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Recommendations for Improving Women's Bone Health Throughout the Lifespan

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Abstract

Osteoporosis is a common condition in which deteriorating bone tissue results in an increased risk of low trauma fracture. Influenced by the role of estrogen in building and maintaining bone mineral density, women have different patterns of bone accrual and loss compared with men, resulting in a lower peak bone mass and a greater lifetime fracture risk. Moreover, fracture risk increases significantly in postmenopausal women who have depleted estrogen levels. Osteoporotic fractures pose serious consequences—ranging from an inability to perform basic tasks and an increased risk of repeat fracture to the need for assisted living and even death. There is also a large economic toll associated with the health care costs required for post-fracture care. The Society for Women's Health Research (SWHR) convened an interdisciplinary Bone Health Working Group to review the current state of science and practice concerning women's bone health and osteoporosis care and to explore strategies to address gaps in screening, diagnosis, and treatment of bone disease in women. Women's bone health care must shift its paradigm from one of postmenopausal and post-fracture care to a preventive model that engages touchpoints throughout the lifespan. To achieve this paradigm shift, the Working Group recommends prioritizing efforts to build public awareness and clinical education of preventive bone health care for women, increase access to screening tools, improve patient–provider communication, and treat osteoporosis using a broader risk stratification approach.

Keywords: bone health, fracture, osteoporosis, dual-energy X-ray absorptiometry, menopause, preventive screening

Introduction

OSTEOPOROSIS IS A systemic skeletal disease that is characterized by low bone mass and structural deterioration of bone tissue, leading to bone fragility and an increased risk of fracture.¹ An estimated 54 million Americans have osteopenia (low bone density) or osteoporosis, and more than half of adults over 50 years old have poor bone health.^{2,3} Women make up 80% of the 10 million Americans with

osteoporosis, and an additional 27.3 million women are estimated to have osteopenia.²

Women carry a greater lifetime fracture risk than men, as women tend to have smaller, thinner bones than men, reach a lower peak bone mass (PBM), and tend to lose bone at a younger age and more rapid pace.⁴ Further, estrogen plays an important role in women's bone development over the lifespan, and estrogen decline after menopause puts women at a significantly higher risk of developing osteoporosis later in

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life.⁵ In the United States, the lifetime risk of having a low trauma fracture is 33% for women over 50 years old, and approximately half of Caucasian females will experience an osteoporotic fracture in their lifetime.^{3,6}

Osteoporotic fractures have significant implications for morbidity and mortality. Hip fractures, in particular, can have drastic impacts on daily function, with up to 80% of patients unable to perform basic tasks post-fracture and 64% requiring a nursing home stay.³ Quality of life can be vastly improved for women who successfully avoid fracture through appropriate screening and preventive care. Even with evidence-based consensus screening guidelines available, screening tools remain underutilized. Up to 91% of women over 65 years old with a previous low trauma fracture are not screened for osteoporosis.⁷

Further, osteoporosis and related low trauma fractures take a significant economic toll in preventable health care costs. There was an estimated \$5.7 billion in allowed cost for subsequent fractures suffered by Medicare fee-for-service beneficiaries with an initial fracture in 2016.⁷

The Society for Women's Health Research (SWHR) convened a group of subject-matter experts for a roundtable meeting to review current clinical guidelines, practices, and health care policies related to the screening, diagnosis, and treatment of women's bone health and disease, with a focus on bone fracture prevention and osteoporosis care. This interdisciplinary group included health care providers and researchers with expertise in adolescent and women's bone health care, endocrinology, orthopedics, sports medicine, rheumatology, epidemiology, geriatrics, and public health; patients with a history of osteoporosis, bone fracture, and advocacy leadership; and policy professionals with experience in the bone health and osteoporosis landscape.

Collectively, the members of the SWHR Bone Health Working Group were selected to represent diversity in training, background, area of expertise, and geographic location, among other characteristics. Table 1 provides a list of the Working Group members and affiliations. The SWHR Bone Health Working Group was charged to identify ways in which to address access barriers to appropriate preventive care and treatments for women's bone health across the lifespan. Several consensus recommendations emerged from the roundtable discussions, coalescing around the following four priority areas: (1) promoting early education and a bone healthy lifestyle, (2) increasing access and coverage for dual-energy X-ray absorptiometry (DXA) screening, (3) broadening and improving patient-provider conversations, and (4) expanding the risk stratification approach to osteoporosis care.

