

SAFER Karachi: Strengthening an Adapted Fall Prevention Intervention for Resilience in Older Adults – A Pilot Study in Karachi

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Summary/Abstract

Falls are a leading cause of morbidity, disability, and loss of independence among older adults, yet fall prevention remains underexplored in low- and middle-income countries (LMICs) like Pakistan. Older adults in urban Karachi face unique challenges, including limited healthcare access, lack of insurance coverage, and reliance on caregivers, making them particularly vulnerable to fall-related complications. Existing fall prevention programs, primarily developed in Western settings, may not be directly applicable to this context. This pilot study aims to adapt and evaluate the effectiveness of the Stepping On program, a community-based, evidence-driven fall prevention intervention, within Karachi's urban communities. The study will employ a pre- and post-quasi-experimental design, enrolling 50 participants. The 7-week intervention will include strength and balance training, environmental safety education, medication review, vision care, and behavioural change strategies, with follow-up home visits and booster sessions. Primary outcomes include fall incidence, self-reported through monthly fall logs, while secondary outcomes will assess fall self-efficacy, mobility, cognitive function, emotional well-being, and adherence. Mobility and cognitive function are closely linked; cognitive impairments can affect balance and gait, increasing fall risk. Reduced mobility both heightens this risk and may result from cognitive decline. Data collection will involve baseline assessments, follow-ups at 2 and 4 months, and qualitative interviews to refine cultural adaptations. Findings from this pilot will inform a scalable, locally relevant fall prevention strategy for Pakistan's aging population, bridging critical research gaps and supporting the integration of fall prevention into community health services.

INTRODUCTION

Background

The global aging population presents a significant challenge for healthcare systems worldwide. According to the World Health Organization (WHO), the aging population is defined as individuals aged 60 years or older [1]. By 2030, one in six people worldwide will be 60 years or older. By 2050, the global population of individuals aged 60 and above is expected to double, reaching 2.1 billion [2]. Although aging is associated with a decline in physiological and functional capacity of the musculoskeletal and neurological systems, the high prevalence of falls is a major contributor to morbidity and mortality among older adults. Falls are recognized as the most common geriatric syndrome [3].

Falls are the second leading cause of unintentional injury-related deaths worldwide, with an estimated 684,000 deaths each year, over 80% of which occur in low- and middle-income countries. Older adults aged 60 and above experience the highest number of fatal falls [4]. A meta-analysis found that 26.5% of older individuals globally experience falls, making it a primary cause of both disability and death in this age group. Even those who fall without injury often face long-term negative effects. Older adults who fall once are at a higher risk of falling again within the following year. This fear of falling can also contribute to depression and reduced mobility [5]. A study conducted in Pakistan on older adults found that 34% of participants reported experiencing at least one fall in the past year [6]. Major outcomes because of falls include bone fractures and head injuries [6,7].

Falls are not isolated incidents; they trigger a cascade of health complications in older adults [8]. While some falls result in minor injuries, others lead to fractures, reduced mobility, and long-term disability. According to the 2022 study conducted on older adults in long-term care, injuries were reported in 38.2% of falls, whereas 85.9% of injuries involved direct impact to the injured body part [9]. Beyond the physical consequences, falls also contribute to psychological distress, including fear of falling, anxiety, and social withdrawal [10]. A Vietnamese study from 2019 noted that people suffering from falls in the last 12 months (60.4%) had higher rates of psychological distress compared to those who did not fall. The psychological distress rate increased from patients with one comorbidity (18.8%), two comorbidities (32.4%), and three or more comorbidities (50.0%) [11]. When mobility declines due to repeated falls, it increases sedentarism, which in turn worsens

chronic conditions like cardiovascular disease, osteoporosis, and cognitive impairment [12]. Multimorbidity—the presence of multiple chronic conditions—exacerbates fall risks and consequences by increasing frailty, impairing balance, and reducing physical strength. Falls among older adults with multimorbidity can accelerate functional decline, leading to a greater need for institutionalized care and increasing healthcare costs [13]. A 2022 study from India also reported a significant association between falls and multimorbidity [14]. Given the growing geriatric population in urban Karachi, where healthcare accessibility is already fragmented due to limited geriatric services and inadequate home safety modifications, fall prevention must be a top priority in public health planning.

