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Original Article

Characteristics and Circumstances of Falls in Older Adults Attending Outpatient Clinics: A Cross-Sectional Observational Study

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Abstract

Objective: To describe the characteristics and circumstances of falls in older adults attending outpatient clinics in Singapore. **Methods**: This cross-sectional observational study retrospectively analysed data from 241 older adults across three outpatient clinics between 2024 and 2026. Sociodemographic and falls-related data were recorded, together with the Clinical Frailty Scale, SARC-F, Parker Mobility Score, Charlson Comorbidity Index, Falls Efficacy Scale–International, handgrip strength, and Short Physical Performance Battery. Descriptive statistics characterised participants and fall circumstances. Generalised linear mixed models examined associations between fall circumstances, participant characteristics, and two fall outcomes at the individual fall-event level. **Results**: Among 393 recalled events, 52.7% occurred outdoors and 73.0% were attributed to loss of balance. Many fallers (87.6%) reported at least one injurious fall and 59.3% reported an inability to get up after a fall. Hearing impairment, polypharmacy, comorbidity burden, recurrent falls, and handgrip strength differed across age groups, whereas activity-specific concern about falling, generalised fear of falling, and fear-related activity restriction did not. **Conclusion**: Falls occurred across both indoor and outdoor settings and were often injurious. An inability to get up from the floor after a fall was commonly reported. Findings suggest that future practice and research should consider forms of falls preparedness training.

Keywords: Falls, Older Adults, Outpatient, Injurious Falls, Inability to get up

Introduction

Falls are a major public health concern, contributing to morbidity, functional decline, and healthcare utilisation worldwide[1]. Each year, there are an estimated 684,000 fatal falls with approximately 37.3 million falls needing medical attention[1]. Falls are rarely attributable to a single factor. They typically arise from interactions among age-related physiological changes, health conditions, functional limitations, medication use, behavioural factors, and environmental demands[2]. The World Falls Guidelines have therefore recommended that older adults at high risk of falls be offered a comprehensive multifactorial falls risk assessment to inform personalised multidomain interventions, spanning gait and balance, underlying acute and chronic disease management, medication,

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concerns about falling, sensory and nutritional status, and environmental hazards[3].

Tailoring risk-factor assessment can benefit from contextualised local falls and environment information, including how and where falls occur for older adults. Previous studies have shown that fall characteristics and circumstances vary across populations and environments. In the Geelong Osteoporosis Study, a population-based Australian sample of 2,631 adults aged 20-97 years, the 12-month prevalence of self-reported falls was 26.9%, rising with age to 46.8% among those aged 85 years and older[4]. Most fall-related injuries were attributed to extrinsic causes (60.7%), and the majority of falls occurred outdoors (62.6%)[4]. Men more often experienced multiple falls, whereas fall-related injuries were more common among women[4]. A Spanish community study of 966 adults aged 75 years and older reported a one-year fall prevalence of 25.9%, with 70% of fallers having fallen on more than one occasion[5]. Falls were more common during the colder seasons and morning hours, with over half of falls occurring inside the home, particularly among those aged 85 years and older, and women more often required assistance to get up from the floor[5]. These divergent profiles, outdoor and extrinsically driven falls in one setting, and indoor, recurrence-dominated falls in another, demonstrate that fall circumstances are shaped by local patterns of activity, environment, and climate, and cannot be assumed to transfer between populations.

Understanding fall characteristics and circumstances is therefore critical. Fall characteristics describe features of the individual and event, such as recurrent falling, injury, and the ability to get up after a fall[4]. An inability to get up after a fall can erode confidence in everyday activity, prompting the activity restriction that accelerates deconditioning and further fall risk[6]. Fall circumstances describe the context surrounding the event, including its location, the activity undertaken, and the precipitating mechanism[7]. These mechanisms may involve intrinsic contributors, such as muscle weakness, dizziness, or an acute medical event, and extrinsic contributors, such as slips, trips, and environment-related perturbations. Greater insight into fall characteristics and circumstances within a local context offers a more clinically meaningful account of the interaction between fall experiences, individual functional capacity, and everyday activities, which can directly inform the design of fall prevention and management interventions.

