DOI: 10.58490/ctump.2025i9TA.3485

OSTEOPOROSIS RISK ASSESSMENT FOR COMMUNITY-DWELLING OLDER ADULTS: A CROSS-SECTIONAL STUDY IN HO CHI MINH CITY

Bui Dinh Hoan[1], Nguyen Van Hung[2], Nguyen Thanh Giang[2], Le Nguyen Cam Tu[3], Huynh Thanh Phu[4], Nguyen Thuy Trang[5], Nguyen Duy Hoang[6], Pham Duy Quang[7*]

1. Southeast Asia Institute for Human Resource Development
2. District 5 Health Center, Ho Chi Minh City
3. Can Tho University of Medicine and Pharmacy
4. National Hospital of Odonto-Stomatology, Ho Chi Minh City
5. Binh Dan Hospital
6. CarePlus International Clinics Vietnam
7. Nguyen Tat Thanh University
**Corresponding author: duyquanghmu@gmail.com*

Received: 01/4/2025
Reviewed: 24/4/2025
Accepted: 25/6/2025

ABSTRACT

***Background**: Osteoporosis is a common feature in the elderly population. Despite many review articles mentioning osteoporosis in inpatients, there is a lack of original research directly investigating osteoporosis in the community, particularly among the elderly population.* ***Objectives**: We aimed to evaluate the risk of osteoporosis in individuals and to determine some related factors associated with the risk using the OSTA and OSTC tools among community-dwelling elderly adults in Ho Chi Minh City, Vietnam.* ***Materials and methods:** This cross-sectional study started in January 2024 and was conducted for six months. Multi-level mixed methods sampling was used to randomly select 6 out of 12 wards in District 5, Ho Chi Minh City, Vietnam. We studied 285 participants aged 60 years and older who were invited for a routine medical check-up in a health center.* ***Results:** The mean OSTA value of the elderly participating in the study was -2.97 ± 2.50, in which the high and medium-risk groups of osteoporosis accounted for 26.3% and 59.0%, respectively. The elderly had a risk of osteoporosis according to the OSTC score of 97.9%. The high risk of osteoporosis was associated with age (aOR 21.06, 95% CI 6.80 to 65.24), BMI (aOR 10.88, 95% CI 3.63 to 32.59) and gender (aOR=2.79, 95% CI 1.25 to 6.26).* ***Conclusions**: In conclusion, the findings indicate a high prevalence of osteoporosis risk among the elderly in a district of Ho Chi Minh City, as assessed by the OSTA and OSTC scores. Elderly persons suffer an increased risk of osteoporosis with age and a reduced nutritional state. Research indicates that OSTA is an effective tool, consistent with earlier studies focused on Vietnamese populations. It is straightforward and user-friendly. Utilizing OSTA may motivate both patients and clinicians to evaluate osteoporosis risk and recommend bone mineral density (BMD) measurements as needed, potentially preventing severe events before they occur in the future.*

***Keywords**: osteoporosis risk, geriatric, OSTA, OSTC.*

I. INTRODUCTION

Osteoporosis is a major public health problem in the elderly; approximately 200 million women around the world are affected by osteoporosis, with osteoporotic fractures affecting 30% of women and 20% of men (≥ 50 years) [1]. Older people are at higher risk of osteoporotic fractures, which can lead to deformity, poor quality of life, disability, loss of independence, and higher mortality. In Europe, a previous study showed that about 12% of

vertebral fractures commonly occur in individuals aged 50-70 [2]. The prevalence of osteoporosis in Vietnam ranges from 14-16% and is trending upward [3],[4]. Assessment of the high-risk population of osteoporosis is an important factor in comprehensive geriatric care. In 2001, Koh *et al*. introduced the Osteoporosis Self-Assessment Tool for Asians (OSTA), which is appropriate for postmenopausal Asian women [5]. This simple risk assessment tool is a practical, common screening for osteoporosis and is designed to increase awareness of osteoporosis and encourage the appropriate use of BMD measurements. We used a semiquantitative method in this study to assess osteoporosis risk because it is more widely used in epidemiological studies for the community screening of osteoporosis which aims to:

1. Assess the prevalence of osteoporosis risk in an elderly population in one urban district using OSTA and OSTC scores.
2. Determine the factors associated with the severity of osteoporosis risk among community-dwelling Vietnamese elderly at a health center.

II. MATERIALS AND METHODS

2.1. Materials

All subjects came from District 5, which is one of the highest population-density urban districts in Ho Chi Minh City, Vietnam. The study duration was 06 months, from January 2024 to June 2024.

