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Health Beliefs about Osteoporosis and Osteoporosis Screening in Older Women and Men

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Abstract

Objective—To examine older adults' beliefs about osteoporosis and osteoporosis screening to identify barriers to screening.

Design—Cross-sectional mailed survey.

Setting—Western Pennsylvania.

Methods—Surveys were mailed to 1830 women and men aged 60 years and older. The survey assessed sociodemographic characteristics, osteoporosis and general health-related characteristics, and beliefs about osteoporosis severity, susceptibility, screening self-efficacy, and screening response efficacy. Analyses included Wilcoxon rank-sum tests to compare belief dimension scores, and multivariable ordinal logistic regression analyses to evaluate association between osteoporosis beliefs and potential explanatory variables.

Results—Surveys were completed by 1268 individuals (69.3 per cent). Mean age of respondents was 73.3 years, and most were female (58.7 per cent). Individuals demonstrated greatest belief in the severity of osteoporosis and least belief in personal susceptibility ($P < .001$). Older individuals believed less strongly than younger individuals in osteoporosis severity (OR, 0.95 per 1-year increase in age; 95 per cent CI, 0.92–0.97) and response efficacy (OR, 0.97 per 1-year increase in age; 95 per cent CI, 0.95–0.99). Women believed more strongly than men in osteoporosis susceptibility (OR, 1.87; 95 per cent CI, 1.38–2.53) and screening self-efficacy (OR, 2.87; 95 per cent CI, 1.17–7.07). Individuals with high self-rated health status had greater belief than those with low self-rated health status in screening self-efficacy (OR, 3.59; 95 per cent CI, 1.89–6.83).

Conclusion—Older adults demonstrate several beliefs that may be barriers to osteoporosis screening, including low belief in susceptibility to osteoporosis. These beliefs should be targeted with patient education to improve screening rates.

Keywords

geriatrics; patient education; osteoporosis; screening; survey research

Introduction

Osteoporosis affects approximately 8 million women and 2 million men in the United States^{1,2}, and often leads to long-term morbidity or mortality³⁻⁶. In 2005, osteoporosis contributed to over 2 million fractures and direct costs of nearly \$17 billion⁷. By 2040, the number of hip fractures and associated costs are expected to double or triple because of the aging population⁸. Studies indicate that about one-half of all postmenopausal women and one-quarter of white men over the age of 60 years will experience an osteoporotic fracture in their lifetime^{9,10}.

Most individuals with osteoporosis are asymptomatic, undiagnosed, and untreated. In the National Ambulatory Medical Care Survey, investigators found that primary care physicians diagnosed osteoporosis in fewer than 2 per cent of women over 60 years old, even though the expected prevalence in this population is 20 to 30 per cent¹¹. Men appear to be diagnosed and treated less often than women^{12,13}. Several groups have endorsed osteoporosis screening in older adults. The US Preventive Services Task Force (USPSTF) recommends that all women aged 65 and older should be screened for osteoporosis¹⁴. The 2008 National Osteoporosis Foundation Guidelines concur and suggest that all men aged 70 and older be screened¹⁵. The American College of Physicians recommends that clinicians periodically assess older men for osteoporosis risk factors and perform dual-energy x-ray absorptiometry in those who are at increased risk and are candidates for medical therapy¹⁶.

Previous studies suggest that health beliefs are important determinants of whether individuals participate in health screening¹⁷⁻²¹. The Health Belief Model is a widely used conceptual framework to explain and predict health-related behaviors. This model indicates that patient-level factors related to undertaking health-related action such as disease screening include perceived susceptibility to a condition, perceived severity of the condition, perceived benefits to taking a health-related action, perceived barriers to taking action, cues to action (external events that prompt the desire to make a health change), and self-efficacy (belief in one's ability to improve health by taking action)²²⁻²⁵. Several smaller studies have found these beliefs to be related to osteoporosis-preventing behaviors²⁶⁻²⁸. Our study was designed to examine health beliefs about osteoporosis and osteoporosis screening in a large group of older women and men to determine barriers to screening.

