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(*) Corresponding author

Original research article

DOI: <https://doi.org/10.20544/uklop.2026.639>

Received: 12.11.2025 • Accepted after revision: 04.01.2026 • Published: 10.05.2026



#UKLO
Annual International
Scientific Conference

CORRELATION BETWEEN FUNCTIONAL ABILITY AND FALL RISK AMONG INSTITUTIONALIZED ELDERLY RESIDENTS

Viktorija Prodanovska – Stojchevska*

University “St. Kliment Ohridski” - Bitola, Higher Medical School - Bitola

ORCID: <https://orcid.org/0009-0009-3488-1727>

viktorija.stojchevska@uklo.edu.mk

Tanja Jovanovska

University “St. Kliment Ohridski” - Bitola, Higher Medical School - Bitola

ORCID: <https://orcid.org/0009-0009-6316-0769>

tanja.jovanovska@uklo.edu.mk

Izabela Filov

University “St. Kliment Ohridski” - Bitola, Higher Medical School - Bitola

ORCID: <https://orcid.org/0000-0003-3526-7007>

izabela.filov@uklo.edu.mk

Denis Arsovski

University “St. Kliment Ohridski” - Bitola, Higher Medical School - Bitola

ORCID: <https://orcid.org/0000-0003-4992-686X>

denis.arsovski@uklo.edu.mk

Angelka Jankulovska

University “St. Kliment Ohridski” - Bitola, Higher Medical School - Bitola

ORCID: <https://orcid.org/0000-0002-4840-0308>

angelka.jankulovska@uklo.edu.mk

Daniela Petkovska

University “St. Kliment Ohridski” - Bitola, Higher Medical School - Bitola

ORCID: <https://orcid.org/0009-0002-9389-7023>

daniela.petkovska@uklo.edu.mk

ABSTRACT

This research examined the relationship between functional ability and fall risk among institutionalized elderly persons. The objective was to determine how levels of independence in activities of daily living measured by the Barthel Index correlate with general functional capacity and vulnerability to falls. A quantitative, cross-sectional design was used including 30 participants from 53 to 89 years from a residential care home in Kravari, North Macedonia. Functional performance was assessed across ten activities of daily life categories, and descriptive and inferential statistics were performed using Pearson correlation, t-test, analysis of variance, and multiple linear regression. Results indicated that 40% of participants had severe dependence, while 26.7% were totally dependent, with a mean Barthel score of 47.83 ± 32.92 . Strong positive correlations were found between total functional independence and subdomains of mobility ($r = 0.927$), transfer ($r = 0.897$), and toileting ($r = 0.861$), all with $p < 0.001$. The regression model found toileting, feeding, and dressing as predictors of independence ($R^2 = 0.891$, $p < 0.001$). These results confirmed that reduced functional ability is associated with increased fall risk and stress the importance of rehabilitation focusing on mobility, postural control, and self-care restoration in institutionalized elderly persons.

Keywords: functional ability; fall risk; Barthel Index; geriatrics; rehabilitation; mobility; independence

INTRODUCTION

Falls represent are of the main causes of morbidity, mortality, and loss of functional capacity among elderly persons, especially those living in institutionalized environments such as nursing homes and palliative care facilities (Vaishya & Vaish, 2020; Neah Albasha et al., 2023). With older age, the interaction between physiological, cognitive, and environmental factors increases vulnerability to falls that result in serious health consequences and reduced quality of life (Trevisan et al., 2021; Nazarko, 2022; Liu et al., 2025). According to the World Health Organization, approximately 28-35% of people of 65 years and more experience at least one falls each year, and this proportion rises to 32-42% for persons over 70 years (WHO, 2008). The prevalence is higher in institutionalized elderly home cares where fragility, multimorbidity, and limitations in mobility are common (Zhang et al., 2024). Functional ability, the capacity to perform activities of daily living independently is a key factor in maintaining autonomy and preventing falls among the elderly (Tornero-Quiñones et al., 2020). Declines in muscle strength, balance, coordination, and sensory function impair postural control that increases fall sensitivity (Wang et al., 2022). Assessing functional ability with standardized instruments offers a deeper comprehension into the physical capacity of the elderly persons and can serve as an early indicator of fall risk (Bassett et al., 2020; Arsovski et al., 2025). Conversely, recurrent falls can cause further functional decline, creating a self-perpetuating cycle of dependency, inactivity, and fear of falling (Chandrasekaran et al., 2021).

