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Psychological and Behavioural Determinants of Fall Prevention in Elderly Individuals Living Independently

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Falls constitute a significant public health issue among older adults, frequently resulting in functional deterioration, diminished autonomy, and greater healthcare demands. In addition to physical frailty, behavioural factors play a crucial role in determining fall risk and adherence to preventive measures among elderly individuals living independently. Psychological elements, including fear of falling and risk perception, interact with everyday behaviours such as engagement in physical activity, implementation of home safety practices, and participation in social activities. This study aims to identify key psychological and behavioural factors influencing fall prevention in community-dwelling older adults who maintain independent living. Data were collected from 3,850 adults aged 65 years and older residing independently, utilising structured questionnaires. Psychological variables were assessed using validated instruments measuring fall-related self-efficacy, emotional distress, and cognitive function, whereas behavioural factors encompassed exercise frequency, use of assistive devices, and patterns of medication management. Multivariate logistic regression, structural equation modelling, and reliability analyses were conducted using Statistical Package for the Social Sciences (SPSS) and Analysis of Moment Structures (AMOS) to determine both direct and indirect relationships between the identified determinants and fall prevention outcomes. Findings revealed that greater self-efficacy in fall prevention, regular participation in balance-focused exercise, proactive modification of home hazards, and robust social engagement were associated with a significant reduction in fall incidence ($p < 0.05$). In contrast, higher levels of fear of falling and depressive symptoms were correlated with lower engagement in preventive behaviours and a heightened likelihood of falls. These results underscore the importance of enhancing psychological resilience and encouraging adaptive safety behaviours as integral

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elements of comprehensive fall prevention interventions for independently living older adults.

Keywords: Fall Prevention, Psychological Determinants, Behavioural Risk Factors, Independent Older Adults, Fear of Falling, Community-Based Aging behavior.

Introduction

System-Level Aging Stability and Fall Risk Dynamics

Falls among older adults represent a critical concern, directly affecting functional competence and the ability to maintain autonomous movement in later life. Gradual declines in neuromuscular coordination, integration of proprioceptive signals, sensory feedback, and postural control mechanisms increase susceptibility to instability during routine activities. Consequently, fall prevention has become a central focus in advancing operational safety and supporting continued independent living, both within aging systems engineering and gerontological research (Çekok & Anaforoğlu, 2025).

Figure 1: Environmental and Behavioural Fall Prevention Measures

The social consequences of falls can extend beyond the immediate physical injury, often leading to diminished self-confidence, restricted

mobility, and accelerated decline in functional capacity (Figure 1). These effects tend to cascade, imposing substantial demands on healthcare systems and weakening the resilience of individuals. Therefore, the adoption of multidimensional approaches that move beyond a sole focus on physical factors is essential to achieve effective fall prevention.

State-of-the-Art Physical and Environmental Risk Mitigation Paradigms

Current research on fall prevention has primarily focused on reducing biomechanical and environmental hazards. Additional strategies that can be evaluated under controlled conditions include balance and strength training, the use of mobility-assistive devices, and modifications to the living environment. Multimodal interventions and architectures are commonly employed in rehabilitation engineering and geriatric healthcare systems. Despite their demonstrated effectiveness in structured settings, fall incidence among older adults living independently remains elevated. This discrepancy between controlled outcomes and real-world performance highlights limitations in existing prevention frameworks, which often fail to comprehensively account for the factors that shape adaptive behaviours and consistent performance in daily life (Abaza & Hegland, 2026).

Cognitive–Behavioural Modulation of Stability-Oriented Actions

Psychological regulatory processes exert a significant influence on stability-related behaviours by shaping risk assessment, confidence calibration, and decision-making thresholds. Factors such as fear of falling, perceived self-efficacy, cognitive appraisal, and emotional regulation modulate both movement initiation and strategies for interacting with the environment. Elevated perceptions of threat often result in activity avoidance, physical deconditioning, and diminished adaptive capacity. Conversely, insufficient awareness of hazards may lead to unsafe locomotor behaviours, even in familiar settings.

Figure 2 illustrates how physical, behavioural, environmental, habitual, clothing, and medication-related factors interact to create a cycle that increases fall risk, reduces physical activity, and reinforces fear of falling. Behavioural patterns also indicate fall risk by shaping routines that adhere to safety practices. Engagement in conditioning exercises, compliance with therapeutic regimens, utilisation of assistive devices, and consistent implementation of environmental safety measures directly influence stability outcomes. Although these behaviours are theoretically modifiable, they remain strongly influenced by sustained cognitive alignment, motivation, and perceived practical value. A failure to achieve this alignment restricts both the resilience and scalability of existing fall prevention systems (Röhrich et al., 2025).

