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Adherence to Osteoporosis Screening and Its Related Factors: A Population-Based Study, Kerman, Iran

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Abstract

Background: Adherence to screening services is a prerequisite for the success of screening programs.
Objectives: This study aimed at determining factors associated with participants' compliance with Dual-energy X-ray Absorptiometry (DXA) screening for osteoporosis.
Methods: In this population-based participatory study, 1000 males and females older than 55 years old were invited to participate in the study. The study took place in the city of Kerman, Iran, where subjects were informed face to face about the risk factors and complications of osteoporosis and asked to complete a questionnaire. The subjects were then invited to visit a densitometry center for a free DXA study. Four rural areas and 4 locations in Kerman were selected based on municipal divisions.
Results: A total of 923 individuals completed the questionnaire: 562 (60.9%) were female, nearly two-thirds were from urban areas, and 284 (30.8%) were willing to undergo densitometry. Eight percent had a history of corticosteroid use for more than 3 months. About two-thirds of the participants were walking less than 150 minutes per week. In the logistic regression analysis, urban residents (OR = 1.88), females (OR = 1.52), and those who perceived high risk of osteoporosis (OR = 1.67) were more likely to adhere to DXA screening.
Conclusions: On the whole, despite informing people about osteoporosis and offering free services, compliance to densitometry was not remarkable.

Keywords: Hip Fracture, Prevention, Population-Based Screening

1. Background

Osteoporosis, known as a silent killer, is a major public health problem worldwide (1). Osteoporosis refers to bone density that is 2.5 standard deviations or less than (T-score $\leq$ -2.5 SD) the mean peak bone mass in reference young individuals (2). Osteoporotic fractures reduce people's quality of life and increase their risk of mortality (3). Hip fracture, in particular, is the most devastating of all fractures, such that 1 in 5 people with this type of fracture die in the first year, post-injury (3). Estimates indicate that the number of hip fractures will increase by approximately 4 times, between 1990 and 2050 (4). Currently, hip fractures account for the highest share of mortality and disability (disability-adjusted life years) among osteoporotic fractures (5).

A recent meta-analysis showed that 17% of Iranians older than 30 years experienced osteoporosis, and the incidence grew over time; the main reason being an increase in life expectancy in Iran (6). In terms of osteoporosis-induced hip fractures, Iran is among high incidence countries, or so-called "red countries" (7). A population-based study showed that peak bone mass is lower in Iran than in either American or European populations (8).

Osteoporosis does not appear clinically until bone fracture, therefore, early detection is crucial in high-risk patients, especially the elderly (9). Because 50% of hip fractures occur due to osteoporosis, any actions to prevent or facilitate early detection of osteoporosis can have a significant impact on controlling hip fracture (10). Different methods are used to screen for osteoporosis; among them, Dual-energy X-ray Absorptiometry (DXA) is the gold standard and most widely used method (11,12). The majority of professional societies agree with the screening age of 65 years and older for females (9); however, there is no con-

sensus regarding the screening age for males. The National Osteoporosis Foundation and the American College of Preventive Medicine recommend screening for males aged 70 years and older without risk factors (12).

Although no clinical trials on the impact of DXA screening have yet been reported, longitudinal studies have shown that the use of this type of screening was associated with a 36% reduction in the incidence of hip fracture (13). To increase the effectiveness of screening, it is very important to assess the participation of people in screening programs (14) and to explore factors associated with their nonadherence (15). Despite the importance of DXA screening in the early detection of osteoporosis (16), studies in the United States showed that only 30% of females and 4% of males older than 65 years had a DXA exam (9). In this regard, it seems necessary to study the adherence of individuals to DXA screening to increase their compliance because success will not be achieved in reducing the burden of disease "without a system that addresses the determinants of adherence" (17). According to the World Health Organization (WHO), adherence is defined as "the extent to which a person's behavior follows medical advice" (17). In general, studies have shown that osteoporosis screening adherence is lower than cancer screening adherence, and the few studies performed in Western countries (9,14) have placed more emphasis on treatment than on compliance to screening (18). To the best of the author's knowledge, this is the first study to assess the level of patients' adherence to DXA screening and the relevant factors under controlled conditions in a non-Western country.