Recommendations

Promoting early education and a bone healthy lifestyle

Clinical care for osteoporosis typically occurs late in adult life, as bone mineral density (BMD) naturally decreases and risk for fracture increases substantially with age.⁴ However, there is value in starting conversations and encouraging individuals to adopt proactive measures to build bone and reduce risk for fracture much earlier in life, especially while bones are still developing.

Adolescence is a critical period for bone mineral accrual, as 40%–60% of adult PBM is accrued during the adolescent years.⁸ It is estimated that a 10% increase in the PBM of children and adolescents can reduce the risk of an osteoporotic fracture during adulthood by 50%.⁹ In women, the rate of bone accrual peaks in early adolescence (11–14 years old), though bones slowly con-

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tinue to build in the years immediately following, until PBM is achieved in young adulthood (25–35 years old).¹⁰ Preventive measures initiated during childhood and adolescence when bone mass is still being accrued can have lifelong benefits.

Diet and exercise are two established ways to increase, maintain, and support BMD throughout the lifespan, while also mitigating fall and fracture risk. Calcium plays a critical role in building and maintaining healthy bone, and vitamin D facilitates proper absorption of calcium.¹¹ Although both are available as supplements, dietary intake is the preferred way to satisfy the daily consumption recommendations. Dairy products have a particularly high calcium content and are invaluable to a calcium-rich diet. However, it is difficult to achieve sufficient circulating levels of vitamin D from diet alone.

Thus, the National Academy of Medicine recommends, and clinical societies that engage bone health also endorse, vitamin D supplementation for all children, adolescents, and young adults.¹² Since the release of this recommendation in 2010, investigations continue to elucidate associations between vitamin D and bone health outcomes.

Weight-bearing physical activity stimulates bone remodeling and is the most positive modifiable intervention for building healthy bone in adolescents.¹³ Weight-bearing and resistance exercises must be paired with a balanced diet (and

vice versa) to continue to support reduced bone loss later in life.¹⁴ It is especially important to encourage older adults to take measures to reduce fall risk regardless of previous fracture history. Muscle-strengthening physical activity, balance training, and exercising caution with daily activities are some ways to avoid fracture and maintain bone health and independence late in life.¹⁴

Regular menstrual cycles in female and young adult adolescents, along with appropriate body mass index (weight for height and age), indicate that exercise is balanced with nutrition—the optimal state for healthy bone development. Absent or irregular menstrual periods (amenorrhea and oligomenorrhea, respectively), if prolonged, have long-term consequences for BMD development due to the associated estrogen deficiency, which is often not realized until years after the PBM window has passed.^{15,16} Adolescents who engage in disordered eating behaviors (*e.g.*, patients with anorexia nervosa) are at increased risk for severe nutrient and/or caloric deficiencies and menstrual irregularities.¹⁷

Elite athletes can also experience significant caloric deficits without disordered eating, given their extreme levels of energy expenditure via exercise. The combination of menstrual irregularity, low energy availability, and subsequent low BMD is known as the female athlete triad (recently expanded and named the Relative Energy Deficiency in Sport, RED-S Syndrome)—a disorder that often goes unrecognized and may have irreversible consequences.¹⁸

Interventions require eating and exercise behavior modifications, but promoting health literacy and education for adolescents, their parents, and their coaches that address both their athletic and health goals can serve as an important preventive measure. Given that the use of tobacco products and alcohol can also diminish bone health, emphasizing healthy habits that avoid substance use and abuse in youth can contribute to better health outcomes throughout the lifespan.¹⁹ Updating broader public health awareness campaigns (*e.g.*, Best Bones Forever!) for the current generation of young audiences may be an effective means to reach this population.²⁰

Increasing access and coverage for DXA screening

Currently, the health care system performs poorly in assessing bone health, and screening recommendations are not satisfactorily modeled for secondary prevention. The U.S. Preventive Services Task Force (USPSTF) and Bone Health and Osteoporosis Foundation (BHOFF) recommend bone measurement screening for osteoporosis in women 65 years and older and in women younger than 65 who are at increased clinical risk.^{14,21} However, rapid bone loss can occur in women through the early postmenopausal years, leading to increased risk for osteoporosis.²² As such, the Working Group highlighted that another underutilized window of opportunity to engage women around the topic of PBM and bone health is during the transition to menopause (perimenopause).

