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### Authors

Birabaharan, Morgan

Kaelber, David C

Karris, Maile Y

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## Bone Mineral Density Screening Among People With HIV: A Population-Based Analysis in the United States

Morgan Birabaharan,<sup>1</sup> David C. Kaelber,<sup>2,3</sup> and Maile Y. Karris<sup>1</sup>

<sup>1</sup>Department of Infectious Diseases and Global Public Health, Department of Medicine, University of California, San Diego, La Jolla, California, USA, <sup>2</sup>Departments of Internal Medicine, Pediatrics, and Population and Quantitative Health Sciences, School of Medicine, Case Western Reserve University, Cleveland, Ohio, USA, and <sup>3</sup>Center for Clinical Informatics Research and Education, The MetroHealth System, Cleveland, Ohio, USA

HIV infection is associated with premature bone loss. The potential impact of recently updated osteoporosis screening guidelines is unknown. In a population-based cohort, we found low adherence and sex differences among eligible people with HIV.

**Keywords.** bone mineral density; HIV and aging; human immunodeficiency virus; non-AIDS comorbidities; osteoporosis.

In the past decade, the gap in projected lifespan between people with HIV (PWH) and HIV-seronegative counterparts has narrowed [1, 2]. However, PWH experience age-related medical comorbidity at an earlier age and in excess [3–5]. Among common comorbidities are low bone mineral density and osteoporosis. Poor bone mineral health appears to stem from virus-related factors, specific antiretrovirals, and health inequities such as poor nutrition, low body weight, increased substance use, and low vitamin D [6]. The consequences of poor bone health, osteoporotic fractures, have major medical and economic consequences, including early mortality, disability, and loss of independence [7, 8].

In 2013, the HIV Medicine Association (HIVMA) and the Infectious Diseases Society of America (IDSA) released new guidelines for osteoporosis screening for PWH [9]. Given the risk for premature bone loss, bone mineral density (BMD) screening is now recommended for all HIV-infected men and postmenopausal women at 50 years of age. This is in accordance with an independent panel of infectious diseases and endocrinology experts as well as other organizations including the European AIDS Clinical Society [6, 10, 11]. In the general

population, normal-risk females are screened at age  $\geq 65$  years, and the screening of males without risk factors remains controversial [12].

Despite these recommendations, the frequency of BMD screening among PWH remains unclear. Potential barriers such as knowledge gaps and insurance coverage may impact HIV provider and patient adherence. The purpose of the present investigation was to compare the overall and subgroup utilization of BMD screening in a large population of PWH in the United States.

### METHODS

#### Study Population

We performed a cross-sectional analysis using a research platform (Explorys; IBM Watson Health, Cambridge, MA, USA) that sources clinical data from 27 health systems containing 70 million unique lives [13]. Clinical information from electronic medical records, laboratories, practice management systems, and claims systems is mapped to Unified Medical Language System ontologies to create longitudinal records for unique patients. Data are standardized and curated according to common controlled vocabularies and classification systems [14–16]. Both inpatient and outpatient visits are captured, and persons with all types of insurance as well as those who are self-pay are represented. Patient counts are reported to the nearest 10 to maintain confidentiality. The MetroHealth System Institutional Review Board has deemed population-level data analysis with de-identified patient data, such as performed herein, not to be human studies research and waived necessity for informed consent.

PWH were identified using a validated algorithm (77% sensitivity, 100% specificity) that uses a combination of an ICD-9 or ICD-10 code related to HIV and antiretroviral treatment [17]. To identify a cohort receiving routine care that is obtaining BMD screening for primary prevention, persons with osteoporosis ( $\geq 2$  ICD-9 codes of 733.0 or ICD-10 code M81) or pharmacological therapies for osteoporosis before obtaining BMD screening were excluded from analysis (Supplementary Table 1).

#### Statistical Analysis

The analysis was limited to patients age 50 years or older with an active status in the database from January 11, 2016, to January 11, 2021, who were not missing demographic data on age, sex, race, or insurance status. The primary outcome was BMD screening, defined by Current Procedural Terminology (CPT) codes (Supplementary Table 1). Among women age  $\geq 65$  years or older in the general population, 36% of the

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Correspondence: Morgan Birabaharan, MD, Division of Infectious Diseases and Global Public Health, University of California, San Diego, 9500 Gilman Drive, La Jolla, San Diego, CA 92093 (mbirabarahan39@gmail.com).