Few studies have examined the characteristics and circumstances of falls in Singapore. This study therefore addressed three research questions: (i) What are the characteristics and consequences of falls among older adults attending outpatient clinics? (ii) What are the circumstances of these falls, specifically their location and precipitating mechanism? (iii) Are fall location, precipitating mechanism, age group, gender, and comorbidity burden associated with an injurious fall and with inability to get up independently after a fall?

Methods

This study employed a cross-sectional observational design using retrospectively collected data from the Built Environment in Falls and Arthritis (BE-FIT) study. Ethical approvals were obtained from the institutional review boards of NHG Health and Singapore Institute of Technology. Data were drawn from participants attending the orthopaedic and geriatric outpatient clinics of three public hospitals in Singapore between May 2024 and January 2026. Participants were eligible if they were 50 years and older, conversant in English or Mandarin, independent community ambulant with or without walking aids, had experienced at least one fall during the preceding 12 months, and provided written informed consent. Participants were excluded if they had moderate-to-severe psychological issues or cognitive impairment that precluded valid participation, were wheelchair bound, were pregnant or had any other medical conditions that the study team judged would prevent full participation. The dataset included socio-demographic variables including age, gender, ethnicity, educational level, marital status, and living arrangement. Health-related information included self-reported vision impairment, hearing impairment, foot problems, and the number of medications currently taken. Polypharmacy was defined as the concurrent use of five or more medications.

Study variables

The Clinical Frailty Scale (CFS)[8] was used to assess frailty. The CFS is a validated nine-point scale ranging from 1 (very fit) to 9 (terminally ill), based on clinical judgement of comorbidity, function, and cognition, with higher scores indicating greater frailty.

The SARC-F questionnaire[9] was used to assess the risk of sarcopenia. The SARC-F is a validated five-item screening tool evaluating strength, assistance with walking, rising from a chair, climbing stairs, and falls. Each item is scored from 0 to 2, yielding a total score ranging from 0 to 10, with higher scores indicating greater risk. A score of ≥4 was used to indicate high risk of sarcopenia.

The Parker Mobility Score[10] was used to determine functional mobility. The Parker Mobility Score is a validated three-item measure evaluating mobility within the home, outside the home, and during shopping activities. Each item is scored from 0 to 3, yielding a total score ranging from 0 to 9, with higher scores indicating better mobility.

The Charlson Comorbidity Index (CCI)[11] was used to assess comorbidity burden. The CCI is a validated weighted index that predicts mortality risk based on the presence and severity of chronic conditions. Participants were categorised as having no comorbidity (CCI = 0), mild comorbidity (CCI 1–2), or moderate to severe comorbidity (CCI ≥3).

The Falls Efficacy Scale–International (FES-I)[12] was used to assess activity-specific concern about falling. The FES-I is a validated 16-item questionnaire evaluating the level of concern about falling across a range of daily activities. Each item is scored from 1 (not at all concerned) to 4 (very concerned), yielding a total score ranging from 16 to 64, with higher scores indicating greater concern about falling.

A single-item question was used to assess generalised fear of falling[13]. Generalised fear of falling reflects a broader emotional state that may lead individuals to avoid activities they remain capable of performing[14]. Participants were asked whether they were afraid of falling with responses recorded on a three-point scale (not at all, somewhat, or very much afraid). Responses were dichotomised as no fear (not at all) or presence of fear (somewhat or very much afraid) for analysis. Activity restriction due to fear was then assessed using a follow-up question. Participants who reported a generalised fear of falling were asked whether they had restricted their activities because of this fear. Responses were recorded as yes or no, and activity restriction was reported as a proportion of those reporting fear of falling.

Maximum handgrip strength[15] was assessed using a handheld dynamometer. Participants performed the test according to standardised procedures, and the highest value achieved was recorded in kilograms (kg), with higher values indicating greater muscle strength.

The Short Physical Performance Battery (SPPB)[16] was used to assess physical performance. The SPPB comprises standing balance, gait speed, and chair stand performance. Each component is scored from 0 to 4, yielding a total score ranging from 0 to 12, with higher scores reflecting better lower extremity function.

