Awareness of Osteoporosis among 368 Residents in China: A Cross-Sectional Study

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Abstract

Background: Studies on osteoporosis awareness among general population in China are still limited. We examined the level of osteoporosis awareness among residents in China, determined the risk factors associated with lower level of osteoporosis awareness, and assessed the sources of their knowledge about osteoporosis.

Methods: We conducted a cross-sectional study among 368 general residents aged 30 years or older from 19 provinces during January-March 2018 in China. All participants were identified and interviewed face-to-face by medical students in Jilin University using a structured questionnaire. Osteoporosis awareness scores (percent of correct answer) was determined across several domains, including definition, diagnosis, risk factors, and prevention of osteoporosis. We used multiple linear regression models to test the relationship between risk factors and overall awareness scores.

Results: The mean age of participants was 52.9 ± 10.2 years, and 53% of them were male. Osteoporosis awareness score for definition was 77.7%, diagnosis 49.6%, risk factors 49.2%, treatment 60.5%, and prevention 69.9%. The overall awareness score was 67.8%. Lower family income and education level were significantly associated with lower overall awareness score (all $p < 0.05$). Television or radio health program was reported to be their main source of knowledge about osteoporosis.

Conclusion: The awareness level for osteoporosis is moderate; lower family income and education level were risk factors for lower awareness. Television or radio health program had the greatest contribution to osteoporosis awareness.

Background

Osteoporosis characterized as low bone mass and micro-architectural deterioration is a major public health problem. It is estimated to affect 200 million women worldwide and causes more than 8.9 million fractures annually [1]. By 50 years of age, one in three women and one in five men will suffer a fracture in their remaining lifetime [2]. It is projected that by 2050, 50% of hip fractures will occur in Asia, with the majority occurring in China [3]. Osteoporosis affects almost 7.0 million Chinese over the age of 50 and causes about 687,000 hip fractures in China each year [4]. Improving osteoporosis awareness is useful for controlling this problem, because high level of osteoporosis awareness increases possibility of early osteoporosis detection and promotes effective osteoporosis prevention and treatment rate [5, 6].

Past studies have shown relatively low levels of osteoporosis awareness within the general population in China [7-12]. However, studies on osteoporosis awareness among general population in China are still limited. In addition, there is no studies have ever addressed the way of source of knowledge about osteoporosis. We examined the level of osteoporosis awareness among residents in China, determined the risk factors associated with lower level of osteoporosis awareness, and assessed the sources of their knowledge about osteoporosis.

Methods

Study setting and population

This cross-sectional survey was conducted during January-March 2018 in China. The inclusion criteria for the survey participants were 1) aged 30 years or older at the interview; and 2) in a state of clear consciousness. The exclusion criterion for the survey was the participants didn't have data on osteoporosis awareness. The participants were identified and interviewed face-to-face by medical students in Jilin University (Enrolment year: 2017; Specialty: Preventive Medicine) using a structured questionnaire. The participants for this survey included the relatives, friends and neighbours of the students. All medical students were trained by related researchers together before conducting the survey. This study was approved by the Ethical Committee Board at School of Public Health, Jilin University. Each participant also provided written-informed consent to this study.

Study measures

Socio-demographics (sex, age, body weight, height, residence, education level, and family annual income), lifestyle information (smoking, alcohol use), prior fracture and prior bone mineral density test were collected using a structured questionnaire. Body mass index (BMI) was calculated as body weight (kg) divided by squaring of body height (m^2). Educational level was classified as primary and below (Years 1-6), junior (Years 7-9), senior (Years 10-12) and undergraduate and postgraduate educations (Years 13 and above). Residence was classified as urban, rural and cross regions. Cross region is an overlapping area between urban and rural area that has both urban and rural.

We assessed osteoporosis awareness level using the following domains, including by definition, diagnosis, signs/symptoms, treatment, complications, prognosis, causes, risk factors, and prevention of osteoporosis; the questionnaire about osteoporosis awareness was the same as a previous published research [13]. The reliability and validity of the questionnaire was tested among 30 Chinese subjects prior to the formal survey. This questionnaire had a good internal consistency (Cronbach's $\alpha = 0.746$). Under factorial validity test, the related components explained a cumulative 60% of the variance in the awareness scores. The Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett's test of sphericity both showed that the results were suitable for factor analysis. Besides the osteoporosis awareness questions, we also collected the sources of the participants acquiring their existing osteoporosis knowledge (e.g., newspapers and magazines, advertising leaflets, television or radio health program).