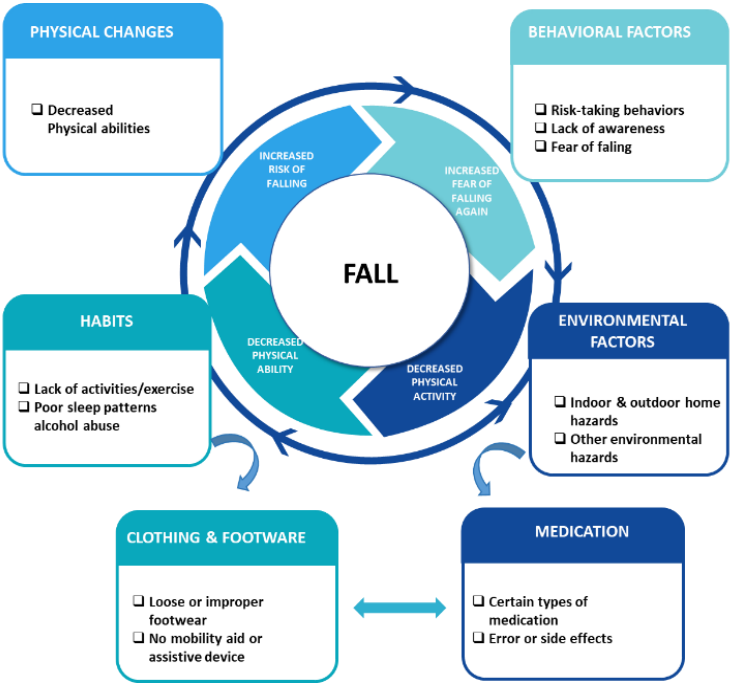

Figure 2: Cycle of Factors Contributing to Falls in Older Adults' Health

Structural Deficiencies in Determinant Integration Frameworks

Conventional fall prevention models are largely reductionist, isolating biomechanical deficits from cognitive and behavioural regulatory mechanisms. Fragmented assessment approaches inadequately capture the dynamic interplay between psychological states and behavioural responses, limiting both predictive accuracy and the sustainability of intervention programmes. Consequently, preventive performance may decline when applied outside supervised or time-limited contexts. Empirical investigations that integrate psychological and behavioural predictors into comprehensive fall prevention strategies for independently living older adults are scarce. The absence of holistic determinant frameworks hinders the development of adaptive, behaviour-sensitive prevention systems capable of responding to real-world variability (Alsanousi & Prabhu, 2025). This limitation represents a significant challenge in optimising ageing systems.

Analytical Objective and Scientific Advancement

This study investigates the psychological and behavioural factors that influence fall prevention among older adults living independently,

utilising structured assessments and analytical evaluation. The focus is on identifying modifiable cognitive and behavioural variables that guide stability-related decision-making and engagement in preventive actions. An integrative analytical approach is employed to delineate the interaction pathways that govern fall risk dynamics. The findings contribute to a deeper technical understanding of determinant-based fall prevention, supporting the design of adaptive, person-centred safety frameworks. Improved insight into cognitive–behavioural interactions enhances system reliability, preserves functional autonomy, and fosters innovation in gerontology and rehabilitation engineering research. Figure 3 presents an overview of fall prevention incorporating psychological and behavioural factors (Hajatnia et al., 2023).

Figure 3: Overview of Fall Prevention with Psychological and Behavioural Factors

Related Work

Previous research highlights the considerable impact of falls among older adults, indicating that psychological factors, including fear, self-efficacy, and cognitive function, interact with behavioural practices, activity engagement, and environmental supports to shape fall risk and preventive outcomes (Aminazad et al., 2025).

Epidemiology and Consequences of Falls in the Elderly

Yang et al. (2026) assessed fear of falling among older adults who were confined to their homes. A cross-sectional quantitative design was employed, utilising standardized fear-of-falling instruments alongside demographic questionnaires among community-dwelling participants. High levels of fear were prevalent, with 64.7% of participants reporting

significant fear, which showed a strong association with prior fall history ($p < 0.01$). As the participants were housebound, the findings were limited in their generalisability to more physically active older populations.

In a separate study, Nur'amalia et al. (2025) investigated both direct and indirect relationships of fall-related factors in community-dwelling older women using structural equation modelling (SEM). The cross-sectional study involved 90 women aged 60 years and above (August–September 2023). Data were collected through structured questionnaires covering fall incidence, fear of falling, and gait efficacy, as well as physical assessments of function and activity levels. SEM analysis revealed that fall incidence was directly associated with physical activity ($\beta = 0.243$, $p = 0.009$), gait efficacy ($\beta = -0.318$, $p = 0.001$), and physical function ($\beta = 0.233$, $p = 0.02$). Indirect effects of physical function were mediated by physical activity and gait efficacy, while physical activity showed a significant correlation only with physical function ($\beta = 0.236$, $p = 0.038$), which was observable primarily in small, cross-sectional samples. The evidence from these studies has been systematically compiled and summarised in Table 1.

Table 1

Overview of Fall Risk Assessment and Digital Interventions

Reference	Objective	Method	Result	Limitation
(Poncumhak et al., 2025)	Identification of fall risk through the Fear of Falling Scale	Psychometric validation and correlation with functional balance assessments	Demonstrated high reliability (Cronbach's $\alpha = 0.91$) and a strong inverse relationship with balance impairment ($r = -0.62$, $p < 0.001$)	External generalizability limited due to single-community sample
(Pettersson et al., 2025)	Implementation of digital balance-training for fall prevention	Randomized controlled trial comparing digital exercise intervention with control	Fall risk decreased by 35%; significant enhancement in lower-limb strength ($p < 0.01$)	Participation limited by technology availability and digital literacy
(Leite et al., 2025)	Evaluation of a mobile home-exercise application for fall prevention	Usability testing and expert content validation in older adults	Satisfaction exceeded 85%; balance performance improved by 18% ($p < 0.05$)	Small pilot sample restricted generalizability of effectiveness

Psychological Determinants of Fall Risk

Alkhamis et al. (2025) investigated cognitive function and fear-related factors as psychological predictors of balance impairment. Cross-sectional models were employed to examine the relationship between cognitive test scores, fear-of-falling scales, and balance performance. Findings indicated that balance deterioration was significantly predicted by fear of falling

independence (0.41, $p < 0.001$), while cognitive decline contributed substantially to fall susceptibility. The observational design, however, limited causal inferences. Soh et al. (2025) explored the theoretical interplay between falls efficacy and fear of falling. Quantitative assessments of efficacy beliefs and fear constructs were applied using validated psychological measures in older adults. Lower falls efficacy scores were strongly associated with elevated fear levels ($r = -0.68$, $p < 0.001$), highlighting considerable psychological vulnerability. The absence of longitudinal tracking constrained the predictive capacity of these measures. The relevant findings from previous research have been systematically compiled and are presented in Table 2.

Table 2

Psychological Factors Influencing Fall Risk Perception

Reference	Objective	Method	Result	Limitation
(Arai & Mangyo, 2026)	Investigation of associations between fall history, fear, health literacy, and self-efficacy	Survey-based structural equation modelling among community-dwelling older adults	Previous fall incidents raised fear scores by 22%; higher self-efficacy was significantly associated with lower fear levels ($p < 0.01$)	Regional sample constrained cross-cultural applicability
(Hasan et al., 2025)	Evaluation of fall risk perception in older adults and their caregivers	Cross-sectional assessment of perceived susceptibility and comparative risk	48% of participants underestimated their personal fall risk despite recorded fall events	Use of self-reported measures introduced potential response bias

Behavioural Determinants of Fall Prevention

Leite et al. (2025) validated a mobile-based home exercise programme aimed at fall prevention. Following structured intervention exposure, usability testing and functional balance assessments were conducted. Balance performance improved by 18%, and adherence during the intervention exceeded 80%. However, sustained behavioural adherence was not observed due to a limited follow-up period. Lee and Kim (2024) examined the relationship between fear of falling and health-related quality of life, considering the mediating role of depression and the moderating effect of physical activity. Structural equation modelling indicated that higher fear scores significantly predicted depressive symptoms ($\beta = 0.52$, $p < 0.001$), which in turn reduced quality-of-life measures by 27 points. The cross-sectional design limited interpretation of mediation effects over time. The pertinent findings from these studies are systematically summarised in Table 3.

