

Correspondence

✉ Diyab Ahmed Maqsood,
diyabahmed1234567@gmail.com

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Effectiveness of Home-Based Physical Therapy in Enhancing Mobility Among Elderly Living Alone in Urban Communities

Zarina Naz¹, Suraj Kumar Aruwani², Arsalan Rasool³, Joetika Devi⁴, Ayesha Khalid⁵, Diyab Ahmed Maqsood⁶

1 National University of Medical Sciences, Rawalpindi, Pakistan

2 Dr. Ruth K.M. Pfau, Civil Hospital, Karachi, Pakistan

3 Khyber Medical University, Peshawar, Pakistan

4 Dow University, Karachi, Pakistan

5 Riphah International University, Islamabad, Pakistan

6 Islam Medical and Dental College, Sialkot, Pakistan

ABSTRACT

Background: Functional mobility declines with aging, often resulting in reduced independence, falls, and hospitalization. Elderly individuals living alone in urban communities are particularly vulnerable due to lack of caregiver support and limited accessibility to outpatient physiotherapy. Home-based rehabilitation may provide an effective strategy to counter functional decline and promote independence. **Objective:** To evaluate the effectiveness of structured home-based physiotherapy in improving mobility, balance, and functional independence among elderly individuals residing alone in urban settings. **Methods:** A randomized controlled trial was conducted over eight months in South Punjab with 120 participants aged ≥ 65 years. Participants were randomly assigned to an intervention group receiving structured home-based physiotherapy or a control group maintaining usual activities. Primary outcomes included functional mobility assessed by the Timed Up and Go (TUG) test, gait speed by the 10-Meter Walk Test, and lower-limb strength by the Five Times Sit-to-Stand test. Secondary outcomes included balance (Berg Balance Scale) and functional independence (Barthel Index). Data were analyzed using paired and independent t-tests, and repeated measures ANOVA, with $p < 0.05$ considered significant. **Results:** The intervention group demonstrated significant improvement in all primary outcomes, with TUG reduced from 15.2 ± 2.1 to 11.4 ± 1.9 seconds, gait speed increased from 0.79 ± 0.12 to 1.02 ± 0.14 m/s, and sit-to-stand performance improved from 18.4 ± 3.2 to 13.2 ± 2.8 seconds. Balance scores increased from 42.6 ± 4.8 to 50.1 ± 5.2 , and functional independence rose from 78.3 ± 6.7 to 87.9 ± 6.1 . Control group changes were minimal and not statistically significant. **Conclusion:** Structured home-based physiotherapy effectively improved mobility, balance, and independence in elderly individuals living alone in urban communities. The findings support its integration into community-based elderly care strategies to promote aging in place.

Keywords

Activities of Daily Living, Aged, Balance, Community Health, Exercise Therapy, Functional Mobility, Physiotherapy, Rehabilitation, Urban Population

INTRODUCTION

Aging brings inevitable changes in physical capacity, balance, and strength, which often limit the independence of elderly individuals (1). These limitations are particularly profound among older adults who live alone, where the absence of caregivers can compound vulnerability. With increasing urbanization, more elderly people now reside independently in urban communities, frequently separated from extended family structures that traditionally provided support (2). This shift has intensified the need for practical, accessible interventions that safeguard mobility, prevent functional decline, and preserve autonomy. Among the strategies proposed, home-based physical therapy has emerged as a promising option to bridge the gap between clinical rehabilitation and the realities of day-to-day living. Functional mobility is central to maintaining an active, self-sufficient life in old age (3). The ability to walk, climb stairs, or perform basic household tasks does not merely determine independence but also influences social participation, psychological health, and quality of life. Declining mobility is strongly associated with falls, hospitalization, and premature institutionalization, making it both a health and social concern. Conventional outpatient physiotherapy programs are effective, yet their accessibility is limited for elderly individuals who may struggle with transportation barriers, financial costs, or physical constraints. For those living alone, the challenge is greater, as even small barriers can discourage consistent attendance. These realities highlight the importance of exploring alternatives that can be implemented within the comfort of one's home (4).