2. Methods

2.1. Setting

This study was conducted during year 2016, using a community-based participatory approach in Kerman, the largest city in the South-East of Iran, where two-thirds of the people live in urban areas. Kerman as the 10th most populous city of Iran has a population of nearly 800000 with moderate climate and a strong cultural heritage. More than 8% of inhabitants are aged 60 years or over. The target population consisted of people older than 55 years. The reason for choosing people in this age group is the high prevalence of osteoporosis in Iranians, who are younger than 65 years (8); in addition, most females are expected to experience menopause at this point in their lives. Recently, some Western studies have also suggested this age cut-off for DXA study (19).

2.2. Sampling

Trained Community Health Workers (CHWs) visited various households selected through cluster sampling. The target population consisted of Kerman county residents. Sampling framework included 4 rural areas and 4 municipal divisions of Kerman city, which were randomly chosen from a list of areas under coverage of urban and rural health centers. A total of 30 clusters, each with 35 households, were enrolled in the study. From these households, 1000 people were invited to complete a questionnaire. It was estimated that a sample size of 1000 subjects was needed to estimate the prevalence in densitometry compliance of 30% with a statistical precision of $\pm$ 4% (95% confidence interval) and a design effect of 2.0 due to cluster sampling.

Inclusion criteria were oral informed consent and age older than 55 years. People, who were taking bisphosphonates or calcitonin and those undergoing hormone replacement therapy for treatment of osteoporosis were excluded.

2.3. Protocol

Primary care services in Iran are routinely provided in both rural and urban areas by CHWs. Community Health Workers are required to communicate with the covered population either directly or through health volunteers by phone or in person at least once every 3 months. After introducing themselves and explaining the objectives of the study, an eligible member of the household was randomly selected and interviewed on the doorstep of their home. An informed consent was obtained from the subject before completing the questionnaire, and he or she was then invited to visit a densitometry center for a free hip densitometry exam. The subject was also informed face to face about the risk factors and complications of osteoporosis, and an illustrated pamphlet with scientific descriptions and the address of the densitometry center was provided. In cases there was a definite diagnosis of osteoporosis, the patients were referred to a rheumatologist.

2.4. Ethical Considerations

The study protocol was approved by the Ethics Committee of Kerman University of Medical Sciences (IR.KMU.REC.1394.364). After explaining the goal and the protocol of the study for the potential participants, verbal consent was obtained.

2.5. Assessment Tool

A questionnaire was prepared by the authors and its content validity was confirmed according to experts and an extensive literature review (1,3,13,20-22), and previous experience which showed acceptable validity and reliability (20). The questions addressed demographic variables and possible factors associated with osteoporosis,

and measured the perceived risk of osteoporosis using a visual analogue scale. Arbitrarily, if the perceived risk score was higher than the median (i.e. 3), it was considered high and otherwise low.

2.6. Statistical Analysis

A multivariate logistic regression model was used to determine the relationship between variables and their adherence to DXA screening, and the Hosmer-Lemeshow test was used for model fitness. P values of < 0.5 were considered significant. Statistical analyses were done using the SPSS 21 software.

3. Results

A total of 1000 individuals were invited for interviews, and 923 of them accepted the interview (93.2% response rate), 562 (60.9%) of whom were females. Table 1 shows the baseline characteristics of the study population. Mean ($\pm$ SD) body weight and height of male participants were 69.0 (12.1) and 165.6 (11.8), and for females, they were 66.5 (12.3) and 158.7 (8.2), respectively. Mean ($\pm$ SD) body mass index in the sample was 26.6 (5.6).