Fall risk factors are typically divided into two categories: personal (or intrinsic) and environmental (or extrinsic) [15]. Personal factors include individual characteristics such as age, educational level, functional abilities, and chronic conditions such as dementia, gait problems, and previous history of falls [16,17]. Environmental risk factors involve hazards in and around the home, such as poorly fitting footwear, slippery floors, loose rugs, tripping obstacles, absence of stair railings or grab bars, unstable furniture, and inadequate lighting. The risk of falling increases with both the number of risk factors and advancing age [15]. Certain risk factors, such as age and gender, cannot be changed. However, many other falls risk factors, such as muscle strength, balance, medication use, and cognitive function, can be addressed through interventions [15,17]. Identifying high-risk individuals through proper assessments is essential for timely interventions that reduce falls and their negative impact on older adults.

Interventions to prevent falls in older adults effectively reduce both the risk of falling and the frequency of falls per month. The most effective approach is a comprehensive falls risk assessment and management program [18]. The World Guidelines for Falls Prevention and Management for Older Adults strongly recommend multidomain falls risk interventions, including strength and balance exercises, medication reviews, cardiovascular management, vision and hearing optimization, foot care, vitamin D supplementation, and home environment modifications [17]. Despite the proven effectiveness of fall prevention strategies, their implementation remains inadequate, particularly in resource-limited settings. Older adults, especially those in low- and middle-income countries (LMICs) like Pakistan, face numerous barriers to accessing these interventions, leaving them at a heightened risk of falls and their associated complications.

Rationale

Importance of the Problem

Older adults are one of the most vulnerable yet overlooked populations [19]. As life expectancy increases, so does the burden of ageing-related health challenges, yet older adults remain underrepresented in research, especially in LMICs like Pakistan. They face unique structural barriers such as lack of insurance coverage, inadequate social support, and heavy reliance on caregivers for their healthcare needs. These factors limit their access to preventive care, often leading to delayed medical attention and worsened health outcomes. Without proper interventions, older adults experience a gradual loss of independence, increased hospitalization rates, and a heightened risk of institutionalized caretaking [20].

What Gaps the Research Question will Address

Despite the well-documented impact of falls on older adults, there is limited research on fall prevention strategies in South Asian contexts, particularly in urban settings like Karachi. Most existing fall prevention programs have been developed and tested in Western settings, making their direct applicability to LMICs questionable. Furthermore, few studies integrate contextualized interventions that account for the unique cultural, environmental, and socioeconomic challenges faced by older adults in Pakistan. This study will bridge this gap by adapting an evidence-based fall prevention intervention to fit the needs of urban older adults in Karachi, ensuring that solutions are locally relevant, feasible, and scalable.

How the Proposed Project will Improve Knowledge and/or Practice

This study will contribute new knowledge into fall prevention for older adults in urban Pakistan, which can inform clinical practice, and community health programming. The findings will provide empirical evidence on the effectiveness of a locally adapted fall prevention intervention in Karachi's urban setting. It will generate actionable recommendations for integrating fall prevention into community health services. Moreover, it will serve as a model for future studies and interventions in other urban LMIC settings, addressing the broader issue of ageing populations and their health needs. By addressing these gaps, this research will help shift the focus from reactive fall management to proactive fall prevention, improving quality of life, mobility, and healthcare outcomes for older adults in Karachi.

Study Objective

To adapt and test the effectiveness of a fall prevention program within Karachi's urban community settings among older adults.

METHODS

Study Design

This study will use a quasi-experimental pre-test-post-test design.

Study Population

For the formative assessment, the study will target older adults, aged 60 years and above, caretakers, geriatricians, and physical therapists. For the pilot intervention, the study will target older adults residing in the urban communities of Karachi.

Study Setting

The study setting will be community settings in Districts Central and East in clusters (Jamshed Town and New Karachi) that were previously a part of the Centre for Cardiometabolic Risk Reduction in South Asia (CARRS) Pakistan Cohort. Formative assessments will be conducted in both the homes of older adults and caretakers as well as health facilities within the identified districts. The intervention will be implemented in the homes of the study participants.

Study Duration

The study will be conducted over a 10-month period, including formative research, intervention implementation, and post-intervention follow-up.