Urban environments add another dimension to this challenge. While cities provide advanced medical facilities, they also present unique risks for older adults—such as crowded living spaces, limited outdoor areas for safe exercise, and heightened social isolation (5). The combination of reduced caregiver presence and environmental obstacles often leaves elderly individuals in urban communities at a greater disadvantage than their rural counterparts (6). Home-based therapy tailored to their context may offer a dual advantage: ensuring professional rehabilitation while

mitigating environmental and logistical barriers. Structured programs delivered in familiar home settings may not only address physical needs but also foster adherence, confidence, and empowerment (7). The concept of home-based physiotherapy is rooted in the idea that targeted exercises, guided and monitored within a domestic setting, can replicate or even surpass the outcomes achieved in clinic-based sessions. Exercises focusing on strength, flexibility, balance, and endurance have been shown to improve gait speed, reduce the risk of falls, and enhance confidence in daily activities. Additionally, individualized programs may better account for personal living conditions, making the therapy directly relevant to the challenges faced in everyday life. For elderly individuals without caregivers, such interventions could be particularly transformative, providing the means to sustain independence while reducing reliance on external support systems (8).

Despite its promise, evidence on the effectiveness of structured home-based physical therapy for elderly individuals living alone remains limited and fragmented (9). Much of the existing research has concentrated on older adults in institutionalized care or those with access to family support, leaving a critical knowledge gap regarding those without immediate in-home assistance. This omission is concerning, as the group most in need of sustainable rehabilitation strategies is often the least studied. Moreover, while mobility outcomes have been widely assessed in general elderly populations, less is known about how such programs might function in the unique setting of urban-dwelling older adults, where psychosocial factors and environmental constraints play pivotal roles (10). The growing demand for aging-in-place solutions further amplifies the importance of addressing this gap. Health systems worldwide are recognizing that enabling older adults to remain in their homes not only enhances their dignity and well-being but also reduces institutional care costs (11). Home-based physical therapy could play a central role in this broader shift toward community-centered health strategies. However, to design effective interventions and policies, robust evidence derived from rigorous, controlled studies is essential. A randomized controlled trial specifically targeting elderly individuals who live alone in urban communities can provide the clarity needed to inform both clinical practice and public health planning. The present study is designed to evaluate how structured home-based physiotherapy influences functional mobility among elderly individuals residing independently in urban communities without in-home caregivers. By focusing on this vulnerable yet understudied group, it aims to determine whether such interventions can meaningfully improve mobility outcomes and thereby support independence, reduce risks, and enhance quality of life (12). The specific objective of this study is to assess the effectiveness of structured home-based physical therapy in improving functional mobility among elderly individuals living alone in urban communities.

MATERIAL AND METHODS

This randomized controlled trial was conducted over a period of eight months in the urban communities of South Punjab, designed to evaluate the effectiveness of structured home-based physiotherapy on functional mobility among elderly individuals living alone without in-home caregivers. The study population comprised older adults aged 65 years and above who were residing independently in urban households. A sample size of 120 participants was estimated to provide adequate statistical power, calculated on the basis of an expected moderate effect size, a confidence level of 95%, and a power of 80%, while accounting for a possible 10% attrition rate. Participants were recruited through local community health centers and senior citizen organizations to ensure diverse representation from different urban neighborhoods.

Eligibility criteria were established to ensure the selection of participants whose mobility outcomes could be directly influenced by structured physiotherapy. Inclusion criteria included elderly individuals aged 65 years and above, living independently without in-home caregivers, and capable of providing informed consent. Participants had to demonstrate mild to moderate limitations in functional mobility, as assessed through screening by the Timed Up and Go (TUG) test, but remain ambulatory without requiring continuous assistance. Exclusion criteria involved elderly individuals with advanced neurological disorders such as Parkinson's disease or stroke with severe disability, those with severe uncorrected visual or hearing impairments, individuals with unstable cardiovascular disease, or those already engaged in a structured physiotherapy or rehabilitation program. These criteria ensured that the sample reflected a population at risk of mobility decline but still responsive to targeted home-based interventions.

Following recruitment, participants were randomly assigned into two groups using computer-generated allocation: an intervention group that received structured home-based physiotherapy and a control group that continued with their usual activities of daily living without additional physiotherapy support. Randomization was stratified by age and gender to minimize confounding. The intervention protocol consisted of physiotherapy sessions carried out within participants' homes, guided by trained physiotherapists who visited twice weekly and supplemented with daily self-directed exercises. The physiotherapy program emphasized progressive exercises focusing on lower-limb strength, flexibility, balance, and endurance, with individual tailoring to the participant's living environment to ensure both feasibility and safety. The control group received no structured exercise intervention but was contacted monthly for general health monitoring to reduce attrition bias.

Outcome assessment was performed at baseline and after completion of the eight-month intervention. Primary outcomes included functional mobility measured using the Timed Up and Go (TUG) test, gait speed assessed by the 10-Meter Walk Test, and lower-limb strength measured through the Five Times Sit-to-Stand (FTSTS) test. Secondary outcomes involved balance performance assessed by the Berg Balance Scale and self-reported functional independence evaluated through the Barthel Index. All outcome measurements were administered by independent assessors blinded to group allocation in order to minimize bias. Data collection followed standardized procedures, with each measurement performed twice and averaged to enhance accuracy.