Methods

Study Participants and Procedures

With approval from the University of Pittsburgh Institutional Review Board, we designed and carried out a cross-sectional survey of 1830 women and men who were aged 60 and older, were living in the greater Pittsburgh region, and were listed in the university's Claude D. Pepper Registry for studies on mobility and balance in older adults. Individuals were initially recruited for this registry through other clinical studies at the university, mailings to university alumni, faculty, and staff, community events at senior citizen centers and a continuing care facility, and newspaper advertisements. The vast majority of registry participants were community-dwelling.

In November 2007, all members of the registry were asked to complete a 44-item survey. The survey was mailed to them, along with information describing the purpose of the study. Participants were assured that their responses would remain anonymous, and they were provided with a prepaid return envelope. No incentive payments were offered. The completed surveys were collected over a 6-month period, and the survey responses were dual-entered (entered independently by two individuals) and validated to ensure data integrity.

The survey included questions about sociodemographics, risk factors for osteoporosis, mobility, falls, knowledge of osteoporosis, prior screening for osteoporosis, personal history of osteoporosis, and an osteoporosis-specific version of the Risk Behavior Diagnosis Scale (RBDS). The RBDS is a 12-item scale used to measure 4 dimensions of beliefs about health threat and efficacy: disease severity, disease susceptibility, self-efficacy (for performing a health-related behavior), and response efficacy (belief that a specific behavior produces a desired result)^{29,30}. The scale is theoretically guided by the Extended Parallel Process Model, which can be thought of as an explanatory version of the Health Belief Model that can be used to develop effective health risk messages to motivate health-protective behaviors^{29,31}. The RBDS has demonstrated a high degree of reliability (Cronbach's alpha of each belief scale in the range of 0.71-0.90)³⁰, as well as content, construct, and predictive validity, and been shown to predict several preventive behaviors, including colon cancer screening^{29,30}.

Statistical Analyses

We computed descriptive statistics for each survey item. In the RBDS, each of the 4 dimensions consists of 3 items that are rated in terms of a 5-point Likert scale ranging from “strongly disagree” (1 point) to “strongly agree” (5 points). We summed item scores within each dimension to produce dimension scores ranging from 3 to 15 for each study participant. After creating 4 categories of scores for each dimension (categories of 3-6, 7-9, 10-12, and 13-15), we performed a Kruskal-Wallis test to determine whether the distribution of scores among these categories differed significantly ($P \leq .05$) for the various dimensions. We also performed Wilcoxon rank sum tests to determine whether individual comparisons between belief dimension scores differed significantly ($P \leq .05$).

We performed ordinal logistic regression analyses to evaluate statistical associations between RBDS dimension score categories (response variables) and individual variables that we thought may be related to osteoporosis beliefs (explanatory variables). The explanatory variables included age (coded in 1-year increments), sex, self-reported race (white vs. black), educational level (completed college or higher vs. less than college), family history of osteoporosis, prior screening or testing for osteoporosis, prior diagnosis with osteoporosis, self-rated health status (poor/fair vs. good/very good/excellent), weight (coded in 0.45 kilogram (1-pound) increments), current smoking, alcohol intake (3 or more drinks in one sitting at least 4 times per week vs. less), history of steroid use for more than 1 month, loss of height of greater than 2.54 centimeters (1 inch), use of an assistive device to ambulate, use of arms to get up from a chair most of time, history of a fall within the past 5 years, fear of falling, and difficulty in traveling to doctor appointments on own (no difficulty vs. some difficulty or cannot travel on own).

To further evaluate the association between osteoporosis beliefs and explanatory variables, we included the individual variables shown to be significantly related to RBDS dimension scores ($P \leq .10$) as variable candidates in stepwise backward selection multivariable ordinal logistic regression models. We checked for evidence of multicollinearity of variables and for interactions between variables. We considered variables and interaction terms with P values $\leq .05$ to be significant in the final multivariable models. To perform all analyses, we used Stata version 10.0 (StataCorp, College Station, Texas).

Results

Characteristics of Survey Respondents

Of the 1830 individuals to whom surveys were sent, 1268 (69.3 per cent) responded (Table 1). The mean age of respondents was 73.3 years (range, 60-93; standard deviation, 7.3).

