# ASSESSMENT OF MOBILITY AND RELATED FACTORS AMONG OLDER PATIENTS WITH OSTEOPOROSIS

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*This cross-sectional study was conducted to assess mobility and related factors among older people with osteoporosis treated at the National Geriatric Hospital. Mobility was assessed using the Time Up and Go test (TUG test). The proportion of participants with mobility impairment was 22.0%. The mean time of the TUG test was 12.3 ± 3.9 (seconds). There were significant associations between impaired mobility and age ≥ 80 years old with OR=3.3, knee osteoarthritis with OR=3.5, and diabetes with OR=3.0. There were significant associations between impaired mobility and geriatric syndromes: frailty syndromes (OR=3.5), low levels of physical activity (OR=3.5), and high risk of falls (OR=3.0). In conclusion: one in five older osteoporosis patients has impaired mobility. Our results highlighted that advanced age, knee osteoarthritis, diabetes, and geriatric syndromes such as frailty, low physical activity level, and high risk of falls were significantly associated with mobility in older patients with osteoporosis.*

**Keywords: Mobility, elderly, osteoporosis.**

## I. INTRODUCTION

Osteoporosis is a metabolic bone disorder, characterized by a decline in bone mineral density as well as destruction of bone microarchitecture, leading to increase in the risk of fractures.[1] Osteoporosis is often underdiagnosed and undertreated, partly because it is a clinically silent disease until a fragility fracture occurs.[1] Osteoporosis is the most frequent bone disorder in people with a global prevalence of 18.3%.[2] All fragility fractures are marked by pain and a deterioration in physical, social, and psychological function - all elements of life quality.[3]

Physical function limitations not only have a negative impact on older people's quality of life and independence but also raise the risk of morbidity and mortality.[4] Several reports have investigated the relationship between physical performance and osteoporosis.[5,6] Physical function is an individual's ability to perform physical tasks and activities and is known to be affected in OP, among those both with and without fracture.[5] Fractures can result in reduced mobility and physical function. They can also result in chronic pain or affect the ability to self-care. Fractures can also have long-term consequences on physical function and greatly affect patients' health-related quality of life.[7] Osteoporosis was substantially correlated with a reduction in functional capacity such as having trouble with running, lifting heavy objects, participating in sports, or doing hard work, as well as difficulties holding one's balance while bathing or descending stairs. Physical function is significantly associated with health-related quality of life in older people with osteoporosis and vertebral fractures.

The Timed Up and Go (TUG) test is a commonly used method of assessing functional mobility among older adults in geriatric clinics.

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The test measures speed during several functional maneuvers, including standing up, walking, turning, and sitting down. Limited training and equipment are required, so the test is convenient in clinical settings. It is an integral measure of gait speed and balance in widespread clinical settings.[8] Exploring the limitations and factors that affect mobility among older patients with osteoporosis can develop interventions to promote physical function as much as possible. However, data about mobility of the older population with osteoporosis are lacking. Thus, this study was conducted to assess mobility and related factors among older people with osteoporosis examined and treated at the National Geriatric Hospital.

## II. SUBJECTS AND METHODS

### 1. Subjects

Patients aged 60 years old and older -diagnosed with osteoporosis according to WHO criteria-were examined and treated at the National Geriatric Hospital from June to October 2022, and had the physical and cognitive abilities to do a face-to-face interview.

***Exclusion criteria***

Patients with severe acute conditions such as ketoacidosis coma, hyperosmolar coma, coma due to cerebrovascular accident, exacerbation of heart failure decompensation, liver failure, exacerbation of chronic obstructive pulmonary disease.

### 2. Study design

- A cross-sectional descriptive study

- The sample was selected according to the convenience sampling method

- The sample size is calculated using the formula:

$$n = \frac{(z_{1-\alpha/2})^2}{d^2} \; p\,(1 - p)$$

p = 0.21 (The prevalence of mobility impairment in older people in Vietnam.[9]

According to the formula, the smallest sample size is n = 130 patients. + 141 patients participated in this study.