Fall variables

Falls data were collected via a self-reported questionnaire. A fall was defined as "an event which results in a person coming to rest inadvertently on the ground or floor or other lower level"[3]. Participants reported the number of falls experienced in the preceding 12 months. Detailed circumstance data included the fall location, the precipitating cause, whether an injury occurred, and whether they could get up from the floor independently. Fall location was classified as indoor or outdoor. Falls occurring within the place of residence were classified as indoor, and all other falls including those occurring inside public buildings, were classified as outdoor. Indoor locations were further categorised as bedroom or study room, living or dining area, kitchen, toilet, or stairs and steps. Outdoor locations were categorised as public places, streets or walkways, public transport, or stairway and curbs. Precipitating causes were classified as trip, slip, loss of balance through volitional movements, external perturbations (e.g., being pushed), or medical cause (e.g., fainting, blacking out, passing out, loss of leg strength, vertigo, or dizziness). Fall-related injuries were classified into three groups: (i) bruises, sprains, cuts and abrasions, (ii) fracture and significant physical injury, and (iii) head impact.

Statistical Analysis

Data were analysed using R version 4.5.1 (R Foundation for Statistical Computing, Vienna, Austria). Descriptive statistics summarised participant characteristics and fall events. Categorical variables were reported as frequencies and percentages, and compared across age groups using the chi-square test, or Fisher's exact test, where expected cell counts were small. Continuous and ordinal variables were reported as medians and interquartile ranges and compared using the Kruskal-Wallis test. To convey magnitude as well as statistical significance, Cramér's V was reported for categorical associations and epsilon-squared for Kruskal-Wallis tests, and 95% confidence intervals were reported for key proportions. Missing data were quantified for every variable and were minimal, affecting no more than 1.7% of observations for any single variable and fewer than 1% of data points overall. For the participant-level descriptive summaries, single imputation was applied using the median for continuous variables and the mode for categorical variables[17]. For the event-level models, completed records were used without imputation.

Associations with an injurious fall and with an inability to get up independently were examined at the level of the fall event using generalised linear mixed models with a logit link. Each reported fall contributed a record, and a participant-level random intercept accounted for the correlation between the falls of people who fell more than once. The predictors were specified a priori on clinical grounds, comprising location, precipitating mechanism, age group, gender, and comorbidity burden. The predictor set was kept deliberately parsimonious to preserve an adequate ratio of events to variables. Outdoor location, loss of balance, the 65-to-74-year age group, male, and no comorbidity served as reference categories. All other participant characteristics were treated as descriptive and were not entered into the models. The adequacy of the number of predictors relative to the outcome was assessed using the number of events per variable, calculated against the smaller outcome category. Predictor cells were examined for sparseness and complete or quasi-separation before fitting, and multicollinearity was assessed using generalised variance inflation factors. Given that the injurious-fall outcome had fewer events in its smaller category, its model was additionally refitted using Firth's penalised-likelihood method as a sensitivity analysis to confirm that the estimates were not affected by sparse-data bias. Odds ratios with 95% confidence intervals are reported as the measure of association for every predictor. Statistical significance was set at $p < 0.05$.

Results

Two hundred and forty-one community-dwelling older adults with a recent history of falls were included in this study. Participants had a mean age of 75.0 years (SD 8.1);

Characteristics	Total (n=241)
Age, years, mean (SD)	75.0 (8.1)
Age, years, range	53 - 97
Male (n (%))	85 (35.3)
Female (n (%))	156 (64.7)
Ethnicity (n (%))	
Chinese	206 (85.5%)
Malay	15 (6.2%)
Indian	15 (6.2%)
Others	5 (2.1%)
Marital status (n (%))	
Married	152 (63.1%)
Divorced	12 (5.0%)
Single	26 (10.8%)
Widowed	51 (21.2%)
Living arrangement (n (%))	
Alone	36 (14.9%)
With family	143 (59.3%)
With family and domestic helper	49 (20.3%)
With domestic helper	10 (4.1%)
Unrelated individuals	3 (1.2%)
Number of falls in the past year (n (%))	
One	140 (58.1%)
Two or more falls	101 (41.9%)
Key study variables	**Median (IQR1-IQR3)**
Clinical Frailty Scale score (Maximum frailty score = 9)	4 (3-4)
SARC-F questionnaire score (Worst performance score = 10)	2 (1-4)
Parker mobility score (Maximum functional mobility score = 9)	9 (7-9)
Charlson Comorbidity Index (CCI) (Maximum comorbidity burden score = 37)	1 (0-1)
Falls Efficacy Scale-International (FES-I) (Highest concerns about falling = 64)	26 (20-34)
Maximum handgrip strength in kg	20.4 (16.0-24.0)
Short Physical Performance Battery (SPPB) (Highest lower extremity function = 12)	9 (7-11)

Table 1. Characteristics of the participants.

