



## Original Article

### Factors Associated with Risk of Fall in Elderly Population

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#### ABSTRACT

**Background:** Fall-related injuries and complications are common in the elderly population. Falls can be induced by a variety of internal or extrinsic circumstances. In Pakistan, awareness about the risk factors associated with falls in the elderly population might be a great step in saving the expenses leading to the treatment of the elderly population. **Objective:** To determine the factors associated with fall risk in the elderly population. **Methods:** After taking approval from the ethical committee of the university, this cross-sectional study based on a research survey that included subjects above 60 years of age was conducted. Local Pakistani regions like Islamabad and Rawalpindi were included in the community. Individuals with neurological deficiencies or comorbid conditions, a history of falls, fractures or any surgery were excluded from the study. A sample size of 184 older participants was recruited in this study using non-probability convenient sampling. The self-structured questionnaire was used asking the older population about their age, previous history of falls and fears concerning falls while the outcome measuring scales used were the activities-specific balance confidence scale and the Berg balance scale. **Results:** Out of 184, there were 108 (55.97%) men and 81 (44.02%) women. The mean age was  $69.76 \pm 8.5$ , with a minimum age of 60 and a maximum age of 108. When assessed using an activities-specific balance confidence scale, surgical history, medical history, incidents due to falls, and previous episodes of fall show a significant association with a minimum score of 15.12 and a maximum score of 99.30 with a mean of  $68.83 \pm 24.39$ . On the contrary, medical history, history of fall injuries due to falls, and p-value less than 0.05 are significant factors when assessed using the Berg balance scale with a minimum score of 9 and a maximum score of

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56 with a mean of  $43.57 \pm 12.3$ . **Conclusion:** Elderly Females are at greater risk of falls while physical inactivity is another factor that leads to falling. There is no link between systemic, respiratory, or cardiac history and fall risk but problems in the vestibular system concerning the inner ear which controls balance are associated with falls in the elderly population.

## INTRODUCTION

Age is an ongoing process that commences at birth and progresses with the length of our life.<sup>1,2</sup> In recent years, 60 years or more has been regarded as the chronological age in developed countries, according to the United Nations as the average age has decreased over the centuries.<sup>3</sup> Schwartz has also discussed the increasing age based on functional abilities and he claimed that human functional abilities gradually deteriorate with age.<sup>4,5</sup> Due to unidentified illnesses and wars, the average age fell in the 19th century and 40 years were regarded as old age. However, more recently, longevity has substantially grown.<sup>2</sup> The percentage of older persons aged 65 and above increased over the past 25 years, from 15% in 1983 to 16% in 2008, according to the United States office of national statistics, an increase of 1.5 million people.<sup>5</sup>

People who are 16 years old or younger fell from 21 to 19% in the same period. This trend is predicted to continue, and by 2033, elderly people will make up 23% of the population, compared to younger people, who will make up 18%.<sup>6</sup> This increase in the elderly population is happening in many emerging nations at a time when both demographic and socioeconomic changes are being felt there.<sup>7</sup> Rowe and Kahn categorized aging into two distinct categories based on changes in physiological mechanisms with advancing age.<sup>8</sup> Due to several variables, such as

depression, chronic illnesses, inactivity, hunger and other socio-economic issues, Pakistan's chronological aging process begins earlier than it would elsewhere.<sup>9-11</sup>

Inactivity reduces the dietary demands of the aged, as well as metabolic activity, which affects all organ systems in general.<sup>12,13</sup> With aging, organ function decline produces a variety of illnesses and impairments. It also impairs self-control, coordination, and balance among bodily parts and activities, which leads to injuries and accidents.<sup>14-16</sup> Typical aging is associated with declines in all physiological frameworks, including muscle instability, heart issues, eyesight problems, coordination, impaired postural responses and cerebral impairments, all of which have been shown to increase the chance of falls in older population.<sup>17</sup> Berg et al. defined a fall as "any situation in which an individual loses equilibrium to the point that their body makes contact with the floor".<sup>18</sup>