### 3. Variables

- General information: age, gender, weight, height, body mass index (BMI).
- Comorbidities characteristics
- Osteoporosis characteristics: T-score, diagnosed duration, symptoms of osteoporosis, treatment

***Mobility: Timed Up and Go test***

TUG test was performed using an ordinary armchair and a stopwatch. Participants were seated with their backs against the chair. They were instructed to stand up, walk for 3m (to a mark on the floor), turn around, walk back to the chair, and then sit down. The task was done at the ordinary walking speed. Timed calculation in seconds started on the word "go" and stopped as the participant sat down. Evaluation: A completed time ≥ 13.5 seconds is the cut-off point to identify those who have mobility impairment.[8]

***Characteristics of some geriatric syndromes:***

Physical activity level was assessed according to the International Physical Activity Questionnaire- Short Form (IPAQ-SF). Polypharmacy was assessed by asking patients and families/ caregivers, viewing prescriptions, and referring to medical records. Nutrition status was evaluated using the Mini Nutritional Assessment - Short Form (MNA-SF). Depression was performed using the Geriatric Depression Scale (GDS-15). Sleep disturbance was screened by the Pittsburgh Sleep Quality Index (PSQI). Cognitive impairment was assessed by the Mini-Mental State Examination (MMSE). The risk of falls was assessed by

asking the 21-item fall risk index. Frailty syndrome was assessed by the Clinical Frailty Scale (CFS).

**4. Tools and data collection method**

Data were collected by using a research questionnaire through interviews, diagnosis tests, and medical records at the National Geriatric Hospital.

**5. Data processing and data analysis**

The process of data coding, entry into REDCap, and analysis was done by using Statistical Package for Social Science (SPSS) software (version 22.0). Descriptive statistics were adopted to examine characteristic data: frequency, percentage, and mean with standard deviation. T-test, Chi-square, and Univariate logistic regression were performed to evaluate the factors associated with mobility in osteoporosis patients. Statistical significance was accepted at the 95% confidence level ($p < 0.05$).

**6. Ethical consideration**

Study subjects were explained clearly about the purpose of the study, and they were willing to participate in the study. Collected data was used for research. The results of the study were proposed for improving the health of the community, not for other purposes.

## III. RESULTS

**1. General characteristics**

**Table 1. Demographic characteristics among participants (n = 141)**

| Characteristics | | Frequency (n) | Percentage (%) |
|---|---|---|---|
| **Age group (year)** | 60 – 69 | 50 | 35.5 |
| | 70 – 79 | 55 | 39.0 |
| | ≥ 80 | 36 | 25.5 |
| **Gender** | Male | 8 | 5.7 |
| | Female | 133 | 94.3 |
| **BMI ($kg/m^2$)** | < 18.5 | 19 | 13.5 |
| | 18.5 – 22.9 | 69 | 48.9 |
| | ≥ 23.0 | 53 | 37.6 |
| | | Mean ± SD | |
| Mean age (year) (Min – Max) | | 73.1 ± 8.6 (60 – 97) | |
| Mean BMI ($kg/m^2$) | | 21.9 ± 3.0 | |

Participants aged 70 – 79 years old accounted for the highest proportion 39.9%. The majority of study participants were females, accounting for 94.3%. The percentage of underweight and overweight were 13.5% and 37.6%, respectively.

**2. Mobility (TUG test) in older patients with osteoporosis**

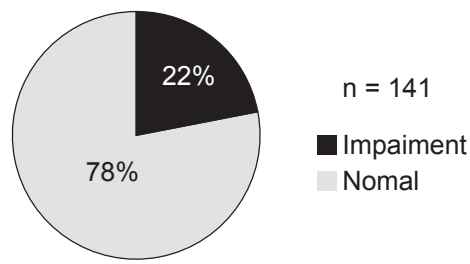


**Figure 1. Assessment of mobility using the TUG test**

The proportion of participants with mobility impairment by TUG test accounted for 22.0%. The mean time of the TUG test was 12.3 ± 3.9 seconds.

