Osteoporosis International (2019) 30:1395–1401
https://doi.org/10.1007/s00198-019-04952-5

ORIGINAL ARTICLE

Factors affecting willingness to get assessed and treated for osteoporosis

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Received: 4 December 2018 / Accepted: 14 March 2019 / Published online: 3 April 2019

Abstract

Summary Individuals with poor knowledge of osteoporosis and lower socioeconomic status, including being single and having a lower level of annual income, are less likely to be assessed or treated for osteoporosis. Individuals with particular osteoporosis risk factors such as smokers and heavy drinkers are overlooked for diagnosis. Further study is needed to identify and address the existing barriers and to promote osteoporosis management for women with these risk factors.

Introduction Despite the negative health consequences of osteoporosis and the availability of effective treatment, a pervasive and persistent prevention care gap for osteoporosis remains present throughout the world. We attempted to identify the factors affecting the willingness of patients to either undergo or avoid assessment and treatment for osteoporosis.

Methods A nationwide online survey was conducted in 926 Korean women over age 50. The survey included questions addressing three domains: (1) clinical and socio-demographic characteristics, (2) questions concerning the reasons for undergoing or avoiding osteoporosis assessment or treatment, and (3) knowledge of osteoporosis as measured using the modified Korean version of Facts on Osteoporosis Quiz. The assessed and non-assessed participants were compared in terms of their clinical and socioeconomic statuses, reasons for undergoing or avoiding osteoporosis management, and levels of knowledge of osteoporosis.

Results The highest-ranked reason for undergoing osteoporosis assessment was fear of osteoporotic fracture, while the highest-ranked reason for avoiding osteoporosis assessment was not feeling a need to get tested for osteoporosis. Participants who sought assessment for osteoporosis were older and more likely to be married, and had greater knowledge of osteoporosis than those who did not seek assessment. The two groups were found to be similar in terms of tobacco use and daily alcohol use. Patients who had been diagnosed with osteoporosis but either did not initiate or discontinued osteoporosis treatment within 1 year were younger and had lower levels of annual income than those who began and continued treatment.

Conclusion Individuals with poor knowledge of osteoporosis and those of lower socioeconomic status, including those who were single and had a lower level of annual income, were less likely to be assessed and treated for osteoporosis. Individuals with particular osteoporosis risk factors such as smokers and heavy drinkers are overlooked for diagnosis. Further study is needed to identify and address the existing barriers and to promote osteoporosis management for women with these risk factors.

Keywords Assessment · Knowledge on osteoporosis · Osteoporosis · Risk factors · Socio-demographic characteristics · Treatment · Willingness

Introduction

Osteoporosis is a major public health concern in the older population, with an estimated prevalence of 14–16% in women aged 50 and older [1]. The lifetime risk of a typical osteoporotic fracture increases to 30–40% in women older than 50 [2], and the risk of a future fracture increases by 1.5 to 9.5 times following a fragility fracture depending on the patient's age as well as the number and sites of previous fractures [3, 4]. Fragility fractures can greatly impact one's quality of life, often resulting in impaired mobility and loss of independence [5, 6].

Although fragility fractures can be prevented by treating osteoporosis [7], and evidence-based guidelines have stressed the importance of appropriate medical and nonmedical treatment for osteoporotic patients [8–10], a pervasive and

Y. H. Roh and E. S. Lee contributed equally to the work The authors thank the Korean Society for Bone and Mineral Research for supporting the online survey.

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persistent prevention care gap for osteoporosis remains evident throughout the world, as less than one fourth of women aged 65 or older underwent bone mass measurement [11–14]. In addition to healthcare practitioner referral practices, the gap between the treatment guidelines and real clinical practice involving osteoporosis may be attributable to issues involving personal choice/autonomy, patient preferences, risks, and benefits. In addition, uncertainty regarding information on and demands of the treatment is also a cause for concern. A correct diagnosis of osteoporosis in patients rests foremost on a patient seeking medical help, and several studies investigated patient willingness, concerns, and avoidance in order to identify the factors affecting patient decisions to be assessed and treated for osteoporosis [15–18]. However, no in-depth comprehensive assessments regarding individuals' clinical and socio-demographical factors that affect the assessment and treatment of osteoporosis have been performed.

In order to further understand the decision-making process regarding the assessment and treatment of osteoporosis, we attempted to identify the factors affecting the willingness of patient to undergo or to avoid assessment and treatment for osteoporosis. We hypothesized that individuals would have specific reasons for their choices of whether or not to undergo assessment and treatment for osteoporosis. Using a multiple response questionnaire, we investigated whether those who had undergone osteoporosis assessment/treatment would have different characteristics than those who had avoided osteoporosis assessment/treatment in terms of sociodemographic data, clinical characteristics, and knowledge of osteoporosis.

