Osteoporosis Knowledge Among Individuals With Recent Fragility Fracture

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Abstract

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BACKGROUND—To evaluate osteoporosis knowledge among patients with fractures and to evaluate factors associated with osteoporosis knowledge.

METHODS—Patients with fragility fractures participated in a telephone interview. Participants were asked what they thought osteoporosis was. Unadjusted odds ratios (OR, 95% CI) were calculated to identify factors associated with a correct definition. Predictors identified in univariate analysis were entered into multivariable logistic regression models. A subset also completed the Facts on Osteoporosis Quiz.

RESULTS—One hundred twenty-seven patients (82% women) participated in the study, with mean (SD) age being 67.5 (12.7) years. Ninety-five (75%) respondents gave correct osteoporosis definitions. The odds of an individual providing a correct definition of osteoporosis were higher for those who reported a diagnosis of osteoporosis or those who reported higher education levels, but the odds decreased with increasing age. A total of 49 (39%) respondents completed the Facts on Osteoporosis Quiz; the average score was 13.6 (3.8) of 21. Areas that respondents scored poorly on were related to key risk factors.

CONCLUSION—Many patients with fractures are unaware of important risk factors. Education initiatives aimed at improving osteoporosis knowledge should be directed at individuals at high risk of fracture. Nurses and other allied healthcare providers working in fracture clinics, acute care, and rehabilitation settings are in an ideal position to communicate information about osteoporosis and fracture risk to individuals with a recent fragility fracture.

Background

Fragility fractures are often the first symptom of osteoporosis, a skeletal disorder characterized by compromised bone strength (National Institutes of Health, 2000). A fragility fracture is a fracture that occurs with minimal trauma, such as a fall from a standing height. Fragility fractures create impairments in physical function and can also result in pain, deformity, fear of falling, a loss of independence, and increased mortality (Adachi et al., 2001; Papaioannou et al., 2002; Petrella, Payne, Myers, Overend, & Chesworth, 2000). New guidelines for diagnosis of osteoporosis incorporate a person's history of fragility fractures as one of several determinants of future fracture risk (Kanis, Johnell, Oden, Johansson, & McCloskey, 2008; Siminoski et al., 2005). Increasing age and a history of fragility fracture predict subsequent fractures independent of bone mineral density (Kanis et al., 2004). Therefore, individuals who experience fragility fractures should be considered for fracture prevention strategies.

With a chronic disease such as osteoporosis, patient self-management is an important component to effective fracture prevention, especially with self-care issues such as adequate calcium and vitamin D intakes, fall prevention, and exercise (Holman & Lorig, 2004). Healthcare knowledge has been identified as one of the predisposing factors affecting health behavior in the Predisposing, Reinforcing, and Enabling Constructs in Educational Diagnosis and Evaluation (PRECEDE) model (Green & Kreuter, 2005). Patient education may enhance risk perceptions and improve the likelihood of adherence to therapy (Gold & McClung, 2006). Several studies have revealed deficits in osteoporosis knowledge among community-living individuals, particularly knowledge of risk factors and preventative

strategies (Ailinger & Emerson, 1998; Juby & Davis, 2001; Phillipov, Phillips, Leach, & Taylor, 1998; Ribeiro, Blakeley, & Laryea, 2000; Satterfield, Johnson, Slovic, Neil, & Schein, 2000; Williams, Cullen, & Barlow, 2002). A review of the literature revealed that although a number of instruments have been developed to evaluate osteoporosis knowledge, and intervention studies have targeted osteoporosis knowledge among community-living individuals, important gaps still exist in the literature regarding the layperson's understanding of osteoporosis, predictors of osteoporosis knowledge, and how knowledge affects behavior (Werner, 2005).

Although previous studies have evaluated osteoporosis knowledge among community-living individuals, no study to date has evaluated osteoporosis knowledge among individuals who have suffered fragility fractures. Given the established relationship between the history of a fragility fracture and future fracture risk, patients with fragility fractures are an important group to target for educational intervention. Therefore, establishing how much is known about osteoporosis among individuals who have experienced a fragility fracture is essential. The purpose of the current study is to describe knowledge of osteoporosis among individuals with fragility fractures and, secondarily, to identify factors that may predict knowledge of osteoporosis.