64.7% were female and 85.5% were of Chinese ethnicity. Approximately two-fifths (41.9%) reported recurrent falls. The cohort had modest levels of frailty, sarcopenia risk and comorbidity. The median Clinical Frailty Scale score was 4 (IQR 3–4), the median SARC-F score was 2 (IQR 1–4), and the median Charlson Comorbidity Index was 1 (IQR 0–1). Median maximum handgrip strength was 20.4 kg (IQR 16.0–24.0). Participant characteristics are presented in Table 1.

Several participant characteristics varied with age, as shown in Table 2. Hearing impairment, polypharmacy, and comorbidity burden each differed significantly across successive age groups (all $p < 0.01$), while vision impairment, foot impairment, and generalised fear of falling did not. Recurrent falling rose significantly across age groups, from 15.4% in those aged 64 years and under to 50.0% in those aged 85 years and older ($p = 0.021$, Cramér's V = 0.20). Most participants (87.6%) reported at least one injurious fall (95% confidence interval [CI], 82.8–91.1), and more than half (59.3%) reported at least one fall after which they were unable to get up independently (95% CI 53.0–65.3). The high burden of injurious falls ($p = 0.31$, Cramér's V = 0.12), and inability to get up independently ($p = 0.11$, Cramér's V = 0.16) was distributed across the age range rather than concentrated in the oldest participants. The 241 participants contributed 393 fall events with recorded circumstances. Falls were almost evenly divided between indoor and outdoor settings, with 186 occurring indoors (47.3%) and 207 outdoors (52.7%). Loss of balance (73.0%) was the predominant precipitating mechanism, followed by slips (11.7%), trips (7.4%), medical causes (6.4%), and external perturbations (1.5%) (Table 2). Fall-related consequences were common. Of the 393 events with injury data, 72.3% resulted in injury and 48.0% resulted in an ability to get up independently. Among the 284 injurious falls, bruising, sprains, cuts and abrasions were most frequent (63.7%), followed by fracture or significant physical injury (34.5%) and head impact (19.7%). The distribution of falls across venues, mechanisms and injury types is shown in Figure 1.

Factors associated with an injurious fall and an inability to get up independently were examined at the fall-event level using a generalised linear mixed model with a participant-level random intercept. The ratio of non-injurious events to estimated model parameters was 9.8, and no predictor category showed complete or quasi-complete separation. The estimated standard deviation of the random intercept was 0.88, indicating meaningful clustering of fall outcomes within participants and supporting the use of a mixed-effects model. Falls occurring indoors had lower odds of resulting in injury than falls occurring outdoors (odds ratio [OR] 0.41, 95% CI 0.23–0.71; $p = 0.002$). Female sex was associated with higher estimated odds of injury, although the association did not reach statistical significance after accounting for within-participant clustering (OR 1.75,

