HHS Public Access

Author manuscript

J Am Geriatr Soc. Author manuscript; available in PMC 2023 March 01.

Published in final edited form as:

J Am Geriatr Soc. 2021 September ; 69(9): 2692–2695. doi:10.1111/jgs.17316.

The Break in FRAX: Equity Concerns in Estimating Fracture Risk in Racial and Ethnic Minorities

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Keywords

Equity; Race; Bias in Medicine; Fracture; Osteoporosis

Though equitable care for racial and ethnic minorities has been a longstanding concern in medicine, the Vyas et al.'s recent New England Journal of Medicine article highlighted a subset of clinical algorithms whose use of race may perpetuate inequities in clinical care.[1,2] This includes the U.S. Fracture Risk Assessment Tool (FRAX) which, uniquely among Western countries, differentiates among 4 racial/ethnic groups: Caucasian, Black, Hispanic, and Asian.[3,4] Though FRAX has become useful for clinical decision making, we see serious concerns in continuing to use FRAX to estimate fracture risk and determine osteoporosis treatment when it systematically underestimates the risk in non-White populations.

FRAX was developed by the World Health Organization Collaborating Centre for Metabolic Bone Diseases at the University of Sheffield after identifying significant risk factors for fracture through meta-analyses of large observational cohorts.[3] The group identified differences in fracture risk across countries and, within the U.S., across racial/ethnic groups that led to the development of separate calculators. In the United States, the Black, Hispanic and Asian calculators include the same variables as the Caucasian calculator but also incorporate a correction factor which results in lower calculated fracture risk among these groups (See Table 1).[4] These correction factors were derived from outdated cohort studies from the 1980s and 1990s, which showed a differential fracture risk by race and ethnicity.[4] Racial and ethnic differences have been associated with differences in bone mineral density (BMD) and thus by implication with biology or genetics that can be proxied by race and ethnicity. However, there is an increasing consensus in both medicine and sociology that race/ethnicity is a social construct.[5] As such, race/ethnicity does not represent biological difference, but a complex relationship also comprised of socioeconomic, political, geographic, and environmental factors. We conclude that the reductionism imposed by FRAX in the U.S., and no other Western nation, propagates structural racism in the clinical setting.

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Previous studies have shown that relationship between race/ethnicity and bone mineral density follows the general pattern that NHB men and women have higher BMD whereas Asian populations have lower BMD compared to NHWs.[6,7] Currently, dual-energy x-ray absorptiometry (DXA) is widely used as a diagnostic tool to estimate BMD through two-dimensional images.[8] However, areal BMD, as measured from two-dimensional images using dual x-ray absorptiometry (DXA), does not account for three-dimensional bone size, shape, and body weight. Differences in areal BMD between racial and ethnic groups largely disappear when incorporating these factors.[7,9]

Many environmental and social factors influence BMD and fracture risk. Lower income and educational status have been correlated with decreased BMD, thought to be operationalized through nutritional factors like calcium and vitamin D status, physical activity, and access to medical care.[6,10,11] Recent epidemiological shifts in fracture incidence over the last decade, such as decreased fracture risk in the NHW population and increased risk in the Hispanic population, also implicate environmental factors rather than genetic or evolutionary factors.[12-14]

FRAX does not account for disparities in medical comorbidities that contribute to fracture risk among minority patients. For example, type 2 diabetes mellitus has been associated with increased fracture risk, despite similar or increased BMD in older adults.[15] The only clinical condition included in FRAX is rheumatoid arthritis, however the distribution of DM in the U.S. population falls disproportionately on NHB, Hispanic and South Asian populations.[16] Additionally, FRAX incorporates the competing risk of mortality in its fracture risk calculation. That is, the probability of a major osteoporotic fracture or hip fracture is calculated in relation to the probability of death within the same time period. Therefore, disparities in life expectancy among minority groups, particularly NHB Americans, similarly lower the calculated fracture risk among these groups. Additionally, to our knowledge, the competing mortality risk has not been adjusted in FRAX calculations since its development, despite the gains in life expectancy across racial and ethnic groups and especially in NHB Americans.

Finally, unlike FRAX in Europe, Australia, and Canada, FRAX in the US imposes dichotomies that do not represent individuals in clinical practice. For example, among patients who identify as both Black and White, clinicians must select a single calculator. Such patients' fracture risk is 57 to 47% lower (depending on gender) if they are identified as Black compared to White, a non-trivial difference.

The lower fracture risks for racial and ethnic minorities estimated by FRAX exist in the context of lower quality osteoporosis care for NHB patients. NHB patients are less likely to be referred for DXA scan and less likely to be counseled on calcium or vitamin D supplementation than their NHW counterparts.[17] In addition, once diagnosed, NHB people with osteoporosis are less likely to be treated for their osteoporosis than NHW people.[18-20] One-year mortality from hip fracture has improved with the advent of osteoporosis-directed medications, but the overall estimated 1-year mortality remains high– 23% in women and 33% in men.[21] Thus, undertreatment of osteoporosis has real ramifications for survival and morbidity. FRAX also calculates lower fracture risk in Asian

and Hispanic Americans. There is relatively little data on treatment and outcomes from osteoporosis in these populations, and more research is needed to understand if there are disparities in osteoporosis outcomes and treatment in these groups.[22]

The FRAX U.S. calculator disadvantages racial and ethnic minorities by systematically calculating a lower fracture risk for these groups. Given the recommended treatment thresholds by the National Osteoporosis Foundation, this lower calculated risk decreases the likelihood of osteoporosis treatment for minority patients who already suffer worse outcomes from osteoporosis and fracture. In addressing the disparities we see in osteoporosis care, we encourage clinicians to build in standardized screening to their workflows to avoid biased assumptions about which populations are more likely to have osteoporosis. Moreover, it is also incumbent on us as healthcare providers to understand the limitations of the tools that we use, a point that has become ever more clear as we reckon with the racist history that underlies many innovations in clinical medicine.[23] We urge clinicians to view FRAX as an estimate alongside their clinical assessment of risk factors (e.g., falls risk, comorbidities, medications). In addition, we recommend that clinicians compare FRAX estimates derived from the different U.S.-based calculators for their patients to understand the range of fracture risk and the extent to which race/ethnicity is influencing calculated risk. More importantly, we recommend that the use of race and ethnicity in the U.S. FRAX calculators be re-evaluated. While not a factor in other Western nations, the inclusion of race/ethnicity in the U.S. promotes the assumption of a simple biological difference, despite ample evidence that race is a social construct involving a complex interaction of factors including structural racism. Continued inclusion of race/ethnicity propagates this simplification, resulting in differential and, we argue, disparate osteoporosis care in the US.

Funding:

Research reported in this publication was supported by the National Center for Advancing Translational Sciences of the National Institutes of Health under Award Number TL1 TR002555. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

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Impact Statement:

We certify that this work is novel of recent clinical research. It adds a synthesized evidence base motivating a change in the use of the Fracture Risk Assessment Tool (FRAX) for greater equity in osteoporosis care.

Key Points

- FRAX estimates a lower risk of fracture for racial and ethnic minorities
- Lower estimates of fracture risk are based on outdated studies and a faulty conception of biological race

Why does this matter?

We may be undertreating fracture risk in racial and ethnic minorities leading to greater morbidity and mortality.

Table 1:

Correction Factors for Fracture Risk Estimates in U.S. FRAX Calculators by Race and Ethnicity compared to non-Hispanic White/Caucasian

Racial/Ethnic Group	Female Gender	Male Gender
Black	0.43	0.53
Hispanic	0.53	0.58
Asian	0.50	0.64