Methods

Participants

Male and female patients who were treated for a fragility fracture by orthopaedic surgeons at two major teaching hospital fracture clinics were recruited to participate. Fractures had to occur at the radius, humerus, femur, rib, tibia (in female patients only), pelvis, or vertebrae to be considered a possible osteoporotic fragility fracture (Kanis et al., 2001). Participants were considered eligible for inclusion in the study if they were 40 years of age or older and if they had experienced a fragility fracture within 24 months of the interview date. All patients who had sustained a fracture at specified sites were identified by orthopaedic surgeons. Exclusion criteria were as follows: fractures of the hands, feet, skull, clavicle, ankle, or the tibia in male patients; fracture due to malignancy; non-fragility fractures; not living in the community; not able to communicate in English; on dialysis; unable to complete interview because of memory loss, dementia, other medical reasons, and fracture more than 2 years before (to avoid problems with recall) (see Figure 1). Patients were also asked to describe the incident in which the fracture occurred, to verify whether the fracture was a fragility fracture. A fracture occurring in any event that was not a fall from standing height or similar nontraumatic event was reviewed by at least three physicians among the research team and a decision was made whether to include or exclude the fracture. Letters were sent to patients from their physicians, requesting their participation in the study. All patients received a follow-up telephone call to confirm whether they were interested in participating. Interviews were conducted from September 2005 to June 2006. The study received approval by the Hamilton Health Sciences Research Ethics Board and the St. Joseph's Healthcare Research Ethics Board.

Survey

A telephone interview was conducted with individuals who agreed to participate, using a survey instrument and process that have been described previously (Giangregorio et al., 2008, 2009). Interview data were gathered by using a computer-assisted telephone interviewing system (Voxco, Montreal, Quebec, Canada). The interview contained structured questions about sociodemographic information, prescription medication use in the past year, medical and fracture history, and family history of osteoporosis.

To determine whether individuals who had had a fragility fracture understood what osteoporosis was, they were asked the following questions:

1. Do you know what osteoporosis is?
2. If Yes, what do you think it is?

Question 1 was included to assess perception of knowledge, and possible responses were “yes”, “no,” and “unsure.” Question 2 was included to provide a more detailed understanding of their perceived definition of *osteoporosis*, and responses were qualitative in nature. *Osteoporosis* has been defined as a skeletal disorder characterized by compromised bone strength, where bone strength is related to bone density and quality (National Institutes of Health, 2000). A response to Question 2 was considered correct if it referred to bone strength or lack of, where many variations were accepted, to be conservative: weak bones, thin bones, deterioration of bones, fragile bones, porous bones, that bones break easily, loss of calcium from bones, brittle bones, loss of bone density, or holes in bones. Responses to Question 2 were considered incorrect if (1) they mentioned only disease of the bones, (2) they indicated that it was a crippling disease and they did not specify the definitions above, (3) the individuals said that they did not know what osteoporosis was or were unsure, and (4) the individuals provided an answer that was incorrect. It was hypothesized that having an osteoporosis diagnosis or risk factors might be associated with an increased probability of knowing the definition of *osteoporosis*, and age and gender have been previously identified as correlates of knowledge (Kutsal et al., 2005; Saw et al., 2003; Werner, 2003), so the following demographic and health-related variables were considered as potential correlates of being able to provide a correct definition of *osteoporosis*: age; gender; education; history of a previous fracture; family history of fracture at wrist, spine, or hip after the age of 40 years; or ever being told they have osteoporosis. One person responded “don’t know” regarding family history of fracture; the response was recorded as a “no.” Variables were selected for hypothesis-generating purposes.