Table 1. Demographic Characteristics of Participants (n = 923)

Variable	Number	Percentage
Age, y		
55.0 - 59.9	293	31.7
60.0 - 64.9	224	24.3
65.0 - 69.9	147	15.9
> 70	259	28.1
Gender		
Male	562	
Female	361	60.9
Education		
Illiterate	39.1	37.2
Elementary	290	31.4
Secondary	81	8.8
High school diploma	121	13.1
College	88	9.5
Residency		
Urban	563	61.0
Rural	360	39.0

Several risk factors associated with osteoporosis had different frequencies (Table 2); thus, some risk factors were observed in a significant percentage of respondents, including menopause occurring before the age of 45 in nearly one-fourth of the females, consumption of corticosteroids for more than 3 months in 8% of patients, and opium use in 16.4%. Only one person reported consuming alcohol.

Table 2. Variables Associated with Osteoporosis (n = 923)

Variable	Number	Percentage
Corticosteroids consumption	74	8.0
Antiepileptic	16	1.7
History of osteoporosis or fracture of hip, wrist, or lumbar vertebrae in father	49	5.3
History of osteoporosis or fracture of hip, wrist, or lumbar vertebrae in mother	70	7.6
Consumption of calcium pills/syrup	247	26.8
Smoking/hookah use	120	13.0
Opium abuse	151	16.4
Alcohol consumption	1	0.1
Walking time per week, min		
< 150	578	62.6
> 150	345	37.4
Daily use of milk/yogurt, cup		
not at all	199	21.6
1 - 3	609	66.0
> 3	115	12.5
Hearing about osteoporosis	153	16.6
Amenorrhea before 45 years	132	23.5
Breastfeeding	138	24.6
Mean $\pm$ SD of age of menarche	13.6 $\pm$ 1.6	
Mean $\pm$ SD of delivery number	1.6 $\pm$ 3.1	

Of the 932 people, who were invited for densitometry, 284 people underwent the exam (30.8%, CI 95%: 27.9 to 33.8). In logistic regression analysis, place of residence, gender, and perceived risk of osteoporosis were significantly associated with adherence to DXA (Table 3).

As shown in Table 4, the prevalence of osteoporosis increases in patients, who have undergone densitometry as they age ($P < 0.001$), so that more than one-third of people older than 70 years experienced osteoporosis.

4. Discussion

The study showed that despite initially informing the subjects about the risks of osteoporosis and providing free densitometry, less than one-third of people older than 55 years adhered to the DXA study. In a relatively similar study by the same team in the same settings regarding adherence to mammography in breast cancer screening, 22.4%

Table 3. Factors Associated with Densitometry Compliance Based on Logistic Regression Analysis

Variable	Adherence Frequency (%)	OR (Adjusted)	CI 95%	P Value
Age, y				
55.9 - 59	87 (29.7)	Reference	Reference	
60.9 - 64	76 (33.9)	1.46	(0.2 - 98.17)	0.060
65.9 - 69	51 (34.7)	1.34	(0.2 - 86.09)	0.201
> 70	70 (27.0)	1.01	(0.1 - 67.52)	0.950
Gender				
Male	88 (24.4)	Reference	Reference	
Female	196 (34.9)	1.52	(0.0 - 44.83)	0.012
Education				
Illiterate	94 (27.4)	Reference	Reference	
Primary	84 (29.0)	1.07	(0.1 - 74.56)	0.716
Secondary	31 (38.3)	1.45	(0.2 - 83.54)	0.190
High school diploma	45 (37.2)	1.38	(0.2 - 84.26)	0.199
University	30 (34.1)			
Residency				
Urban	77 (21.4)	Reference	Reference	
Rural	207 (36.8)	1.88	(1.2 - 34.62)	< 0.001
Dealing with educational materials				
Yes	49 (32.0)	Reference	Reference	
No	235 (30.5)	0.93	(0.1-62.40)	0.731
Perceived risk				
Low	124 (24.7)	Reference	Reference	
High	160 (38.1)	1.67	(1.2 - 23.25)	< 0.001
History of osteoporotic fracture in parents				
No	248 (30.0)	Reference	Reference	
Yes	36 (37.5)	1.20	(0.1 - 76.90)	0.430

Table 4. Prevalence of Femoral Neck Osteoporosis in Different Age Groups that Accepted Densitometry (284 People)