- **Inclusion criteria**: A group of Vietnamese people aged ≥ 60 years, recruited from the health check-up population of the District 5 Health Center were included.

- **Exclusion criteria:** Included medical history or evidence of hyper or hypoparathyroidism, cancers, hip or joint replacement, use of estrogens, corticosteroids, bisphosphonate drugs, and missing most medical records. We also excluded any questionnaires that were incompletely answered.

2.2. Methods

- **Study design:** This research was a cross-sectional study.

The sample size was calculated using a single population proportion formula:

$$N = Z^2_{(1-\alpha/2)} \quad \frac{p\,(1-p)}{d^2}$$

N: the desired sample size from a large population.

α: level of significance, choose α = 0.05

$Z_{(1-\alpha/2)}$ = two-tailed Z-score confidence level (1.96).

d: absolude error (0.05)

p: The prevalence of osteoporosis in the elderly. Choose p = 0.243 (The prevalence of osteoporosis in the elders was reported in Asia with systematic review and meta-analysis by Nader Salari) [6].

Therefore, our study's sample size was calculated to be at least 283 participants. Consequently, we recruited 285 participants for the research.

- **Sampling method:** This study followed the multi-level mixed methods sampling design. We used a stratified cluster random sampling method to enroll 6 out of 12 wards in District 5. In the second level of sampling design, the participants were recruited by using the convenience sampling method. All elderly individuals who met the inclusion criteria during the study period were included until the sample size was sufficient.

- **Variables and Tools:**

Data about the age, gender, ethnic group and body mass index (BMI) categories, were collected from routine medical check-up days. Subgroup analysis was conducted based on the gender groups (male or female), ethnic group (Kinh or other), age ≥ 80 years old (yes or no), BMI ≥ 18.5 kg/m^2 (yes or no), and if osteoporosis risk (low-medium risk or high-risk).

Classification of osteoporosis risk based on OSTA score. The sensitivity and specificity of screening tool evaluation in predicting osteoporosis were 91% and 45 compared to dual-energy X-ray absorptiometry (DXA) scan as the gold standard, respectively [5]. OSTA was calculated using the equation OSTA = 0.2×[weight (kg) – age (year)]. Participants were classified into three categories based on OSTA indices: high-risk subjects (OSTA < −4), intermediate-risk subjects (OSTA −4 to −1), and low-risk subjects (OSTA > −1). Nguyen Ngoc Bich (2015) proposed criteria for these categories with better cutoff points for the postmenopausal Vietnamese women OSTA: < −3: high-risk; –3 ≤ OSTA ≤ 0: intermediate-risk groups; > 0: low-risk groups [7].

In 2007, Juying Zhang *et al*. introduced the performance of the OSTC score as a screening tool for primary osteoporosis among women in China ≥ 40 years old, which yielded sensitivity (76.8%) and specificity (75.1%) evaluation in this study, Kappa value was 0.51 (p=0.000). OSTC score (*Osteoporosis screening tool for Chinese*) = weight (kilogram) – 2× age (years) + 50. Values were classified as follows: an OSTC score ≤ 0 indicated that the patient was at risk for osteoporosis, and an OSTC score > 0 indicated that the patient was at no risk for osteoporosis [8].

- **Techniques and Data Collection Process:** A well-trained family physician and nurse interviewed each participant to complete the questionnaire that incorporated risk factors of osteoporosis risk in the tool.

- **Data Processing and Analysis:** For baseline data, continuous variables were expressed as mean ± standard deviation (SD) and categorical variables as frequency (percentage). A Chi-square test (for categorical variables) or the one-way ANOVA test (for continuous variables) was used to examine the differences between different groups. Statistical analyses were performed using R Statistical Software (version 4.4.2; R Foundation for Statistical Computing, Vienna, Austria). The independent association of demographic data (age categories, gender, ethnic group, and BMI) and osteoporosis risk with potential confounders was analyzed using multivariable logistic regression analysis. A two-tailed P < 0.05 was considered statistically significant.

- **Research ethics:** The present study was reviewed and approved by the Institute Ethics Committee of Hong Bang International University (No. 242/PCT-HDDD-SDH). The study only collected data with the approval of the participants. Participants' personal information is kept confidential.