A subset of the interview participants agreed to complete a mailed osteoporosis knowledge questionnaire, the Facts on Osteoporosis Quiz (FOOQ). The FOOQ was mailed to participants who indicated that they would be willing to complete it; it is a valid and reliable, true or false, 20-item questionnaire based on Orem’s Self-Care theory (Ailinger & Emerson, 1998; Ailinger, Lasus, & Braun, 2003; Ailinger, Harper, & Lasus, 1998). Because we were interested in understanding whether individuals with fragility fracture understand whether having a fragility fracture results in an increased risk of future fractures, the following true or false question was added (for a total of 21 questions): “A person who has had a spine

fracture in the past is much more likely to have another fracture than a person who has not had a fracture.”

Statistical Analyses

Descriptive statistics for demographic and clinical participant characteristic are presented as mean (*SD*) for continuous variables or count (percentage) for categorical variables. Scores on the FOOQ are presented as mean (*SD*). The results of the current study represent secondary analyses from a study that was designed to determine factors associated with perceived susceptibility to osteoporosis and fractures (Giangregorio et al., 2008). Unadjusted odds ratios (OR) and 95% CIs were used to identify individual factors that were associated with a correct definition of osteoporosis (coded “1” if response is correct; and “0” otherwise). To be conservative, factors found to be statistically significant at an α value of .20 in the univariate analysis were entered into multivariable logistic regression models to identify factors that are associated with a correct definition of *osteoporosis*. When both the two variables that exhibited collinearity were significant in univariate analyses, only one was included, and the one chosen was based on clinical relevance. We examined the residuals to assess model assumptions. Goodness of fit for the models was performed by using the Hosmer–Lemeshow test (Hosmer & Lemeshow, 1989). Data were managed and analyzed using by SPSS software (version 15.0), and all statistical tests were two-sided. The criterion for statistical significance was set at an alpha value of .05.

Results

Demographic and clinical characteristics of the 127 participants are listed in Table 1. The response rate for the telephone interview was 29% (see Figure 1). Female participants represented 82% (106/127) of the sample. The mean (*SD*) age was 67.5 (12.7) years. A history of a fracture prior to the index fracture after the age of 40 years was reported by 51 (40%) participants and 56 (44%) reported a diagnosis of osteoporosis. Among those with an osteoporosis diagnosis, 45 (80%) were diagnosed before the index fracture. Use of at least one medication, not including calcium and vitamin D supplements, for osteoporosis was reported in 54 (43%) individuals.

Do You Know What Osteoporosis Is?

Most of the respondents (91% or 115/127 respondents) reported that they knew what osteoporosis was, 11 (8.7%) of respondents said they did not know what osteoporosis was, and 1 respondent was unsure. Among the respondents who indicated that they did know what osteoporosis was, the qualitative responses were as follows: 95 (75%) respondents gave responses that were considered correct, such as that osteoporosis resulted in bone or calcium loss, weakening/thinning of the bones, or bones becoming porous. The remaining responses were not considered correct and were as follows: six (5%) respondents reported only that it was a disease of the bones, four (3%) respondents reported that it was crippling or resulted in a crooked spine but did not refer to a disease of bones, five (4%) respondents gave an incorrect response but it was related to bones (e.g., loss of bone marrow), five (4%) respondents gave an answer related to arthritis or other definition unrelated to osteoporosis

or bones. The remaining 12 (9%) respondents reported that they did not know what osteoporosis was or were unsure.

Predictors of Knowledge of the Definition of Osteoporosis

In multivariable analyses, certain variables were significantly related to an individual providing a correct definition of *osteoporosis* (see Table 2). The odds of an individual providing a correct definition of *osteoporosis* were higher for those who reported a diagnosis of osteoporosis (OR = 3.61, 95% CI = 1.34–9.71, $p = .011$) or those who reported higher education levels (OR = 5.08, 95% CI = 1.31–19.73, $p = .019$, for high school; OR = 8.46, 95% CI = 1.72–41.56, $p = .009$, for college/university; and OR = 11.39, 95% CI = 0.91–141.97, $p = .059$, for graduate school, compared with elementary school education), but the odds decreased with increasing age (OR = 0.96, 95% CI = 0.92–1.00, $p = .049$), Hosmer–Lemeshow goodness-of-fit statistic $df(8) = 8.202$, $p = .414$.