Age Group	Number	Normal	Osteopenia	Osteoporosis
55.0 - 59.9	87	32 (36.8)	41 (47.1)	14 (16.1)
60.0 - 64.9	76	18 (23.7)	42 (55.3)	16 (21.1)
65.0 - 69.9	51	10 (19.6)	29 (56.9)	12 (23.5)
> 70	70	4 (5.7)	41 (58.6)	25 (35.7)
Total	284	64 (22.5)	153 (53.9)	67 (23.6)

of females, who had completed the risk assessment questionnaire performed the free mammogram (23), which was lower than the participation rate obtained from this study (i.e. 30.8%). In African American and Caucasian postmenopausal females, 21% and 27% were adherent to DXA (24), respectively, whereas the mammography screening rate was far higher in the same subgroup of population in the United States (70%) compared with densitometry (25). The reason for the variation in adherence between the 2 countries can be attributed to the difference in perceived risk, self-efficacy for screening, illness behavior of individuals, and affordability and accessibility of services (26,27). However, it has been proven that free services can increase compliance (26); in other words, if the people had to pay

for densitometry, then the adherence rate would certainly be lower.

With emphasis by US health policy makers on the risks of osteoporosis (28) and growing public awareness of the benefits of densitometry screening, the rate of people undergoing DXA exams is increasing (9). The study also showed that the rate of adherence to the DXA study in people, who perceived high risk of osteoporosis was 1.7 times higher. The rate of adherence in females was 1.5 times that of males. This finding was also indicated by other studies, so that in comparison with 4% of males, 30% of females in the elderly population of the United States had a history of DXA screening (9). Although the risk of osteoporosis in females is twice that of males, it should be noted that the risk of death due to hip fracture in hospitals is 2 times greater in males than in females (29).

One other important factor that affects adherence to screening is physical access to services and disparity (24). In this study, the odds ratio was considered in relation to the location of people's homes, so that urban residents were 1.9 times more likely than rural residents to adhere to DXA screening. Thus, one reason for attendance to screening after listening to the recommendations of CHWs was perhaps due to people's proximity to the densitometry center. A small percentage of respondents (about 17%) were trained or had read an article about osteoporosis, which was lower compared with similar studies from Western countries (20). It should be noted that the high level of information about osteoporosis that comes from the media and friends does not necessarily lead to increased concern (18).

According to the World Health Organization (WHO), a screening program is effective when at least 70% of eligible people are covered (30). The adherence rate of 31% is very low despite CHWs providing face-to-face education to individuals, providing them with a pamphlet, and offering them free DXA screening.

Due to low acceptance rate of densitometry (about 31%), one cannot argue about the prevalence of osteoporosis with confidence, and it was found that only 6% of people older than 70 years had normal bone density, which confirms the need for screening even in males older than 70 years old (31). Non-adherence remains a major challenge in screening of osteoporosis, which has recently been emphasized by authorities (32).

Prevalence of 2 risk factors was worrisome in this study. It has been shown that opium addiction is a potent risk factor for osteoporosis and increases the risk threefold (22). More than 16% of the study population were opium users, which was similar to a study in the same geographical area for people older than 50 years (33). The prevalence of this risk factor should be considered in national guidelines of osteoporosis screening in Iran. A second risk factor involved corticosteroid use. That is, 8% of the participants had a history of corticosteroid consumption for longer than 3 months, and studies have shown that the frequency of corticosteroid consumption in Iranian females is about 4 times higher than in Hindi females (21).

The main limitation of the current study was that it was done in Kerman city and due to cultural and infrastructural differences, the generalizability of results to the whole country should be done with caution.

As a result of the low adherence of participants in this study, despite initial sensitization through face-to-face education and free densitometry, an abundance of some unique risk factors, and the prevalence of osteoporosis, especially in subjects older than 70 years, it is necessary to perform additional studies to increase adherence to densitometry screening.

Footnotes

Conflict of Interests: None declared by author.

Ethical Approval: The study protocol was approved by the Ethics Committee of Kerman University of Medical Sciences IR.KMU.REC.1394.364).

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