Table 3

Behavioural Factors and Adherence in Fall Prevention

Reference	Objective	Method	Result	Limitation
(Tsai et al., 2024)	Assessment of the combined effects of fear and reduced physical activity on fall susceptibility	Logistic regression among community-dwelling older adults	Elevated fear coupled with low physical activity was linked to a 2.4-fold higher fall risk ($p < 0.01$)	Physical activity measured via self-reported instruments
(Lee et al., 2024)	Examination of adherence patterns in fall-prevention exercise programmes	Mixed-method longitudinal monitoring of participation trends	62% of participants maintained steady adherence; consistent adherence was associated with improved functional mobility ($p < 0.05$)	Significant behavioural dropout observed during later phases

Bajdek et al. (2024) assessed the feasibility of a multicomponent digital fall-prevention programme for older adults at risk. Pilot implementation examined recruitment, adherence, and functional outcomes. Completion rates reached 76%, and functional mobility improved by 15% relative to baseline. However, the small sample size limited the statistical power to support claims of effectiveness. Zhou et al. (2025) re-evaluated the effects of home-based strength and balance exercises in older adults. Randomised allocation demonstrated notable improvements in balance confidence and a 29% reduction in fall incidence ($p < 0.05$). The short duration of follow-up, however, restricted evaluation of long-term recurrence patterns.

Interplay of Psychological and Behavioural Factors

Wu (2025) investigated how physical and mental health outcomes among older adults are affected by their living environments. Cross-sectional modelling indicated that supportive environments reduced psychological distress scores by 21% and indirectly promoted greater engagement in physical activity ($p < 0.01$). The absence of longitudinal assessment, however, limited the ability to evaluate dynamic adaptation to environmental factors over time.

Research Gap

Existing research has largely focused on isolated psychological predictors, such as fear, cognition, and self-efficacy, or on discrete behavioural interventions, including exercise adherence and digital programmes. However, few studies have conducted integrative analyses of psychological and behavioural predictors that capture the interaction between emotional vulnerability and sustained preventive behaviours. To address these gaps, the present study investigates the impact of

psychological and behavioural factors on fall prevention among community-dwelling older adults living independently.

Hypothesis Development

Falls among independently living older adults are conceptualised as the outcome of dynamic interactions between psychological vulnerability and behavioural regulation. A theoretical model integrating fall incidence (FI) with fear-avoidance and health behaviour frameworks provides a lens to understand falls as influenced both by internal cognitive-emotional processes and by external preventive behaviours.

Fall-Related Self-Efficacy (FRSE) and Fall Incidence (FI)

Fall-related self-efficacy reflects an individual's confidence in performing daily activities without losing balance. Theoretical perspectives suggest that perceived capability governs the initiation and maintenance of actions under challenging conditions, as well as adaptive coping in risky situations. High self-efficacy reduces anxiety, which in turn improves motor coordination and attentional control, thereby decreasing instability during ambulation.

H1. Fall-related self-efficacy (FRSE) demonstrates a negative association with fall incidence (FI) among independently living older adults.

Fear of Falling (FOF) and Fall Incidence (FI)

Fear of falling represents heightened sensitivity to perceived physical vulnerability. While moderate concern can enhance vigilance, persistent fear often results in activity limitation, muscular deconditioning, and impaired balance control. During gait tasks, increased postural sway and delayed reaction times are observed, which are further exacerbated by elevated anxiety, disrupting the allocation of attention.

H2. Fear of falling (FOF) demonstrates a positive association with fall incidence (FI) among independently living older adults.

Emotional Distress / Depressive Symptoms (EDS) and Fall Incidence (FI)

Emotional distress interferes with compliance to safety behaviours, adherence to medication regimens, and engagement in physical activity. Neurocognitive evidence indicates that depressive states impair executive functioning and postural control, thereby compromising responsiveness to environmental demands.

H3. Emotional distress / depressive symptoms (EDS) demonstrate a positive association with fall incidence (FI) among independently living older adults.

Cognitive Status (CS) and Fall Incidence (FI)

Cognitive status governs hazard perception, spatial orientation, dual-task performance, and executive decision-making. Deficits in attention or working memory reduce the capacity to anticipate obstacles and adjust gait patterns accordingly.

H4. Cognitive status (CS) demonstrates a negative association with fall incidence (FI) among independently living older adults.

Behavioural determinants encompass modifiable safety actions that convert psychological preparedness into tangible protective measures. Consistent engagement in preventive behaviours decreases exposure to both intrinsic and extrinsic risk factors.

Exercise and Balance-Training Frequency (EBTF) and Fall Incidence (FI)

Consistent engagement in structured physical activities and balance exercises enhances lower-extremity muscle strength, refines proprioceptive accuracy, and improves gait quality. Enhanced neuromuscular responsiveness facilitates rapid corrective actions in response to perturbations.

H5. Exercise and balance-training frequency (EBTF) demonstrates a negative association with fall incidence (FI) among independently living older adults.

Home Safety Practices (HSP) and Fall Incidence (FI)

Minimising extrinsic risk factors and improving safe mobility are achieved through proactive adoption of home modifications. The deliberate management of environmental hazards promotes stable living conditions and reduces unexpected balance disturbances. Consequently, increased engagement in home safety practices is linked to a lower incidence of falls.

H6. Home safety practices (HSP) demonstrate a negative association with fall incidence (FI) among independently living older adults.