Facts on Osteoporosis Quiz

Forty-nine (39%) of the 127 interview participants completed and returned the FOOQ. Female participants represented 86% (42/49) of the FOOQ respondents. The mean (*SD*) age was 68.4 (11.1) years. A history of a fracture prior to the index fracture after the age of 40 years was reported by 23 (47%) FOOQ respondents; a family history of wrist, spine, or hip fracture was reported in 11 (22%); and 23 (47%) reported a diagnosis of osteoporosis. The average score on the FOOQ was 13.6 (3.8) out of a possible 21 correct responses. There were several questions in which more than 35% of the sample answered incorrectly or answered “don’t know” (see Table 3): (1) 35% correctly identified that low-weight women have osteoporosis more often than heavy women, (2) 41% correctly identified that alcoholism was linked to osteoporosis, (3) 25% knew that early menopause is a risk factor for osteoporosis, (4) 31% knew that replacing hormones after menopause can slow bone loss, (5) 39% knew that family history is a risk factor for osteoporosis, and (6) 41% knew that a person who has a spine fracture is much more likely to have another fracture in the future than someone who has not had a fracture. There was one question on the FOOQ that stated “Walking has a great effect on bone health.” The response is false according to the original questionnaire based on the National Institutes of Health (NIH) guidelines, and only 4% of respondents reported this statement to be false.

Discussion

Previous studies have evaluated osteoporosis knowledge among community-living individuals; the current study is novel in that it evaluates osteoporosis knowledge among individuals with fragility fractures and explores predictors of knowledge in this group. Three quarters of fragility fracture patients from two major teaching hospital fracture clinics who participated in the study knew what osteoporosis was when asked to explain osteoporosis in their own words. The odds that individuals knew the definition of *osteoporosis* were higher among individuals who had been told that they had osteoporosis or who reported higher education levels, but the odds decreased with the increasing age. The average scores on the FOOQ reveal that general knowledge about osteoporosis among individuals with fragility fracture could be improved, especially considering that almost half of FOOQ respondents

had a diagnosis of osteoporosis. Knowledge areas that FOOQ respondents scored the most poorly on were related to the understanding of key osteoporosis risk factors: low body weight, excess alcohol intake, family history of osteoporosis, early menopause, and previous spine fracture. Almost 60% of FOOQ respondents did not know that having a spine fracture results in an increased risk of future fractures, suggesting that patients may not understand that osteoporosis causes spine fractures or that having a fracture results in an increased risk of future fractures.

Similar to our current findings in patients with fragility fractures, knowledge of risk factors such as family history have been demonstrated to be poor among middle-aged and elderly women (Ailinger & Emerson, 1998; Gerend, Erchull, Aiken, & Maner, 2006; Saw et al., 2003). A relationship between osteoporosis knowledge and education level among community-living individuals has been demonstrated previously (Kutsal et al., 2005; Saw et al., 2003; Werner, 2003). Saw et al. (2003) demonstrated that women who were younger and were better educated were more likely to have heard of osteoporosis. Similarly, awareness of osteoporosis was inversely correlated with age but positively correlated with education level, among other factors (Kutsal et al., 2005). In contrast, another study did not find a relationship between osteoporosis knowledge and age in women across a wide range of ages (25 to more than 50 years; Terrio & Auld, 2002). Our sample included individuals older than 40 years and the average age was 68 years, so perhaps the relationship between osteoporosis knowledge and age is less evident among individuals younger than 40 years. Variation in osteoporosis knowledge levels among older adults may be influenced by cognition. For example, a quasi-experimental study of an osteoporosis educational intervention suggested that change in osteoporosis knowledge pre- and postintervention was positively correlated with cognition (Abrahamson & Khan, 2006). Risk perceptions may influence the seeking and retention of osteoporosis-related information, or the acceptance of therapies for osteoporosis prevention (Rosenstock, Strecher, & Becker, 1988; Yu & Huang, 2003), and may also be influenced by age; we have published data previously from this cohort that suggest that older patients with fragility fractures are less likely to perceive themselves at risk for future fractures than are younger individuals (Giangregorio et al., 2008). Our study did not assess differences in osteoporosis knowledge or in factors affecting knowledge levels across ethnic groups, but ethnicity may be an important consideration when designing osteoporosis education interventions (Larkey, Day, Houtkooper, & Renger, 2003; Werner, 2003). Given that osteoporosis is often perceived as a disease that affects primarily women, gender may also be an important determinant of osteoporosis knowledge (Juby & Davis, 2001). Gender was not a significant predictor of the knowledge of the correct definition of *osteoporosis* in our study, but only approximately 20% of our participants were men. The analysis presented in the current study was hypothesis generating and the sample size was limited to produce a stable model. Therefore, further prospective studies will be needed to provide insight about the factors that are predictive of osteoporosis knowledge and to determine whether having the knowledge is associated with health-related behavior.