Methods

Study population

This study used cross-sectional baseline data collected from an online panel survey completed by people in South Korea. From a panel of more than one million individuals across various ages, genders, education levels, and other demographic characteristics, 1596 women over age 50 were randomly invited to participate in the survey by email or cell phone message until 1000 subjects had agreed to participate in the study. Among them, 969 completed the survey questions. Thus, the response rate was 61%. We excluded 43 subjects who (1) had primary active bone or metastatic cancer or chemotherapy, (2) were hospitalized in a health maintenance organization, (3) did not match in terms of basic information such as age or region, (4) answered with "I don't know" for our main variables of interest in this study, or (5) recorded an extreme duration of web survey (fewer than 5 min, over 50 min); based on these criteria, we ultimately evaluated 926 subjects for the study. The subjects' mean age was 57.9 (standard deviation 5.3) years. The average annual household income was between $40,000 and $50,000. Four percent (33/926) had less than a high school education. Twelve percent (108/926) were heavy drinkers and 2 % (20/926) were smokers. This survey was conducted by Embrain Online Research Company (Embrain Co., Ltd., Seoul, Korea) between September and October 2018. This survey was approved by our institutional review board, and all participants provided written informed consent prior to participating. All informed consent was obtained by internet or email.

Survey design

The online survey included questions addressing three domains: (1) socio-demographic and clinical characteristics (e.g., age, marital status, annual income, level of education, presence of caregiver, and risk factor for osteoporosis [e.g., previous fracture, steroid use, height change, alcohol, smoking, early menopause, and family history of osteoporosis]); (2) questions concerning the reasons for undergoing or avoiding osteoporosis assessment or treatment; and (3) knowledge of osteoporosis. The questionnaire was designed to be answered within 20 min so as to ensure high-quality responses. This timeframe is suggested in order to avoid survey fatigue and maintain respondent attention on survey items [19]. The mean survey time was 18.0 min, and the questionnaire was pilot-tested and revised in order to clarify the meanings of questions.

In part 1, the patients were asked questions regarding their clinical and sociodemographic characteristics, including clinical risk factors associated with osteoporosis (previous fracture, glucocorticoid therapy, alcohol, smoking, early menopause, and family history), marital status, annual income, educational status, and the existence of a caregiver. In South Korea, all patients are partially covered by the national health system, ultimately making them personally responsible for approximately 30% of total medical costs. Patients with private medical insurance can then claim a portion or all of the remaining costs from insurance companies.

In part 2, individuals answered questions concerning their reasons for undergoing or avoiding osteoporosis assessment; the questions were "I have undergone osteoporosis assessment because of the following reasons. . . " for the assessed group, and "I avoid osteoporosis assessment because of the following reasons. . . " for the non-assessed group. For the patients who had been diagnosed with osteoporosis but either did not undergo or discontinued osteoporosis treatment, they answered questions concerning their reasons for avoiding osteoporosis treatment; "I avoid osteoporosis treatment because of the following reasons. . . " Participants were allowed to respond with more than one answer. Although the questionnaire (of parts one and two)

has not been validated, it appears to have adequate face validity for the purposes of this experiment, and ordinal scales for socioeconomic variables, such as alcohol, smoking, and annual income, are widely used for this purpose.

In part 3, patients were asked to answer questions regarding their knowledge of osteoporosis using the Facts on Osteoporosis Quiz (FOOQ). This measure is based on discussion from the osteoporosis consensus conference of the National Institutes of Health in 2000 [20] and consists of 20 true and false questions. It has been reported to show satisfactory validity and reliability, and has been used to assess knowledge of osteoporosis [20]. We modified two (items 10 and 15) of the 20 items based on current epidemiologic information in Korean and the recommendation of the Korean Society for Bone and Mineral Research [21]. In modified item 10, the residual lifetime risk of osteoporotic fractures was about 60% in Korean women older than 50. In modified item 15, the recommendation of daily calcium intake was 1200 mg/day in Korean populations. The modified version of FOOQ has been shown to be reliable and valid among both the general population and health care providers [22–24].

