Fragility Fracture Risk in U.S Postmenopausal Women: A Comprehensive NHANES Study.

Herriethsiah S. Noah and Huiyi Lin

Department of Biostatistics and Data Science, School of Public Health, Louisiana State University Health Sciences Center, New Orleans, LA, USA.

publichealth.lsuhsc.edu

Background

- Fragility fractures significantly impact morbidity and mortality, especially among postmenopausal women.
- While osteoporosis is a key risk factor, over 50% of fragility fractures occur in women without a densitometric diagnosis of osteoporosis, suggesting a complex interplay of demographic and lifestyle factors.
- Evidence regarding the impact of physical activity and nutrition on bone structural integrity remains inconsistent, particularly at the population level.

Objectives

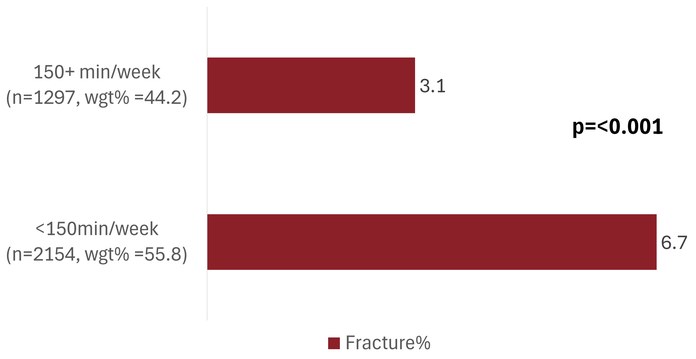
- To assess determinants of fragility fracture among postmenopausal women and to determine whether the relationship between physical activity and fracture risk is modified by obesity status.

Methods

- This study analyzed data from the 2007–2008, 2009–2010, 2013–2014, and 2017–2018 cycles of the National Health and Nutrition Examination Survey (NHANES), including 3,451 postmenopausal women (mean age: 65.1 years).
- The outcome of interest was a history of fragility fracture (hip, wrist or spine), with osteoporosis status and physical activity as key predictors.
- Associations with fracture were examined using logistic regression models.
- All analyses accounted for the complex NHANES survey design by incorporating sampling weights, to ensure representativeness.

Results

Fig 1: Fracture by Physical Activity profile among US postmenopausal women > 50 years (N=3451)



Fracture % are row percentage (proportion of a specified category), while col% are proportion of the total population

Results

Fig 2: Fracture status by bone health among US postmenopausal women > 50 years (N=3451)