Statistical analysis

We used descriptive statistics to describe the characteristics of the study population and main variables. Continuous variables were shown as mean $\pm$ standard deviation (SD); categorical variables were shown as percentages.

Awareness scores were created by assigning a “1” to each correct response and a “0” to each incorrect or “unsure” response. The items were summed for a possible range of 0 to 29, with higher scores reflecting greater awareness. Awareness score was defined as percent of correct answer and individual domain scores were calculated - an average of the percentages of correct answers to each question.

To test the relationship between risk factors and overall awareness score we used multiple linear regression models. It was used to assess the association between overall awareness score and risk factors, with for all covariates such as sex, age, body mass index, residence, educational level, family annual income, prior bone mineral density test, prior fracture, smoking, and alcohol use. Covariates are selected based on their significant in the univariate test.

All statistical analyses were performed by using SPSS software (version: 25.0; SPSS Inc, Chicago, IL).

Results

In total, we collected 372 questionnaires; each student returned an average of six survey questionnaires. A total of 368 valid questionnaires were included in this study (Table 1). The included participants were comparable to excluded participants in term of sex (53% vs 50% of male), age (mean age 52.9 vs 49.7 years) and BMI (mean BMI 23.7 vs 26.2 kg/m²; all $P > 0.05$). The mean age of participants was 52.9 ± 10.2 years; 53% were males. The average BMI was 23.7 ± 3.3 kg/m². Approximately, 18.5% and 36% of participants reported to be current smokers and alcohol users, respectively.

Osteoporosis awareness level

Table 2 presents descriptive data onto osteoporosis awareness scores by domain. Osteoporosis awareness score for definition was 77.7%, diagnosis 49.6%, risk factors 49.2%, treatment 60.5%, and prevention 69.9%. The overall awareness score was 67.8%.

Table 3 indicates that lower family income and education level were significantly associated with lower overall awareness scores (all $p < 0.05$). However, all the other variables were not significantly associated with overall scores of osteoporosis awareness.

With regard to sources of knowledge about osteoporosis, television or radio health program was reported to be their main source of knowledge about osteoporosis (Table 4).

Discussion

Osteoporosis is a significant health problem, which with a growing ageing population is increasing in size. Raising the levels of awareness toward osteoporosis among general population are fundamental factors that ensure success of osteoporosis prevention and control programs [14]. This study examined the level of osteoporosis awareness among residents China, determined the risk factors associated with lower level of osteoporosis awareness, and assessed the sources of their knowledge about osteoporosis.

In this study, overall osteoporosis awareness score was 67.8%; 83.3% of the respondents knew correctly aware the definition of osteoporosis. This proportions figure are higher compared with a similar study in Vietnam that found women answered 49% of the knowledge questions correctly [13]. This discrepancy may be due to the fact that our study participants have higher education level than the Vietnamese participants (graduate 27.7 % vs 19.4%). Because most of other studies used different questionnaires for assessing osteoporosis awareness [15-17], we can only compare the osteoporosis definition awareness between studies. The studies in South Australia, Canada and Greece found that 62%-96% of participants correctly aware the osteoporosis definition. These results are comparable to that in our study.

Regardless of consistent and inconsistent results, our study found a low awareness score about osteoporosis risk factors. In our study, one in every two participants did not know the risk factors and the diagnosis. This figure is identical to a South American study, in which one in every ten participants did not know the osteoporosis risk factors [18]. It may be due to the fact that the participants in Puerto Ricans study have had higher prior fracture than our study participants (49 % vs. 13%), this leads for participants to know about the risk factors of osteoporosis.

It is generally believed that osteoporosis awareness level is greater in females than in males. This is not consistent with our study, in which females and males have similar osteoporosis awareness levels. This is likely due to the fact that males have better education than females in our study (graduate 33.8 % in males vs 20.8% in females; P value = 0.000).

Our results showed higher level of education was associated with better awareness of osteoporosis; this was found in other studies to [12, 19] . It seems that well-educated individuals have more access to information and show more willingness to obtain information on health issues.

In our study, 55.7% of participants reported television or radio health program as their main source of osteoporosis knowledge. The main source of knowledge was also television for the Canadian, Singaporean, and American women with the rates of 76.4, 31.1, and 53%, respectively [17, 19, 20]. As the main source of knowledge on osteoporosis was television, reliable health education messages on osteoporosis should be given via television.

Our study has an advantage and two limitations. First, although the questionnaire about osteoporosis awareness has been used in a previous study, we still validated the questionnaire prior to the formal survey. Our reliability and validity test results suggested the questionnaire is suitable for the present study. Second, this study included only 368 participants; a small sample size has limitation to represent the general Chinese population. However, our osteoporosis awareness results are still comparable to the results reported in a Chinese study that have much bigger sample size than our study [12]. Third, due to cross-sectional design, we are unable to make causal inference about the association between osteoporosis awareness score and related factors.