A lack of clarity in the messages given to patients with fragility fractures may explain some of the observed knowledge gaps. One question on the FOOQ and its responses highlight the confusion surrounding available osteoporosis information. According to the original article describing the FOOQ, the true/false question “Walking has a great effect on bone health” is

said to be false based on the NIH guidelines (Ailinger et al., 1998; Ailinger & Emerson, 1998, 2003). The literature on exercise and bone health suggests that weight-bearing exercise such as walking may prevent bone loss in women but may not result in large increases in bone mass (Bonaiuti et al., 2002). Furthermore, there is evidence that exercise may prevent falls (Gillespie et al., 2003), which may indirectly prevent fractures. National (Osteoporosis Canada) and international (International Osteoporosis Foundation) organizations emphasize the importance of physical activity for the prevention of bone loss, which may explain why only 4% of the sample thought the statement “Walking has a great effect on bone health” is false. Confusion regarding the forms of exercise that may be beneficial in the prevention of osteoporosis has been reported previously (Larkey et al., 2003). In fact, weight-bearing exercises such as walking are recommended in materials for community-living individuals provided by the NIH (<http://nihseniorhealth.gov/osteoporosis/prevention/08.html>) as the best exercises for bone health, suggesting perhaps that this particular question on the FOOQ may not be ideal for assessing a person’s knowledge in the area. Ultimately, future education initiatives should consider providing clear direction on the mode, intensity, and frequency of exercise that will confer bone-sparing and fall prevention benefits.

Previous studies have often excluded women with an osteoporosis diagnosis when attempting to evaluate women’s knowledge of osteoporosis, perhaps because it was assumed that they would have been more likely to have received information about the disease. A study of community-living women (mean age = 40 years) demonstrated that receiving information about osteoporosis was the only significant predictor of osteoporosis knowledge (Williams et al., 2002). Our study demonstrated that patients with fragility fractures who had a diagnosis of osteoporosis were more likely to know the definition of *osteoporosis* than those who did not have a diagnosis; an association between an osteoporosis diagnosis and knowledge of osteoporosis has been demonstrated previously among community-living women (Satterfield et al., 2000). Our findings suggest that even among individuals at risk, deficits in osteoporosis knowledge exist and need to be addressed.

Patient education strategies may be important for enhancing osteoporosis self-management. In a prospective study, providing women with a decision aid about benefits and risks of hormone therapy, educational tools, and feedback about densitometry resulted in an increased use of osteoporosis medications (Papaioannou et al., 1998). A recent quasi-experimental nonrandomized trial demonstrated that patient education (in addition to informing the physician of the fracture and providing treatment guidelines) significantly improved both osteoporosis investigation and treatment rates, resulted in improved persistence with therapy, and was cost-saving (Majumdar et al., 2004, 2007). Similarly, a multifaceted intervention including patient education improved treatment rates among patients with wrist fractures, although knowledge did not change (Cranney et al., 2008). A recent study suggested that education can improve osteoporosis knowledge and that less educated individuals appear to gain the most knowledge (Nielsen et al., 2008). Although patient education may improve osteoporosis knowledge, changes in health beliefs or behavior are not a consistent finding (Sedlak, Doheny, & Jones, 2000; Werner, 2005). For example, osteoporosis education programs developed by using the health belief model were successful at increasing osteoporosis knowledge but did not change health beliefs or

subsequent behavior related to osteoporosis prevention (Sedlak et al., 2000). Patient satisfaction with care, perceived susceptibility to osteoporosis, perceived benefits of medications, and personality traits have all been linked to compliance with osteoporosis management (Cline, Farley, Hansen, & Schommer, 2005; Gerend, Aiken, & West, 2004; Gold & McClung, 2006). Future studies should evaluate the specific aspects of interventions that result in increased knowledge and adherence to preventative strategies and should determine whether changes in knowledge are translated into changes in behavior.