III. RESULTS

Table 1. General characteristics of study participants (n=285)

Characteristics		n	%	OSTA scores	p
Age, years (mean ± SD)		70.0 ± 6.3 (Minimum 60 – Maximum 89)			
Gender	Male	85	29.8	−2.34±2.70	0.006*
	Female	200	70.2	−3.24±2.36	
Ethnic group	Kinh	168	58.9	−3.02±2.41	0.798**
	Chinese	114	40.0	−2.88±2.64	
	Other	3	1.1	−3.67±2.08	
Age categories	60-69	151	53.0	−1.77±2.10	< 0.001**
	70-79	108	37.9	−3.80±1.94	
	≥ 80	26	9.1	−6.46±2.00	
Body mass index (kg/m^2)	< 18.5	21	7.4	−6.05±1.93	< 0.001**
	18.5 – 24.9	176	61.7	−3.61±2.00	
	≥ 25.0	88	30.9	−1.05±2.14	

**t-test; **One-way ANOVA test*

Table 1 shows that 285 participants lived in District 5, Ho Chi Minh City. The mean age of the participants was 70.0 years, and the standard deviation (SD) was 6.3 years (range, 60-89 years). Likewise, 85 (29.8%) were male and 200 (70.2%) were female. The mean ± SD OSTA was −2.34±2.70 for males and −3.24±2.36 for females (P=0.006). When dividing by age group, the average OSTA score decreases from high to low, with the following order: the 60-69 years (−1.77±2.10), 70-79 years (−3.80±1.94), and the lowest in the ≥ 80 years (−6.46±2.00) (P < 0.001). Similarly, the average OSTA score decreases from high to low, with the following order: BMI ≥ 25 (−1.05±2.14), BMI 18.5-24.9 (−3.61±2.00), and the lowest BMI < 18.5 (−6.05±1.93), (P < 0.001).

Table 2. The osteoporosis risk using the OSTA score with the recommended cutoff thresholds from the different studies (n=285)

OSTA categories		Koh *et al.*		N.N. Bich *et al.*	
		n	%	n	%
Risk of osteoporosis	High risk	75	26.3	112	39.3
	Moderate risk	168	59.0	150	52.6
	Low risk	42	14.7	23	8.1
OSTA score (mean ± SD)*		−2.97 ± 2.50			

There were 42 low-risk (OSTA > −1) subjects (14.7%), 168 intermediate-risk (OSTA −4 to −1) subjects (59.0%), and 75 high-risk (OSTA < −4) subjects (26.3%). In the meantime, three risk categories were arbitrarily created using the OSTA index value with cutoffs of 0 and −3: high risk (39.3%), moderate risk (52.6%), and low risk (8.1%).

Table 3. The osteoporosis risk in the elderly using the OSTC score (n=285)

Screening classification		n	%
Risk of osteoporosis	Not at risk	6	2.1
	At risk	279	97.9
OSTC score (mean ± SD)		−34.86 ± 17.32	

From the table above, 97.9% of the elderly are at risk of osteoporosis, while only 2.1% are not at risk. The average score, according to OSTC, is −34.86 ± 17.32.

Table 4. Multivariable analysis of factors associated with osteoporosis risk in old people using the OSTA score based on Koh *et al.* (n=285)

Variable		High-risk	Low-medium risk	OR (95% CI)	p	aOR (95% CI)	p
Gender	Female	56 (28.0)	144 (72.0)	1.35 (0.74-2.46)	0.323	2.79 (1.25-6.26)	0.012
	Male	19 (22.4)	66 (77.6)				
Ethnic group	Kinh	46 (27.4)	122 (72.6)	1.14 (0.67-1.96)	0.625	1.48 (0.77-2.84)	0.240
	Other	29 (24.8)	88 (75.2)				
Age categories	≥ 80	22 (84.6)	4 (15.4)	21.38 (6.30-72.55)	<0.001	21.06 (6.80-65.24)	<0.001
	< 80	53 (20.5)	206 (79.5)				
BMI (kg/m^2)	< 18.5	16 (76.2)	5 (23.8)	11.12 (3.68-33.56)	<0.001	10.88 (3.63-32.59)	<0.001
	≥ 18.5	59 (22.4)	205 (77.6)				

OR, odds ratio; CI, confidence interval; aOR: adjusted odds ratio.

On multiple regression analysis, a lower BMI (< 18.5) was associated with excess osteoporosis risk in the elderly population (aOR=10.88, 95% CI 3.63-32.59). The prevalence of osteoporosis risk in the elderly population aged ≥ 80 years increased significantly compared with those below 80 years (aOR=21.06; 95% CI 6.80-65.24). Females were more likely to be osteoporosis risk than males (aOR=2.79; 95% CI 1.25-6.26).