Characteristics	Total (n=241)	Subgroup by Age				P value	Effect size
		≤ 64 (n = 26)	65–74 (n = 82)	75–84 (n = 103)	≥85 (n = 30)		
Has vision impairment (%)	168 (69.7)	18 (69.2)	61 (74.4)	66 (64.1)	23 (76.7)	0.378	0.11
Has hearing impairment (%)	55 (22.8)	1 (3.8)	10 (12.2)	30 (29.1)	14 (46.7)	<0.001*	0.31
Has foot impairment (%)	51 (21.2)	5 (19.2)	19 (23.2)	24 (23.3)	3 (10.0)	0.427	0.11
Polypharmacy (%)	105 (43.6)	3 (11.5)	29 (35.4)	55 (53.4)	18 (60.0)	<0.001*	0.29
Comorbidity burden							
No	117 (48.5)	21 (80.8)	44 (53.7)	40 (38.8)	12 (40.0)	0.001*	0.22
Mild	98 (40.7)	4 (15.4)	28 (34.1)	48 (46.6)	18 (60.0)		
Moderate to severe	26 (10.8)	1 (3.8)	10 (12.2)	15 (14.6)	0 (0.0)		
FES-I, median (IQR)	26 (20–34)	23.5 (20.0–32.8)	28.0 (21.3–35.0)	26.0 (21.0–33.5)	22.5 (19.0–31.8)	0.374	0.01
Presence of generalised fear of falling	204 (84.6)	23 (88.5)	75 (91.5)	82 (79.6)	24 (80.0)	0.113	0.15
Activity restriction due to generalised fear of falling*	100 (49.0)	9 (39.1)	39 (52.0)	42 (51.2)	10 (41.7)	0.610	0.10
Experienced two or more falls	101 (41.9)	4 (15.4%)	33 (40.2%)	49 (47.6%)	15 (50.0%)	0.021*	0.20
Experienced injurious falls	211 (87.6)	22 (84.6)	69 (84.1)	91 (88.3)	29 (96.7)	0.313	0.12
Unable to get up post fall	143 (59.3)	11 (42.3)	46 (56.1)	69 (67.0)	17 (56.7)	0.108	0.16

*Values are n (%) calculated within age group unless otherwise stated. FES-I is presented as median (interquartile range) and compared using the Kruskal-Wallis test. Categorical variables were compared using the chi-square test, or Fisher's exact test where expected cell counts were small. Effect sizes are Cramér's V for categorical comparisons and epsilon-squared for the Kruskal-Wallis test. FES-I, Falls Efficacy Scale-International. *Activity restriction due to fear of falling was calculated among the 204 participants who reported a presence of fear of falling.*

Table 2. Characteristics of the participants and falls stratified by age group.

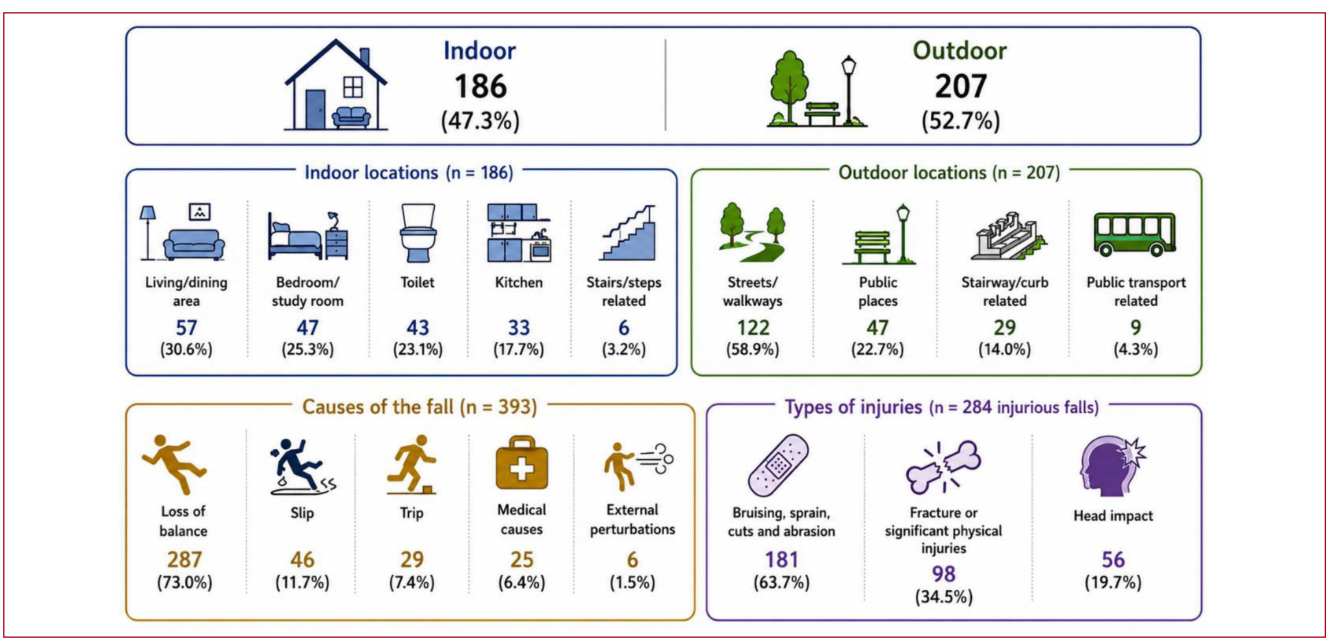

Figure 1. Characteristics and Circumstances of 393 fall events.