Eligibility Criteria

For the formative assessment, eligible participants will include older adults aged 60 and above residing in the study area for at least six months and not experiencing severe cognitive impairment. Caretakers must be 18 or older, serve as the primary caregiver to an older adult, and be actively involved in daily care. Geriatricians should be licensed physicians with at least two years of experience in older adult care, while physical therapists must hold relevant qualifications and have at least one year of experience working with older adults.

For the main intervention, the eligibility criteria is as follows:

Inclusion Criteria:

- Older adults, aged 60 years and above, residing in urban Karachi

Exclusion Criteria:

- Individuals who rely on assistive devices for mobility
- Bedbound and homebound individuals who require full-time assistance
- Individuals with diagnosed cognitive impairment or dementia

Exposure/Intervention

The intervention will be an adapted version of the **Stepping On** program [21], tailored to the cultural and environmental context of Karachi. Stepping On is a community-based, evidence-based fall prevention program designed to reduce falls and improve confidence among older adults living independently. The program is led by a healthcare professional and integrates cognitive-behavioural strategies, strength and balance exercises, and environmental safety education to promote self-efficacy and behaviour change in preventing falls. Studies have shown that Stepping On reduces fall rates by approximately 31%, making it a valuable intervention for community-dwelling older adults at risk of falls [22].

The intervention package includes a 7-week intervention program with weekly 2-hour group sessions, focusing on:

- Strength and Balance Training – Exercises to improve mobility and prevent falls
- Home and Environmental Safety – Identifying and mitigating fall hazards
- Medication Review – Understanding risks associated with medications that affect balance
- Vision and Footwear Education – Addressing vision impairments and proper footwear selection
- Behavioural Change Strategies – Encouraging self-management and long-term adherence to fall prevention practices
- Community Mobility Skills – Navigating obstacles in public spaces safely
- Social and Peer Support – Group discussions to reinforce learning and motivation

A follow-up home visit is conducted within 6 weeks of the intervention to reinforce behavioural changes and environmental modifications followed by a booster session after 3 months which encourages continued adherence to the program.

To enhance feasibility, safety, and contextual relevance in a low-resource urban setting, minor strengthening measures will be incorporated into the intervention while retaining the core structure of the Stepping On program. All intervention facilitators will undergo standardized training prior to implementation to ensure consistent delivery of intervention components. Exercise-related components will be delivered with input from a licensed physiotherapist to ensure appropriateness and safety for older adults. Context-specific enhancements will be incorporated based on formative findings, team consultation, and review of implementation practices in similar settings, given their relevance to fall risk and overall wellbeing in older adults. Supportive tools will also be integrated to facilitate behavior change and improve adherence. These refinements will help improve participant engagement, self-management, and sustainability of intervention effects without altering the fundamental design of the intervention.

Variables of Interest and Study Tools

Exposure Variable and Assessment:

The primary exposure variable in the study is participation in the Stepping On program intervention. Participation in the program will be measured through attendance (number of sessions attended), engagement level, and adherence to home-based recommendations (e.g., exercise, home modifications). Self-reported

exercise logs, facilitator ratings, and follow-up checklists will quantify participants' level of engagement in specific intervention components.

Outcome Variables and Assessment:

While the adapted Stepping On program is designed to reduce fall incidence among older adults, this pilot study, due to its short follow-up duration, will primarily focus on assessing the feasibility, acceptability, and short-term effects of the intervention. Findings from this study will inform a larger trial capable of evaluating long-term fall incidence reduction.

Primary Outcome:

- Feasibility of implementing the adapted Stepping On program in urban Karachi, assessed through:
 - Recruitment rate, retention, session attendance, and adherence (tracked through logs and facilitator ratings).
- Acceptability of the Stepping On Program among participants, measured through:
 - Participant feedback, qualitative interviews, and facilitator evaluations

Secondary Outcomes:

| Measure | Assessment Tool |
|---|--|
| Activities of Daily Living (ADL) | Katz Index of Independence in Activities of Daily Living |
| Fall-related self-efficacy | Modified Falls Efficacy Scale |
| Changes in mobility and balance | Timed Up and Go (TUG) test |
| Nutritional status | Mini Nutritional Assessment (MNA) |
| Sleep quality | Pittsburgh Sleep Quality Index (PSQI) |
| Quality of Life (QOL) | WHOQOL-BREF |
| Cognitive capacity assessment | Montreal Cognitive Assessment (MoCA) |
| Emotional wellbeing | Kessler Psychological Distress Scale (K-10) |
| Home and community safety modifications | Self-reported adherence checklist |