Assistive Device Usage (ADU) and Fall Incidence (FI)

Correct and consistent use of assistive devices, including canes and walkers, enhances mechanical stability and load distribution during ambulation. When appropriately fitted, these devices support musculoskeletal weaknesses and maintain proper postural alignment. Utilising reliable aids reduces gait variability and facilitates safer transitions in mobility.

H7. Assistive device usage (ADU) demonstrates a negative association with fall incidence (FI) among independently living older adults.

Medication Management Patterns (MMP) and Fall Incidence (FI)

Polypharmacy and improper medication use contribute to dizziness, hypotension, sedation, and impaired alertness. Structured medication management, including adherence to prescribed regimens, dosage control, and monitoring of side effects, mitigates these physiological risks.
H8. Medication management patterns (MMP) demonstrate a negative association with fall incidence (FI) among independently living older adults.

Social Participation (SP) and Fall Incidence (FI)

Active participation in social activities promotes mobility, cognitive engagement, and psychological resilience. Involvement in community initiatives encourages habitual movement and reinforces health-supportive behaviours. Social connectedness also mitigates depressive symptoms and counteracts the physical decline associated with isolation. Informal monitoring and peer support further improve adherence to preventive practices.
H9. Social participation (SP) demonstrates a negative association with fall incidence (FI) among independently living older adults.

Mediating Role of Exercise and Balance-Training Frequency

Self-efficacy exerts both direct and indirect influences on health outcomes. Strong confidence in balance capabilities fosters sustained engagement in physical conditioning. Individuals with high FRSE are more committed to regular participation in physical activity and balance exercises. The resulting improvements in neuromuscular coordination and muscular strength contribute to reduced instability and lower fall risk.
H10. Exercise and balance-training frequency (EBTF) mediates the relationship between fall-related self-efficacy (FRSE) and fall incidence (FI), such that higher FRSE increases EBTF, which subsequently decreases FI.

Figure 4 presents the conceptual framework underpinning this study.

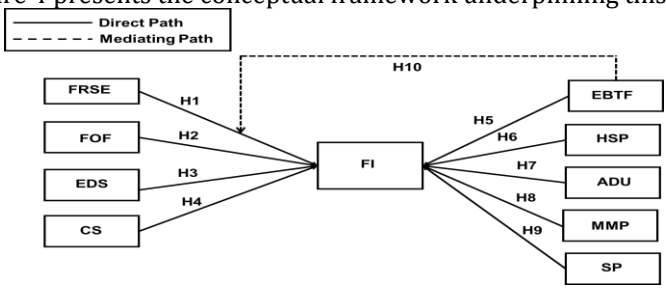

Figure 4: Visualization of Conceptual Framework

Materials and Methods

A community-based cross-sectional analytical design was employed to examine psychological and behavioural determinants of fall prevention among independently living older adults. The study targeted community-dwelling individuals aged 65 years and above residing independently across urban and semi-urban areas, including senior associations, community centres, and independent living facilities. Data were collected over a 12-month period to capture seasonal variations in physical activity patterns and fall occurrences. The analytical framework enabled simultaneous estimation of direct and indirect relationships among psychological factors, preventive behaviours, and fall incidence using multivariate modelling techniques.

Participants and Sampling

Sample Size

A total of 3,850 community-dwelling adults aged 65 years and older was deemed sufficient for multivariate and structural equation modelling analyses. The large sample size ensured stable parameter estimation, minimised sampling bias, and strengthened model reliability. This capacity enabled precise identification of complex associations among psychological variables, behavioural patterns, and fall outcomes.

Selection Criteria (Screened Population: 4,000)

A total of 4,000 community-dwelling adults aged 65 years and older residing in non-institutional settings were screened for eligibility. Interviews assessed independent living status, functional capacity, and stable health conditions. Cognitive integrity and effective communication abilities were confirmed to ensure reliable evaluation of psychological and behavioural determinants relevant to fall prevention.

Inclusion Criteria (n = 3,850)

The study involved 3,850 community-dwelling older adults aged 65 years and above, residing independently in private homes or independent living facilities. Eligible participants demonstrated adequate functional ambulation, with or without assistive devices, and possessed sufficient cognitive capacity to complete the questionnaires reliably. Written informed consent was voluntarily obtained from all participants prior to their inclusion in the study.

Exclusion Criteria (n = 150)

A total of 150 individuals were excluded from the study. This included 30 participants residing in nursing homes or long-term care facilities, 25

participants diagnosed with severe cognitive impairment or advanced dementia, 35 participants who were bedridden or fully dependent on mobility assistance, 30 participants with recent acute neurological or musculoskeletal conditions affecting balance, and 30 participants with significant medical instability requiring continuous clinical supervision.

Sampling Technique

Participants from various residential areas were recruited using a multistage stratified sampling approach. Settlements were first stratified into geographic zones, followed by systematic selection of households at predefined intervals. A screening procedure ensured inclusion of independently living older adults, thereby enhancing the representativeness and external validity of the study.

Data Collection Procedure

Community data were collected by trained field investigators using standardized questionnaires. To ensure response accuracy, participants with minor visual or literacy difficulties were offered neutral verbal administration of questionnaire items. The data encompassed demographic characteristics, psychological factors, behavioural patterns, and fall experiences. On-site checks were conducted to verify completeness and logical consistency, and any missing information, which was below five percent, was addressed immediately during the same session. Figure 5 presents the corresponding pie chart.

