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Knowledge, attitude, and practice of osteoporosis and hip fracture in older Chinese adults

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ABSTRACT

This study assessed the knowledge, attitude, and practices (KAP) regarding osteoporosis and hip fracture among older adults in Ningxia, China, to inform better prevention and management strategies through patient education and lifestyle changes. This cross-sectional study surveyed older adults at Ningxia Hui Autonomous Region People's Hospital (Sep 2022–Nov 2023) using a convenience sampling method, collecting demographic data and assessing KAP scores. Structural equation modeling (SEM) analyzed relationships between KAP and demographics. The analysis included 522 (99.4%) valid questionnaires. The mean knowledge, attitude, and practice scores were 22.66±4.29 (/30, 75.53%), the mean attitude score was 43.13±4.54 (/60, 71.88%), and the mean practice score was 57.15±10.24 (/80, 71.44%), indicating sufficient knowledge, positive attitude, and proactive practice. In the SEM, knowledge was associated with income (β=1.01, P<0.001), frequency of fall prevention (β=-0.55, P<0.001), residence (β=0.97, P=0.030), and falls in the past year (β=0.76, P=0.017). Attitude was associated with knowledge (β=0.21, P<0.001) and alcohol (β=-1.26, P<0.001). Practice was associated with attitude (β=1.09, P<0.001), frequency of fall prevention (β=-1.86, P<0.001), and use of anti-osteoporosis drugs (β=2.63, P<0.001). Older adults in Ningxia demonstrated generally good KAP toward osteoporosis and hip fracture; however, targeted educational interventions addressing specific knowledge gaps may help further improve preventive practices and support behavior change.

Keywords: knowledge, attitude, practice; osteoporosis; hip fracture; older adults; cross-sectional study.

INTRODUCTION

Osteoporosis is a generalized skeletal disorder characterized by low bone density, deterioration of bone microarchitecture, and compromised bone strength, often leading to fragility fracture due to excessive bone loading from a fall or certain activities of daily living [1-3]. The prevalences of osteoporosis in women ≥50 years old across studies ranged from 9.8% to 29.9% [4, 5], while the prevalences in men ranged from 2.5% to 9.4% [4, 6]. These prevalence vary across studies and regions, as they are influenced by factors such as ethnicity, country of origin, and geographical location. For example, previous epidemiological studies have shown notable differences in the prevalence of osteoporosis between Asian and Western populations, as well as variability among regions within China [7, 8]. Osteoporosis is typically a silent disorder until a symptomatic fragility fracture occurs [1-3]. The lifetime fracture risk for women and men ≥50 years is 50% [9] and 10%-30% [2, 10, 11], respectively. Hip fracture is one of the most serious and disabling consequences of osteoporosis and represents a key clinical outcome of poor bone health. Hip fracture is a fracture of the upper portion of the femur (anywhere from the femoral head to about 5 cm below the lesser trochanter), typically resulting in groin and thigh pain; if the fracture is displaced, the affected extremity generally appears shortened (with hip positioned in external rotation and abduction), and the patient is unable to bear weight [12, 13].

Preventing osteoporosis and fractures includes visiting a family physician to evaluate the risk factors, radiological testing, and prescription of calcium and vitamin D supplements and, if necessary, anti-bone resorption

drugs [1-3]. Proper lifestyle habits, including diet and exercise, and taking medications are also necessary [14]. Still, although straightforward, it requires proper knowledge and attitude to put into practice. Knowledge, attitude, and practice (KAP) surveys can provide quantitative and qualitative data on the gaps, misconceptions, and misunderstandings that constitute barriers to the optimal implementation of a specific set of actions in a particular population [15, 16]. A study in two districts in Lebanon revealed poor knowledge and attitude toward osteoporosis among adults [17]. Students [18], adults [19], and older adults [20] in Malaysia were revealed to have poor KAP toward osteoporosis. Adult Pakistani women were reported to have a good knowledge of osteoporosis, but there were several gaps [21]; similar results were reported among university students in the United Arab Emirates [22], but another study revealed poor KAP toward osteoporosis among adults of the same country [23]. Previous studies in China examined the KAP toward osteoporosis in specific patient populations, such as patients with chronic kidney disease [24] and knee osteoarthritis [25]. A recent review of the awareness status of osteoporosis in the Chinese general public indicated a low awareness [26]. Still, data pertaining to the KAP toward osteoporosis and hip fracture in older Chinese adults remains limited. Considering that hip fracture is one of the most serious and disabling consequences of osteoporosis and represents a key clinical outcome of poor bone health, and also serves as an important clinical indicator of underlying osteoporosis, assessing KAP toward both osteoporosis and hip fracture provides a more comprehensive understanding of patient awareness and preventive behaviors.