Despite widespread prevention efforts, falls are the leading cause of morbidity in the elderly.<sup>19</sup> Falls can cause hip fractures, extended hospitalizations, paralysis and even death.<sup>10</sup> Even if no significant damage occurs, the ensuing dread of falls and self-inflicted mobility constraints can be contributing causes to reliance and admissions to supervised care.<sup>20</sup> The risk of falls increases with age.<sup>21</sup> New data reveals that falls are the leading cause of spinal disorders in the elderly, however, even when there is no major injury, falls affect their quality of life. This undermines their confidence and impedes their future mobility.<sup>22</sup>

Falls can be induced by a variety of internal or extrinsic circumstances, although their etiology is quite complicated. Gait dysfunction, lower limb muscular disorders, poor grip strength, instability, eyesight

problems and mental health issues are just a few examples of intrinsic variables.<sup>23</sup> Falls may also be caused by external causes such as using numerous dementia medications, experiencing bronchodilator adverse effects, or abusing benzodiazepines.<sup>23,24</sup> Nevertheless, a third to a half of all injurious fall incidents or falls in older individuals have been attributed to the home environment.<sup>25,26</sup>

According to estimates, accidents are the seventh most common cause of mortality in older people.<sup>22</sup> Every year, one in three older persons, who are 65 years of age or older fall. In 80 years, this decline rate rises to one out of two.<sup>27</sup> After their initial fall, approximately 50% of such older persons encounter numerous incidents of falling each year and 20–30% of them get moderate to serious injuries.<sup>28</sup>

According to a study conducted in the USA, Medicare spending for older members increases dramatically as a result of fall-related injuries (FRI). On a worldwide scale, the estimated cost of an FRI was \$9,389 (95 percent confidence interval: \$5,969-\$12,808), while the expected cost of Medicare claims from 2007 to 2009 was \$13 billion (95 percent confidence interval: \$9-\$18 billion).<sup>29</sup> This study was conducted to find out the factors associated with the risk of falls in older adults.

Falls are a great source of the healthcare burden and can be fatal as well. This study intends to provide light on the elements that raise an older adult's risk of falling. This would make it easier for us to identify the causes of falls and the many consequences they might cause. Its objectives center on lowering the number of falls among the elderly population will lessen fall-related injuries and other consequences. This would make it easier to point out the areas and lifestyles that are problematic and serve as

guidance for changing habits, a way of life, and the surroundings in which we live including our homes, places of employment, and social contexts leading to better adaptations.

In Pakistan, awareness about the risk factors associated with falls in the elderly population might be a great step in saving the expenses leading to the treatment of the elderly population, especially concerning the poor class of the country who definitely cannot afford expensive treatments after severe injuries resulting from falls in the elderly population.

## METHODS

After taking approval from the ethical committee of the university, this cross-sectional study based on a research survey that included subjects above 60 years of age was conducted. Local Pakistani regions like Islamabad and Rawalpindi were included in the community. Individuals with neurological deficiencies or comorbid conditions, a history of falls, fractures or any surgery were excluded from the study. Out of the 20,000 people who live in Islamabad and Rawalpindi, "Rao Soft" computed a sample size of 184 elderly persons with a 95% confidence interval and a 5% probability of error, using non-probability convenient sampling.

Self-structured questionnaires were used to obtain the data that included demographics, general health, medical and family history and were filled by asking the older population about their previous history of falls and fears concerning falls. The Berg balance scale and activities-specific balance confidence scale were used to assess the risk of falling. Before data collection, both verbal and written consent was obtained. All questionnaire components were thoroughly presented to the

individuals in their native language while considering the ethical concerns.