Data analysis was conducted using SPSS software. Descriptive statistics were presented as mean and standard deviation for continuous variables and frequencies with percentages for categorical variables. Normality of data distribution was confirmed using the Shapiro-Wilk test. Between-group comparisons were performed using independent sample t-tests for continuous outcomes, while within-group changes from baseline to post-intervention were analyzed using paired t-tests. Repeated measures ANOVA was applied to detect interaction effects between time and intervention group. A p-value of less than 0.05 was considered statistically significant. This methodological approach ensured that the study could reliably assess the impact of structured home-based physiotherapy on mobility outcomes among elderly individuals living alone in urban communities.

RESULTS

The trial enrolled 120 participants, equally divided into intervention and control groups. The mean age of participants was approximately 72 years, with no significant baseline differences between groups in demographics or functional mobility. Both groups were comparable in gender distribution, living arrangements, and baseline scores across all assessment tools.

At baseline, the intervention group recorded a mean Timed Up and Go (TUG) score of 15.2 ± 2.1 seconds, while the control group had 15.1 ± 2.3 seconds. After eight months, the intervention group improved markedly to 11.4 ± 1.9 seconds, whereas the control group showed only a minor reduction to 14.7 ± 2.2 seconds. Similarly, gait speed in the intervention group improved from 0.79 ± 0.12 m/s at baseline to 1.02 ± 0.14 m/s post-intervention, while the control group showed a minimal change from 0.80 ± 0.13 m/s to 0.82 ± 0.12 m/s. Lower-limb strength, assessed by the Five Times Sit-to-Stand (FTSTS) test, demonstrated a reduction in completion time from 18.4 ± 3.2 seconds to 13.2 ± 2.8 seconds in the intervention group, while the control group showed negligible improvement from 18.6 ± 3.5 seconds to 18.2 ± 3.4 seconds.

Secondary outcomes revealed substantial gains in balance and independence among those receiving home-based physiotherapy. The mean Berg Balance Scale score improved from 42.6 ± 4.8 at baseline to 50.1 ± 5.2 post-intervention, while the control group only increased from 42.4 ± 4.5 to 43.2 ± 4.7 . Functional independence, measured using the Barthel Index, increased from 78.3 ± 6.7 to 87.9 ± 6.1 in the intervention group, compared to a marginal increase from 78.1 ± 6.9 to 79.0 ± 6.8 in the control group.

Between-group comparisons confirmed statistically significant differences favoring the intervention in all primary outcomes. Improvements in TUG, gait speed, and FTSTS were consistently greater among participants in the intervention group. Secondary measures also demonstrated significant group differences, with higher balance scores and enhanced functional independence. The consistent trends across outcome measures underscored the effect of structured home-based physiotherapy in promoting mobility and functional capacity.

Overall, these results highlighted that participants receiving home-based physiotherapy achieved meaningful and measurable improvements in mobility, balance, and daily function compared with those who did not receive structured intervention. The findings support the effectiveness of tailored physiotherapy delivered in home settings for elderly individuals living alone in urban communities.