Therefore, this study aimed to examine the KAP of osteoporosis and hip fracture in older adults. By identifying gaps in knowledge, negative or neutral attitude, and suboptimal practices, KAP findings can guide the development of tailored educational and motivational intervention materials that directly target the specific deficiencies of the population studied. The results could help design educational and motivational interventions that could improve the management and health of older Chinese adults.

METHODS

Study design and participants

This cross-sectional study survey was conducted at The People's Hospital of Ningxia Hui Autonomous Region between September 1, 2022, and November 30, 2023. The study participants were older adults. The inclusion criteria were 1) middle-aged and older adults >50 years of age and 2) the patients and their families were informed and agreed to participate in the study. The exclusion criteria were 1) older adults who were unable to complete the questionnaire independently due to cognitive, visual, or physical limitations, or those without access to a device to complete the electronic questionnaire or 2) patients with cachexia, as severe physical weakness and poor health status may influence their participation and could bias the assessment of knowledge, attitude, and practices related to osteoporosis and hip fracture. The study was approved by the Medical Ethics Committee of the People's Hospital of Ningxia Hui Autonomous Region (Approval No. ZDYF-020). Written electronic

informed consent was obtained from all participants before completing the questionnaire.

Questionnaire design

The questionnaire was designed based on relevant guidelines [27-29]. After the initial design, the questionnaire was modified based on the opinions of three experts in orthopaedics and public health (each with working experience ≥ 10 years). A small-scale pilot study (30 participants) showed an overall Cronbach's α of 0.894, indicating good internal consistency. The questionnaire was self-developed in Chinese and underwent preliminary validation through expert review (content validity) and a pilot test (face validity). For content validity, three experts reviewed each questionnaire item to assess its correctness, relevance, and alignment with the study objectives. For face validity, participants in the pilot test were asked to report any item that was difficult to understand or answer, and no such feedback was received, indicating good clarity and feasibility.

The final questionnaire was in Chinese (a version translated into English was attached as an **Appendix**) and included information collection in four dimensions, comprising 41 items in total. Among them, basic information included 16 items, the knowledge dimension included 15 items, the attitude dimension included 12 items, and the practice dimension included nine items, wherein item P7 comprised five sub-items, and item P8 comprised four sub-items. For the knowledge dimension, 2 points were given for correct answers, 1 for unclear answers, and 0 for incorrect answers, with a possible score range of 0 to 30 points. The attitude and practice dimensions used a 5-point Likert scale, with options ranging from

very positive (5 points) to very negative (1 point) according to the degree of positivity. The attitude dimension was scored as follows: items A1 and A5-A12 scored 5 to 1, while items A2-A4 scored 1 to 5; the possible score range was 12 to 60 points. For the practice dimension, scores were 5 to 1 for all items, with a possible range of 16 to 80 points. For knowledge, 0-15 points indicated insufficient knowledge, 16-21 points indicated moderate knowledge, and 21-30 points indicated sufficient knowledge. For attitude, scores of 12-30 points indicated negative attitude, 31-42 points indicated neutral attitude, and 42-60 points indicated positive attitude. For practice, 16-40 points indicated negative practice behaviors, 41-56 points indicated moderate practice behaviors, and 57-80 points indicated proactive practice behaviors.