Institutionalized elderly residents are vulnerable group due to factors such as advanced age, chronic diseases, medication use, and limited physical activity (dos Reis & de Jesus, 2015). Environmental hazards, insufficient staff-to-patient proportions and inadequate rehabilitation programs also worsen fall risks (Clemson et al., 2019). Accordingly, finding the relationship between functional ability and fall risk is important for developing preventive interventions and rehabilitation strategies that promote safety, independence, and well-being (Hamm et al., 2016).

Previous research demonstrated associations between lower functional performance and increased fall incidence within this population (Smee et al., 2012; Ho et al., 2021; Sun et al., 2024). However, the extent and strength of this correlation vary across populations and assessment tools. Understanding this relationship in residential care environments provides data for healthcare workers, especially physiotherapists, occupational therapists, and geriatric specialists to develop individualized exercise programs, optimize mobility, and implement effective fall-prevention measures. Hence, the aim of this research is to evaluate the correlation between functional ability and fall risk among institutionalized elderly persons. Through recognizing the degree to which physical function predicts fall probability, this research aims to advance evidence-based geriatric care and support the development of interventions to minimize falls and preserve functional independence.

METHODOLOGY

Study design

This research used a quantitative, cross-sectional design with aim to examine the relationship between functional ability and fall risk among institutionalized elderly persons. This research focused on evaluating how levels of independence in activities of daily living as measured by the Barthel Index, correlate with general functional capacity and susceptibility to falls. This design enabled the collection of objective data at a single time point to assess patterns of dependence and functionality within the population.

Setting and participants

The research was conducted in a residential care home for elderly individuals located in Kravari, Bitola, North Macedonia. A total of 30 participants were included in the analysis,

selected through convenience sampling from residents who met inclusion criteria. Inclusion criteria required participants to be aged 50 years or older, have been institutionalized for at least three months, be cognitively capable of participating in the evaluation or have assistance from caregivers when necessary. Exclusion criteria included acute illness, terminal medical conditions, or refusal to participate. The sample consisted of 18 females (60%) and 12 males (40%), with ages ranging from 53 to 89 years (mean = 70.9 ± 9.2 years). The largest age group was between 70-79 years (36.7%), followed by 60-69 years (30%) and 80-89 years (20%).

Instrument

Functional ability was evaluated using the Barthel Index, a standardized and validated scale that measures performance in ten activities of daily living: feeding, bathing, personal hygiene, dressing, defecation, urination, toileting, transfer, mobility, and stair climbing. Each item was scored on a scale reflecting the level of independence: 0 points = complete dependence, intermediate scores = partial assistance required, maximum score per item = full independence. The total possible score ranges from 0 to 100, where higher scores indicate greater independence. Based on established cut-off points, participants were classified as independent (100 points), moderately dependent (61-90), severely dependent (21-60), or totally dependent (0-20). The Barthel Index was chosen for its simplicity, clinical applicability, and strong reliability in assessing self-care and mobility among older adults.

Data collection

Data were collected through direct observation, structured interviews, and review of clinical records. Each performance of the participant in the Barthel Index items was evaluated by trained physiotherapists and nurses working at the institution. In cases of communication difficulty, caregiver input was included to ensure accuracy. All data were recorded in standardized forms and transferred to Microsoft Excel for organization and statistical analysis.