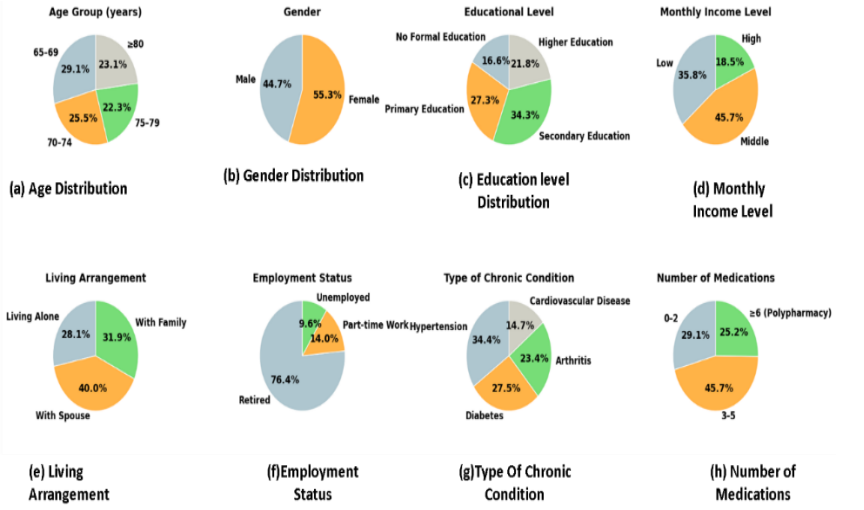

Figure 5: Pie Chart Showing the Demographic Table

Results and Discussion

Table 4 presents the demographic distribution of participants. The largest age group was 65–69 years, comprising 29.1% of the sample, followed by those aged 80 years and above at 23.1%. Female participants represented 55.3% of the cohort, exceeding the proportion of men (44.7%). Secondary education was the most common educational level (34.3%), and 45.7% of participants reported a middle-range monthly income. Regarding living arrangements, 40% resided with a spouse, while 28.1% lived alone. Hypertension was the most prevalent chronic condition (46.2%), and 45.7% of participants used three to five medications, indicating that multimorbidity and polypharmacy were prominent within the cohort.

Table 4

Demographic, Socioeconomic, and Health Characteristics of Older Adult Participants (n = 3,850)

Variable	Category	Frequency (n)	Percentage (%)
Age Group (Years)	65–69	1,120	29.1
	70–74	980	25.5
	75–79	860	22.3
	≥80	890	23.1
Gender	Male	1,720	44.7
	Female	2,130	55.3
Educational Level	No Formal Education	640	16.6
	Primary Education	1,050	27.3
	Secondary Education	1,320	34.3
	Higher Education	840	21.8
Monthly Income Level	Low	1,380	35.8
	Middle	1,760	45.7
	High	710	18.5
Living Arrangement	Living Alone	1,080	28.1
	With Spouse	1,540	40.0
	With Family	1,230	31.9
Employment Status	Retired	2,940	76.4
	Part-time Work	540	14.0
	Unemployed	370	9.6
Type of Chronic Condition*	Hypertension	1,780	46.2
	Diabetes	1,420	36.9
	Arthritis	1,210	31.4
	Cardiovascular Disease	760	19.7
Number of Medications	0–2	1,120	29.1
	3–5	1,760	45.7
	≥6 (Polypharmacy)	970	25.2

4.4 Measures and Instruments

All constructs were evaluated using validated instruments specifically adapted for community-dwelling older adults. Standardized administration and scoring protocols were applied to ensure consistent measurement.

Table 5

Variables and Explanations of Psychological and Behavioural Determinants of Fall Prevention

Variable	Explanation
FRSE	Measures confidence in performing daily activities without falling; predicts engagement in preventive behaviours.
FOF	Assesses concern or anxiety about falling; identifies behavioural withdrawal and mobility restriction.
EDS	Evaluates depressive symptoms, fatigue, and emotional strain; affects adherence to fall-prevention strategies.
CS	Measures memory, attention, and executive control; impacts safe decision-making and hazard recognition.
EBTF	Quantifies participation in physical and balance exercises; strengthens stability and coordination.
HSP	Assesses implementation of safety measures at home; reduces hazards and promotes secure living.
ADU	Evaluates proper use of mobility aids; enhances stability and safer ambulation.
MMP	Assesses adherence and handling of medications; reduces dizziness or cognitive impairment.
SP	Measures engagement in social activities; promotes cognitive, emotional, and physical resilience.
FI	Captures occurrence of falls over twelve months; primary outcome for evaluating fall prevention effectiveness.

In Table 5, higher scores indicate greater levels of each construct unless noted otherwise, while Table 6 presents the individual questionnaire items.

Table 6

Questionnaire Items for Psychological and Behavioural Determinants of Fall Prevention

Variable	Code	Questionnaire Items (4 Per Variable)
FRSE	FRSE1	I am confident in my ability to walk safely without falling.
	FRSE2	I can maintain my balance during daily activities.
	FRSE3	I feel capable of preventing falls in my home environment.
	FRSE4	I can recover my balance if I feel unsteady.
FOF	FOF1	I worry about falling while walking indoors.
	FOF2	I am afraid of falling when using stairs.
	FOF3	Fear of falling limits my daily activities.
	FOF4	I avoid certain movements because I might fall.
EDS	EDS1	I often feel sad or depressed.
	EDS2	I feel little interest or pleasure in daily activities.
	EDS3	I feel emotionally exhausted most days.
	EDS4	I feel anxious about my health and safety.
CS	CS1	I can concentrate well on daily tasks.

	CS2	I rarely feel confused while performing activities.
	CS3	I can remember instructions related to my safety.
	CS4	I can make quick decisions to avoid hazards.
EBTF	EBTF1	I regularly perform balance-training exercises.
	EBTF2	I engage in physical activity at least three times per week.
	EBTF3	I include strength or flexibility exercises in my routine.
	EBTF4	I follow exercise routines recommended by healthcare professionals.
HSP	HSP1	I have removed tripping hazards from my home.
	HSP2	My home has adequate lighting in all areas.
	HSP3	I use non-slip mats in bathrooms and kitchens.
	HSP4	I regularly check my home for potential fall risks.
ADU	ADU1	I use assistive devices (e.g., a cane, a walker) when needed.
	ADU2	I feel comfortable using assistive devices for mobility.
	ADU3	I use assistive devices correctly as instructed.
	ADU4	Assistive devices help me move safely.
MMP	MMP1	I take my medications exactly as prescribed.
	MMP2	I am aware of medication side effects related to dizziness or balance.
	MMP3	I review my medications regularly with a healthcare provider.
	MMP4	I avoid missing or doubling medication doses.
SP	SP1	I regularly participate in social activities.
	SP2	I maintain frequent contact with family or friends.
	SP3	I feel socially supported in my daily life.
	SP4	Social engagement motivates me to stay active and safe.
FI	FI1	I have experienced one or more falls in the past year. *(reverse-coded)*
	FI2	I feel safe while performing daily activities.
	FI3	I actively take steps to prevent falls.
	FI4	My current lifestyle helps me avoid falls.
		Response Scale for all items:
		1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree

Statistical Analysis

A cross-sectional study was conducted with 3,850 independently living older adults to investigate the psychological and behavioural determinants of fall prevention. Data analysis was performed using IBM SPSS Statistics 27 and AMOS 26. Direct and indirect relationships among variables were examined through reliability analysis, exploratory factor analysis (EFA), multivariate logistic regression, and SEM. Statistical significance was set at $p < 0.05$, and model validity and reliability were assessed using standard fit indices.