Questionnaire distribution and quality control

The investigators contacted the communities in advance to obtain permission to conduct the study by communicating with the community administrative staff and obtaining their approval to recruit residents for participation. The electronic questionnaire was hosted on Sojump (http://www.sojump.com), an online survey platform. The questionnaire link was distributed to the participants using a QR code or through a WeChat group, and a convenience sampling method was used. Before completing the questionnaire, the participants were required to click the option “I agree to participate in this study” at the beginning of the e-questionnaire. Participants were recruited on-site during community free clinic activities, where they were invited to join the study after being informed of its purpose and procedures. If participants had any questions

while completing the questionnaire, they could contact the research team for clarification in person, via WeChat, or by telephone.

The study involved 13 orthopedic surgeons, including one chief physician, two associate chief physicians, four attending physicians, and six resident physicians, all of whom had a graduate degree or above. In addition, a professional with a master's degree in orthopedics was enrolled as a research assistant for this project. After 1 week of project training, the research assistant was responsible for coordinating all research activities, such as questionnaire collection and analysis.

All data were collected anonymously, but only one questionnaire submission was allowed for a given IP address to prevent duplication. Each questionnaire was supervised and reviewed by at least one orthopedic surgeon. All incomplete questionnaires were discarded during the collection process and were not included in the overall data. After questionnaire collection, questionnaire screening was carried out, and two investigators checked each questionnaire individually. Incomplete or illogical questionnaires were discarded, and controversial questionnaires were examined by the research assistant and chief physicians to make decisions. Questionnaires with missing responses, all KAP items answered using the same option, with an obvious pattern, or a response time <60 s or >1800 s were considered invalid.

Statistical analysis

The sample size was calculated using the formula for cross-sectional studies:

$$n = \left(\frac{Z_{1-\alpha/2}}{\delta}\right) \times p \times (1 - p)$$

Using $\alpha=0.05$, $Z_{1-\alpha/2}=1.96$, the assumed degree of variability of $p=0.5$ (which maximizes the required sample size), and the admissible error $\delta=0.05$, the theoretical sample size was 480 when including an extra 20% to allow for subjects lost during the study.

All analyses were performed using Stata 17.0 (Stata Corporation, College Station, TX, USA). Two-sided P-values <0.05 were considered statistically significant. The continuous variables were tested for normal distribution using the Kolmogorov-Smirnov test. Variables conforming to the normal distribution were presented as means ± standard deviations. They were analyzed using Student's t-test (comparison of two groups) or ANOVA (comparisons of more than two groups). Variables with a skewed distribution were presented as medians (interquartile range (IQR)) and analyzed using the Mann-Whitney U-test (comparisons of two groups) or the Kruskal-Wallis H-test (comparison of more than two groups). Categorical data were presented as n (%) and analyzed using the chi-squared test. Pearson correlation analysis was used to evaluate the correlation between the three dimensions. Structural equation modeling (SEM) was used to explore the path relationships between KAP and demographic information.

RESULTS

Characteristics of the participants

A total of 525 participants were included in the study, but three questionnaires had missing values for the 8th demographic question ("Do you have any underlying medical conditions? (multiple choices allowed)."). Hence, the final dataset consisted of 522 (99.4%) valid responses. In the final sample, the Cronbach's α for all participants was 0.877, supporting acceptable internal consistency.

The participants were 70.1±7.5 years old. The highest frequencies of participants for each variable were female (50.8%), urban residence (74.3%), primary school education and below (38.5%), retired (62.5%), monthly income 2000-5000 (53.6%), living with someone (91.0%), with comorbidities (97.9%), never smoked (72.2%), never drank alcohol (72.2%), with medical insurance (98.5%), no fracture in the past 2 years (84.3%), not aware the hospital had an osteoporosis clinic (58.0%), never took anti-osteoporosis drugs (54.0%), did not fall in the past year (75.5%), and never was about to fall but prevented the fall in time (33.1%) (**Table 1**).

Summary of key findings

The findings indicated that older adults in Ningxia demonstrated sufficient knowledge, positive attitude, and proactive practices regarding osteoporosis and hip fracture. Significant variations in KAP scores were observed across sociodemographic factors, particularly residence, education level, and income. Knowledge showed a weak positive correlation with both attitude and practice, whereas attitude exhibited a moderate positive correlation with practice.