Awareness of declining bone mass tends to increase in postmenopausal conversations, and usually only after an inciting event (*e.g.*, a bone fracture) or around 65 years of age, when broader screening is recommended for women without certain risk factors.^{14,23} The average age of menopause in the United States is 51 years old; waiting to engage women more than 10 years postmenopause is a missed opportunity to introduce preventive lifestyle practices and potential treatment

options that may preserve bone density and reduce fall and fracture risk as estrogen levels decline and compromise bone health in midlife and later.²⁴

Thus, the Working Group resolved that reducing the consensus guidelines' recommended age for screening to the perimenopause window would provide women and their health care providers with an opportunity to establish a baseline assessment of bone health before the majority of rapid postmenopausal bone loss occurs. Using this preventive approach, BMD and other measures of bone health (*e.g.*, vertebral imaging and height) would then be monitored throughout and after the menopause transition to assess risk of fracture or osteoporosis development.

Notably, the USPSTF is in the process of updating its osteoporosis screening recommendations. In June of 2022, the USPSTF Final Research Plan was released with a Draft Recommendation forthcoming.²⁵ The SWHR encourages bone health researchers, health care providers, and other stakeholders in bone and women's health to support the review process with comments and expert feedback when appropriate.

The value of DXA scans as a tool for prevention and early diagnosis of osteoporosis and fracture cannot be overstated. A study of data from 2008 to 2014 found overall screening rates were low: 21.1%, 26.5%, and 12.8% among women ages 50–64, 65–79, and 80+ years, respectively.²⁶ Even after fracture, screening is not a common practice employed by providers; the Milliman report found that only 9% of female Medicare fee-for-service beneficiaries received BMD testing within 6 months after a new osteoporotic fracture.⁷ Thus, there is an opportunity for health care providers to increase screening, education, and instruction for midlife and older patients.

Vertebral imaging that uses routine lateral spine radiographs or DXA machines with software for vertebral fracture assessment is also a dramatically underutilized screening tool. The majority of vertebral compression fractures are clinically silent and are often undiagnosed for months or years; however, these fractures are a sign of more advanced osteoporosis and are associated with a very high risk of additional fractures—both in the spine and in the rest of the skeleton.²⁷ Targeted screening to identify these fractures is critical for comprehensive risk assessment and often alters management strategies as well.

The implementation of a few key policy measures could also dramatically improve outcomes and reduce costs, particularly for women on Medicare. DXA is considered the gold standard in the assessment of BMD and identifying individuals at risk of osteoporotic fractures. Advancing this standard of care provided to patients at risk for osteoporosis could be made with adjustments in policy at the Centers for Medicare & Medicaid Services (CMS). Due to CMS reimbursement cuts for DXA scans, the number of providers who can perform DXA scans has dwindled and machines are no longer common in provider offices.

The Working Group acknowledges the reality of limited DXA availability that presents barriers to accessing this preventive care tool for many individuals across the country. However, the bipartisan legislation, the Increasing Access to Osteoporosis Testing for Medicare Beneficiaries Act of 2021 (S.1943), introduced in the 117th Congress, aims at restoring reimbursement for Medicare Part B for bone mass measurement using DXA services to 70% of the 2006 levels.²⁸

Passing S.1943 would increase access to screening and lower the consequences that can result from the lack of an osteoporosis diagnosis, including financial and health costs. Beyond

policy changes for DXA reimbursement, according to a joint statement by the American Society for Bone and Mineral Research and the National Osteoporosis Foundation (now BHOFF), if CMS were to reimburse providers for post-fracture care coordination (*i.e.*, the Fracture Liaison Service model that involves assessment, diagnosis, treatment planning and initiation, and follow-up care), it could result in meaningful progress for those who have suffered an osteoporotic fracture and reduce their increased risk for suffering another fracture.²⁹

Updates to the CMS Laboratory National Coverage Determination are expected to be announced in the summer of 2022, which will have major implications on the support for preventive bone health screenings for women.

Broadening and improving patient–provider conversations

Because patients receiving osteoporosis treatment tend to be older adults who have experienced a fracture, osteoporosis care is often provided by specialists, such as rheumatologists, endocrinologists, orthopedic surgeons, and geriatricians. However, if the health care system shifts the focus from treatment after a fracture to prevention throughout the lifespan, then other health care providers can and should be better equipped to offer patient education on these topics.

Primary care providers, pediatricians, and obstetrician/gynecologists are a few examples of providers that regularly engage in women's health care and could introduce prevention-based lifestyle approaches for bone health, as well as provide early screening. The Working Group recommends incorporating conversations about bone health into existing preventive care touchpoints with primary providers, such as annual checkups, well-woman exams, and the "Welcome to Medicare" visit. These appointments are often devoted to chronic conditions, such as diabetes, obesity, hypertension, and cancer screenings.

