Sex and Age-Specific Medication Interaction in Osteoporosis Risk: A Comprehensive Analysis

Audrey Ulfers BA[1], Matthew Bratton BS[1], Gregory Laborde BS[1], Anand Paul PhD[2], Peter Krause MD[3], Deryk Jones MD[4], Lauren Leslie DO[4], Vinod Dasa MD[3]

1. LSU New Orleans School of Medicine 2. LSU New Orleans Department of Biostatistics and Data Science 3. LSU New Orleans Department of Orthopaedics 4. Ochsner Department of Orthopaedics

Introduction

Osteoporosis, a condition marked by reduced bone mineral density (BMD) and increased fracture risk, disproportionately affects older adults, particularly postmenopausal women. While screening guidelines focus on individuals over 50 or those with prior fractures, a significant gap exists in detecting osteoporosis among individuals exposed to long-term medication use.

Several widely prescribed medications—including corticosteroids, levothyroxine, and antiepileptics—have been implicated in BMD loss and increased fracture risk. Despite this, their effects on osteoporosis risk in individuals aged 50-90 without a prior fracture history remain underexplored. Additionally, sex-based differences in medication-induced osteoporosis risk are not well understood, with studies primarily focusing on postmenopausal women, leaving men underrepresented in osteoporosis research.

This study investigates whether chronic use of these medications is associated with an increased prevalence of osteoporosis in individuals aged 50-90. Furthermore, it examines whether sex differences influence this association, aiming to provide insight into the need for more inclusive and proactive screening strategies. By identifying at-risk populations before fractures occur, this research seeks to inform updates to current osteoporosis screening guidelines and improve early prevention efforts.

Sex-Specific Osteoporosis Prevalence

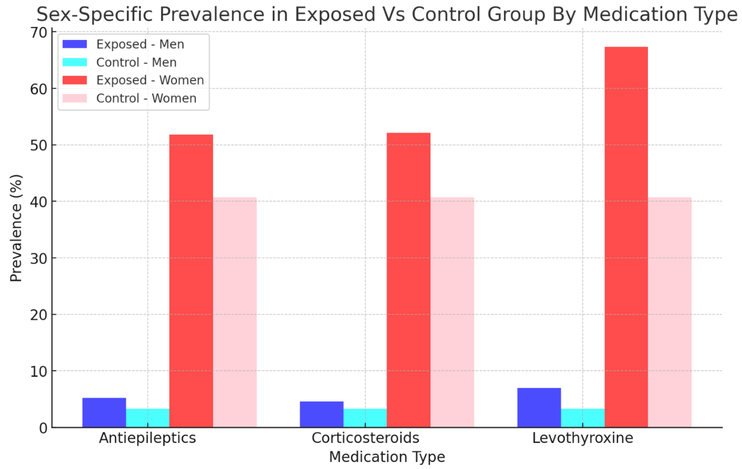

Figure 1: Sex-Specific Osteoporosis Prevalence in Exposed and Control Groups. Women in the exposed group had significantly higher osteoporosis prevalence than men across all medication types (antiepileptics, corticosteroids, and levothyroxine). The control group also showed higher prevalence in women, though the difference was less pronounced.

Sex and Age Specific Osteoporosis Prevalence

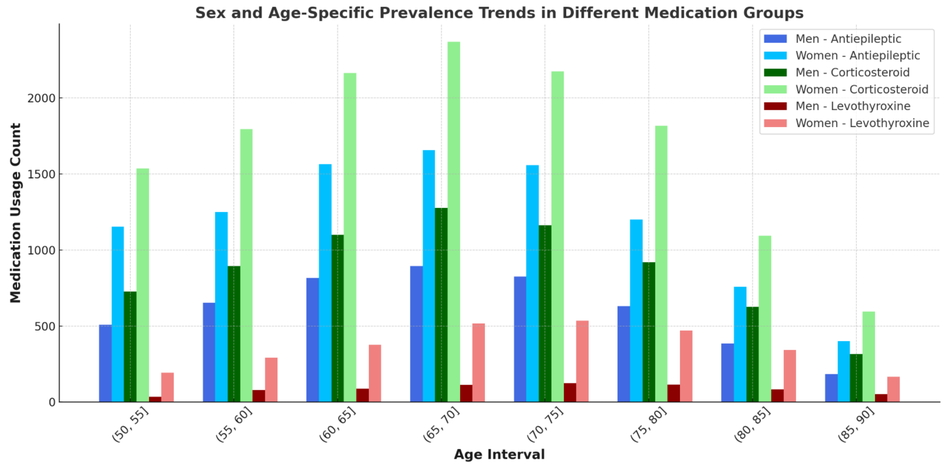

Figure 2: Age-Stratified Osteoporosis Prevalence. Women exhibited highest prevalence rates across all medication groups, with the greatest rates occurring in the corticosteroid group. Prevalence across medication groups and sex increased steadily from 50 years of age, peaking in the 65-70 year range before gradually declining.

Relative Risk of Osteoporosis

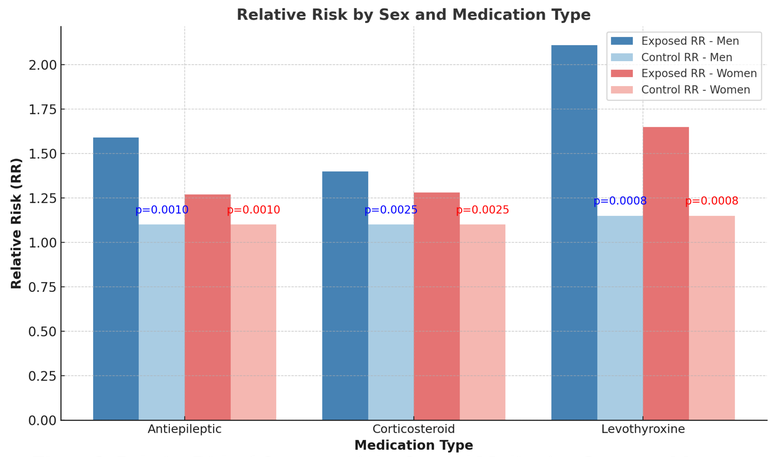

Figure 3: Relative Risk of Osteoporosis by Sex and Medication Category. Men exhibited a higher overall relative risk across each medication category despite lower rates of osteoporosis prevalence, indicating a need for targeted interventions towards men..

Conclusions

This study highlights the significant impact of medication use on osteoporosis risk, with levothyroxine, corticosteroids, and antiepileptics showing elevated prevalence rates in the exposed groups. Women, particularly those taking levothyroxine, were at the highest risk for osteoporosis, underscoring the need for sex-specific prevention strategies. The prevalence of osteoporosis increased with age, with a sharp rise observed between ages 60-70, indicating a critical window for intervention. Despite the higher prevalence in women, men also demonstrated elevated risk, particularly those on levothyroxine, highlighting the need for proactive monitoring in both sexes. Our findings emphasize the importance of early screening, personalized treatment strategies, and preventive measures such as calcium and vitamin D supplementation to mitigate osteoporosis risk in patients on long-term medications. Further research is needed to understand the underlying mechanisms linking medication use with bone fragility, as well as the potential role of genetic and lifestyle factors in osteoporosis development.