95% CI 0.93–3.28; p = 0.083). Precipitating mechanism, age group and comorbidity burden were not significantly associated with injury.

Generalised variance inflation factors were close to unity for all predictors, indicating no evidence of problematic multicollinearity. Estimates from the penalised-likelihood sensitivity analysis were materially consistent with those from the primary model. Indoor falls remained associated with lower odds of injury (OR 0.44), and the direction and statistical significance of the remaining associations were unchanged. These findings suggest that the primary estimates were robust to potential small-sample bias arising from the relatively limited number of non-injurious events.

For the modelling relating to an inability to get up independently, the events-per-parameter ratio was 17.2. The estimated standard deviation of the participant-level random intercept was 1.50, indicating substantial within-participant clustering in the ability to get up following a fall. Falls occurring indoors had lower odds of resulting in an inability to get up than falls occurring outdoors (OR 0.45, 95% CI 0.23–0.87; p = 0.017). Female sex was strongly associated with higher odds of being unable to get up independently (OR 4.80, 95% CI 1.95–11.9; p < 0.001). Moderate-to-severe comorbidity burden was also associated with higher odds of an inability to get up compared with no comorbidity burden (OR 6.85, 95% CI 1.80–26.1; p = 0.005). Mild comorbidity burden showed an association in the same direction, although it did not reach statistical significance (OR 2.08, 95% CI 0.97–4.48; p = 0.061). Precipitating mechanism and age group were not significantly associated with the outcome. Generalised variance inflation factors indicated no evidence of problematic multicollinearity.

Discussion

This study examined the characteristics and circumstances of falls among community-dwelling older adults attending outpatient clinics in Singapore, and the factors associated with two consequential outcomes: (i) sustaining an injury; and (ii) being unable to get up independently. The analysis included 393 recalled fall events reported by 241 participants. Falls were distributed across indoor (47.3%) and outdoor (52.7%) settings. Loss of balance (73.0%) was the most frequently reported precipitating mechanism, and recurrent falls affected 41.9% of participants. In this sample, the proportions reporting at least one injurious fall (87.6%) and at least one fall followed by inability to get up independently (59.3%) were high. Despite the substantial consequences reported, participants' concerns about falling were lower than the mean level reported in a Singapore primary-care sample[18], suggesting that activity-specific concern about falling was not uniformly high across functionally ambulant outpatient cohorts. These figures should be interpreted in the context of clinic-based recruitment, which likely selected participants whose fall-related injuries or underlying health conditions had prompted specialist follow-up, rather than a representative community sample.

The circumstance profile observed in this study differs from those reported in other settings, reinforcing the argument that patterns of falling may not transfer readily across populations or countries. In contrast to the outdoor and extrinsically driven falls that predominated in the Geelong Osteoporosis Study[4], falls in the present cohort were more evenly distributed between indoor and outdoor locations, and were attributed to a loss of balance experienced in different environments. This finding suggests that interventions should consider both balance and physical capacity and the environmental contexts[19]. The high proportion of falls occurring outdoors, including on streets, walkways, stairways, kerbs and in public places, reflects the importance of considering environmental features as part of interventions, particularly within Singapore's high-density urban environment[20].

In this study, we found that indoor falls carried lower odds of injury and of an inability to get up than outdoor falls. Outdoor environments may expose older adults to hard surfaces, uneven terrain, kerbs and greater distances from potential assistance, each of which may increase the severity of impact or make unaided recovery more difficult[21]. By contrast, some indoor falls may occur during lower-velocity activities and in proximity to furniture and fixtures that can be used to support recovery from the floor[22]. Although this finding represents an association observed within a single clinic-based cohort and should not be interpreted causally, it is consistent with the proposition that fall consequences are shaped by the interaction between individual capacity and the environment in which the fall occurs[23]. Given the greater likelihood of injury and inability to get up following outdoor falls, fall-preparedness interventions may complement conventional falls prevention by teaching strategies to reduce injury during a fall, get assistance and recover safely from the floor[24].