The focus on bone health and the impact of osteoporosis, especially when it leads to fracture, should be elevated to convey how these preventable issues could significantly disrupt one's quality of life if not diagnosed and managed early.³⁰ Other health professionals who work with female adolescents and athletes, such as personal trainers, physical therapists, nutritionists, and dietitians, are uniquely positioned to recognize risk for low bone mass and provide early intervention before damage becomes irreversible.

Improving patient–provider communication will likely require additional clinical training, with a greater emphasis on the primary prevention of bone disease—both in school (*e.g.*, medical, nursing, physician assistant, midwifery schools) and during practical training (*e.g.*, residency, rotations, fellowships). To maximize the benefit of primary care touchpoints, providers need to be equipped to assess the bone health of their patients, provide initial education, and determine whether a specialist referral is needed.

Additional education might also highlight the utility of physical activity in treating low bone mass, the value of conducting in-office balance assessments, and the role of accurate height measurements in the assessment of bone disease in older patients.¹⁴

Social determinants of health, cultural background, ancestry, individual preferences, and other unique contributors to each woman's identity must be considered to have informed, culturally competent conversations with patients.

Providers must make strides to address disparities in osteoporosis care and close the gap among communities of color. For example, non-white women are less likely to be screened and/or treated for osteoporosis post-fracture, and they also experience a higher mortality rate after fracture.³¹ Connecting with diverse communities and tailoring education and communication to meet individual needs will enhance the impact of clinical recommendations in practice.³²

Health care providers must also consider the language used to engage patients in conversations regarding both the prevention and treatment of low bone mass. There are considerable psychosocial sequelae associated with living with osteoporosis, including stigma and anxiety, as a patient grapples with the diagnosis of a chronic condition that is associated with fragility and has negative connotations.³³ The Working Group recommends employing an empowering attitude to diagnosis delivery that does not emphasize fragility and evoke fear.

Providers should expand their sensitivity training and preparation to combat existing stereotypes, ageism, and misinformation related to bone health. Although low bone mass is a significant health concern, it is one that can be well managed through lifestyle and medical therapies and a collaborative approach to treatment.³

Expanding the risk stratification approach to osteoporosis care

In recent years, domestic and international organizations, such as the American Association of Clinical Endocrinology, the American College of Endocrinology, the International Osteoporosis Foundation, and the European Society for Clinical and Economic Aspects of Osteoporosis, have recommended an expanded framework for stratifying risk for fracture into additional high risk and very high risk categories to guide treatment decision making.^{34,35}

The Working Group recommends increased and earlier routine screening of BMD and fracture risk assessment than the current guidelines by initiating evaluation at the time of menopause, leveraging the risk-based stratification paradigm to appropriately address BMD concerns based on the individual's risk category. Based on the results of that assessment, when making treatment recommendations, moderate-risk patients could be put on an estrogen patch, raloxifene, or in some cases, a short course of oral bisphosphonates.

High-risk patients could be treated with oral or intravenous bisphosphonates, rank ligand antibody injections, or in some cases, anabolic agents. Very high-risk patients should be considered for anabolic agents as initial therapy, followed by antiresorptive agents. Not only does this expanded stratification approach guide decisions regarding pharmacotherapy, but it also seeks to leverage lifestyle interventions and education, particularly for low- to moderate-risk patients, further supporting a lifespan approach to bone health care.³⁴

It should be strongly noted that physicians utilizing this approach must take care to emphasize the value of lifestyle as a first line of treatment for low- to moderate-risk patients and limit pharmacologic intervention to patients with qualifying levels of risk.

Conclusion

Given the growing aging population, the social and clinical burden of osteoporosis and bone fractures are expected to

rise. Both are serious medical conditions that can have significant consequences for quality of life, morbidity, and mortality—especially for women, who have a higher incidence of osteoporosis and a significantly higher lifetime fracture risk than men. Although effective screening tools and treatment options exist, they are underutilized. Hence, the SWHR Bone Health Working Group has proposed several recommendations to improve the frequency of screening in women throughout the lifespan in an effort to elevate action and awareness regarding bone health in women.

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Authors' Contributions

This article was developed through meetings of the SWHR Bone Health Working Group. C.M.: Writing—Original draft, review, and editing. I.O.A.: Conceptualization, supervision, writing—original draft, review, and editing. L.H.: Writing—review and editing. SWHR B.H.W.G.: Conceptualization, investigation, writing—review and editing. All authors read and approved the final article.

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