Reliability and Convergent Validity Analysis

Internal consistency, item correlations, and construct validity were assessed to ensure that the measurement scales accurately captured psychological and behavioural determinants, reflecting strong reliability. This was evaluated using Cronbach's alpha (CA), composite reliability (CR), and convergent validity (average variance extracted, AVE) for the fall-prevention constructs. Table 7 and Figure 6 present the reliability and convergent validity of the study constructs. Cronbach's alpha values

ranged from 0.801 to 0.891, indicating strong internal consistency, with fall-related self-efficacy (FRSE) demonstrating the highest reliability (0.891). Composite reliability (CR) values ranged from 0.845 to 0.915, again with FRSE exhibiting the highest score (0.915), reflecting robust construct reliability.

Table 7

Reliability and Convergent Validity Results

Construct	CA	Composite Reliability (CR)	AVE
FRSE	0.891	0.915	0.683
FOF	0.874	0.903	0.651
EDS	0.861	0.892	0.623
CS	0.882	0.908	0.664
EBTF	0.847	0.886	0.609
HSP	0.833	0.872	0.592
ADU	0.814	0.858	0.548
MMP	0.856	0.889	0.616
SP	0.869	0.898	0.642
FI	0.801	0.845	0.521

All constructs had an average variance extracted (AVE) above 0.50, confirming adequate convergent validity, with FRSE showing the highest AVE at 0.683.

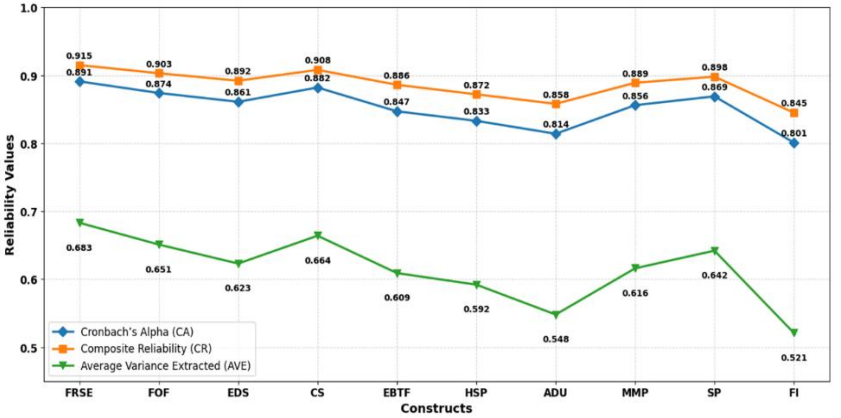

Figure 6. Reliability and Convergent Validity analysis

Multivariate Logistic Regression

Identifies independent predictors of fall incidence and evaluates the strength, direction, and significance of these associations using odds ratios (OR), confidence intervals (CI), and p-values, thereby determining which psychological and behavioural factors increase the risk of falls among older adults. Table 8 and Figure 7 present the logistic regression outcomes for fall incidence predictors, with all variables contributing significantly to

the model ($p < 0.01$) at Wald values ranging from 6.82 to 33.67. Protective factors that significantly reduced the odds of falling included fall-related self-efficacy (OR = 0.949), cognitive status (OR = 0.957), frequency of exercise and balance training (OR = 0.732), and home safety practices (OR = 0.760). Conversely, fear of falling (OR = 1.091) and emotional distress (OR = 1.063) were associated with an increased risk of falls.

Table 8

Logistic Regression Results for Predictors of Fall Incidence

Predictor Variable	B	SE	Wald χ^2	Odds Ratio (OR)	95% CI for OR	P-Value	VIF
FRSE	-0.052	0.009	33.41	0.949	0.933 – 0.966	<0.001	1.84
FOF	0.087	0.015	33.67	1.091	1.060 – 1.124	<0.001	2.11
EDS	0.061	0.012	25.84	1.063	1.038 – 1.090	<0.001	1.76
CS	-0.044	0.011	16.00	0.957	0.936 – 0.979	<0.001	1.59
EBTF	-0.312	0.058	28.94	0.732	0.654 – 0.820	<0.001	1.68
HSP	-0.274	0.052	27.74	0.760	0.686 – 0.843	<0.001	1.72
ADU	-0.188	0.072	6.82	0.829	0.720 – 0.954	0.009	1.34
MMP	-0.146	0.041	12.68	0.864	0.797 – 0.936	<0.001	1.63
SP	-0.205	0.049	17.49	0.815	0.740 – 0.898	<0.001	1.57

Variance inflation factors ranged from 1.34 to 2.11, indicating absence of multicollinearity and stable regression estimates.

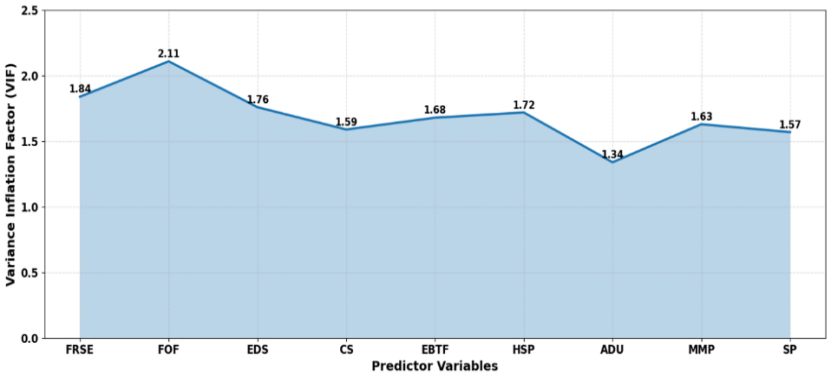

Figure 7: Visualization of VIF Results

Model Fit Analysis

Evaluates the structural validity of SEM models, with fit indices (χ^2/df, CFI, TLI, GFI, AGFI, RMSEA, SRMR) reflecting the degree of agreement between observed data and hypothesized relationships, thereby enabling reliable and interpretable structural estimation. Table 9 presents the model fit indices for both the saturated and estimated structural models of fall-prevention constructs. The constructs demonstrated excellent fit, with CFI values ranging from 0.968 to 0.982, GFI from 0.941 to 0.953, and AGFI at 0.924, indicating strong model adequacy. Residual and error values were minimal, with RMR between 0.020 and 0.027 and RMSEA between 0.045 and 0.051, reflecting only small discrepancies between observed and estimated models. Collectively, these indices confirm that the structural models reliably represent the relationships among psychological and behavioural determinants of fall prevention.