Knowledge, attitude, and practices

The mean knowledge, attitude, and practice scores were 22.66±4.29 (/30, 75.53%), the mean attitude score was 43.13±4.54 (/60, 71.88%), and the mean practice score was 57.15±10.24 (/80, 71.44%), indicating sufficient knowledge, positive attitude, and proactive practice.

Significant differences in knowledge scores were observed according to type of residence (P<0.001), education (P=0.002), occupation (P=0.003), income (P=0.001), living with someone (P=0.041), anti-osteoporosis drugs (P=0.038), fell in the last year (P<0.001), and was about to fall but prevented the fall (P<0.001) (**Table 1**). The knowledge item with the highest correctness rate was K14 (82.76%; “There are many factors contributing to falls, such as environmental factors like carpets, wet floors, as well as lack of exercise and immobility. (Correct)”), and the item with the lowest score was K10 (22.99%; “Having had a fracture does not greatly affect the risk of recurrent fractures. (Incorrect)”.) (**Supplementary Table 1**).

Significant differences in attitude scores were observed according to sex (P=0.001), type of residence (P=0.002), education (P=0.025), occupation (P=0.003), income (P<0.001), living with someone (P=0.010), smoking (P<0.001), alcohol (P<0.001), medical insurance (P=0.005), and was about to fall but prevented the fall (P=0.028) (**Table 1**). The attitude item with the highest score was A12 (88.69%; “I think if a fall occurs and there is a mobility impairment, seeking medical attention immediately is necessary. (P)”), while the item with the lowest score was A3 (2.11%; “I would be very concerned about fracturing a bone if I accidentally fell or experienced trauma. (N)”) (**Supplementary Table 2**).

Significant differences in practice scores were observed according to type of residence (P=0.017), education (P=0.001), occupation (P=0.015), income (P=0.002), smoking (P=0.001), alcohol (P<0.001), awareness of osteoporosis clinic (P=0.001), anti-osteoporosis drugs (P<0.001), and was about to fall but prevented the fall (P<0.001) (**Table 1**). The practice item with the highest score was P7.4 (79.50%; “Regarding factors in the environment that may contribute to falls, the frequency with which you will pay attention to are: Being mindful of obstacles. (P)”), while the item with the lowest score was P8.1 (51.73%; “Regarding the following fall-related risk factors, the frequency with which you will address them are: Avoiding anxiety and excitement. (P)”) (**Supplementary Table 3**).

Correlations

As shown in **Table 2**, the knowledge scores were correlated to the attitude (r=0.2155, P<0.001) and practice (r=0.2276, P<0.001) scores. The attitude scores were correlated to the practice scores (r=0.5007, P<0.001).

Structural equation modeling

The fit of the adjusted SEM (**Figure 1**) was good (**Table 3**). Knowledge was associated with income (β=1.01, P<0.001), frequency of fall prevention (β=-0.55, P<0.001), residence (β=0.97, P=0.030), and falls in the past year (β=0.76, P=0.017). The attitude was associated with knowledge (β=0.21, P<0.001) and alcohol (β=-1.26, P<0.001). The practice was associated with attitude (β=1.09, P<0.001), frequency of fall prevention (β=-1.86, P<0.001), and anti-osteoporosis drugs (β=2.63, P<0.001) (**Table 4**).

DISCUSSION

The prevention and management of osteoporosis require patient action (e.g., visiting a physician and maintaining proper lifestyle habits). This cross-sectional study examined the KAP of osteoporosis and hip fracture in older Chinese adults. The findings showed that participants generally had sufficient knowledge, positive attitude, and proactive practices toward osteoporosis and hip fracture. Nevertheless, specific areas of knowledge could be improved by educational interventions, which should translate into better practice.