Covariates:

- **Sociodemographic Factors:** Age, Gender, Education level, Socioeconomic status (income, employment status), Living arrangement (alone vs. with family)
- **Health and Functional Status:** Comorbidities (self-reported and/or from medical records), Medication Use (especially polypharmacy and medications affecting balance), History of Falls (previous falls in the past year)

Sample Size

This pilot study aims to assess feasibility and estimate the effect size for a future main trial. A total of 50 participants is appropriate based on pilot study recommendations, where 50 corresponds to an estimated effect size of ~0.15 (between extra small and small). This ensures sufficient preliminary data to refine the intervention and inform a fully powered main trial (90% power, 5% significance level) while remaining logistically feasible within resource constraints. The study aims to recruit an equal number of men and women in the study sample.

Sampling Technique

A purposive sampling strategy will be used to recruit older adults from community settings.

Data Collection Process

Pre-Intervention:

- Qualitative interviews to adapt the intervention and ensure cultural relevance.
- Baseline assessment of fall history, mobility, self-efficacy, cognitive function, psychosocial status, nutrition, sleep, and home safety.
- Minor refinement and strengthening of intervention components prior to implementation.

Intervention Phase:

- Weekly group sessions (7 weeks)
- Home visits within 6 weeks of the intervention
- Booster session

Post-Intervention:

- Follow-up assessments every month
- Monthly self-reported fall logs

Monitoring Plan

Study implementation will be monitored through session logs maintained by facilitators and monthly follow-up calls with participants to track falls and engagement. Regular check-ins with the study team will address any challenges in delivery or participation. The principal investigator will oversee session attendance and follow-up data to ensure consistency and quality. Fidelity to the strengthened intervention components will be monitored through facilitator checklists and periodic supervision to ensure consistent delivery.

Data Management

Data will be securely digitized and stored in password-protected databases, ensuring confidentiality and restricted access. All identifiable information will be de-identified before analysis to maintain participant privacy. Data entry will be double-checked for accuracy, and regular quality control checks will be conducted to minimize errors. Backup copies will be maintained in encrypted storage, and only authorized personnel will have access to the dataset.

Data Analysis

Qualitative Analysis: Thematic analysis will assess feasibility, acceptability, and necessary adaptations of the intervention. Codes will emerge inductively based on participant experiences, focusing on barriers, facilitators, engagement, and suggested modifications. Key themes will inform refinements for a larger-scale study, ensuring the intervention is contextually relevant and effectively implemented.

Quantitative Analysis: Descriptive statistics will summarize demographic and baseline characteristics. Pre-post comparisons will be conducted using paired t-tests for normally distributed variables and Wilcoxon signed-rank tests for non-normally distributed variables. Adherence, session attendance, and retention rates will be analysed using frequency distributions. Statistical significance will be set at $p < 0.05$, and all analyses will be conducted using STATA 17 software.

Data Retention and Disposal Plan

All study data will be securely stored for seven years in compliance with institutional data policies. Paper-based records will be stored in locked cabinets accessible only to authorized personnel. Electronic data will be

stored on password-protected devices and encrypted servers. After the retention period, paper records will be shredded, and electronic files will be permanently deleted from all devices and backup systems.

Ethical Considerations

Ethical approval will be obtained from the Aga Khan University Ethics Review Committee (ERC), ensuring compliance with institutional research guidelines for vulnerable populations, particularly older adults. Informed consent will be collected from all participants (or their caretakers, where necessary), with special attention to clear communication and comprehension, considering potential cognitive or sensory limitations. Participants will be informed about voluntary participation and their right to withdraw at any time. Anonymity, privacy and confidentiality will be strictly maintained to protect their autonomy and well-being.

Risk Mitigation Strategy

Trained facilitators will closely supervise all exercises to minimize the risk of injury, ensuring safety throughout the intervention. Emergency protocols will be established at all intervention sites to address any unforeseen incidents promptly. Participants identified as having a high fall risk will be referred to appropriate medical services for further assessment and care.

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