Table 9

Model Fit Indices for Saturated and Estimated Structural Models

Construct	χ^2	df	GFI	AGFI	CFI	PGFI	RMR	RMSEA
FRSE	42.16	16	0.951	0.922	0.981	0.602	0.021	0.047
FOF	39.84	15	0.948	0.917	0.978	0.591	0.023	0.046
EDS	35.67	14	0.953	0.924	0.982	0.604	0.020	0.045
CS	32.45	13	0.946	0.914	0.975	0.586	0.024	0.049
EBTF	34.82	14	0.949	0.918	0.977	0.590	0.022	0.048
HSP	36.10	15	0.952	0.921	0.981	0.600	0.022	0.047
ADU	28.74	13	0.944	0.909	0.972	0.578	0.026	0.050
MMP	30.18	14	0.947	0.912	0.974	0.583	0.025	0.048
SP	33.62	15	0.950	0.919	0.979	0.597	0.023	0.046
FI	26.94	12	0.941	0.905	0.968	0.570	0.027	0.051

Exploratory Factor Analysis (EFA)

Establishes latent construct measurements by examining item-to-construct loadings, variance explained, and inter-factor correlations, providing initial validation along with evidence of convergent and discriminant validity for the fall-prevention variables. Table 10 presents the results of the exploratory factor analysis (EFA) for all measurement constructs. Factor loadings were high, ranging from 0.74 (FI1) to 0.88 (EBTF2), indicating strong item-to-construct correlations. The variance explained by each construct ranged from 6.4% (Fall Incidence) to 8.3% (Exercise & Balance-Training), reflecting substantial representation of the latent dimensions. Constructs such as FRSE (0.79–0.85), FOF (0.80–0.86), and SP (0.81–0.87) demonstrated high loadings, supporting strong convergent validity and a coherent internal structure.

Table 10

Exploratory Factor Analysis (EFA) Results for Measurement Constructs and Items

Construct	Item Code	Factor Loading	Standard Error (SE)	% Variance Explained
FRSE	FRSE1	0.82	0.018	
	FRSE2	0.85	0.017	
	FRSE3	0.79	0.019	7.8
	FRSE4	0.83	0.018	
FOF	FOF1	0.81	0.019	
	FOF2	0.84	0.018	
	FOF3	0.86	0.017	7.4
	FOF4	0.80	0.020	
EDS	EDS1	0.78	0.020	
	EDS2	0.82	0.019	
	EDS3	0.84	0.018	7.1
	EDS4	0.79	0.020	
CS	CS1	0.76	0.021	
	CS2	0.80	0.020	6.8
	CS3	0.83	0.019	
	CS4	0.78	0.021	
EBTF	EBTF1	0.85	0.017	
	EBTF2	0.88	0.016	
	EBTF3	0.82	0.018	8.3
	EBTF4	0.84	0.017	
HSP	HSP1	0.79	0.020	
	HSP2	0.83	0.019	
	HSP3	0.86	0.018	7.2
	HSP4	0.81	0.019	
ADU	ADU1	0.84	0.018	
	ADU2	0.86	0.017	
	ADU3	0.82	0.018	7.6
	ADU4	0.80	0.019	
MMP	MMP1	0.78	0.020	
	MMP2	0.81	0.019	
	MMP3	0.85	0.018	6.9
	MMP4	0.80	0.019	
SP	SP1	0.83	0.018	
	SP2	0.87	0.017	
	SP3	0.85	0.018	7.9
	SP4	0.81	0.019	
FI	FI1	0.74	0.022	
	FI2	0.82	0.019	
	FI3	0.85	0.018	6.4
	FI4	0.80	0.019	

Structural Equation Modelling (SEM)

Examines direct, indirect, and mediated relationships among variables, assessing the psychological and behavioural influences on fall incidence. This analysis tests hypotheses and behavioural pathways, supporting the links between self-efficacy, cognitive status, exercise, safety practices, and

reductions in fall risk. Table 11 indicates that all psychological factors (FRSE, FOF, EDS, CS) and behavioural determinants (EBTF, HSP, ADU, MMP, SP) exerted significant direct effects on fall incidence. Exercise and balance training (EBTF → FI, β = -0.35, t = -8.97) and fall-related self-efficacy (FRSE → FI, β = -0.32, t = -7.80) showed the strongest protective effects. Conversely, fear of falling (FOF → FI, β = 0.29, t = 7.63) and emotional distress (EDS → FI, β = 0.25, t = 6.94) were associated with higher fall risk.

Table 11

SEM Path Analysis Results for Direct and Mediated Effects on Fall Incidence

Hypothesis	Path	Standard Error (SE)	Path Coefficient (β)	T-Value	P-Value	Significance
H1	FRSE → FI	0.041	−0.32	−7.80	< 0.001	Significant
H2	FOF → FI	0.038	0.29	7.63	< 0.001	Significant
H3	EDS → FI	0.036	0.25	6.94	< 0.001	Significant
H4	CS → FI	0.034	−0.21	−6.18	< 0.001	Significant
H5	EBTF → FI	0.039	−0.35	−8.97	< 0.001	Significant
H6	HSP → FI	0.037	−0.27	−7.30	< 0.001	Significant
H7	ADU → FI	0.035	−0.19	−5.43	< 0.001	Significant
H8	MMP → FI	0.036	−0.23	−6.39	< 0.001	Significant
H9	SP → FI	0.038	−0.28	−7.37	< 0.001	Significant
H10	FRSE → EBTF → FI	0.022	−0.14	−6.36	< 0.001	Significant

Social participation (SP → FI, β = -0.28, t = -7.37) and home safety practices (HSP → FI, β = -0.27, t = -7.30) also contributed significantly to reducing falls. Mediation analysis revealed that FRSE indirectly lowered fall incidence through EBTF (β = -0.14, t = -6.36), highlighting the behavioural pathway linking self-efficacy to fall prevention (Figure 8).