Female sex and greater comorbidity burden were associated with higher odds of being unable to get up independently, highlighting the potential importance of physical capacity and physiological reserve. Rising from the floor is a demanding motor task requiring lower-limb and upper-limb strength, trunk control, and the coordinated sequencing of a transfer, and the capacity to perform it declines with reduced muscle strength and accumulating chronic disease[25]. On average, women have lower absolute muscle mass and strength than men, while a greater comorbidity burden may reduce the physiological reserve available to complete a demanding floor transfer[26]. These mechanisms may partly explain the observed associations, although they were not directly examined in the present study. The findings support extending falls prevention beyond efforts to avert the initial fall to include assessment and training of floor-rise ability, post-fall problem-solving and access to assistance. Notably, neither injurious falls nor inability to get up independently was concentrated among the oldest participants, and the estimated associations with age were small. This suggests that consequential falls are not confined to the very old within a clinic-attending population, and that chronological age may provide less clinically useful information than functional and health characteristics. The findings therefore support a shift from predominantly age-based risk stratification towards approaches that consider intrinsic capacity, functional reserve and comorbidity burden when identifying individuals at risk of adverse fall outcomes[27].

Several limitations should be acknowledged. The cross-sectional design precludes causal inference, and the reported associations identify correlates of fall outcomes rather than their causes. Fall circumstances were self-reported and collected retrospectively and were therefore subject to recall bias, particularly among participants reporting multiple falls. The sample was drawn from orthopaedic and geriatric outpatient clinics, which limits the generalisability of the findings to the broader population of community-dwelling older adults. The high prevalence of injurious falls may also have limited statistical discrimination and reduced the precision with which independent associations could be identified. In addition, unmeasured event-level factors, such as the activity being undertaken, surface characteristics, fall direction and availability of assistance, may have contributed to the observed outcomes. Future studies should use prospective designs, record falls close to the time of occurrence and incorporate objective or sensor-based measures where feasible to characterise fall mechanisms and consequences more accurately.

In conclusion, falls among older adults attending outpatient clinics in Singapore arose predominantly from loss of balance across both indoor and outdoor settings and frequently resulted in injury or an inability to get up independently. Indoor falls were associated with lower odds of these consequential outcomes, while female sex and greater comorbidity burden were associated with a reduced capacity to get up independently. These findings underscore the need for falls prevention and management to address not only the likelihood of falling, but also the individual's capacity to minimise injury, recover from the floor and obtain assistance within the environments in which falls occur. Interventions should therefore be tailored to functional and clinical capacity and contextualised to locally relevant environmental demands.

Ethics approval

Ethical approval for the original BE-FIT study was obtained from the NHG Health Domain Specific Review Board (NHG DSRB Ref: 2023/00566). Additional ethical approval for the present retrospective analysis of anonymised BE-FIT data was obtained from the Singapore Institute of Technology Institutional Review Board (Project Ref: RECAS-0753). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

Consent to participate

Participants provided written informed consent for participation in the original BE-FIT study. The requirement for additional informed consent for the present retrospective analysis of anonymised data was waived by the Singapore Institute of Technology Institutional Review Board.

Authors' contributions

Shawn Leng Hsien Soh: Conceptualisation, Formal analysis, Writing – Original Draft. Wong Shiau Ching: Investigation, Writing – Review and Editing. Noor Hafizah Bte Ismail: Investigation, Writing – Review and Editing. Joanne Ee Chia Kwa: Investigation, Writing – Review and Editing. Su Su: Investigation, Writing – Review and Editing. Bryan Yijia Tan: Conceptualisation, Methodology, Writing – Review and Editing. All authors read and approved the final version of the manuscript.

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Disclaimer

Dr Shawn Leng-Hsien Soh is a member of the Editorial Board of JFSF. He was not involved in the editorial handling, peer-review process, or decision-making for this manuscript. The manuscript underwent peer review process by independent experts.

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