**3. Some related factors with mobility**

**Table 2. Association between mobility and general characteristics (n = 141)**

| Characteristics | | Normal mobility (n = 110) | | Impaired mobility (n = 31) | | p-value |
|---|---|---|---|---|---|---|
| | | n | % | n | % | |
| Age group | 60 – 69 | 46 | 41.8 | 4 | 12.9 | < 0.05 |
| | 70 – 79 | 42 | 38.2 | 13 | 41.9 | |
| | ≥ 80 | 22 | 20.0 | 14 | 45.2 | |
| Gender | Male | 8 | 7.3 | 0 | 0.0 | > 0.05 |
| | Female | 102 | 92.7 | 31 | 100.0 | |
| BMI (kg/m$^2$) | < 18.5 | 15 | 13.6 | 4 | 12.9 | > 0.05 |
| | 18.5 – 22.9 | 57 | 51.8 | 12 | 38.7 | |
| | ≥ 23 | 38 | 34.5 | 15 | 48.4 | |
| Knee osteoarthritis | Yes | 21 | 19.1 | 14 | 45.2 | < 0.05 |
| | No | 89 | 80.9 | 17 | 54.8 | |
| Diabetes | Yes | 15 | 13.6 | 10 | 32.3 | < 0.05 |
| | No | 95 | 86.4 | 21 | 67.7 | |
| Lumbar or other joints degeneration | Yes | 21 | 19.1 | 6 | 19.4 | > 0.05 |
| | No | 89 | 80.9 | 25 | 80.6 | |
| Hypertension | Yes | 45 | 40.9 | 14 | 45.2 | > 0.05 |
| | No | 65 | 59.1 | 17 | 54.8 | |
| Parkinson | Yes | 9 | 8.2 | 3 | 9.7 | > 0.05 |
| | No | 101 | 91.8 | 28 | 90.3 | |
| Fall within the past 12 months | Yes | 26 | 23.6 | 9 | 29.0 | > 0.05 |
| | No | 84 | 76.4 | 22 | 71.0 | |
| | | **Mean ± SD** | | | | |
| Age (year) | | 71.6 ± 8.2 | | 78.4 ± 8.0 | | < 0.05 |
| BMI (kg/m$^2$) | | 21.8 ± 2.9 | | 22.2 ± 3.2 | | > 0.05 |
| | | **OR** | | **95%CI** | | |
| Age ≥ 80 years old | | 3.3 | | 1.4 – 7.7 | | < 0.05 |
| Knee osteoarthritis | | 3.5 | | 1.5 – 8.2 | | **< 0.05** |
| Diabetes | | 3.0 | | 1.2 – 7.6 | | **< 0.05** |

Age, knee osteoarthritis, and diabetes were significantly associated with mobility. Age ≥ 80 years old, knee osteoarthritis, and diabetes were associated with an increased likelihood of mobility impairment with OR=3.3, OR=3.5, and OR=3.0, respectively.

**Table 3. The association between mobility and characteristics of osteoporosis**

| Characteristics | | Normal mobility (n=110) | | Impaired mobility (n=31) | | p-value |
|---|---|---|---|---|---|---|
| | | n | % | n | % | |
| Diagnosed duration (year) | Newly diagnosed | 55 | 50.0 | 15 | 48.4 | > 0.05 |
| | < 5 | 38 | 34.5 | 11 | 35.5 | |
| | 5 – 10 | 17 | 15.5 | 5 | 16.1 | |
| Symptoms | Pain (back, long bone) | 99 | 90.0 | 29 | 93.5 | > 0.05 |
| | Loss of height | 43 | 39.1 | 19 | 61.3 | < 0.05 |
| | Spine malformations | 24 | 21.8 | 6 | 19.4 | > 0.05 |
| | Bone fractures after minor injuries | 5 | 4.5 | 1 | 3.2 | > 0.05 |
| | No symptoms | 6 | 5.5 | 0 | 0.0 | > 0.05 |
| Treatment | Yes | 58 | 52.7 | 14 | 45.2 | > 0.05 |
| | No | 52 | 47.3 | 17 | 54.8 | |
| | | Mean ± SD | | | | |
| T-score | Hip | -1.5 ± 1.2 | | -1.6 ± 1.2 | | > 0.05 |
| | Spine | -3.3 ± 0.7 | | -3.5 ± 0.7 | | > 0.05 |

Osteoporosis patients experiencing loss of height had a higher rate of impaired mobility (61.3% vs 39.1%) with p < 0.05. There was no significant difference between diagnosed duration, treatment, and bone mineral density with impaired mobility (p>0.05).

