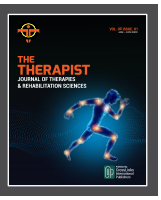
**DOI:** https://doi.org/10.54393/tt.v5i01.186

THE THERAPIST
JOURNAL OF THERAPIES & REHABILITATION SCIENCES
https://thetherapist.com.pk/index.php/tt
ISSN (P): 2790-7406, (E): 2790-7414
Volume 5, Issue 1(Jan-Mar 2024)



**Original Article**

# Assessment of Fall Risk and its Association with Frailty among Elderly

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## ARTICLE INFO

***Key Words:***
Frailty, Elderly Care, Fall Risk, Functional Mobility, Berg Balance Scale, Sit to Stand Test Graph, Functional Reach Test Graph

***How to Cite:***
Nisar, A., Saleem, M., Raza, M. H., Riaz, H., Amjad, F., Arshad, A., Asim, H. A. B., Arslan, M., & Khalid, A. (2024). Assessment of Fall Risk and its Association with Frailty among Elderly : Fall Risk and its Association with Frailty. THE THERAPIST (Journal of Therapies &Amp; Rehabilitation Sciences), 5(01). https://doi.org/10.54393/tt.v5i01.186

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Received Date: 2nd January, 2024
Acceptance Date: 17th March, 2024
Published Date: 31st March, 2024

## ABSTRACT

Falls are a major public health concern about 10% of falls result in serious injuries like traumatic brain injury. Falls can cause poor quality of life and financial costs for both individuals and society. Early detection of who are at high risk of falling makes it easier to provide rehabilitation therapy in the future. **Objectives:** To assess functional mobility, fall risk and its association with frailty among elderly. **Methods:** This cross-sectional study design comprised 90 male / female elderly patients ages 65 to 75. Subjects with limb amputation history, cognitive impairment and ICU status were excluded. Data were gathered from DHQ Kasur andAriz Memorial Hospital. Non-probability convenience sampling was applied. Ethical approval was obtained from institute before conducting research study ran July 2022 to December 2022.Evaluation tools included Berg Balance Scale, Elderly Mobility Scale, Functional Reach Test, and FRAIL Scale. SPSS version 25.0 used to analyze data. Frequencies, percentages, cross tabulations, bar charts, and pie charts were used to display the categorical variables. **Results:** Frailty and fall risk are significantly correlated, with a p-value of less than < 0.001. Mobility and Frailty had significant relationship (p< 0.001). There was significant association between Frailty and balance dysfunction with (p<0.001). There was significant association between Frailty and fall risk with (p<0.001). **Conclusions:** Results suggested that frail elderly were at higher risk of fall and their functional mobility is more compromised as compared to non-frail.

## INTRODUCTION

Frailty is defined as a clinically recognizable state of increased vulnerability, resulting from aging-associated decline in reserve and function across multiple physiologic systems such that the ability to cope with everyday or acute stressors is compromised [1]. Frailty a fairly common biological syndrome in the elderly is identified by decreased reserves in multiple organ systems. It may be initiated by disease, lack of activity, inadequate nutritional intake or physiologic changes of aging. Frailty develops slowly in a stepwise process, manifested as loss of skeletal muscle mass(sarcopenia)[2, 3]. Abnormal neuroendocrine systems and poor energy regulation [4]. Multiple factors are epidemiologically identified with frailty include old age ,female, low socioeconomic status, comorbidities or disability [5]. Falling is one of the most prevalent and hazardous ailments that affect the elderly [6, 7]. Sarcopenia plays a major role in the development of frailty. Age-related changes in alpha motor neurons, type I muscle fibers, muscular muscle atrophy or inadequate levels of vitamin D have all been linked to sarcopenia and the

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subsequent emergence of frailty [5]. It is associated with an elevated likelihood of falls, less autonomy in the elderly and institutionalization with unfavorable health consequences [8, 9]. Clinical indicators of frailty include decreased body mass index, osteoporosis, sarcopenia, inactivity , impaired balance or altered nutritional status. As a result frailty maintains a high risk of restricted daily activities, cardiovascular disease, carcinomas, falls, impaired balance, and a higher probability of hospitalization and fatality [5, 8, 10]. Every year, between 20 and 30 percent of people who are sixty years of age or older may experience a fall. The community's senior residents may experience 0.7 falls year, ranging from 0.2 to 1.6 [11]. According to previous investigations, one of the primary impacts of frailty is falling. In older persons, frailty and pre-frailty constitute significant predictors of falls, with pre-frail people having a 1.36 higher likelihood of falling.Based on existing knowledge, frailty has been linked to older people' motor function and fall risk. Clinicians who handle older individuals are aware of this decline [11]. Older adults are more likely to experience frailty syndrome and fall at a higher probability [12].