Conclusions

The awareness level for osteoporosis is moderate; lower family income and education level were risk factors for lower awareness. Television or radio health program had the greatest contribution to osteoporosis awareness. The findings of this study provide directions for further studies in this area and will be useful for the design of related public health strategies.

Declarations

Ethics approval and consent to participate

This study was approved by the Ethical Committee Board at School of Public Health, Jilin University (Approval No: 2018-03-05). Each participant also provided written-informed consent to this study.

Consent for publication

Consent for publication obtained from participants.

Availability of data and materials

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no competing interests.

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No funding was obtained for this study.

Authors' contribution

The authors made the following contributions: O.K., S.Y., and Y.L. made the conception for this research. O.K. analysed the data and drafted the article. Q.Y., F.W., and S.Y. reviewed/ edited the manuscript. All the authors critically revised the article for important intellectual content. S.Y. contributed to the study design and managed the overall project.

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Not applicable.

Abbreviations

BMD: Bone mineral density; BMI: Body mass index; SD: Standard deviation; SPSS: Statistical Package for the Social Sciences

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Tables

Table 1 Characteristics of study (N = 368)

Characteristics	Values
Male (n, %)	195 (53)
Age group (years)	
30-49 (n, %)	208 (56.5)
50-59 (n, %)	76 (20.7)
60-69 (n, %)	55 (14.9)
Above 70 (n, %)	29 (7.9)
Body mass index (kg/m ²)	23.7 (3.3)
Residence	
Urban (n, %)	166 (45.1)
Rural (n, %)	113 (30.7)
Cross region (n, %)	89 (24.2)
Education	
Primary and below (n, %)	69 (18.8)
Junior (n, %)	113 (30.7)
Senior (n, %)	84 (22.8)
Graduate (n, %)	102 (27.7)
Family annual income (US dollar)	
<1,400 (n, %)	41 (11.1)
1,400-6,999 (n, %)	128 (34.8)
7,000-13,999 (n, %)	97 (26.4)
14,000 (n, %)	102 (27.7)
Prior bone mineral density test (n, %)	68 (18.5)
Prior fracture (n, %)	48 (13)
Smoker	
Current (n, %)	68 (18.5)
Past (n, %)	45 (12.2)
Never (n, %)	255 (69.3)
Alcohol user (n, %)	133 (36.1)

Values are means (SD), unless otherwise specified.

Table 2 Frequencies and percents of correct response by domain (N=368)

Domain		Frequency		Percent	
Mathematics					
Algebra					
Geometry					
Statistics					
Science					
History					
Language Arts					
Social Studies					
Physical Education					
Art					
Music					
Health					
Environmental Studies					
Career Education					
Personal Development					
Life Skills					
Character Education					
Civics					
Government					
Economics					
Law					
Public Safety					
Community Service					
Global Studies					
International Relations					
Cultural Studies					
Religion					
Philosophy					
Psychology					
Sociology					
Anthropology					
Archaeology					
Geography					
Environmental Science					
Biology					
Chemistry					
Physics					
Astronomy					
Earth Science					
Space Exploration					
Technology					
Computer Science					
Engineering					
Mathematics Education					
Science Education					
History Education					
Language Arts Education					
Social Studies Education					
Physical Education Education					
Art Education					
Music Education					
Health Education					
Environmental Studies Education					
Career Education Education					
Personal Development Education					
Life Skills Education					
Character Education Education					
Civics Education					
Government Education					
Economics Education					
Law Education					
Public Safety Education					
Community Service Education					
Global Studies Education					
International Relations Education					
Cultural Studies Education					
Religion Education					
Philosophy Education					
Psychology Education					
Sociology Education					
Anthropology Education					
Archaeology Education					
Geography Education					
Environmental Science Education					
Biology Education					
Chemistry Education					
Physics Education					
Astronomy Education					
Earth Science Education					
Space Exploration Education					
Technology Education					
Computer Science Education					
Engineering Education					