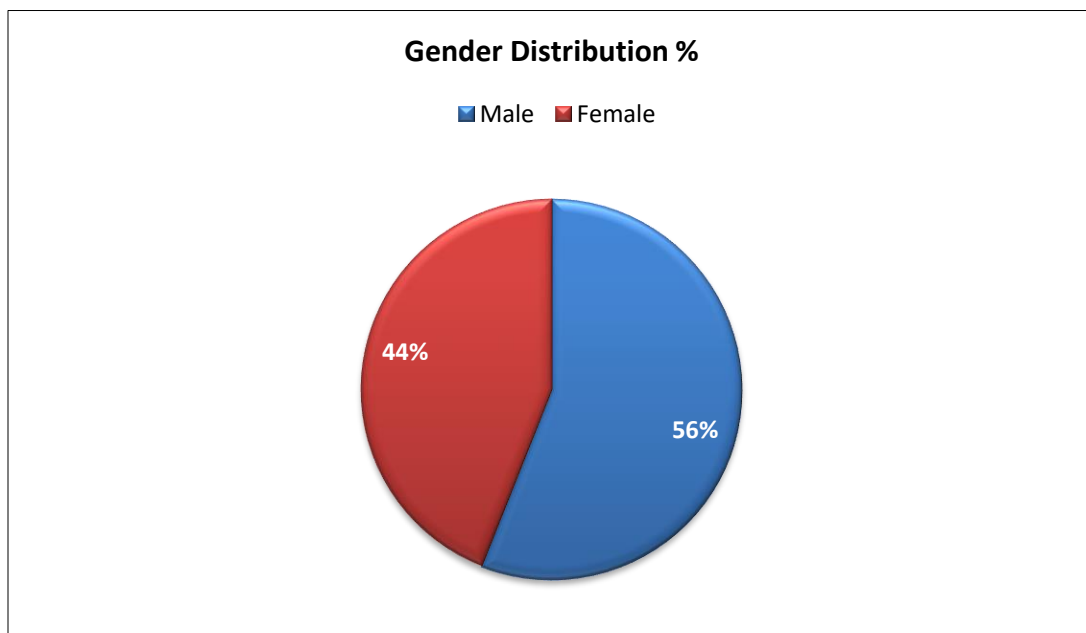
## RESULTS

Figure I showed that out of 184 older persons, 103 (55.97%) were men and 81 (44.02%) were women. Participants aged between 60 to 108 years old ( $69.76 \pm 8.5$ ) as shown in the

table according to the activities-specific balance confidence scale. For performing activities, 46 individuals reported low confidence, 54 had moderate confidence and 81 had high confidence. According to the Berg balance scale (BBS), 15 older persons were at high risk of falling, 40 were at moderate risk, and 129 were at low risk.

**Table I:** Mean and Standard Deviation of Age, Activities Specific Balance Confidence and Berg Balance Scale

Variables	Mean $\pm$ S.D
Age	69.76 $\pm$ 8.5
Activities Specific Balance Confidence Scale	68.83 $\pm$ 24.39
Berg Balance Scale	43.57 $\pm$ 12.3



**Figure I:** Frequency Distribution of Gender

**Table II: Frequency and Percentage of Injuries due to Fall, Surgical Medical Systemic Histories and History of Fall**

	Items	Frequency	Percentage
<b>Surgical history</b>	Cardiac	21	11.4
	Orthopedic	14	7.6
	Gastrointestinal	13	7.1
	Others	10	5.4
	None	126	68.5
<b>Medical history</b>	Cardiac	43	23.4
	Orthopedic	6	3.3
	Gastrointestinal	12	6.5
	Others	55	29.9
	None	68	37
<b>Systemic history</b>	Cardiac	48	26.1
	Gastrointestinal	16	8.7
	Dizziness/Light	12	6.5
	Headedness	12	6.5
	Respiratory	25	13.6
	Musculoskeletal	54	29.3
<b>History of fall</b>	Present	56	30.4
	Absent	128	69.6
<b>Injuries due to fall</b>	Fractures	14	7.6
	Soft Tissue Injuries	7	3.8
	Joint Dislocation	10	5.4
	Skin Laceration/Bruises	12	6.5
		141	76.6

The cross-tab association between gender and activities-specific balance confidence scale revealed that 9% of men and 15% of women had low confidence, 14% of men and 15% of women have moderate confidence, and 31% of men and 13% of women had high confidence in performing the activities depicted in figure II. Elderly men tend to be more confident while performing activities while elderly females were less confident and reported to have more fear of falling than men.