Statistical analysis

Descriptive and inferential statistical analyses were performed to examine functional ability patterns and their relationship with fall risk. Frequencies, percentages, means, standard deviations, minimum, and maximum values were calculated for demographic variables and Barthel Index scores. Pearson correlation coefficients were computed to assess relationships between individual Barthel Index subdomains and total functional independence scores. Independent samples t-tests were used to test gender differences in total Barthel scores. One-way analysis of variance was applied to compare independence levels across age groups. Multiple linear regression analysis was performed to identify which activity of daily life variables predicted the total Barthel Index score.

RESULTS

Table 1: Gender of participants.

Gender	Number of participants	%
Female	18	60
Male	12	40

Table 1 shows the gender of the participants included in this research. Out of 30 participants, 18 (60%) were female and 12 (40%) were male. These results give us a predominance of female participants in the sample, and this result aligns with general demographic trends observed in research involving older populations, where women show higher representation due to greater life expectancy.

Table 2: Age of the included participants.

Age	n	%
50-59	4	13.33
60-69	9	30
70-79	11	36.67
80-89	6	20
Mean $\pm$ Standard deviation	30	70.9 $\pm$ 9.2 Range: 53-89

Table 2 shows the age of the participants involved in this research. The largest proportion of participants (36.7%) were between 70 and 79 years old, followed by those of 60-69 years (30%) and 80-89 years (20%). A smaller number of participants (13.3%) were between 50 and 59 years old, and none were aged 90 or above. The general mean age was 70.9 $\pm$ 9.2 years, ranging from 53 to 89 years, showing that most participants belonged to the older adult population typically encountered in rehabilitation and functional independence assessments.

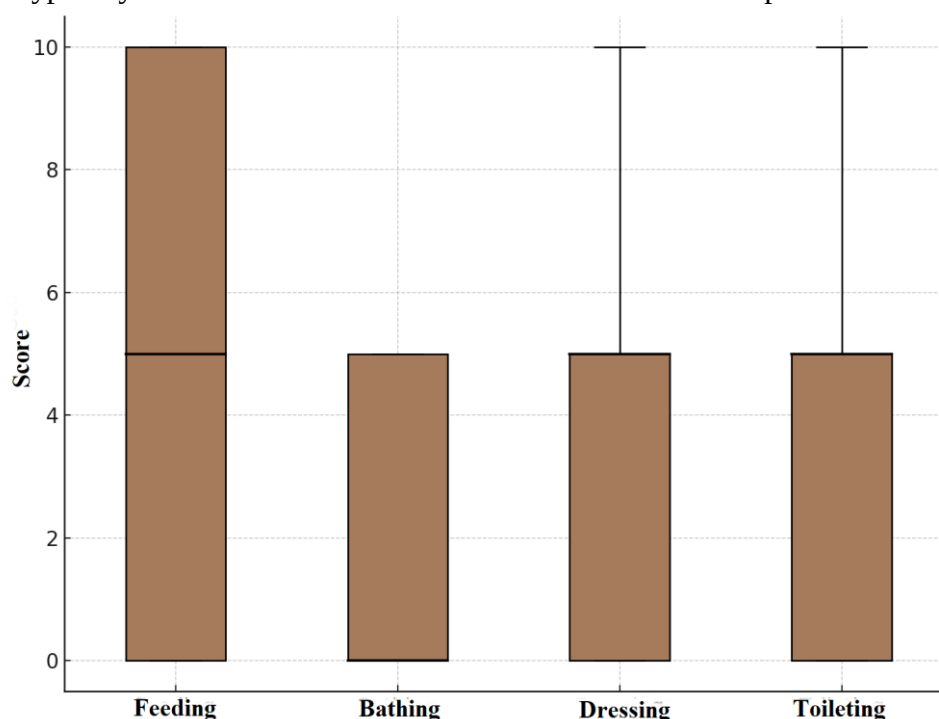
**Figure 1:** Distribution of basic activities of daily living - feeding, bathing, dressing, and toileting.

Figure 1 shows the variability in the performance of participants across four basic activities of daily living: feeding, bathing, dressing, and toileting. The median and interquartile ranges show differences in independence levels, with feeding showing the highest general performance, showing greater self-sufficiency. In contrast, bathing shows the lowest median score, indicating higher dependence in this category. The wider spread of scores in dressing and toileting suggests moderate variability among the persons, likely indirectly showing differing rehabilitation progress and physical limitations. The results from this figure show that personal hygiene and mobility activities tend to decline earlier than feeding ability.