The primary goal of the current study was to bridge the knowledge gap in the literature by evaluating fall risk, mobility and the relationship between these factors and frailty in the elderly.

## METHODS

A cross-sectional study was carried out using non-probability convenience sampling. The sample size was calculated using the Fisher's formula shown below.

$$n = \frac{Z^2 p(1 - p)}{d^2}$$

where

p = expected prevalence or proportion

n= sample size

d= precision(if the precision is 7% then d=0.07)

z= z statistic for a level of significance 95% is equal to 0.95

Prevalence was 12.7% with the level of significance 0.07 the sample size was 86. Both frail and non-frail patients in the outpatient department of physical therapy, as well as patients admitted to the medical ward between the ages of 65 and 75 were included. Data were collected after ethical approval from Ariz Memorial Hospital and DHQ Hospital Kasur with reference number IRB/2023/085, dated February 21, 2023. Study ran from July 2022 to December 2022. Patients with the history of limb amputation, cognitive impairment, patients on wheel chair and in ICU were excluded. Subjects signed consent form before starting the test protocols. The Berg Balance Scale, Elderly Mobility Scale, Functional Reach Test, and FRAIL Scale were all the assessment tools utilized. There were five simple inquiries on the FRAIL scale .People were categorized as robust (0 points), pre-frail (1 to 2 points), or frail (3 points) based on their score, which spanned from 0 to 5. Participants were asked if they felt tired most of the time or weight decrease between previous six months of 5% or more [13]. Functional Reach Test was designed to determine dynamic balance in a single, easy exercise. The reach distance, which is typically measured in inches, was assessed to establish the score difference between the start and finish positions. The mean of the final two trials was recorded when three trials were completed.10" or 25 cm or more Minimal fall risk: 6"/15cm to 10"/25cm. Fall risk was two times higher than average; 6"/15cm or less Fall risk was four times higher than usual;hesitant to make contact Fall risk was eight times higher than average [14]. 5-Times Sit to Stand Test was used to evaluate an older adult's functional lower extremity resilience, transitional motions, balance, and risk of falling. With their arms crossed over their chest and their back resting against a chair, the patient was first sitting. For the patient's safety, the therapist stood by them and provided the necessary protection. Patient were instructed as follows: "When I say 'Go,' get up and sit down as fast as you can five times in a succession. Every time you perform a rep, strive to stand up straight and avoid touching the backrest when you sit" [15]. Health practitioners, such as physical therapists, utilize the elderly mobility scale (EMS), a validated examination, to evaluate the degree of mobility in elderly people. To assess if physical treatment or an exercise regimen had improved the mobility of elderly patients who were fragile, EMS was employed [16]. A patient's ability (or incapacity) to balance securely during a series of specified activities is assessed objectively using the Berg Balance Scale. It took around 20 minutes to finish the list of 14 items, each of which had a five-point ordinal scale with 0 representing the lowest degree of function and 4 representing the maximum level. It excluded the evaluation of gait [17]. Quantitative variables were presented using mean, standard deviation, range,chi square and histograms in the analysis of the data was conducted with SPSS version 25.

## RESULTS

Out of total 90 participants, 44 were female and 46 were male. According to frail scale, out of 90 participants, 45 were non-frail and 45 were frail .To assess fall risk and functional mobility berg balance scale, elderly mobility scale, 5 time sit to stand test or functional reach test were applied on both frail and non-frail elderly. Out of 90 participants, 45 were at high fall risk 5 were at medium fall risk and 40 were at low fall risk. According to elderly mobility scale, out of 90 participants, 46 were dependent, 3 were at borderline, 41 were independent.There was a

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significant association between frailty and fall risk with p-value < 0.001. There was significant association between Frailty and mobility with p-value < 0.001.There was significant association between Frailty and balance dysfunction with p-value < 0.001. There was significant association between Frailty and fall risk with p value < 0.001. As shown in table 1, out of 90 participants, 45(50%) were non-frail elders and 45(50%)were frail elders.