IV. DISCUSSION

4.1. Baseline characteristics of study participants

In this study, we found that the mean age of participants was 70.0 ± 6.3. According to data from the Vietnam Association of Gerontology and Geriatric, the proportion of elderly people could reach 16.8% of the total population by 2029, and Vietnam currently has a faster population aging rate compared to the global average [9]. The aging population creates a burden on the healthcare system as the demand for healthcare for the elderly increases. In addition, the percentage of elderly people from the Chinese ethnic group is high (40%), and District 5 is currently a densely populated area where many people live and work. With BMI, the group of elderly individuals with a BMI classified as overweight-obese has a higher percentage compared to the group with a BMI classified as undernourished (30.9% vs. 7.4%). This indicates a significant change in health issues in urban areas, with a much higher risk of obesity compared to the group at risk of chronic energy deficiency.

4.2. OSTA and OSTC scores

Another study by Nguyen Thi Thuy Trang conducted in Long My Health Center, Hau Giang Province, indicates that OSTA < − 4 (high-risk group) was 15.8% (5% in males and 10.8% in females), moderate risk (− 4 ≤ OSTA ≤ − 1) was 31.2% (12.9% in males and 18.3% in female), OSTA > − 1 (low risk) was 53% (25.7% in male and 27.3% in female) [10]. Furthermore, our study also revealed that, under the same criteria, the proportion of individuals at high risk of osteoporosis was nearly double (26.3% compared to 15.8%). The clear difference between the two studies lies in the sampling criteria: Thuy Trang *et al.* study included women over 18 years of age who came for medical examination, while our study focused on the elderly population. In the Nguyen Ngoc Bich study, followed by the statistical analysis by Koh *et al*., 7.4% of postmenopausal women (≥ 40 years) had a severe

risk of osteoporosis and 42.9% had a moderate risk of osteoporosis. At a modified version cutoff of this study, 11.6% were at high risk (OSTA < −3), and the intermediate risk category (0 to −3) represented 62.3% of participants[7]. When comparing both cutoff thresholds, in our study, the high-risk of osteoporosis rates were 26.3% and 39.3% (OSTA < −3), respectively. The detection rates in the OSTA medium-risk were 59.0% and 52.6% (−3 ≤ OSTA ≤ 0), respectively. Notably, in a study by Nguyen Ngoc Bich, after re-evaluation using the DXA method, 96.7% and 93.6% of women in the high-risk group were confirmed to have osteoporosis. This indicates that age is clearly a significant factor related to osteoporosis, with the risk increasing as age advances.

Regarding the OSTC score, 97.9% of the study population is in the osteoporosis risk group. This result is much higher than the study by Zhang J (75.8%), which focused on postmenopausal women over 40 [8]. One reason for this result is that in Zhang's scoring formula, the age factor is multiplied by 2, which causes most elderly individuals in the study group to fall into the osteoporosis risk group. The nature of elderly individuals already places them in the risk group, so what needs to be determined is whether they fall into the high-risk group. For this reason, the OSTC score may not be suitable when applied to the elderly.

Although the OSTC and OSTA scoring formulas were initially developed based on data for postmenopausal women, we also agree with My Hanh Bui's opinion that the prediction scores of both OSTA and OSTC can be easily calculated without complex methods. These two predictive factors can be simply collected in the community and applied in primary healthcare practice [11].

4.3. Associated factors with the severity of osteoporosis risk

One study by Hoang Thi Bich *et al.* conducted at the National Geriatric Hospital, with a research subject group of more than 60 years old, showed that the majority of people with osteoporosis, as assessed by bone density (in the femoral neck and lumbar spine), belong to the age group of ≥ 80 years. Most of the sample were female (93.6%) [12]. In our study, the OSTA score for females (−3.24±2.36) was significantly lower than that for males (−2.34±2.70); the difference was statistically significant (P=0.006). Additionally, regression analysis indicated that elderly women have a 2.79 times higher risk of osteoporosis compared to men (aOR=2.79; 95% CI 1.25-6.26; P=0.012). Most current studies are focusing on postmenopausal women, as the onset of osteoporosis occurs earlier, and the rate of bone loss is faster in females due to hormonal decline. The research results also indicate that the average score of the research group was −34.86±17.32 according to OSTC, significantly lower than -25.7±18.9 in My Hanh Bui's study [11], in a study of postmenopausal women in Vietnam. In this study, the average age was 64.1±7.7, while in our study it was 70.0±6.3. Furthermore, 94.4% of the subjects were at risk of osteoporosis, compared to 97.9% in our study. This indicates that there wasn't much difference in the risk rates; however, the OSTA scores showed a notable discrepancy. The risk of osteoporosis increased in association with increasing age and was significantly higher among women than among men, which closely resembled earlier findings. It is also an important component in the two indices we surveyed. In accordance with studies by Peter Pietschmann *et al.* and Khaled A. Alswat *et al.* revealed that the burden of osteoporosis in adults increases with age, starting earlier and being higher in adult women than in adult men. However, major fragility fractures in adults contribute to increased mortality in men more than in women [13], [14].