Most respondents were female (58.7 per cent), white (92.9 per cent), had completed college (75.0 per cent), and had high self-rated health status (88.2 per cent rated their status as good, very good, or excellent). 96.1 per cent of survey respondents had heard of osteoporosis, 62.6 per cent had been previously tested for osteoporosis, and 22.6 per cent had been diagnosed with osteoporosis.

Scores on the Risk Behavior Diagnosis Scale

Table 2 summarizes the responses to the RBDS items, and the Figure shows distributions of scores on each of the 4 dimensions. The distributions of scores differed significantly among dimensions ($P < .001$). All individual comparisons between each of the belief dimensions were significant (all P s $< .001$). The respondents' beliefs, ranging from strongest to weakest, were ordered as followed: belief in osteoporosis severity, belief in self-efficacy with respect to osteoporosis screening, belief in response efficacy of osteoporosis screening, and belief in personal susceptibility to osteoporosis.

Multivariable Models of Osteoporosis Beliefs

Severity belief—Age, family history of osteoporosis, and prior testing for osteoporosis were significantly associated with belief in osteoporosis severity. Older respondents believed less strongly than younger individuals in osteoporosis severity (OR, 0.95 per 1-year increase in age; 95 per cent CI, 0.92-0.97). Individuals with a family history of osteoporosis believed more strongly in osteoporosis severity (OR, 1.72; 95 per cent CI, 1.30-2.28). There was a significant positive interaction between older age and prior testing for osteoporosis (OR, 1.04; 95 per cent CI, 1.00-1.07). When we included this interaction in the model, prior testing for osteoporosis by itself was not a significant predictor of belief in osteoporosis severity. There was no evidence of multicollinearity in the severity belief model.

Susceptibility belief—Personal history of osteoporosis, family history of osteoporosis, sex, weight, alcohol intake, and prior screening or testing for osteoporosis were significantly associated with belief in osteoporosis susceptibility. Respondents believed more strongly in osteoporosis susceptibility if they had a personal history of osteoporosis (OR, 12.36; 95 per cent CI, 8.35-18.29), if they had a family history of osteoporosis (OR, 3.39; 95 per cent CI, 2.47-4.63), if they were female (OR, 1.87; 95 per cent CI, 1.38-2.53), or if they had been tested for osteoporosis (OR, 1.43; 95 per cent CI, 1.05-1.95). Respondents believed less strongly in osteoporosis susceptibility if they had a higher weight (OR, 0.99 per 0.45kg increase in weight; 95 per cent CI, 0.99-1.00) or if they were heavy drinkers (OR, 0.34; 95 per cent CI, 0.15-0.79). There was no evidence of multicollinearity or significant interactions between the variables included in the susceptibility belief model.

Self-efficacy belief—Prior screening or testing for osteoporosis, self-rated health status, sex, personal history of osteoporosis, history of fall within past 5 years, age, and smoking status were significantly associated with belief in osteoporosis screening self-efficacy. Respondents believed more strongly in self-efficacy with respect to osteoporosis screening if they had been tested for osteoporosis (OR, 771.78; 95 per cent CI, 48.06-12394.15), had a high self-rated health status (OR, 3.59; 95 per cent CI, 1.89-6.83), were female (OR, 2.87; 95 per cent CI, 1.17-7.07), had a personal history of osteoporosis (OR, 2.31; 95 per cent CI, 1.62-3.28), or had fallen within the past 5 years (OR, 1.36; 95 per cent CI, 1.05-1.76). There was a significant positive interaction between female sex and prior testing for osteoporosis (OR, 1.96; 95 per cent CI, 1.03-3.70). There were significant negative interactions between older age and prior testing for osteoporosis (OR, 0.93; 95 per cent CI, 0.90-0.97), between female sex and high self-rated health status (OR, 0.32; 95 per cent CI, 0.14-0.74), and between female sex and current smoking (OR, 0.10; 95 per cent CI, 0.01-0.96). In the model that included these interactions, age and smoking status by themselves were not significant

predictors of belief in osteoporosis screening self-efficacy. There was no evidence of multicollinearity in the self-efficacy belief model.