**Table 1:** Frail and Non- frail Elders

| Frailty | Frequency (%) |
|---|---|
| **Non- frail Elders** | 45 (50) |
| **Frail elders** | 45 (50) |
| **Total** | 90 (100) |

According to Berg Balance Scale Analysis, out of 90 participants, 45 (50%) were at high risk of fall, 5 (5.56%) were are at moderate risk of fall and 40 (44.44%) were at low risk of fall (Figure 1).

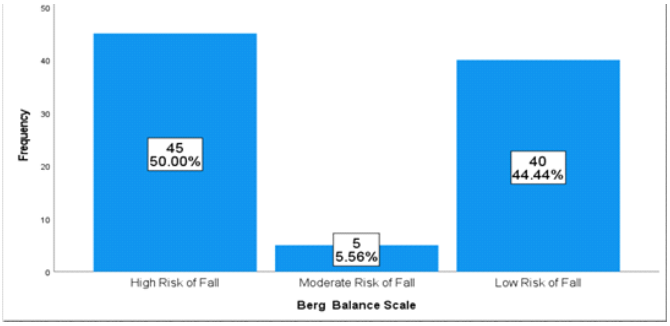


**Figure 1:** Berg Balance Scale Graph

Elderly Mobility Scale (EMS) showed that out of 90 participants 46 (51.1%) were dependent, 3 (3.3%) were at borderline and 41(45.6%)were independent (Table 2).

**Table 2:** Elderly Mobility Scale (EMS)

| EMS | Frequency (%) |
|---|---|
| **Dependent** | 46 (51.1) |
| **Borderline** | 3 (3.3) |
| **Independent** | 41 (45.6) |
| **Total** | 90 (100) |

The results of 5-times sit to stand test showed that out of 90 participants, 40 (44.44%) were normal and 50 (55.56%) were with balance dysfunction (Figure 2).

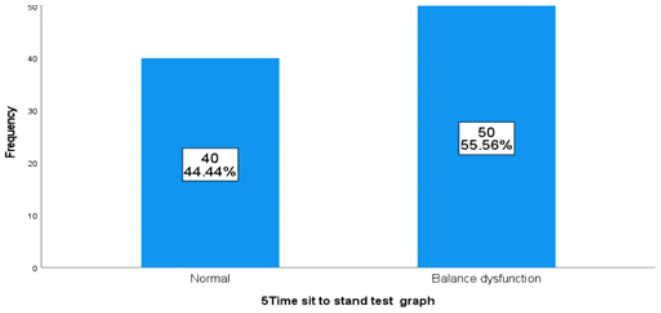


**Figure 2:** 5-Times Sit to Stand Test Graph

According to the findings of functional reach test, out of 90 participants, 45(50%) were at high fall risk, 2(22.2%) were at moderate fall risk, and 43(47.78%) were at low fall risk (Figure 3).

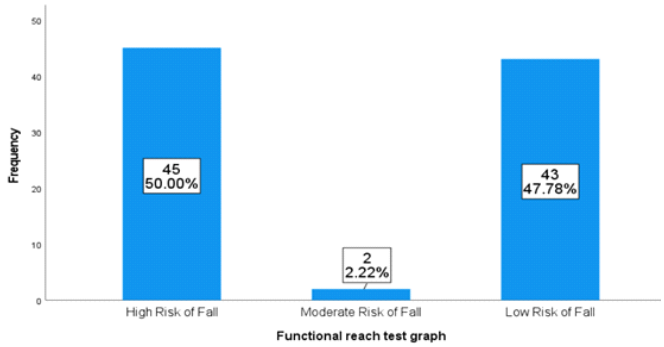


**Figure 3:** Functional Reach Test Graph

Association between Frailty and Berg Balance Scale using chi square showed Pearson chi-square value (90.000) and Likelihood Ratio (124.766).There was significant association between frailty and fall risk with (p-value < 0.001)(Table 3).

