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Examining the Interaction Between Calcium Supplement Use, Demographics, and Lifestyle Factors on Bone Health of Women

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Examining the Interaction Between Calcium Supplement Use, Demographics, and Lifestyle Factors on Bone Health in Women

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**Abstract**

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**Introduction**

From the time we are born until we die our skeleton has two key cell types that are shaping our bones. They are called osteoblasts and osteoclasts. Osteoblasts are responsible for bone formation; they secrete organic components that form the matrix of bone tissue and deliver calcium and other minerals to the bone. Osteoclasts on the other hand perform a function called bone reabsorption, they secrete acids and enzymes that dissolve the mineralized bone matrix. This entire process is regulated by osteotropic hormones.1 Osteoporosis is a condition defined as a bone mineral density (BMD) measurement that falls 2.5 standard deviations below normal.2 Osteoporosis puts people at risk of fractures, even from little to no trauma, which result in what are known as fragility fractures and spontaneous fractures respectively. The most concerning of these fractures are hip and spine fractures, which pose significant burdens to individuals and healthcare systems worldwide due to their associated morbidity, mortality, and economic costs. 3

It’s important to study at risk groups to predict if someone suffers from osteoporosis before they experience a fragility fracture. There are strategies to help prevent osteoporosis from developing, they look different depending on population. One of the critical groups are women who are perimenopausal. We see on average a loss of 6-7% of BMD during the menopause transition.4 Calcium supplementation has emerged as a promising strategy for abating BMD decline during this transitional phase. However, the efficacy of calcium supplementation appears to be contingent upon various individual factors, including demographic characteristics and lifestyle habits. Studies have indicated that calcium intake beyond five years post-menopause can help mitigate bone loss, whereas its impact within the initial five years post-menopause appears to be negligible.5

**Background**

This paper uses data obtained from the SWAN data set. The Study of Women’s Health Across the Nation (SWAN) is a multi-site longitudinal epidemiological study designed to investigate the health of women during their middle years. It is sponsored by the National Institute on Aging (NIA), the National Institute of Nursing Research (NINR), the National Institutes of Health (NIH), Office of Research on Women's Health, and the National Center for Complementary and Alternative Medicine. Data date back as far as 1994, and in 1997 the study grew to 3,302 total participants. This study is representative of five different racial/ethnic backgrounds and has varied backgrounds and cultures.6

The menopause transition is a critical period in a woman's life marked by significant hormonal changes, leading to accelerated bone loss and heightened fracture risk. Bones break when the force exerted on them exceeds their strength. The load-bearing capacity of bones becomes compromised when the rate of bone resorption exceeds that of bone formation, resulting in a progressive decline in bone mineral density (BMD) and structural integrity. “SWAN established that there is a rapid phase of bone loss in a 3-year period around the final menstrual period (FMP); BMD begins to decline around 1 year prior to the FMP, and continues to decrease in early post menopause, with a slight reduction in loss rate around 2 years after the FMP.”7

This study seeks to demonstrate how machine learning and predictive modeling can be applied to identify potential osteoporosis prior to a fragility fracture and thus alleviate the strain posed both to individuals and to our medical systems.

**Methods**

The demographic predictors chosen for this study are age, race, income and alcohol consumption.

Regression Analysis

Multiple Regression Analysis

Nest Models

PCA?

**Notes:**

Research Question:

Are there specific demographic or lifestyle factors that modify the association between calcium supplement use and bone mineral density loss in women?

Argument:

Predictive modeling can be used to help identify and mitigate the damage done by osteoporosis.

Demographics used in this study: Age, Race and Income, Alcohol.