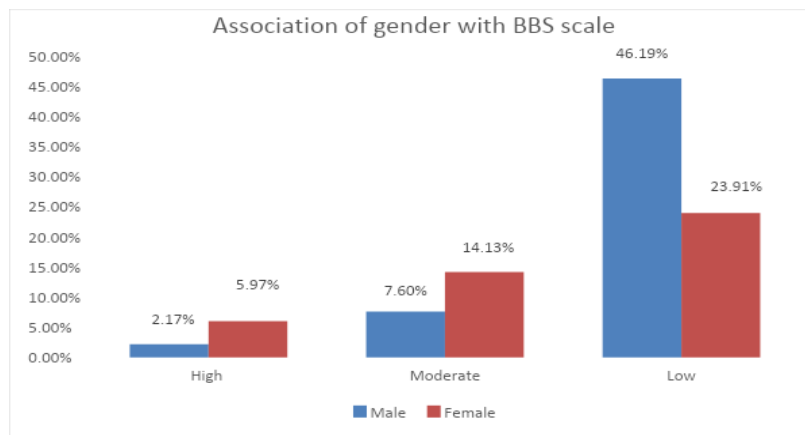
As shown in figure III, the association between gender and BBS revealed that 46% of

men and 23% of women had low fall risk, 7% of men and 24% of women had moderate fall risk, and 2% of men and 5% of women had high fall risk. Since this current study included only the elderly population it was obvious to have a low BBS score owing to their age. Cross-tabulation of surgical history and the BBS revealed that 8% of patients had a high risk of falling, 21% moderate risk, and a 70% low chance of falling.

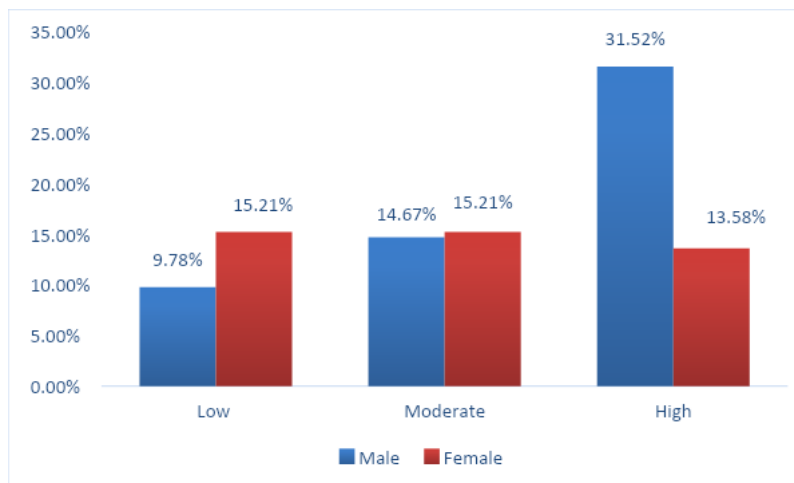
The cross-tabulation of surgical history and the activities-specific balance confidence scale showed that 25% of people had low, 29% medium, and 45% high confidence levels for

carrying out daily activities. In a cross-tabulation of medical history and BBS, the risk of falling was shown to be 8% high risk, 21% moderate, and 71% low risk. According to the cross-tabulation of medical history and the activities-specific balance confidence scale, 25% had low, 29% medium, and 45% had high chances of falling. Cross-tabulation of the BBS and systemic issues revealed that 21% had moderate and 8% had high scores.

According to a cross-tabulation between the systemic and activities-specific balance confidence scale, 25% of people had low, 29% moderate, and 45% high fall risk. Cross tabulation of the history of falls and the activities-specific balance confidence scale revealed a 25% low level of confidence, 29% medium level and 45% high level.



**Figure II:** Association of Gender with Berg Balance Scale



**Figure III:** Association of Gender with Activities Specific Balance Confidence Scale

confidence scale, 25% of people had low, 29% moderate, and 45% high fall risk. Cross tabulation of the history of falls and the activities-specific balance confidence scale revealed a 25% low level of confidence, 29% medium level and 45% high level.

Cross-tabulation of the activities-specific balance confidence with fall history revealed that there was an 8% high, 7% moderate, and 70% low risk of falling. Cross-tabulation of fall-related injuries and the BBS revealed that 8% of cases had a high risk of injury, 21% moderate risk and 70% had a high likelihood of falling. According to a cross-tabulation of fall-related injuries and the activities-specific balance confidence scale, 25% of people had high, 29% moderate, and 45% low levels of activity confidence.