Data analysis

In part 1 of the survey, the clinical and sociodemographic characteristics were compared using the Mann-Whitney *U* tests for continuous variables and the chi-square and Fisher exact tests for categorical variables. In part 2 of the survey, the items associated with the decision to either undergo or avoid osteoporosis assessment or treatment were ranked. In part 3, knowledge of osteoporosis was compared between the treated and non-treated groups. We entered potential predictors of $p < 0.05$ in bivariate analyses in a multivariable logistic regression model in order to identify any effects of potential predictors on the assessment and treatment of osteoporosis. The allowable number of predictor variables in that logistic regression was dictated by the number of outcomes of interest (assessment and treatment for osteoporosis). One predictor variable for every eight to ten occurrences of interest was permitted in order to avoid overfitting of the model to the data. Statistical significance was accepted at $p < 0.05$. All statistical analyses were performed using SPSS for Windows (version 18.0, SPSS Inc., Chicago, IL, USA).

Results

Reasons for undergoing or avoiding osteoporosis assessment or treatment

The highest-ranked reason for undergoing osteoporosis assessment was a fear of osteoporotic fracture, as opposed to a physician's recommendation or the recommendation of family or friends to be tested for osteoporosis (Table 1). The highest-ranked reason for avoiding osteoporosis assessment was not feeling a need to get tested for osteoporosis, as opposed to a perceived lack of convenience in accessing healthcare facilities or economic burden to pay the bills. The highest-ranked reason for discontinuing osteoporosis treatment in those diagnosed with osteoporosis was not feeling a need to be treated due to an asymptomatic and non-painful condition rather than a perceived lack of convenience in accessing healthcare facilities or economic burden to pay the bills.

Socio-demographic and clinical characteristics and knowledge of osteoporosis

Our secondary hypothesis was that the groups would differ in terms of clinical and sociodemographic data as well as knowledge of osteoporosis. Participants in the assessed group were older ($p < 0.001$), more likely to have four risk factors for osteoporosis (previous fracture [$p < 0.001$], height loss [$p < 0.001$], family history of osteoporosis [$p = 0.021$], glucocorticoid use [$p = 0.032$]), married ($p = 0.003$), and had a greater knowledge of osteoporosis ($p = 0.018$) than those in the non-assessed group (Table 2). The groups were found to be similar in terms of comorbidities, tobacco use, daily alcohol use, presence of caregiver, annual income, and level of education. Multivariable logistic analysis revealed that older age (1-year

Table 1 Rank order for reasons for choosing to undergo or avoid osteoporosis assessment

Rank	The assessed group	Proportion (%)	The non-assessed group	Proportion (%)
1	Fear of osteoporotic fracture	55%	Unfelt need to get tested for osteoporosis (belief that osteoporosis is not a serious disease)	58%
2	Physician's recommendation for osteoporosis testing	30%	Perceived inconvenient to access healthcare facilities	27%
3	Advice to be tested for osteoporosis from family or friends	8%	Economic burden to pay the bills	22%
4	Family history of osteoporosis	4%	Lack of awareness regarding osteoporosis assessment	12%

The percentages of the responses do not add up to 100%, as participants were allowed to respond with more than one answer

Table 2 Characteristics of women with osteoporosis who do or do not get assessed and treated for osteoporosis

Characteristics	Assessed group	Non-assessed group	*P*	Treated group	Non-treated group	*p*
Number	256	670		58	88	
Socio-demographic factors						
Age (year)	59.2 (5.3)	57.4 (5.3)	*< 0.001*	61.1 (5.5)	59.2 (5.3)	*0.034*
Married status (married and partnered)	228 (89%)	543 (81%)	*0.003*	53 (91%)	82 (93%)	0.686
Annual income of < $20,000	33 (13%)	94 (14%)	0.652	4 (7%)	17 (19%)	*0.036*
Less than high school education	6 (2%)	27 (4%)	0.216	3 (5%)	2 (2%)	0.346
Absence of a caregiver at home	14 (5%)	52 (8%)	0.225	4 (7%)	3 (3%)	0.334
Risk factors for osteoporosis						
Previous low-trauma fracture	47 (28%)	56 (8%)	*< 0.001*	14 (24%)	19 (22%)	0.719
Glucocorticoid use (> 1 month)	30 (12%)	49 (7%)	*0.032*	13 (22%)	8 (9%)	*0.025*
Height loss (> 1 in.)	89 (35%)	151 (23%)	*< 0.001*	23 (40%)	28 (32%)	0.331
Alcohol use (> 3 times/week, ≥ 3 drinks at a time)	30 (12%)	78 (12%)	0.973	4 (7%)	12 (14%)	0.202
Smoker (≥ 1 pack/day)	5 (2%)	15 (2%)	0.789	2 (3%)	2 (2%)	0.670
Early menopause	29 (11%)	62 (9%)	0.342	10 (17%)	9 (10%)	0.218
Family history of osteoporotic fracture	61 (24%)	115 (17%)	*0.021*	13 (22%)	24 (27%)	0.509
Knowledge of osteoporosis						
FOOQ (scores)	14.41 (2.13)	14.05 (1.90)	*0.018*	14.31 (2.13)	14.25 (2.00)	0.862