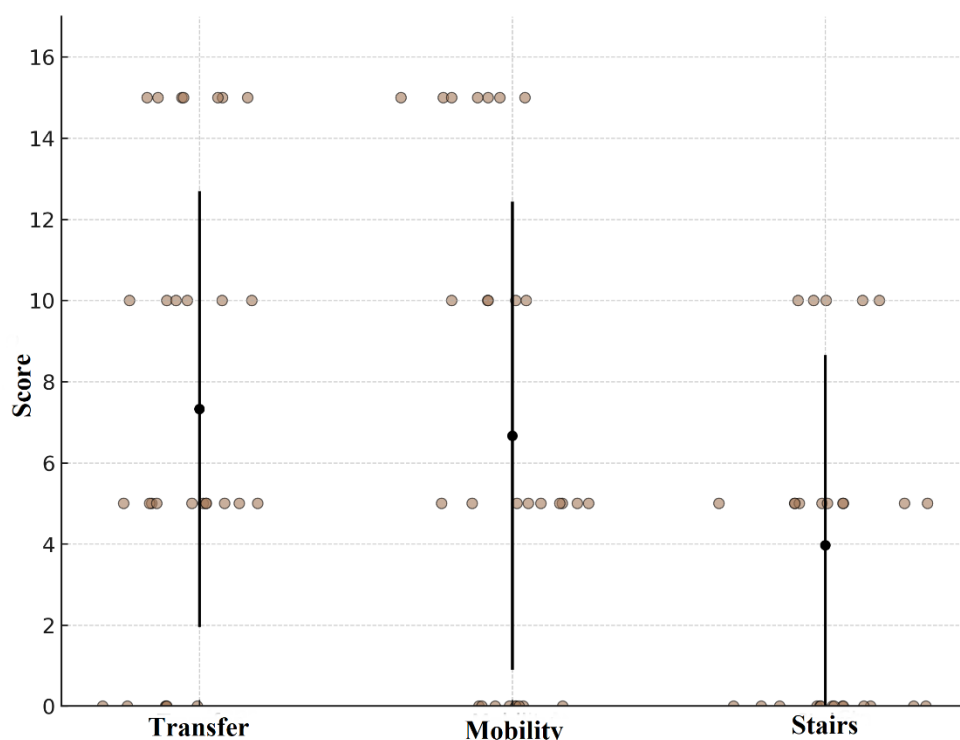


Figure 2: Distribution of functional mobility scores - transfer, mobility and stairs with individual data points.

Figure 2 shows the individual distribution of scores for the functional mobility categories - transfer, mobility and stairs as assessed by the Barthel Index. Each brown circular marker shows a score of each participant, visualizing variability in performance across the sample. The overlaid black dots and error bars indicate the mean $\pm$ standard deviation for each category, providing a clear view of central tendency and data dispersion. The results show that participants showed moderate independence in transfer and mobility activities, whereas stair climbing showed the lowest mean score and the highest variability, defining greater physical challenge and balance limitations in this category. The pattern shows the progressive decline in functional mobility associated with increasing physical demands of each activity.

Table 3: General functional independence levels based on total Barthel Index scores.

Functional independence level	n	%
Independent	3	10
Moderate dependence	7	23.33
Severe dependence	12	40
Total dependence	8	26.67
Mean $\pm$ standard deviation, range)	30	47.83 $\pm$ 32.92 (0-100)

Table 3 shows the general functional independence levels of the participants according to their total Barthel Index scores. The results reveal that the largest proportion of participants (40%) showed severe dependence, followed by 26.7% classified as totally dependent, indicating a high level of assistance required for daily functioning. A smaller sample of the participants showed moderate dependence (23.3%), while only 10% achieved full independence across all assessed categories. The general mean Barthel Index score was 47.83 $\pm$ 32.92, with scores ranging from 0 to 100, indicating substantial variability in the levels of independence of the respondents. These findings show the predominance of functional

limitations within the sample, defining the need for continuous and individualized rehabilitation to improve self-care and mobility.