However, our study has some limitations. The cross-sectional study conducted in an

urban district of Ho Chi Minh City at a specific point in time cannot provide conclusions about the causal relationship between risk factors and the prevalence of osteoporosis in the community. The sample size is quite small for a community-based study, and only urban citizens are enrolled.

V. CONCLUSION

The results suggest that the prevalence of osteoporosis risk in one district in HCM City was high as measured by the OSTA and OSTC scores. The OSTA tool is evaluated as simple and suitable for conditions in Vietnam. It is significant for screening because older adults will be diagnosed with osteoporosis early, helping to limit complications from fractures and reduce the burden on the healthcare system and caregivers.

REFERENCES

1. Sözen T, Özışık L, Başaran NÇ. An overview and management of osteoporosis. *Eur J Rheumatol*. 2017. 4(1), 46-56. doi:10.5152/eurjrheum.2016.048.
2. Clynes MA, Harvey NC, Curtis EM, Fuggle NR, Dennison EM, Cooper C. The Epidemiology of Osteoporosis. *Br Med Bull*. 2020.133(1),105-117. doi:10.1093/bmb/ldaa005.
3. Nguyen HG, Lieu KB, Ho-Le TP, Ho-Pham LT, Nguyen TV. Discordance between quantitative ultrasound and dual-energy X-ray absorptiometry in bone mineral density: The Vietnam Osteoporosis Study. *Osteoporosis and Sarcopenia*. 2021.7(1),6-10. doi:10.1016/j.afos.2021.03.003.
4. Vu Thi Thu Hien, Nguyen Cong Khan, Nguyen Thi Lam, *et al*. Determining the Prevalence of Osteoporosis and Related Factors using Quantitative Ultrasound in Vietnamese Adult Women. *American Journal of Epidemiology*. 2005.161(9),824-830. doi:10.1093/aje/kwi105.
5. Koh LK, Sedrine WB, Torralba TP, *et al*. A simple tool to identify asian women at increased risk of osteoporosis. *Osteoporos Int*. 2001.12(8),699-705. doi:10.1007/s001980170070.
6. Salari N, Darvishi N, Bartina Y, *et al*. Global prevalence of osteoporosis among the world older adults: a comprehensive systematic review and meta-analysis. *J Orthop Surg Res*. 2021.16,669. doi:10.1186/s13018-021-02821-8.
7. Nguyen Ngoc Bich. Study of the OSTA index in assessing osteoporosis risk in postmenopausal women aged 40 years and older. Resident doctor's thesis, Hanoi Medical University. 2015.90.
8. Zhang J, Wu T, Yang D. A study on osteoporosis screening tool for Chinese women. *Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi*. 2007.21(1),86-89.
9. Nguyen Trung Anh. Orientation for developing human resources specialized in geriatrics in Vietnam. 2024.17. hoilaokhoavietnam.vn/upload/attach/cs-20241025453b.pdf
10. Nguyen Thi Thuy Trang. Determination of osteoporosis risk and associated factors in patients at Long My Town Health Center, Hau Giang Province, 2021-2022. Master of nutrition thesis, Hanoi Medical University. 2022. 87.
11. Mh B, Pt D, Ql K, *et al*. Evaluation of community-based screening tools for the early screening of osteoporosis in postmenopausal Vietnamese women. *PloS one*. 2022.17(4). doi:10.1371/journal.pone.0266452
12. Hoang Thi Bich, Tran Thi To Chau, Hoang Thi Phuong Nam. Some factors related to bone density in geriatric patients at the National Geriatric Hospital. *VMJ*. 2021.507(1). doi:10.51298/vmj.v507i1.1380.
13. P P, M R, W S, K KS. Osteoporosis: an age-related and gender-specific disease--a mini-review. *Gerontology*. 2009.55(1). doi:10.1159/000166209.
14. Alswat KA. Gender Disparities in Osteoporosis. *J Clin Med Res*. 2017.9(5),382-387. doi:10.14740/jocmr2970w.