Domain	Domain score (%) (Correct response: T = True, F = False)	Correct response, (%)	N
Definition of Osteoporosis	Osteoporosis is a condition of easy joint dislocation (F)	222 (60.3)	
	Osteoporosis is a condition of low bone mineral density (T)	296 (80.4)	
	Osteoporosis is a condition of high bone mineral density (F)	340 (92.4)	
	Domain score = 77.7%		
Diagnosis of Osteoporosis	Osteoporosis is diagnosed using X-ray of the bone (T)	192 (52.2)	
	Osteoporosis is diagnosed with physical exam (F)	173 (47.0)	
	Domain score = 49.6%		
Common signs/symptoms of osteoporosis	Headache is a common sign/symptom of osteoporosis (F)	310 (84.2)	
	Frequent fractures is a common sign/symptom of osteoporosis (T)	312 (84.8)	
	Mood change is a common sign/symptom of osteoporosis (F)	313 (85.1)	
	Domain score = 84.7%		
Treatment of osteoporosis	Osteoporosis can be treated with calcium and vitamin D (T)	321 (87.2)	
	Osteoporosis can be treated with surgical correction (F)	273 (74.2)	
	Osteoporosis can be treated with hormone replacement (T)	74 (20.1)	
	Domain score = 60.5%		
Complications of osteoporosis	Diabetes is a complication of osteoporosis (F)	313 (85.1)	
	Hypertension is a complication of osteoporosis (F)	310 (84.2)	
	Hip fracture is a complication of osteoporosis (T)	311 (84.5)	
	Domain score = 84.6%		
Prognosis for Osteoporosis	Osteoporosis can lead to joint swelling and morning stiffness (F)	162 (44.0)	
	Osteoporosis can lead to hip fractures and subsequent complications (T)	286 (77.7)	
	Domain score = 60.8%		

Common causes of Osteoporosis	Overweight is a common cause of osteoporosis in women (F)	225 (61.1)
	Lack of estrogen is a common cause of osteoporosis in women (T)	156 (42.4)
	High protein diet is a common cause of osteoporosis in women (F)	263 (71.5)
	Domain score = 58.3%	
Risk factors for Osteoporosis	Low rice intake is a risk factor for osteoporosis in women (F)	233 (63.3)
	Post menopause is a risk factor for osteoporosis in women (T)	158 (42.9)
	Smoking is a risk factor for osteoporosis (T)	152 (41.3)
	Domain score = 49.2%	
Risk of osteoporosis over a woman's lifetime	Women are at highest risk for osteoporosis at puberty (F)	315 (85.6)
	Women are at highest risk for osteoporosis during their childbearing ages (F)	244 (66.3)
	Women are at highest risk for osteoporosis after menopause (T)	248 (67.4)
	Domain score = 73.1%	

Table 2 (Continued)

Domain	Domain score (%) (Correct response: T = True, F = False)	Correct response, (%)	N
Prevention of Osteoporosis	Moderate physical exercise can reduce the risk of osteoporosis (T)	272 (73.9)	
	Increased rice consumption can reduce the risk of developing osteoporosis (F)	276 (75.0)	
	A diet rich in calcium and vitamin D can reduce the risk of developing osteoporosis (T)	306 (83.2)	
	Cigarette smoking cessation can reduce the risk of developing osteoporosis (T)	175 (47.6)	
	Domain score = 69.9%		

Table 3 The associations between risk factors and overall awareness score in the multivariable linear regression models

Variables	P value		
Male vs Female	-0.598	0.464	0.198
Age in year	0.008	0.019	0.676
Body mass index (kg/m ²)	0.108	0.057	0.060
Residence			
Urban vs Rural	0.651	0.543	0.231
Cross vs Rural	-0.292	0.547	0.595
Education level			
Junior vs Primary and below	1.551	0.568	0.007
Senior vs Primary and below	2.333	0.644	0.000
Graduate vs Primary and below	1.857	0.693	0.008
Family annual income (US dollar)			
<1,400 vs ≥14,000	-1.171	0.549	0.039
1,400-6,999 vs ≥14,000	-1.243	0.537	0.021
7,000-13,999 vs ≥14,000	-1.136	0.532	0.033
Prior BMD test vs No prior BMD test	0.555	0.498	0.266
Prior fracture vs No prior fracture	-0.850	0.560	0.130
Smoker			
Current vs Never	-1.067	.703	0.130
Past vs Never	-0.581	0.659	0.378
Alcohol user vs No alcohol user	1.021	0.535	0.057

Abbreviations: β = regression coefficient; SE= standard error; BMD = bone mineral density
P significant at ≤ 0.05

Table 4 Percent for each source for obtaining existing osteoporosis knowledge

Source	Percent
Newspapers and magazines	29.1
Advertising leaflets	11.1
Community public paper material	15.2
Community health knowledge lecture	15.8
Television or radio health program	55.7
Internet	22.6
Wechat group	29.1
Chatting with friends and family members	40.5
None	10.1