The implementation of appropriate osteoporosis management and education strategies after fragility fracture should begin with identification of individuals at risk in the acute postfracture setting. Staff nurses and nurse educators can play a pivotal role in this process and in the delivery of osteoporosis risk messages and education. However, it may be necessary to specifically appoint a member of the interdisciplinary team to be responsible for directing osteoporosis management after fragility fracture to ensure that it is systematically implemented. For example, implementing an osteoporosis coordinator (often a nurse or clinical nurse specialist) to target individuals with fragility fractures for osteoporosis assessment, treatment, and education increases the identification of individuals at risk and may reduce hip fractures and associated healthcare costs (Majumdar, Lier, Beaupre, Hanley, Maksymowych, Juby, et al., 2009; Sander, Elliot-Gibson, Beaton, Bogoch, & Maetzel, 2008; Ward, Laughren, Escott, Elliot-Gibson, & BogochBeaton, 2007). Therefore, a strategic plan for targeting patients with fragility fractures for appropriate osteoporosis management is crucial and should include nursing staff as an integral component.

The current study has a few limitations. Among the potential pool of participants, 42% chose not to participate and 30% could not be contacted to determine whether they were eligible. Many of the potential pool of participants had had hip fractures, and so it is very likely that many of those lost to follow-up were no longer living in the same residence or had died. We acknowledge that this is a potential source of responder bias. We did not have bone density data to confirm whether all participants have osteoporosis. However, having a fragility fracture is an independent predictor of future fractures (Kanis et al., 2004). The proportion of respondents reporting a diagnosis of osteoporosis is relatively high when compared with previous reports of the proportion of patients with fragility fractures diagnosed with osteoporosis after fracture (Giangregorio, Papaioannou, Cranney, Zytaruk, & Adachi, 2006; Papaioannou et al., 2004), suggesting that we may have overrepresented individuals with diagnosed osteoporosis. However, because higher knowledge levels are observed among those with an osteoporosis diagnosis (Satterfield et al., 2000), inclusion of a more representative sample may have actually demonstrated larger knowledge gaps. Finally, individuals living in long-term care were excluded, and patients who had a hip fracture or were men were underrepresented.

Conclusion

In summary, many patients with fragility fractures are unaware of important osteoporosis risk factors. Having a diagnosis of osteoporosis, younger age, and higher education levels were associated with providing a correct definition of *osteoporosis*.

Education initiatives aimed at improving osteoporosis knowledge should be directed at individuals at high risk, including patients with fragility fractures, and should address important risk factors for fracture. Nursing and other allied healthcare providers are essential members of any strategic plan to improve osteoporosis management. Efforts to improve osteoporosis knowledge among patients with fragility fractures should include clear, evidence-based messages and should also include efforts to evaluate whether changes in knowledge also bring about increases in preventative behaviors.

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Figure 1.
 Flow diagram of participant recruitment and inclusion—exclusion.