Table 4: Pearson correlations between Barthel Index subcategories and total functional independence score.

Subcategory	<i>r</i>	<i>p</i> -value
Mobility	0.927	< 0.001
Transfer	0.897	< 0.001
Toileting	0.861	< 0.001
Defecation	0.845	< 0.001
Dressing	0.819	< 0.001

Table 10 show the results of the Pearson correlation analysis examining relationship between individual Barthel Index subcategories and the total functional independence score. All subcategories showed strong positive correlations with the total score ($r = 0.819\text{--}0.927$, $p < 0.001$), indicating that higher performance in each specific activity of daily living corresponds to greater general independence. The strongest relationships were observed for Mobility ($r = 0.93$) and Transfer ($r = 0.90$), showing their roles in determining general functional autonomy. These results show that rehabilitation for mobility and transfer training may produce the greatest impact on improving total independence levels in institutionalized or post-rehabilitation persons.

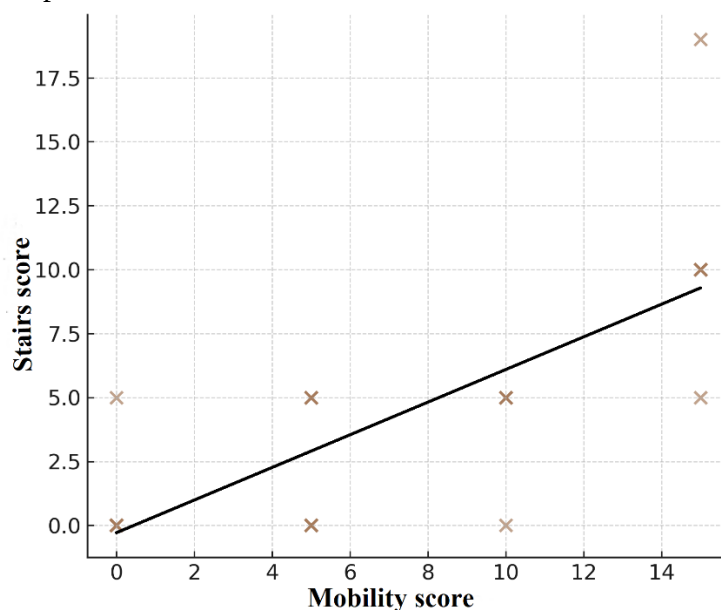


Figure 3: Relationship between mobility and climbing stairs.

Figure 3 shows the positive linear relationship between mobility and stair-climbing as assessed by the Barthel Index. Each point represents an individual score of the participants, with the regression line showing the general trend. A strong and statistically significant correlation ($r = 0.785$, $p < 0.001$) shows that participants with greater mobility capacity also achieved higher stair performance. This suggests that lower limb strength, coordination, and balance contribute to both categories.

Table 5: Multiple linear regression predicting total functional independence.

Predictor	B (unstandardized coefficient)	Std. error	<i>t</i>	<i>p</i> -value
Constant	2.883	2.067	1.395	0.176
Feeding	1.573	0.390	4.030	0.001
Bathing	0.843	0.634	1.330	0.197
Dressing	1.176	0.532	2.209	0.037
Toileting	2.123	0.484	4.385	< 0.001

Table 11 show the results of a multiple linear regression model examining the predictive contribution of key activities of daily living on total functional independence as measured by the Barthel Index. The model was statistically significant ($F(4,25) = 25.18$, $p < 0.001$) and accounted for 89.1% of the variance in total independence, indicating excellent explanatory power. Among the predictors, toileting ($B = 2.12$, $p < 0.001$), feeding ($B = 1.57$, $p = 0.001$), and dressing ($B = 1.18$, $p = 0.037$) showed as significant determinants of total functional capacity. In contrast, bathing showed no significant predictive value ($p = 0.197$), possibly due to uniformity of scores or reliance on environmental adaptations. These results show that self-care and toileting abilities are important categories influencing functional recovery and should be prioritized in rehabilitation to improve independence.