Ningxia is the 25th region in terms of population density in China, the 29th in terms of total gross domestic product (GDP), and the 18th in terms of per-capita GDP. It is, therefore, a region with a middle socioeconomic status in China. In the present study, older Chinese adults showed good levels of knowledge, positive attitude, and proactive practices toward osteoporosis and hip fracture, which aligns with some previous findings in populations with higher health awareness. A previous study in Chinese patients with chronic kidney disease, a population at high risk of osteoporosis, revealed a moderate KAP toward osteoporosis [24]. Another study revealed moderate KAP toward osteoporosis among Chinese patients with knee osteoarthritis [25]. A recent review of the awareness status of osteoporosis in the general Chinese public indicated a low awareness, but that awareness was better in older adults than in middle-aged individuals, probably due to older adults being a population at higher risk of osteoporosis and hip fractures [26]. Nevertheless, various KAP levels can be observed in different countries. A study from Pakistan showed that women

had a good KAP toward osteoporosis [21], possibly because women are more affected than men and that more public health efforts are deployed for them. University students in the United Arab Emirates also showed good KAP [22], likely reflecting the influence of higher education and greater access to health information. Still, a study in adults in the United Arab Emirates also showed good KAP [23]. On the other hand, studies reported poor KAP toward osteoporosis among Malaysian students [18], adults [19], and older adults [20]. The differences among countries could be related to the public health education provided to the general population and the quality of the healthcare systems.

The present study showed that a higher income, urban residence (often associated with a better socioeconomic status), and the number of falls in the past year were positively associated with knowledge. The socioeconomic status is a well-known determinant of health literacy [30]. In addition, the number of falls in the past year could encourage the patients to seek more information about osteoporosis and fractures, or they could receive information from healthcare providers if they had to consult. These findings suggest that exposure to health information and access to healthcare services may play an important role in improving knowledge levels. On the other hand, the frequency of fall prevention was negatively associated with knowledge and practice but positively associated with attitude, which could be related to a false security feeling that the patient could prevent all falls until the one time he could not. Taking anti-osteoporosis drugs was positively associated with practice, indicating that

the patient is taking active measures to manage osteoporosis and prevent complications.

Osteoporosis and hip fractures in older adults are important public health issues associated with significant morbidity and mortality [31, 32]. Although the present study showed a good knowledge of the participants toward osteoporosis and hip fracture, some knowledge areas could be improved, including osteoporosis in men vs. women, the association between falls and osteoporosis, the importance of preventing falls, the relationship between age and hip fracture, the relationship between a history of fracture and the risk of future fractures, and the prevention of osteoporosis. The correlations among knowledge, attitude, and practice support the importance of strengthening health education to enhance overall disease management. Such targeted interventions may help translate knowledge into sustained behavior change and reduce the risk of fragility fractures among older adults. Nevertheless, the correlations were weak, and could not be interpreted as evidence of causality, the effectiveness of such interventions needs evidence from further studies.

This study had limitations. It was performed at a single center and used a convenience sampling method, resulting in a relatively small sample size (considering the prevalence of osteoporosis) covering a single geographical area in one Chinese province (Ningxia), which limited the representativeness. The study was cross-sectional, preventing the analysis of causality. A SEM analysis was performed to estimate causality, but it must be stressed that in such cases, causality is statistically inferred rather than observed [33-35]. Therefore, the observed associations should be

interpreted with caution and cannot be considered evidence of true causal relationships. Local investigators designed the questionnaire and could be influenced by local practices and policies, limiting exportability and generalizability. In addition, the exclusion of individuals who were unable to complete the questionnaire or lacked access to an electronic device may have introduced selection bias, likely leading to an overestimation of KAP and potentially limiting the representativeness of the sample. Finally, all KAP studies are at risk of social desirability bias, in which the participants can be tempted to answer what they know they should think or do instead of what they are thinking or doing [36, 37]. Considering that knowledge was sufficient, bias is possible. Despite these limitations, the findings provide useful implications for clinical practice, as strengthening patient education and early preventive strategies could help reduce the risk of osteoporosis-related fractures among older adults.

In future research, we plan to conduct longitudinal follow-up studies to examine changes in KAP over time and to evaluate the effectiveness of targeted educational interventions based on the gaps identified in this study. This will help determine whether improvements in knowledge can lead to lasting changes in attitude and practices. In addition, expanding the study to multiple regions in China would allow for comparisons across different sociodemographic backgrounds and improve the generalizability of the findings.

In conclusion, older adults in Ningxia (China) have a good KAP toward osteoporosis and hip fracture. Still, specific areas of knowledge could be improved by educational interventions. Since knowledge was related to

attitude and practice, improving knowledge may contribute to better preventive practices toward osteoporosis and hip fracture. These findings highlight the importance of strengthening health education and early prevention strategies to support better self-management and reduce the risk of osteoporotic fractures among older adults.