**Table 4. The association between mobility and geriatric syndromes (n=141)**

| Geriatric syndromes | Impaired mobility | |
|---|---|---|
| | OR | 95%CI |
| Frailty syndrome | **3.5** | 1.5 – 8.2 |
| Low physical activity level | **3.5** | 1.2 – 9.7 |
| High risk of fall | **3.0** | 1.3 – 7.2 |
| Polypharmacy | 1.5 | 0.7 – 3.3 |
| Depression | 1.3 | 0.6 – 3.0 |
| Cognitive impairment | 1.0 | 0.4 – 2.5 |
| Malnutrition | 1.0 | 0.4 – 2.1 |
| Sleep disturbance | 0.8 | 0.3 – 2.0 |

Significant associations existed between mobility and frailty syndrome, low physical activity level, and risk of falls. Frailty syndrome, low physical activity level, and high risk of falls were associated with an increased likelihood of mobility impairment with OR=3.5, 3.5, and 3.0, respectively.

## IV. DISCUSSION

Our results highlighted mobility characteristics and some related factors with impaired mobility among older patients with osteoporosis at the National Geriatric Hospital.

The mean time of the TUG test was 12.3 ± 3.9 seconds. The proportion of participants with mobility impairment by TUG test accounted for 22.0%. The mean time of the TUG test in our study was greater than the study conducted in postmenopausal women with osteoporosis aged 50 – 60 years, with 9.7 ± 0.9 seconds. This study also indicated that a longer time to complete the TUG test is an independently predicted osteoporosis factor among postmenopausal women.[10] Mousa et al. found that in older people aged 60 years or over, poor mobility, as indicated by TUG > 20 seconds, was associated with reduced lumbar spine and femur neck BMD, and was strongly related to increased 10-year fracture risk of both hip and major/ fragility osteoporotic fractures.[8]

The study found a significant relationship between age and mobility, which is poor TUG test performance increasing with age. Moreover, the age group of ≥ 80 years old had an increased in the possibility of poor mobility 3.3 times. The findings corroborate the result of the previous study and indicate that older people perform poor mobility as age advances.[11] Our study results were comparable with the results of a previous study in which BMI and gender did not show any influence on TUG performance.

TUG performance requires various mobility skills of sit-to-stand, straight-ahead gait, and turning, and uses more information processing than other mobility tests. Besides, diabetes patients may experience changes in sensory functions, which may play a critical role in balance control and the decline in strength of knee and ankle muscles. Kraiwong et al. discovered that older adults with type II diabetes, whether they had sensory impairment or not, performed worse on the TUG than those without diabetes.[12] Our study found that diabetes increased the risk of impaired mobility in older adults with osteoporosis 3.0 times. In addition, the prevalence of impaired mobility performance was 3.5 times higher in patients with knee osteoarthritis. This finding is in agreement by knee osteoarthritis as a joint disorder with predominant symptoms including knee pain that is gradual in onset and worsens with activity, knee stiffness, and loss of muscular strength of the lower extremity muscles. As a result, it limits valued physical activities and causes difficulty with mobility and functional disability.

Decreased bone mass in older individuals may cause progressive micro-fracture, which may lead to vertebral height loss and spine deformities. In our study, osteoporosis patients experiencing loss of height were associated with impaired mobility. Although spine malformation reduces the range of motion and affects flexibility and balance stability, there is no significant association with the TUG test. We also note that there was no significant difference between diagnosed duration, treatment, and bone mineral density with impaired mobility.

The older osteoporosis patients with frailty syndrome had a significantly higher prevalence of impaired mobility than those without frailty syndrome. Frailty syndrome raised the risk of

impaired mobility 3.7 times, 95%CI 1.4 – 9.8. It is supported by a previous study that the TUG test was strongly associated with frailty status in older adults and frailty according to Fried's criteria was associated with mobility impairment.[13]

Low physical activity levels increased the prevalence of impaired mobility 3.5 times in those patients with moderate or high physical activity levels. It was consistent with previous studies that high physical activity levels are associated with greater functional capacity in the older.[14]

Older adults with osteoporosis with high risks for falls can produce avoidant strategies such as using excessive caution when getting around or avoiding activities that can harm conditioning and mobility. Our study identified that a high risk of falls was associated with an increased likelihood of mobility impairment with OR=3.0. It is not surprising because the TUG test was used to predict the risk of falls.

## V. CONCLUSIONS

One in five older osteoporosis patients has impaired mobility. Our results highlighted that advanced age, knee osteoarthritis, diabetes, and geriatric syndromes such as frailty, low physical activity level, and high risk of falls were significantly associated with mobility in older patients with osteoporosis.

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