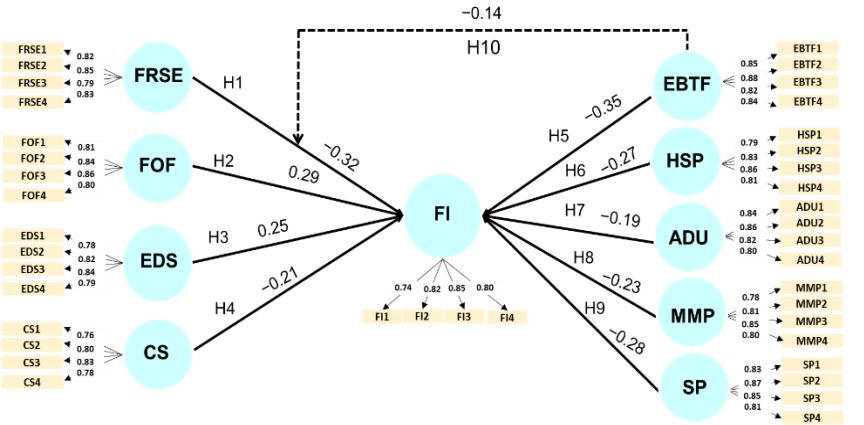

Figure 8: Representation of SEM Results

This study investigated the combined influence of psychological and behavioural determinants on fall incidence among independently living older adults. Prior studies, such as those using the Fear of Falling Scale, were limited in external validity due to single-community sampling. Constraints in digital literacy and technology access restricted inclusivity in digital balance-training interventions, while small pilot sample sizes reduced statistical power and limited the evaluation of home exercise applications (Yang et al., 2026). Regional homogeneity also limited the cross-cultural generalizability of associations between fall experience, fear, and self-efficacy (Pettersson et al., 2025). Additionally, reliance on self-reported perceptions introduced bias in evaluating fall risk among both older adults and caregivers (Leite et al., 2025).

The current study overcame these limitations by employing a large, multi-community sample, applying objective, statistically driven modelling, increasing demographic diversity, integrating psychological and behavioural constructs, and utilising standardised measurement tools. The findings indicate that enhanced fall-related self-efficacy, preserved cognitive function, regular exercise, structured medication management, social engagement, and proactive home safety practices significantly reduced fall likelihood ($p < 0.05$). Conversely, elevated fear of falling and emotional distress increased fall risk. These results confirm that fall prevention is not solely dependent on biomechanical factors but reflects a multidimensional response encompassing cognitive-emotional regulation and sustained preventive behaviour. The behavioural pathway linking self-efficacy to fall reduction was further supported by the mediating role of exercise.

Analysis of psychological and behavioural factors demonstrates a multidimensional interaction between mental health, behavioural patterns, and fall-related outcomes. Psychological resilience emerges as a critical determinant of independence and fall prevention (Sotelo-Ojeda et al., 2025). Emotional stability enables older adults to manage everyday challenges effectively, enhancing performance in instrumental activities of daily living and supporting safety (Saez-Sanz et al., 2025). Literature consistently shows a strong association between fear of falling and fall incidence (Pedale et al., 2025). Excessive fear not only reduces physical activity but also impairs engagement in preventive measures (Rider et al., 2026), corroborating findings that heightened anxiety and behavioural symptoms, especially during crises such as the COVID-19 pandemic, exacerbate fall risk (Kuroda et al., 2022). Importantly, strategies that strengthen self-efficacy related to fall prevention exert a measurable protective effect (Momtaz et al., 2025).

Behavioural interventions, including regular exercise and proactive home hazard management, play a crucial role in preventing falls (Kaur,

2025). Creating age-friendly environments and promoting adaptive behaviours facilitate older adults' safety (Chen et al., 2025). These findings are consistent with evidence demonstrating widespread depressive symptoms among older adults across Europe, underscoring the need for interventions that address both psychological and environmental determinants (Melo et al., 2025). Effective medication management is also essential, as improper intake can contribute to cognitive confusion and increased fall risk (Moye, 2022). Integrating psychological interventions with practical strategies enhances overall quality of life while reducing fall risk (Cauli et al., 2021).

The study also highlights the importance of combining supportive technologies with community-based programmes to foster social engagement and peer support (Łapko et al., 2026). By addressing psychological resilience and incorporating practical routines, efficient fall-prevention strategies can be developed that meet the needs of older adults living independently. Comprehensive approaches—including promoting psychological strength, encouraging exercise participation, implementing home safety measures, and managing emotional and cognitive health—are vital to reducing fall-related injuries and enhancing overall well-being in the elderly population.

Conclusion

This study investigated the influence of psychological and behavioural determinants on fall prevention among independently living older adults. Data were obtained from 3,850 community-dwelling participants aged 65 years and above using structured, validated questionnaires. Analyses were conducted using multivariate logistic regression and structural equation modelling via IBM SPSS 27 and AMOS 26. Results revealed that fall-related self-efficacy (FRSE, OR = 0.949), engagement in exercise and balance training (EBTF, OR = 0.732), and adherence to home safety practices (HSP, OR = 0.760) significantly reduced fall risk ($p < 0.001$), whereas elevated fear of falling (FOF, OR = 1.091) increased the likelihood of falls. Model fit indices demonstrated robust adequacy (CFI = 0.953, TLI = 0.941, RMSEA = 0.046, SRMR = 0.041). Incorporating both psychological and behavioural variables enhanced the predictive accuracy and informed the development of a comprehensive, multidimensional fall-prevention framework. Limitations included the cross-sectional design and reliance on self-reported data, highlighting the need for future longitudinal, multi-regional, and intervention-based studies to validate and extend these findings.

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