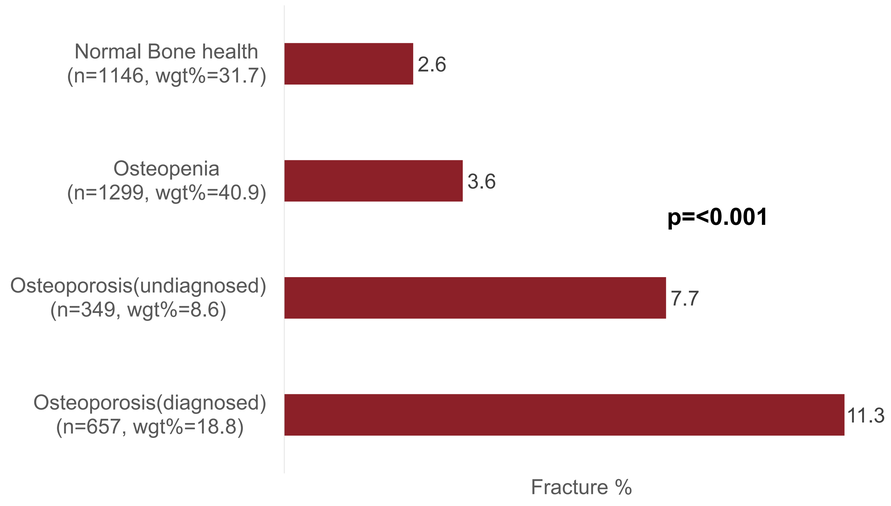
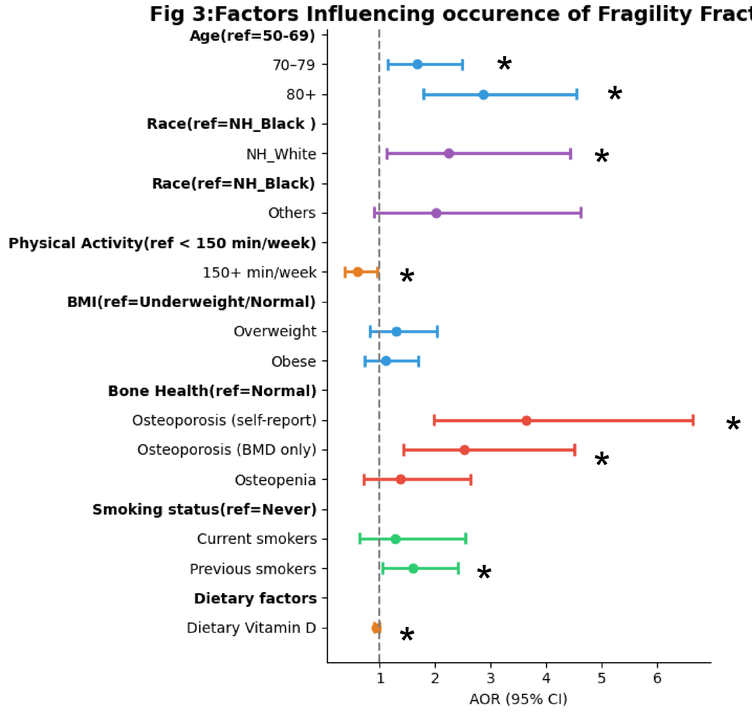


Fig 3:Factors Influencing occurence of Fragility Fracture N=3404



** p value< 0.05*

This is a fully adjusted model with all the variables displayed, present in the model.

Discussion

- Overall, 5.1% of postmenopausal women reported a history of fragility fracture.
- NH-white women were associated with approximately twice the fracture risk compared to NH-black women *(fig 3),* driven by significant racial disparities in bone mineral density (BMD), skeletal geometry, muscle mass, and bone turnover rates (Bao et al., 2023)
- More than 50% of postmenopausal women are insufficiently active *(fig 1),* even though physical activity was associated with 40% reduction in fracture risk *(fig 3).* Evidence shows strength and resistance training improves balance, enhance muscle bulkiness and improves BMD, all factors preventing falls and fractures (Kumar et al., 2025).
- Overall, 27.4% of postmenopausal women in US have osteoporosis and about one third of them are unaware of this diagnosis *(fig 2).* Moreover, this group is associated with almost three times odds of fracture compared to those with normal bone health (OR=2.53, CI 1.42-4.50).
- Obesity status did not modify the relationship between physical activity and fracture risk in our study. Recent evidence suggests that body composition—specifically lean body mass, rather than BMI—influences fracture occurrence (Lee et al., 2023).

Recommendations

- Our findings underscore the need for targeted fracture prevention strategies that address both underlying bone health and modifiable lifestyle behaviors.
- Interventions promoting regular physical activity, particularly weight-bearing and muscle-strengthening exercises, alongside smoking cessation and improved osteoporosis screening may help reduce fracture risk.
- Special attention should be given to women who are unaware of their bone health status, as early identification and intervention in this group could substantially reduce the overall fracture burden in the population.

References

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2. S. Kumar, C. Smith, R.J. Clifton-Bligh, B.R. Beck, C.M. Girgis, Exercise for Postmenopausal Bone Health – Can We Raise the Bar?, Current Osteoporosis Reports 23(1) (2025).
3. J. Lee, J.H. Jung, J. Kim, C. Jeong, J. Ha, M.H. Kim, J.M. Lee, S.A. Chang, K.H. Baek, K. Han, D.J. Lim, Associations between body composition and the risk of fracture according to bone mineral density in postmenopausal women: a population-based database cohort study, Eur J Endocrinol 189(5) (2023) 527–536.