**Table 3:** Association between Frailty* Berg Balance Scale (Cross tabulation)using Chi Square Test.

| Frailty | | Berg Balance scale graph | | | Total |
|---|---|---|---|---|---|
| | | High Risk of Fall | Moderate Risk of Fall | Low Risk of Fall | |
| **Non-Frail elders** | **Count** | 0 | 5 | 40 | 45 |
| | **% within Frailty** | 0.0% | 11.1% | 88.9% | 100.0 % |
| **Frail elders** | **Count** | 45 | 0 | 0 | 45 |
| | **% within Frailty** | 100.0% | 0.0% | 0.0% | 100.0 % |
| **Total** | **Count** | 45 | 5 | 40 | 90 |
| | **% within Frailty** | 50.0% | 5.6% | 44.4% | 100.0 % |
| **Chi Square Test** | | | | | |
| | | **Value** | | **p-value** | |
| **Pearson Chi-Square** | | 90.000[a] | | <.001 *** | |
| **Likelihood Ratio** | | 124.766 | | <.001*** | |

Association between Frailty and elderly mobility scale using chi square showed Pearson chi-square value (86.087) and Likelihood Ratio (115.131). There was a significant association between frailty and fall risk with (p-value < 0.0010)(Table 4).

**DOI:** https://doi.org/10.54393/tt.v5i01.186

**Table 4:** Association between Frailty* Elderly Mobility Scale (Cross tabulation) using Chi Square Test

| Frailty | | Elderly Mobility Scale | | | Total |
|---|---|---|---|---|---|
| | | Dependent | Borderline | Independent | |
| Non-Frail elders | Count | 1 | 3 | 41 | 45 |
| | % within Frailty | 2.2% | 6.7% | 91.1% | 100.0 % |
| Frail elders | Count | 45 | 0 | 0 | 45 |
| | % within Frailty | 100.0% | 0.0% | 0.0% | 100.0 % |
| Total | Count | 46 | 3 | 41 | 90 |
| | % within Frailty | 51.1% | 3.3% | 45.6% | 100.0 % |

| Chi Square Test | | |
|---|---|---|
| | Value | p-value |
| Pearson Chi-Square | 86.087 | <.001 *** |
| Likelihood Ratio | 115.131 | <.001*** |

Association between Frailty and 5-times sit to stand test using chi square showed Pearson chi-square value (72.0000) and Likelihood Ratio (92.258).There was a significant association between frailty and fall risk with (p-value < 0.001)(Table 5).

**Table 5:** Association between Frailty * 5-Times Sit to Stand Test (Cross tabulation) using Chi Square Test

| Frailty | | 5-Time sit to stand test graph | | Total |
|---|---|---|---|---|
| | | Normal | Balance dysfunction | |
| Non-Frail elders | Count | 40 | 5 | 45 |
| | % within Frailty | 88.9% | 11.1% | 100.0 % |
| Frail elders | Count | 0 | 45 | 45 |
| | % within Frailty | 0.0% | 100.0% | 100.0 % |
| Total | Count | 40 | 50 | 90 |
| | % within Frailty | 44.4% | 55.6% | 100.0 % |

| Chi Square Test | | |
|---|---|---|
| | Value | p-value |
| Pearson Chi-Square | 72.000 | <.001 *** |
| Likelihood Ratio | 92.258 | <.001*** |

Association between Frailty and functional reach test using chi square showed Pearson chi-square value (90.0000) and Likelihood Ratio (124.766).There was significant association between frailty and fall risk with p-value (< 0.001)(Table 6).