Response efficacy belief—Prior testing for osteoporosis, age, and weight were significantly associated with belief in osteoporosis screening response efficacy. Respondents believed more strongly in response efficacy with respect to osteoporosis screening if they had been tested for osteoporosis (OR, 3.21; 95 per cent CI, 2.44-4.22). Older individuals believed less strongly in screening response efficacy (OR, 0.97 per 1-year increase in age; 95 per cent CI, 0.95-0.99), as did individuals with higher weight (OR, 0.99 per 0.45kg increase in weight; 95 per cent CI, 0.99-1.00). There was no evidence of multicollinearity or significant interactions between the variables included in the response efficacy model.

Discussion

When we surveyed 1268 women and men aged 60 and older about 4 dimensions of osteoporosis-related beliefs, we found that the respondents generally had greatest belief in the severity of osteoporosis and their self-efficacy for osteoporosis screening. Individuals also tended to believe in response efficacy of osteoporosis screening (belief that screening is effective and reduces risk), although to a lesser degree than their belief in osteoporosis severity and self-efficacy. Interestingly, survey respondents reported low overall belief in their personal susceptibility to osteoporosis. In fact, only 44.6 per cent of respondents agreed or strongly agreed that they were at risk for osteoporosis, and only 26.3 per cent agreed or strongly agreed that they were likely to develop it. Given the high prevalence of osteoporosis and risk for osteoporotic fractures in elderly adults, low general belief in susceptibility to osteoporosis is remarkable. Nevertheless, our finding is consistent with findings in several earlier studies of osteoporosis beliefs^{19,32-34}. Our finding that prior screening or testing was significantly associated with all of the dimensions of beliefs that we evaluated supports the idea that these beliefs may affect osteoporosis prevention behavior. Results from a smaller recent study support the idea that osteoporosis beliefs are related to osteoporosis prevention behavior²⁸. Thus, targeting osteoporosis beliefs with patient education may be a worthwhile strategy to evaluate in an effort to improve screening rates. Belief in osteoporosis susceptibility may be particularly important to target with patient education, as belief in osteoporosis susceptibility in older adults is low, and perceived susceptibility to a health condition has been shown to be a strong predictor of health-related behavior concerning that condition, such as screening participation^{20,21,28,35}.

Other findings in our study also point to the need for patient education to improve screening rates. We found that individuals with several known risk factors for osteoporosis were more likely to have certain health beliefs about osteoporosis that may be barriers to screening. Most remarkably, older respondents in our study believed less strongly in osteoporosis severity and screening response efficacy than younger respondents. Age is the strongest individual risk factor for osteoporosis, with older individuals being at highest risk. Other studies have also found knowledge deficits among older adults about the severity of osteoporosis, for example in a recent large study of older women by Cadarette, et al.³⁶. Also notable were our findings that individuals with risk factors of prolonged steroid use, loss of height, and heavy drinking did not perceive themselves to have an increased susceptibility to osteoporosis, when controlling for other variables. We also found that men generally had lower belief in osteoporosis susceptibility, which is in agreement with findings from several other studies^{37,38}. Additionally, men and individuals with low self-rated health status had lower belief in their self-efficacy for osteoporosis screening. These groups of individuals may particularly benefit from osteoporosis education.

Our study had several limitations that deserve mention. First, about 30 per cent of individuals who were sent surveys did not respond, and there may have been response bias. Second, our study population consisted of individuals who volunteered for a research registry, and the population was disproportionately white, healthy, and highly educated; additionally, almost all our survey participants had heard of osteoporosis, and most had been tested for osteoporosis. Thus, our survey population may not be representative of the general population as a whole, which may limit the generalizability of our results. However, it is likely that if even in our survey population individuals did not feel themselves to be personally susceptible to osteoporosis, and demonstrated other beliefs that may be barriers to osteoporosis screening, these barriers may be an even larger problem in the general population of older adults. Third, our survey may not have measured all of the variables that significantly affect osteoporosis beliefs. Fourth, our finding that belief in response efficacy was generally lower than the beliefs in severity and self-efficacy may have been biased by different interpretations of the following survey item: "If I get a screening test done for osteoporosis, I am less likely to get osteoporosis or suffer an osteoporotic fracture." In response to this item, several respondents pointed out that screening alone was insufficient to prevent osteoporosis because treatment was also needed. This particular interpretation of the item may have made respondents less likely to indicate agreement with the statement.