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None.

Authors' contributions

Feng Ma, Zhaofu Wang, Xiaohai Luo, Ning Wu, and Xiaolin Ma carried out the studies, participated in collecting data, and drafted the manuscript. Feng Ma, Yanjun Hu, and Bin Yu performed the statistical analysis and participated in its design. Feng Ma and Zhaofu Wang participated in the acquisition, analysis, or interpretation of data and drafted the manuscript. All authors read and approved the final manuscript.

Data availability statement

All data generated or analyzed during this study are included in this article and supplementary information files.

Competing interests statement

The authors declare that they have no competing interests.

Ethics approval and consent to participate

This work has been carried out in accordance with the Declaration of Helsinki (2000) of the World Medical Association. This study was approved by the Medical Ethics Committee of Ningxia Hui Autonomous Region People's Hospital ([2021]-ZDYF-020), and all participants provided written informed consent.

Consent for publication

Not applicable

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Figure Legends:

Figure 1. Structural equation model after adjustment.

568 **Table 1. Characteristics of the participants**

n=522	N (%)	Knowledge score (0–30)		Attitude score (12–60)		Practice score (16–80)	
		Mean ± SD	P	Mean ± SD	P	Mean ± SD	P
Total		22.66±4.29		43.13±4.54		57.15±10.24	
Sex			0.363		0.001		0.149
Male	257 (49.2)	22.4±4.30		42.47±4.56		56.48±10.33	
Female	265 (50.8)	22.8±4.26		43.77±4.43		57.79±10.12	
Age (years)	70.10±7.53						
Residence			<0.001		0.002		0.017

Non-urban	134 (25.7)	21.3±4.04		42.18±4.71		55.48±9.474	
Urban	388 (74.3)	23.1±4.28		43.46±4.43		57.72±10.43	
Education			0.002		0.025		0.001
Primary school and below	201 (38.5)	21.9±4.03		42.66±4.70		55.49±10.19	
Middle school	175 (33.5)	23.4±4.37		43.2±4.43		58.50±10.14	
High school/secondary school	73 (14.0)	21.9±4.20		42.83±4.39		55.19±10.36	
College/Undergraduate and above	73 (14.0)	23.5±4.40		44.57±4.21		60.43±9.31	
Occupation			0.003		0.003		0.015
Retired	326 (62.5)	23.1±4.4		43.54±4.47		58.15±10.2	

		1		7	
Not retired	14 (2.7)	21.5±4.2	43.5±4.41	59.35±10.9	
		0		7	
Farming	86 (16.5)	22.0±4.0	43.24±4.55	54.93±10.8	
		3		2	
Not working	96 (18.4)	21.6±3.8	41.57±4.47	55.40±8.99	
		3			
Family's monthly per			<0.00	<0.001	0.002
capita income			1		
<2000	140 (26.8)	21.4±3.7	41.62±4.49	54.91±9.68	
		4			
2000-5000	280 (53.6)	22.7±4.4	43.66±4.60	57.40±10.6	
		6		2	
>5000	102 (19.5)	24.1±3.9	43.75±3.94	59.51±9.34	
		9			
Cohabitant			0.041	0.010	0.178

Yes	475 (91.0)	22.7±4.25		43.29±4.54		57.30±10.32					
No	47 (9.0)	21.2±4.44		41.55±4.22		55.61±9.24					
Comorbidities											
(Multiple choice possible)	86 (16.5)	-	-	-	-	-	-				
Diabetes	225 (43.1)	-	-	-	-	-	-				
Hypertension	34 (6.5)	-	-	-	-	-	-				
Kidney disease		-	-	-	-	-	-				
Coronary heart disease	19 (3.6)	-	-	-	-	-	-				
Hepatobiliary disease	15 (2.9)	-	-	-	-	-	-				
Peptic ulcer or bleeding	17 (3.3)	-	-	-	-	-	-				