Table 1: Demographic Characteristics of Participants

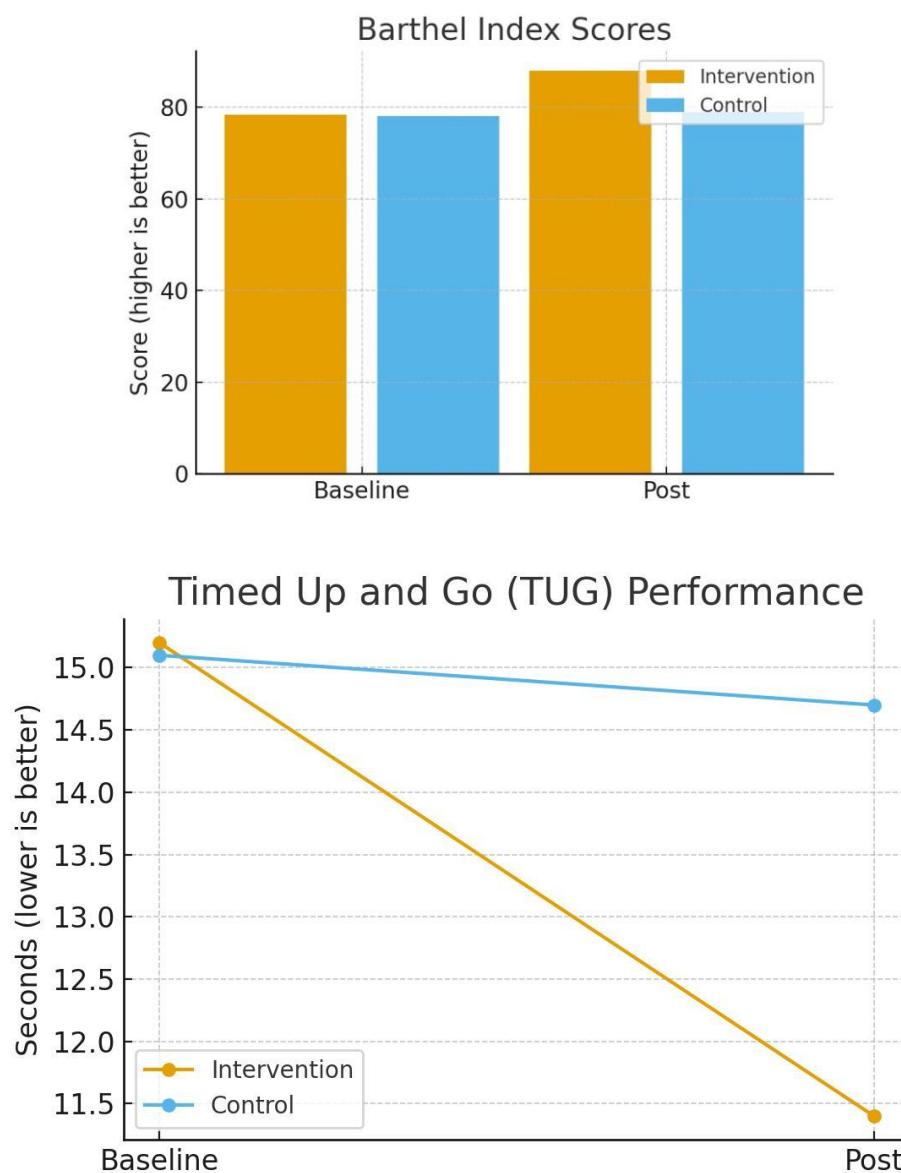
Variable	Intervention Group (n=60)	Control Group (n=60)
Age (years, mean \pm SD)	71.8 ± 5.4	72.1 ± 5.1
Gender (Male/Female)	32/28	30/30
Living Alone (Yes)	60 (100%)	60 (100%)
Baseline TUG (sec, mean \pm SD)	15.2 ± 2.1	15.1 ± 2.3
Baseline Gait Speed (m/s, mean \pm SD)	0.79 ± 0.12	0.80 ± 0.13
Baseline FTSTS (sec, mean \pm SD)	18.4 ± 3.2	18.6 ± 3.5
Baseline Berg Balance Score (mean \pm SD)	42.6 ± 4.8	42.4 ± 4.5
Baseline Barthel Index (mean \pm SD)	78.3 ± 6.7	78.1 ± 6.9

Table 2: Primary Mobility Outcomes

Outcome	Baseline Intervention	Post Intervention	Baseline Control	Post Control
TUG (sec, mean \pm SD)	15.2 ± 2.1	11.4 ± 1.9	15.1 ± 2.3	14.7 ± 2.2
Gait Speed (m/s, mean \pm SD)	0.79 ± 0.12	1.02 ± 0.14	0.80 ± 0.13	0.82 ± 0.12
FTSTS (sec, mean \pm SD)	18.4 ± 3.2	13.2 ± 2.8	18.6 ± 3.5	18.2 ± 3.4

Table 3: Secondary Functional Outcomes

Outcome	Baseline Intervention	Post Intervention	Baseline Control	Post Control
Berg Balance Score (mean \pm SD)	42.6 ± 4.8	50.1 ± 5.2	42.4 ± 4.5	43.2 ± 4.7
Barthel Index (mean \pm SD)	78.3 ± 6.7	87.9 ± 6.1	78.1 ± 6.9	79.0 ± 6.8