Each value is given as either the mean (standard deviation) or the number of patients (proportion %). Significant p-values are shown in italic font

FOOQ Facts on Osteoporosis Quiz

increase; OR = 1.07, 95% CI 1.04, 1.10), marital status (married status; OR = 1.97, 95% CI 1.27, 3.05), previous history of fracture (OR = 2.52, 95% CI 1.89, 3.67), height loss (OR = 1.90, 95% CI 1.49, 2.93), and knowledge of osteoporosis (one unit increase; OR 1.08, 95% CI 1.02, 1.16) were independently associated with willingness to get tested for osteoporosis (Table 3). Patients who had been diagnosed with osteoporosis but had not initiated treatment or who had discontinued treatment within 1 year were younger ($p = 0.034$) and had lower annual incomes ($p = 0.036$) than those who continued treatment (Table 2). Multivariable regression analysis revealed that younger age (one unit decrease; OR = 1.08, 95% CI 1.02, 1.21) and lower annual income (< $20,000; OR = 2.83, 95% CI 1.21, 8.25) were independently associated with the discontinuation of osteoporosis treatment (Table 4).

Discussion

Our study is a large-sized patient study of the characteristics associated with osteoporosis assessment and treatment. In this study, we identified the factors affecting the willingness of patients to undergo or avoid assessment and treatment for osteoporosis. This was done in an attempt to understand the decision-making process regarding

Table 3 Univariate and multivariable regression analyses for independent predictors to get assessed for osteoporosis

Variables	Univariate analysis			Multivariate analysis		
	OR	95% CI	*p*	OR	95% CI	*p*
Age	1.09	1.05–1.13	0.010	1.07	1.04–1.10	0.004
Married status	1.90	1.54–2.54	0.021	1.97	1.27–3.05	0.032
Previous low-trauma fracture	2.47	1.72–3.32	0.000	2.52	1.89–3.67	0.000
Glucocorticoid use	1.09	0.94–1.39	0.215			
Height loss	1.83	1.45–2.59	0.009	1.90	1.49–2.93	0.001
Family history of osteoporotic fracture	1.51	1.04–1.99	0.044			
Knowledge of osteoporosis	1.10	1.06–1.15	0.008	1.08	1.02–1.16	0.021

OR odds ratio, *CI* confidence interval

Table 4 Univariate and multivariable regression analyses for independent predictors to get treated for osteoporosis

Variables	Univariate analysis			Multivariate analysis		
	OR	95% CI	*p*	OR	95% CI	*p*
Age	1.10	1.04–1.23	0.029	1.08	1.02–1.21	0.021
Annual income	3.23	1.92–8.92	0.001	2.83	1.21–8.25	0.009
Glucocorticoid use	1.61	1.12–2.21	0.039			

OR odds ratio, *CI* confidence interval

osteoporosis assessment and treatment from the patient's perspective. Although the causalities of the relationships have yet to be determined, individuals' clinical characteristics, socioeconomic status, knowledge of osteoporosis, and health care system issues are all associated with willingness to get assessed and treated for osteoporosis.

We found that younger age and unmarried status were significant factors for avoiding getting tested for osteoporosis, while younger age and lower level of annual income were associated with discontinuing osteoporosis treatment. It is likely that being unmarried or having a lower level of annual income hindered the active participation of patients in the decision-making process for osteoporosis management. Some previous studies have suggested that older individuals are less likely to be treated than younger individuals [15, 25], while others have demonstrated that younger patients are less likely to receive pharmacologic treatment for osteoporosis [17, 26]. This discrepancy may be attributable to the participants' characteristics (younger age cut offs, knowledge of osteoporosis) as well as the cultural or healthcare system. The results of this study are consistent with the findings of previous studies indicating that older age and socioeconomic status are associated with osteoporosis assessment and treatment [17, 27]. Some studies have shown that lower income is associated with lower BMD testing and also affects treatment initiation following the detection of osteoporosis for previously unscreened, postmenopausal women [27]. Others have reported that single status and lower annual income are associated with non-treatment of osteoporosis [17]. In this study, lower annual income was associated with osteoporosis treatment but not osteoporosis assessment. This discrepancy of socioeconomic factors affecting osteoporosis assessment or treatment may be partly attributable to issue with the health care system. Most Korean citizens are enrolled in the Korean national health insurance program, and all health care providers submit patient data, including diagnoses and medical costs, to the Health Insurance Review Agency (HIRA) in order to obtain reimbursement of 70% of the total medical costs from the government. As a medically essential diagnostic procedure, osteoporosis assessment (BMD testing) does not require any payment from women aged 54 years or older. About 97% of the Korean population is covered by this system; the remaining 3% are either covered by a Medical Aid Program or are temporary or illegal residents.