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cohort had received BMD screening in our database, which is similar to the prevalence estimate of 37% in other population databases [18]. We assessed overall BMD screening use among PWH and within demographic subgroups. To help assess insurance as a possible barrier to care, an exploratory subgroup analysis of HIV patients age 50–64 years stratified by insurance status was performed and not extended to those age ≥65 years because of Medicare eligibility. To help gauge the importance of BMD screening, frequency of osteoporotic fractures in the study population was evaluated using ICD codes (Supplementary Table 1). Because large data sets will result in statistically significant data that may not have clinical significance, hypothesis tests were not performed. The analysis was primarily descriptive.

## RESULTS

### Participant Demographics

We identified 16 590 PWH. Most were 50–64 years in age (12 530; 75.5%); the sample consisted of 12 870 males (77.6%) and 3720 females (22.4%). White and Black patients constituted 8570 (51.2%) and 6060 (36.5%) individuals, respectively. Within the cohort, 6390 were on Medicare (38.5%), 2060 were on Medicaid (12.4%), and 8150 had private insurance (49.1%).

### BMD Screening Rates

Overall, 1390 (7.4%) of HIV-eligible adults received BMD screening. Screening was lowest in those 50–64 years of age (870; 6.9%), but higher with older age (65+ years: 530; 13.1%). BMD screening was more common among females than males (14.8% vs 6.7%). Sex differences in BMD screening were observed among both age categories (Figure 1). BMD screening among Black (7.8%), White (9.0%), and other race (8.1%) individuals was similar. In subgroup analysis, age 50–64 years, Medicaid, private insurance, and Medicare had 4.5%, 6.4%, and 8.8% BMD screening rates, respectively. Fracture rates were

elevated among all HIV subgroups relative to HIV-seronegative counterparts (Figure 2).

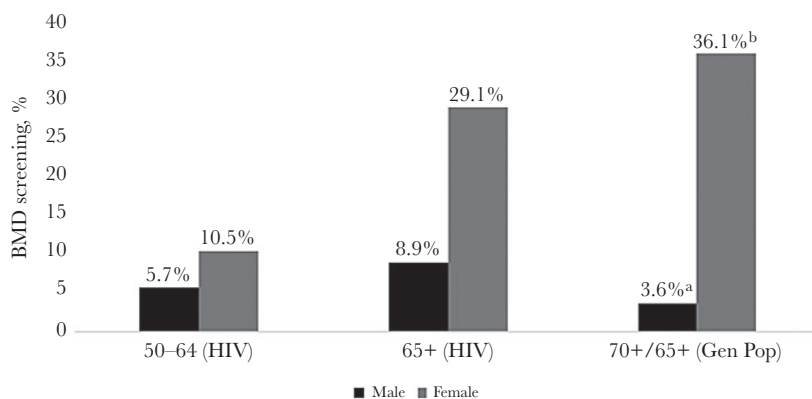
## CONCLUSIONS

In this study, we estimated the frequency of BMD screening among eligible PWH. Over 90% of PWH ≥50 years of age did not undergo osteoporosis screening. Men were less likely to complete screening than females. Frequency of screening did not differ greatly by race, but people with older age (≥65 years) and either Medicare or private health insurance were more likely to undergo BMD testing.

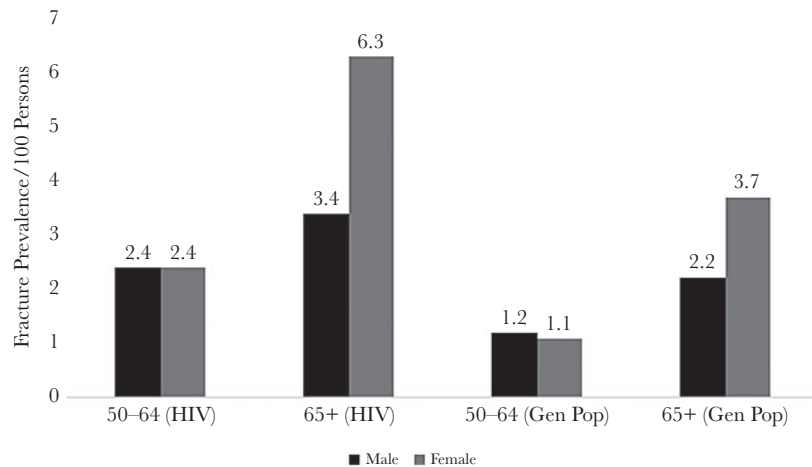
Few studies have investigated BMD screening adherence to IDSA/HIVMA guidelines. In a cohort of 225 patients at a single academic medical center in the United States, only 12.4% of PWH were found to have performed BMD screening [19]. In a national audit of adult HIV services in the United Kingdom, only 16.7% of PWH over the age of 70 had BMD measured [20]. A recent study in the United States of 197 veterans with HIV found that 16.2% received BMD screening [21].