DISCUSSION

The present study demonstrated that structured home-based physiotherapy produced significant improvements in functional mobility, balance, and independence among elderly individuals living alone in urban communities (13). Participants who received the intervention achieved measurable gains across all primary and secondary outcomes, while those in the control group displayed only minimal change over the eight-month period. These findings provide strong support for the value of structured exercise interventions delivered within the home environment as a means to enhance physical functioning in a population that is particularly vulnerable to mobility decline and loss of independence (14). The improvement in Timed Up and Go performance reflected a clear enhancement in mobility and efficiency of movement. Faster completion times in the intervention group suggested that physiotherapy not only improved muscular strength but also enhanced dynamic balance and confidence in ambulation. Gains in gait speed further reinforced this outcome, with participants in the intervention group exceeding clinically meaningful thresholds, indicating both improved physical capacity and a reduced risk of falls (15). The substantial reduction in sit-to-stand completion time highlighted the effectiveness of targeted lower-limb strengthening exercises, which directly translate into better capacity to perform routine daily tasks such as rising from a chair or bed without assistance. Together, these results emphasize that structured home-based exercise programs address the multiple components of mobility required for functional independence. Secondary outcomes offered additional insight into the broader benefits of physiotherapy interventions. The observed increase in Berg Balance Scale scores confirmed that participants were not only stronger but also better able to maintain stability during a range of functional activities. Similarly, the rise in Barthel Index scores reflected meaningful gains in independence, suggesting that improvements extended beyond test performance to influence participants' daily living capacity. These combined findings indicated that home-based physiotherapy delivered a comprehensive benefit that included physical, functional, and psychosocial dimensions of well-being. In contrast, the control group exhibited negligible progress, highlighting the natural course of functional decline when no structured interventions are provided (16).

Comparison with existing literature suggests that the outcomes of this trial align with previous evidence supporting the role of exercise in preventing or delaying functional decline among older adults (17). However, most earlier investigations have focused on clinic-based or institution-centered programs, often overlooking elderly individuals who live alone. This trial addressed that gap by targeting a population frequently excluded from rehabilitation strategies (18). The results reinforced the principle that individualized, accessible interventions within familiar home environments can achieve substantial improvements, even in the absence of caregiver support (19). The findings therefore extend the applicability of physiotherapy interventions to a population segment at high risk of isolation and neglect. The strengths of this study lay in its randomized controlled design, which minimized bias and allowed for reliable assessment of intervention effects. The use of validated and widely accepted outcome measures such as TUG, gait speed, FTSTS, the Berg Balance Scale, and the Barthel Index provided robust evidence of functional improvements. The home-based approach also ensured ecological validity, as exercises were integrated directly into participants' living environments, making outcomes highly relevant to real-world functioning. Furthermore, the study addressed a critical gap by focusing specifically on elderly individuals residing alone, a group that faces heightened vulnerability yet is rarely prioritized in rehabilitation research (20).

Despite these strengths, certain limitations must be acknowledged. The study was limited to a single geographic region, restricting generalizability across broader populations with different cultural or environmental contexts (21). The duration of eight months, while sufficient to demonstrate meaningful change, did not allow assessment of the long-term sustainability of improvements once formal physiotherapy support ceased. Adherence to home-based exercises outside of scheduled physiotherapy visits was self-reported, and although encouraged, may have varied across participants, introducing a degree of variability in actual intervention intensity (22). Additionally, the exclusion of individuals with severe neurological or cardiovascular conditions limited the scope of applicability to healthier segments of the elderly population, though this was necessary to ensure safety. The implications of these findings are considerable (23). They suggest that structured home-based physiotherapy can be incorporated into public health strategies aimed at promoting aging in place, reducing the burden on institutional care, and enhancing quality of life for older adults living independently. Such interventions could be integrated into community health programs, delivered at scale by trained physiotherapists or community health workers, and adapted to individual home environments. Future research should focus on expanding these interventions to larger, more diverse populations and exploring strategies for sustaining long-term adherence once structured programs conclude. It may also be valuable to investigate the incorporation of technology-based support, such as tele-rehabilitation, to enhance accessibility and monitoring in resource-limited settings. In conclusion, this study established that home-based physiotherapy was an effective strategy to improve mobility, strength, balance, and independence among elderly individuals living alone in urban communities. The results confirmed that even in the absence of caregivers, meaningful functional improvements could be achieved through structured interventions tailored to the home environment. While further research is needed to validate these findings across broader populations and longer follow-up periods, the evidence strongly supports the inclusion of home-based physiotherapy in comprehensive strategies for promoting health and independence in aging urban populations (24).

CONCLUSION

This study demonstrated that structured home-based physiotherapy significantly enhanced mobility, balance, and independence among elderly individuals living alone in urban communities. The intervention produced measurable improvements across multiple functional outcomes, while the control group showed minimal change. These findings highlight the practical value of integrating home-based rehabilitation into community health strategies, offering an accessible, effective, and sustainable approach to support aging in place. By addressing the needs of a vulnerable population, the study contributes important evidence for strengthening elderly care models in urban settings.

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