In conclusion, our study found several important potential barriers to osteoporosis screening in elderly adults, including low overall belief in susceptibility to osteoporosis, inverse relationship between age and belief in osteoporosis severity and screening response efficacy, and lower beliefs in osteoporosis susceptibility and screening self-efficacy in men. These are important beliefs to target with patient education in an effort to improve osteoporosis screening rates in older patients who are at greatest risk for osteoporosis.

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Figure. Distributions of Osteoporosis-Specific Risk Behavior Diagnosis Scale Belief Dimension Scores

Scores could range from 3 (“strong disagreement” with each item) to 15 (“strong agreement” with each item) for each belief dimension. Some clustering of scores within individual dimensions occurred when individuals answered the same response for each item within the dimension (ex. indicating agree on each item results in a score of 12).

Table 1
Characteristics of the Survey Respondents^{*†}

Characteristics	Number (%)
<i>Sociodemographic characteristics</i>	
White race	1148 (92.9)
Female sex	664 (58.7)
Completed college	926 (75.0)
<i>Osteoporosis-related characteristics</i>	
Has heard of osteoporosis	1215 (96.1)
Has a family history of osteoporosis	292 (23.8)
Has been screened or tested for osteoporosis	783 (62.6)
Has been diagnosed with osteoporosis	283 (22.6)
<i>Other health-related characteristics</i>	
Has a high self-rated health status (rated as good, very good, or excellent)	1114 (88.2)
Is a nonsmoker	1248 (98.7)
Has a history of alcohol use ≥ 4 times per week, ≥ 3 drinks at a time	32 (2.6)
Has a history of steroid use for more than 1 month	103 (8.2)
Has experienced a loss of height of >2.54 centimeters over the lifetime	435 (35.3)
Is ambulatory without the use of an assistive device	1152 (91.3)
Uses arms to get up from a chair most of the time	460 (36.8)
Has fallen within the past 5 years	609 (48.6)
Has a fear of falling	512 (40.9)
Has difficulty traveling to doctor appointments on own	127 (10.1)

* There were 1268 survey respondents. However, there was some missing data for each of the characteristics in this table. Percentages shown for each characteristic are percentages of those individuals who reported an answer for that characteristic. Percentage of missing data for sex was 10.8 per cent; percentages of missing data for all characteristics were < 4 per cent.

[†] Mean age of respondents was 73.3 years (range, 60-93; standard deviation, 7.3). Mean weight was 76.9 kg (range, 42.6-147.4; SD 16.9).

Table 2
Responses to Osteoporosis-Specific Items on the Risk Behavior Diagnosis Scale*

Dimension and Item	Percentage of Respondents (%)				
	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
<i>Severity</i>					
1. I believe osteoporosis is a serious disease.	44.2	46.7	7.3	0.8	0.2
2. I believe osteoporosis is a severe disease.	32.3	41.7	20.2	2.8	0.2
3. I believe osteoporosis is a significant disease.	38.7	47.2	11.0	0.6	0.1
<i>Susceptibility</i>					
4. I am at risk for getting osteoporosis.	17.6	27.0	27.4	20.2	4.7
5. It is likely that I will get osteoporosis.	12.1	14.2	37.8	24.9	7.3
6. It is possible that I will get osteoporosis.	13.7	41.1	28.7	8.9	3.1
<i>Self-efficacy</i>					
7. I am able to get a screening test done to help detect osteoporosis.	34.4	49.7	11.8	1.5	0.5
8. Screening to detect osteoporosis is easy to do.	36.8	38.6	21.9	1.0	0.1
9. Osteoporosis screening is convenient.	29.1	37.8	29.0	2.2	0.1
<i>Response efficacy</i>					
10. Osteoporosis screening works to help detect osteoporosis.	41.5	48.0	9.2	0.2	0.0
11. Screening is an effective way to detect osteoporosis.	41.6	46.5	10.4	0.3	0.0
12. If I get a screening test done for osteoporosis, I am less likely to get osteoporosis or suffer an osteoporotic fracture.	8.4	15.5	31.2	28.0	15.2

* Because of rounding, percentages may not total 100.