Our study demonstrates an even lower screening rate among PWH. In contrast to prior studies, which are limited by selection bias associated with tertiary single-center or multicenter investigations, our population sample is drawn from various health care settings across all US Census regions. Therefore, our cohort is likely a more accurate estimate of BMD screening for PWH in the United States [22].

The lower likelihood of men with HIV to perform BMD screening is concerning. Our study demonstrates that among PWH age 50–64 years, fracture rates are similar between men and women with HIV (MWH; WWH). Further, MWH age ≥65 years had similar fracture rates as women age ≥65 in the general population, who are USPSTF recommended to receive BMD screening. Despite the high occurrence of fractures in MWH, WWH were 2–3 times more likely to undergo BMD screening than MWH. Other studies have also demonstrated



**Figure 1.** Sex differences in BMD screening among PWH. <sup>a</sup>Bone mineral density screening among males is not USPSTF recommended, but is recommended by the National Osteoporosis Foundation for all men age 70 years and older. <sup>b</sup>Bone mineral density screening is USPSTF recommended for all females age 65 years and older. Abbreviations: BMD, bone mineral density; Gen pop, general population; PWH, people with HIV; USPSTF, US Preventive Services Task Force.



**Figure 2.** Vertebral, hip, and wrist fracture prevalence in patients without diagnosed osteoporosis stratified by HIV serostatus and sex.

that fracture rates among MWH are similar and at times higher than WWH [23, 24].

As higher rates of fractures among WWH cannot explain more screening, we suspect the sex differences in BMD screening in our study reflect a knowledge gap among providers and sex differences in risk perception. A survey study of 644 Infectious Diseases physicians found that 55% of providers always/almost always performed osteoporosis screening for postmenopausal women in comparison to performing osteoporosis screening for only 33% of men age  $\geq 50$  years [25]. Further, focus groups that assessed attitudes toward osteoporosis demonstrated that men were less likely than females to think osteoporosis was a disease of aging associated with risk of new fractures and disability [26]. Both physician and patient risk perceptions seem to be implicated in poor BMD screening among males. Thus, ongoing provider and patient education may be necessary to alleviate sex differences.

Additionally, the recommendation of early screening relative to the general population may be prohibited by costs and insurance coverage. HIV remains an unrecognized risk factor for osteoporosis among major expert panels including the United States Preventive Services Task Force (USPSTF), which may preclude coverage for early screening. Our finding that those age 50–64 years with Medicare and private insurance were more likely to receive screening than those with Medicaid reinforces the presence of a financial barrier.

There are limitations to the present study that bear consideration when interpreting the results. HIV-specific factors (ie, CD4, viral load) are not available in the database. Moreover, we could not capture data for patients who sought care in health systems not included in the database. There is also a potential for misclassification with the use of ICD codes. However, to mitigate the influence of possible misclassification bias, we used validated case definitions to identify PWH. Despite these limitations, this population-based analysis reports important data.

Our study includes one of the largest and most diverse older PWH cohorts studied for osteoporosis screening, which allowed subgroup analysis including sex, race, and insurance status.

In conclusion, despite guideline recommendations, there remains low BMD screening among older PWH and particularly among MWH. Knowledge gaps and insurance coverage may be contributing barriers. Given estimates that predict that 70% of PWH will be 50 years and older in 2030, it is critical to prioritize health screenings that prevent negative health outcomes such as falls and fractures to preserve independent function and enhance well-being [27].

#### Supplementary Data

Supplementary materials are available at Open Forum Infectious Diseases online. Consisting of data provided by the authors to benefit the reader, the posted materials are not copyedited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.

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**Patient consent.** Neither ethical approval nor informed consent was required for this analysis, which did not involve human subjects' research.

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