DISCUSSION

The results of this research show the relationship between functional ability and fall risk among elderly residents that are institutionalized, showing patterns of dependency and interdependence between various activities of daily living. The general results show that the majority of participants showed severe or total dependence, pointing out the vulnerability of this population to both physical and environmental problems that compromise autonomy. Strong correlations were observed between mobility, transfer, and toileting categories and the total Barthel Index score, suggesting that these areas play a big role in maintaining general functional independence. The significant predictive value of toileting, feeding, and dressing further shows the importance of preserving basic self-care and postural control abilities as important components of fall prevention. These results confirm that functional deterioration and fall susceptibility are connected phenomena, and they support the need for comprehensive rehabilitation with focus on mobility improvement, balance training, and individualized support to sustain independence and reduce fall risk among institutionalized elderly persons.

The results of Zak et al. (2015) complement the results of our research, showing the close link between reduced functional capability and elevated fall risk among institutionalized older adults. Their research on post-arthroplasty patients showed that limited mobility, multiple comorbidities, and medication use increased fall susceptibility, results that align with our research - mobility, transfer, and toileting independence were decisive factors in maintaining general functionality.

Another research by Nascimento et al. (2024) also supports our results by showing the influence of functional capacity, balance, and physical activity levels on fall risk among older adults. Their research showed that institutionalized elderly individuals showed poorer balance and mobility than physically active or exercising peers, yet experienced fewer actual falls, likely due to reduced environmental exposure and controlled living conditions. These results connect with our observation that participants with greater dependence in mobility and transfer categories showed lower general functional independence.

One study by Baixinho et al. (2022) in their research showed a high prevalence of falls (41.6%) and frequent recurrence, especially among residents with cognitive impairment

who showed lower adherence to safety and self-care practices. Similarly, our research revealed that deficits in functional independence, especially in mobility, toileting, and transfer activities contributed to increased fall risk within institutional environments. The research by Poncumhak et al. (2025) complements with our research by showing the predictive relationship between fear of falling, functional balance, and fall risk in older adults. Their analysis of community-dwelling elderly showed that persons with greater fear of falling, as measured by the newly developed FOF-10 Scale, showed poorer balance and higher fall incidence, with strong correlations between FOF-10, TUG, and FES-I scores ($\rho = 0.929-0.573$, $p < 0.001$). These results connect with our study where reduced functional independence was associated with elevated fall susceptibility among institutionalized residents.

Limitations and future directions

This research has several limitations that should be acknowledged. The relatively small sample size limits the generalizability of the results and may not fully represent the diversity of functional profiles among institutionalized elderly persons. Also, the cross-sectional design prevents establishing causal relationships between reduced functional ability and fall risk, as changes in independence levels and rehabilitation could not be observed. The research also relied solely on the Barthel Index for assessing functional independence; while this tool is widely validated, incorporating complementary assessments such as balance and gait tests could have provided a more comprehensive understanding of fall-related factors.

Future research should define these limitations through longitudinal researches that track changes in functional capacity and fall occurrence over time, as well as through larger, multicenter samples to strengthen external validity. Integrating physical, cognitive, and psychological assessments in future models could enable a more holistic approach to fall-risk evaluation.

CONCLUSIONS

The results of this research confirm a strong interrelationship between functional ability and fall risk among institutionalized elderly persons. The majority of participants showed severe or total dependence, defining their vulnerability to mobility decline and recurrent falls. The most important determinants of general independence were mobility, transfer, and toileting, which together accounted for the majority of variance in total functional capacity. These results define the need for individualized rehabilitation programs with focus on postural control, strength training, and the restoration of self-care abilities. Prioritizing these domains, healthcare workers could reduce fall risk, improve independence, and promote safer aging within institutional care environments.

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