In this study, participants in the assessed group exhibited greater knowledge of osteoporosis than those in the non-assessed group. A previous study has suggested that greater knowledge of osteoporosis encourages help-seeking behavior in patients [28], while a lack of knowledge can be a barrier to help-seeking [29]. Many women with fragility fractures could not identify their fractures as evidence of poor bone strength due to a lack of knowledge of osteoporosis, instead opting to view them as a result of just slipping [30]. Patient comprehension of a disease, its treatment, and the physician's instructions plays a crucial role in subsequent health management [31]. The results of this study also suggest that increased knowledge of osteoporosis is associated with help-seeking behavior, meaning that it is crucial for individuals at risk of osteoporosis to possess adequate knowledge of osteoporosis. The results of our study are consistent with previous findings that individuals of lower socioeconomic status may be at greater risk of having fewer health literacy skills and resources than others [32]. Taking this into account, a healthcare provider should consider informing patients of osteoporosis and recommending treatment programs to them with concise explanations tailored to basic levels of health literacy. By contrast, there was no difference in the proportion of osteoporosis assessment according to the level of education. These results may be attributable to the fact that respondents in an online survey may be more educated and conscious about health and osteoporosis issues; in addition, this study had a small number of subjects with less than a high school education, leading to limited statistical power.

It is noteworthy that a substantial mismatch was found between women who could benefit from treatment for osteoporosis and those who actually sought treatment. Women who are older, with a previous fracture, height loss, glucocorticoid use, and family history of osteoporosis are being more frequently assessed. By contrast, women with other established risk factors, including tobacco use and daily alcohol use, were assessed similarly to those without these factors. These results suggest that individuals with particular osteoporosis risk factors may be overlooked for diagnosis and treatment, while those with certain other osteoporosis risk factors are not overlooked in this way. Thus, further study is needed to identify and address the barriers to osteoporosis assessment that exist for women who smoke or drink heavily.

There were a number of limitations to our study. First, this is an observational study, and the associations found

between the variables and the willingness to get assessed and treated for osteoporosis may not be causal. Thus, there are limitations in interpreting the relationship between these factors. Second, the questionnaire regarding the reasons for undergoing or avoiding osteoporosis assessment has not been validated. While the questionnaire has not been validated, it appears to have adequate face validity for the purposes of this experiment, because the simulated question is representative of the respondent's real-world experience. Third, the present study was limited by a lack of information regarding the participants' health providers (provider-patient relationship), patient behavior factors (exercise), and clinical data from medical records, which are potentially associated with osteoporosis management and would provide complimentary information to our work. Self-reported medical procedures, such as the BMD test, could also be prone to a lack of subject understanding and recall bias. Fourth, our study had a small number of cases with certain osteoporosis risk factors, such as smokers and those with less than a high school education, which may have limited our ability to detect an association between these specific characteristics and osteoporosis management. Self-reported responses to questionnaires regarding alcohol use and smoking may involve an underreporting phenomenon, due to the fact that Korean women may deny having an alcohol or smoking habit [33]. This may introduce the potential for reporting bias. Fifth, our sample provides no information on patients with undiagnosed osteoporosis or osteopenia, who are estimated to comprise over 50% of those with the condition. Fifth, our study population was drawn from online panels, and the data were collected via questionnaires. Respondents in an online survey may be more educated and conscious about health and osteoporosis issues. Potential participants may also be more comfortable using an online system as opposed to an in-person reporting process. Thus, non-panel individuals may differ from panel participants due to the potential selection bias associated with the use of an online panel. Finally, patients were limited to a single ethnic population drawn from South Korea, and therefore, their specific characteristics, as well as cultural and healthcare system differences, may also affect patient preferences. Thus, the results may not be generalizable to other populations.

Given these limitations, our study showed that individuals with poor knowledge of osteoporosis and lower socioeconomic status including being single and having a lower level of annual income were less likely to be assessed or treated for osteoporosis. Individuals with particular risk factors, including smokers and heavy drinkers, were assessed and treated for osteoporosis similarly to those with these risk factors. Further study is needed to identify and address the existing barriers, and to promote osteoporosis management for women with these risk factors.

Compliance with ethical standards This study obtained the ethics approval from the ethical committee of the Ewha Womans University Medical Center.

Conflicts of interest None.

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