Cerebrovascular disease	15 (2.9)	-	-	-	-	-	-
Respiratory diseases	156 (29.9)	-	-	-	-	-	-
No comorbidities	11 (2.1)	-	-	-	-	-	-
Smoking			0.062		<0.001		0.001
Never smoked	377 (72.2)	22.9±4.35		43.67±4.42		58.15±10.18	
Used to smoke	74 (14.2)	21.7±4.28		42.14±4.62		55.62±9.46	
Still smoke	71 (13.6)	22.1±3.76		41.26±4.43		53.42±10.34	
Drinking alcohol			0.120		<0.001		<0.001
Never	377 (72.2)	22.8±4.28		43.66±4.53		58.21±10.28	
Used to drink	88 (16.9)	21.8±4.2		42.13±4.68		55.22±8.56	

alcohol		6				
Still drink alcohol	57 (10.9)	22.2±4.2		41.19±3.48	53.08±10.9	
		2			5	
Medical insurance			0.171		0.005	0.284
Yes	514 (98.5)	22.6±4.2		43.20±4.52	57.20±10.2	
		8			7	
No	8 (1.5)	20.6±4.4		38.75±3.19	53.75±7.47	
		7				
Fractures in the past			0.688		0.169	0.270
2 years						
Yes	82 (15.7)	22.4±4.6		42.46±4.20	56.06±9.72	
		4				
No	440 (84.3)	22.6±4.2		43.25±4.59	57.35±10.3	
		2			2	
Aware that the			0.076		0.060	0.001
hospital has an						

osteoporosis clinic					
Yes	219 (42.0)	22.9±4.49	43.61±4.39	59.10±10.17	
No	303 (58.0)	22.4±4.12	42.78±4.61	55.73±10.06	
Anti-osteoporosis drugs use		0.038	0.964		<0.001
Yes	240 (46.0)	23.0±4.30	43.14±4.16	58.85±9.53	
No	282 (54.0)	22.3±4.25	43.12±4.84	55.69±10.60	
Number of falls in the past years		<0.001	0.895		0.055
0	394 (75.5)	22.2±4.15	43.09±4.61	56.59±10.28	
1	100 (19.2)	24.2±4.4	43.21±4.32	58.82±10.4	

		7			8
≥2	28 (5.3)	22.8±4.25	43.42±4.35	59±7.76	
Prevented the fall in time			<0.001	0.028	<0.001
Always	23 (4.4)	26±4.51	45±4.32	67.21±6.82	
Often	100 (19.2)	23.6±4.11	42.94±4.54	60.77±9.39	
Sometimes	87 (16.7)	22.7±4.04	42.33±4.49	54.90±9.76	
Occasionally	139 (26.6)	21.6±4.39	42.78±4.53	56.69±9.98	
Never	173 (33.1)	22.3±4.08	43.68±4.50	55.21±10.27	

569

570 **Table 2. Correlation analysis**

	Knowledge	Attitude	Practice
Knowledge	1		
Attitude	0.2155 (P<0.001)	1	
Practice	0.2276 (P<0.001)	0.5007 (P<0.001)	1

