors include obesity, altered joint biomechanics, prior joint injuries, occupational factors, the effects of sports and physical activities and the result of developmental abnormalities. However, the most important risk factor in all populations is age (Felson, 2004).

**Metabolic Syndrome (MS) and Osteoarthritis**

Several studies have shown that individuals with obesity or overweight have increased risk of OA in the knee (Oliveria SA, Felson DT, Cirillo PA, Reed JI & Walker AM, 1999 & Gelber AC, Hochberg MC, Mead LA, Wang NY, Wigley FM, Klag MJ, 1999) and hip (Flugsrud GB, Nordsletten L, Espehaug B, Havelin LI, Engeland A & Meyer HE, 2006); however the role of obesity for the