**Table 6:** Association between Frailty* Functional Reach Test (Cross tabulation) using Chi Square Test.

| Frailty | | Functional reach test | | | Total |
|---|---|---|---|---|---|
| | | High Risk of Fall | Moderate Risk of Fall | Low Risk of Fall | |
| Non-Frail elders | Count | 0 | 2 | 43 | 45 |
| | % within Frailty | 0.0% | 4.4% | 95.6% | 100.0 % |
| Frail elders | Count | 45 | 0 | 0 | 45 |
| | % within Frailty | 100.0% | 0.0% | 0.0% | 100.0 % |
| Total | Count | 45 | 2 | 43 | 90 |
| | % within Frailty | 50.0% | 2.2% | 47.8% | 100.0 % |

| Chi Square Test | | |
|---|---|---|
| | Value | p-value |
| Pearson Chi-Square | 90.000 | <.001 *** |
| Likelihood Ratio | 124.766 | <.001*** |

## DISCUSSION

The current research revealed that, in comparison to elderly individuals who are not frail, frail elderly individuals have a higher risk of falling and have decreased functional mobility.The fall frequency in the United States for individuals 65 years of age and older fluctuated between 28.2-36.3% [18]. Because of aging-related biological changes and an increase in life expectancy, there has been a significant rise in the frequency of falls. This WHO statement is supported by the research's findings, which show that, among the 19 studies reviewed, a prospective longitudinal study involving 315 senior individuals from 11 towns across three counties in Sweden had the greatest prevalence of falls. 93% of the participants fell, and 58.8% of them were fragile, according to the data, which were consistent with recent study [3, 11]. Falls are considered indicators of functional decline and markers of frailty [19]. Conversely, it was noted that the frequency of falls varied between 8.2% and 93.0% [3, 20]. According to Kashikar and Nagarkar, 26% of Indians are frail (pre-frail: 63.6%; non-frail: 10.4%) [21]. Although Ali et al., discovered frailty in 55.4% of Pakistani elder adult (Intermediate fragile – 44.6%), these results were consistent with recent studies [22]. Frailty was prevalent in 46.2% of males and 46.1% of women in Nepal and 15.2% of pre-frail people in 48.5% of Sri Lanka [23, 24]. Premature death is more likely to occur in frail elderly persons [25]. All SF-36 subgroups with the lowest scores were those of a study by Azeynel et al., on frail patients. According to the Hendrich II Fall Risk Model, 337 (80.2%) patients were classified as high-risk, while 83 (19.8%) patients were classified as low-risk. In the fragile category, the proportion of patients with low quality of life and a significant fall risk peaked at 96%. Among senior hospital patients, frailty is a significant geriatric syndrome. Frailty is frequently accompanied with low quality of life and an increased risk of falling [26]. A prospective cohort research nested inside a RCT was carried out to investigate the relationships between frailty and future falls with short-term incidents in older adults living in the community. For a period of 24 weeks, 248 community-dwelling individuals over 65 who had never experienced more than three falls and were assigned to the usual care arm of an exercise intervention study were prospectively followed for falls. 46 of the 248 individuals were deemed fragile, and 57 of them fell at least once while being monitored. Fallers were categorized as frail (19/57, 33.3%) compared to non-fallers (27/191, 14.1%), and fallers had a

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higher mean FI (0.21) compared to non-fallers (0.14). These outcomes aligned with recent research demonstrating a substantial correlation (p 0.001) between fall risk and frailty [27]. According to a study done in 2021 by Petermann-Rocha et al., frailty was present in 92.1% of patients with sarcopenia or cachexia and had the greatest prevalence (45%). People with frailty alone and frailty plus sarcopenia showed higher all-cause death rates compared to those without any conditions; these findings were consistent with current study [28].The result of this research is that there is a significant relationship between the functional quality and the frailty phenotype in terms of both appendicular skeletal muscle mass. Frailty should thus be considered in routine geriatric examinations.

## CONCLUSIONS

The result suggested that frail elderly were at greater risk of fall and their functional mobility is more compromised as compared to non-frail elderly. Frailty and fall risk are significantly correlated there is significant association between Frailty and balance dysfunction .By recognizing the synergistic impact of frailty on fall risk healthcare professionals can implement proactive measures to enhance the well-being and quality of life for the elderly ultimately promoting healthy aging and independence.

## Authors Contribution

Conceptualization: AN, AK
Methodology: AN, FA
Formal analysis: HR, AA
Writing-review and editing: AN, MA, MS, MHR, HABA

All authors have read and agreed to the published version of the manuscript.

## Conflicts of Interest

The authors declare no conflict of interest.

## Source of Funding

The authors received no financial support for the research, authorship and/or publication of this article.

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