## DISCUSSION

Evidence on the causes of falls in the elderly is less and not easily accessible. According to a few studies, there were a variety of factors that can affect fall risk in the elderly. By gauging their level of activity, data was collected from the elderly population in Islamabad and Rawalpindi. Findings indicated that men are more likely to fall than women, as those who used medications, had a history of falls, engaged in less physical activity and used walking aids. In individuals with cardiac, respiratory, vision or hearing issues, it was not significant.

When comparing this study to other studies, it was discovered that some of the contributing factors for falls are similar. (Table II) According to Chang et al.,<sup>30</sup> less physical activity increases the risk of falling, which endorses our findings. An older adults with a low level of physical activity, both males and females, has a higher or lower risk of falling. These conclusions coincide with the findings

of this current study as well. Tinetti ME et al.<sup>31</sup> reported that medications have a significant relationship with falling, which is similar to our findings. Gale R and co-workers<sup>32</sup> determined that females had a higher risk of falling than males and when compared to our findings, this does support our study.

Kathryn M Sibley and co-workers<sup>33</sup> conducted a study to determine whether chronic diseases and falls are associated with community-dwelling Canadians or not. Their study was a population-based study that tend to explore the association with numbers and patterns of various chronic conditions. They concluded that both the number and pattern of chronic conditions were associated with falls. This current study also suggests that chronic and prolonged diseases are somehow contributing factors to the risk of falls. Both studies suggest that further research is required to verify this association and to find out how to integrate consideration of chronic diseases and multiple co-morbidities into assessments for the risk of falls.

Rebecca J. Kamil and co-workers<sup>34</sup> conducted a study to find out the association of incidents of falls in older adults with hearing impairment. They concluded that hearing impairment is independently associated with the risk of falls in the elderly population with a higher risk of falling over time. Future researchers are recommended on finding out the risk of falling in older persons with hearing problems.

Hearing is connected with the vestibular system which includes the inner ear which is concerned with maintaining the balance and equilibrium of the body. Disorders of the inner ear which controls the balance of our body might be the leading cause of falls in the elderly population. This current study also

suggests that the elderly population who already suffers from balance issues nevertheless are at higher risk to fall with a higher percentage of injury than the population of elder adults who do not suffer from any balance issues. Barry E et al. conducted a study on falls and discovered that a history of falls and the use of medications are the main reasons for the risk of falling.<sup>35</sup>

The current study also agreed with the fact that a history of previous falls is one of the main risk factors for falls. Kvelde et al.<sup>36</sup> investigated persistent disorders and fall risk and their findings revealed that chronic obstructive pulmonary disorder and high blood pressure are major risk factors for falling, while in our study respiratory and cardiac problems are less significant ( $p>0.05$ ). This current study showed that elderly people suffering from respiratory and cardiac disorders had a lower risk of fall.

They concluded that treating the depressive symptoms with non-pharmacological approaches must be included as a part of all fall prevention plans especially while considering risk of falls in elderly population. This coincides with our study who also suggests to focus on planning non-pharmacological plans for treatment and to prevent falls in elderly population. If all the risk factors that lead to falls in the elderly population are properly evaluated, then precautionary measures can be incorporated into the regime to avoid and prevent conditions leading to chronic and severe injuries in the elderly population.

Future researchers are recommended to carry out studies concerning the risk factors associated with the elderly population to focus on preventing the risk factors at their initial stages. Problems in the vestibular system concerning the inner ear which controls

balance are associated with falls in the elderly population, so researchers are highly recommended to conduct a study focusing on the association of problems in the inner ears as a source of risk of falls in the elderly population. Conducting a study on a larger sample size of the elderly population would also diversify the results. Prevalence and frequency of falls comparing both genders require more insightful research.

## CONCLUSION

Gender has a substantial relationship with the chance of falling. Women were shown to be more at risk of falling than men. There is no link between systemic, respiratory, or cardiac history and fall risk but problems in the vestibular system concerning the inner ear which controls balance are associated with falls in the elderly population. People who had a previous history of falling are at a higher risk of falling.

## DECLARATIONS

**Consent to participate:** Written consent had been taken from patients. All methods were performed following the relevant guidelines and regulations.

**Availability of data and materials:** Data will be available on request. The corresponding author will submit all dataset files.

**Competing interests:** None

**Funding:** No funding source is involved.

**Authors' contributions:** All authors read and approved the final manuscript.

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