571

572 **Table 3. SEM model fit.**

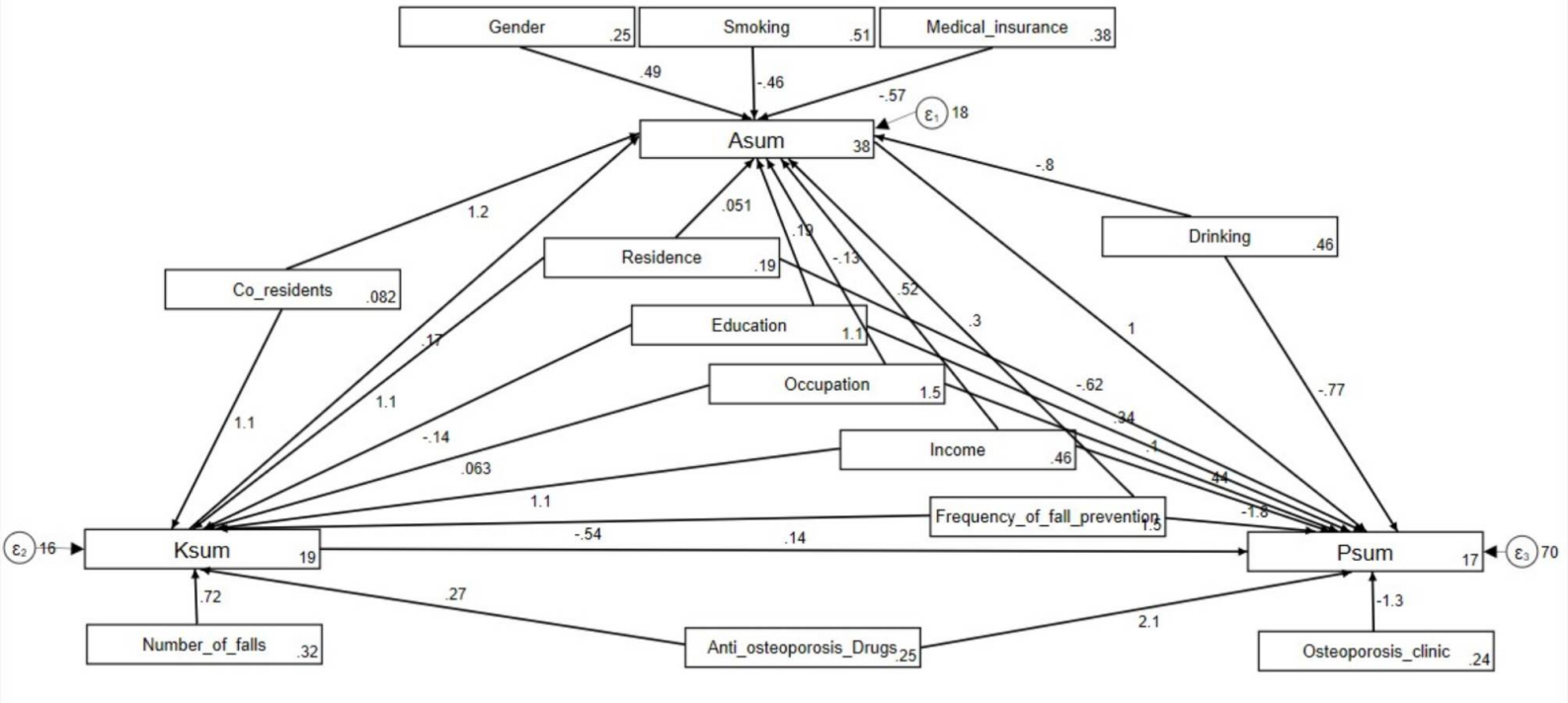
Indicators	Reference	Results
RMSEA	<0.08 Good	0.041
SRMR	<0.08 Good	0.029
TLI	>0.8 Good	0.931
CFI	>0.8 Good	0.965

573

574 **Table 4. SEM model.**

		β	P
Asum <-	Ksum	0.21	<0.001
	Frequency of fall prevention	0.29	0.062
	whether or not drinking alcohol	-1.26	<0.001
Psum <-	Asum	1.09	<0.001
	Ksum	0.15	0.091
	Frequency of fall prevention	-1.86	<0.001
	whether or not using anti-osteoporosis drugs	2.63	<0.001
Ksum <-	Per capita income in the past year	1.01	<0.001
	Frequency of fall prevention	-0.55	<0.001
	Residence	0.97	0.03
	Number of falls in the past year	0.76	0.017
	Whether there are co-residents	1.12	0.072

575


Gender .25
Smoking .51
Medical_insurance .38
.49
-.46
-.57
ε1 18
Asum .38
-.8
1.2
.051
.19
-.13
.52
.3
1
Drinking .46
Residence .19
Co_residents .082
Education 1.1
Occupation 1.5
Income .46
Frequency_of_fall_prevention 1.5
.17
1.1
-.14
.063
1.1
-.62
.34
.4
.44
-1.8
-.77
1.1
ε2 16
Ksum 19
-.54
.14
Psum .17
ε3 70
.72
.27
-1.3
2.1
Number_of_falls .32
Anti_osteoporosis_Drugs .25
Osteoporosis_clinic .24