Table 1**Participant Characteristics ($N = 127$)^a**

Age, mean (<i>SD</i>), year	67.5 (12.7)
Number of women	106 (82)
Menopausal status (women)	
Premenopausal	4 (3.1)
Perimenopausal	3 (2.3)
Postmenopausal	95 (74.8)
Unsure	3 (2.3)
Site of index fracture	
Wrist	72 (56.7)
Hip	26 (20.5)
Other femur fracture	10 (7.9)
Humerus	5 (3.9)
Spine	1 (0.8)
Pelvis	1 (0.8)
Elbow	12 (9.4)
Cause of fracture	
Fall from standing height	75 (59.1)
Twisting	3 (2.4)
Slipping on ice	37 (29.1)
Ice skating	3 (2.4)
Refracture	1 (0.8)
Fall from standing height while running	2 (1.6)
Hit it on something	2 (1.6)
Unsure	1 (0.8)
Spontaneous	3 (2.4)
Average time postfracture, mean (<i>SD</i>), month	11.2 (6.3)
History of fracture	51 (40.2)
Family history of fracture	28 (21.7)
Self-reported height loss	67 (51.9)
At least one fall in the past year ^b	103 (81.1)
Three or more falls in the past year	13 (10.1)
Use assistive aid for mobility (cane, crutches, walker, wheelchair)	45 (35.4)
Four or more prescription medications	53 (41.1)
Average number of prescription medications, mean (<i>SD</i>)	3.7 (3.3)
Marital status	
Single	7 (5.4)
Married	67 (52.8)
Widowed	34 (26.4)
Divorced/separated	19 (14.7)
Living arrangements	

Live alone	45 (34.9)
Live with others	82 (64.6)

^aValues are presented as *n* (%) unless otherwise indicated.

^bIf the respondent's fracture was due to a fall, this fall was included in the total.

Table 2

Multivariable Analysis of Factors Associated With a Correct Definition of Osteoporosis: OR (95% CI) and P Value (N = 127)^a

	Variable (reference)	OR (95% CI)	p
Provided correct definition of osteoporosis	Ever told you have osteoporosis (No)	3.61 (1.34; 9.71)	.011
	Age (per year)	0.96 (0.92; 1.00)	.049
	Highest level of education completed (1–8 years of elementary)		
	High school, grades 9–12	5.08 (1.31; 19.73)	.019
	College or university	8.46 (1.72; 41.56)	.009
	Graduate school	11.39 (0.91; 141.97)	.059
	Family history of fracture at wrist, spine, or hip (No)	2.52 (0.66; 9.67)	.178

^aHosmer–Lemeshow goodness-of-fit statistic = 8.202; *df* = 8; *p* = .414.

Table 3Responses to the Facts on Osteoporosis Quiz ($N = 49$)^a

	“True”	“False”	“Don’t know”	Percentage correct
1. Physical activity increases the risk of osteoporosis	3	42	4	85.7
2. High-impact exercise (weight training) improves bone health	36	2	11	73.5
3. Most people gain bone mass after 30 years of age	9	33	7	67.3
4. Low-weight women have osteoporosis more than heavyweight women	17	19	13	34.7
5. Alcoholism is not linked to the occurrence of osteoporosis	8	20	21	40.8
6. The most important time to build bone strength is between 9 and 17 years of age	33	3	13	67.3
7. Normally, bone loss speeds up after menopause	43	2	4	87.8
8. High caffeine combined with low calcium intake increases the risk of osteoporosis	45	2	2	91.8
9. There are many ways to prevent osteoporosis	40	9	0	81.6
10. Without preventative measures, 20% of women older than 50 years will have a fracture due to osteoporosis in their lifetime	42	1	6	85.7
11. There are treatments for osteoporosis after it develops	43	1	5	87.8
12. A lifetime of low intake of calcium and vitamin D does not increase the risk of osteoporosis	5	38	6	77.6
13. Smoking does not increase the risk of osteoporosis	1	35	13	71.4
14. Walking has a great effect on bone health	47	2 ^b	0	4.1
15. After menopause, women not on estrogen need about 1,500 mg of calcium (i.e., 5 glasses of milk) daily	35	6	8	71.4
16. Osteoporosis affects men and women	46	1	2	93.9
17. Early menopause is not a risk factor for osteoporosis	14	12	23	24.5
18. Replacing hormones after menopause cannot slow down bone loss	14	15	20	30.7
19. Children 9 to 17 years of age get enough calcium from one glass of milk each day to prevent osteoporosis	9	33	7	67.3
20. Family history of osteoporosis is not a risk factor for osteoporosis	8	30	11	61.2
21. A person who has had a spine fracture in the past is much more likely to have another fracture than a person who has not had a fracture	29	5	15	59.2

^aCorrect answers are indicated in bold.^bThe response is false according to the original questionnaire based on the National Institutes of Health guidelines.