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Factors predicting falls and mobility outcomes in patients with stroke returning home after rehabilitation who are at risk of falling

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Factors predicting falls and mobility outcomes in patients with stroke returning home after rehabilitation who are at risk of falling

Abstract

Objective: To identify factors predicting falls and limited mobility in people with stroke at 12 months after returning home from rehabilitation.

Design: Observational cohort study with 12 month follow-up.

Setting: Community.

Participants: People with stroke (n=144) and increased falls risk discharged home from rehabilitation.

Interventions: Not applicable.

Main Outcome Measures: Falls were measured using monthly calendars completed by participants, and mobility was assessed using gait speed over five metres (high mobility (>0.8m/s) versus low mobility (≤0.8m/s). Both measures were assessed at 12 months post-discharge. Demographics and functional measures including balance, strength, visual or spatial deficits, disability, physical activity level, executive function, functional independence and falls risk were analysed to determine factors significantly predicting falls and mobility levels after 12 months.

Results: Those assessed as being at high falls risk (Falls Risk for Older People in the Community (FROP-Com) score ≥19) were 4.5 times more likely to fall by 12 months (OR:4.506, 95% CI:1.71-11.86, p-value:0.002). Factors significantly associated with lower usual gait speed (<0.8m/s) at 12 months in the multivariable analysis were age (OR:1.07, 95% CI=1.01–1.14, p-value=0.033), physical activity (OR:1.09, 95% CI

=1.03-1.17, p-value=0.007) and functional mobility (OR:0.83, 95% CI =0.75-0.93, p-value=0.001).

Conclusion: Several factors predicted falls and limited mobility for patients with stroke 12 months after rehabilitation discharge. These results suggest that clinicians should include assessment of falls risk (FROP-Com), physical activity, and dual task Timed Up and Go during rehabilitation to identify those most at risk of falling and experiencing limited mobility outcomes at 12 months, and target these areas during in-patient and out-patient rehabilitation to optimise long term outcomes.

Keywords: Accidental falls; Gait; Falls risk; Stroke.

Abbreviations

AUD	Australian Dollar
CI	confidence interval
FAB	Frontal Assessment Battery
FES-S	Falls Efficacy Scale (Swedish Modification)
FIM	Functional Independence Measure
FROP-Com	Falls Risk for Older People in the Community
HAPAAS	Human Activity Profile - Adjusted Activity Score
HRQoL	Health-Related Quality of Life
LHS	London Handicap Scale
OR	odds ratio

68	PASE	Physical Activity Scale for the Elderly
69	RCT	randomized controlled trial
70	SPSS	Statistical Package for the Social Sciences
71	TUG	Timed Up and Go

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Stroke is a prevalent medical condition among the adult population,[1] especially in people over the age of 65 years. Stroke affects around 62 million people worldwide,[2] and is the second leading cause of death and the third leading contributor to burden of disease globally.[3] In Australia, stroke was the eighth highest cause of burden of disease in 2011 overall,[4] and the total financial costs of stroke have been estimated to be AUD$5 billion in 2012 (approximately US$3.7 billion, based on April 2017 conversion rates)[5] In addition, over a third of Australians with stroke reported a disability resulting from their stroke,[6] such as incomplete use of limbs and restrictions in physical activity or work.[6] These disabilities have a negative impact on core daily activities like mobility and self-care,[6] and also increase the risk of falling.[7]

Falls are common in people with stroke, who fall 1.5-2 times more than the age-matched older population without stroke.[8, 9] Following stroke, people commonly have physical, cognitive and psychological impairments which can increase their propensity to fall.[10] Some of these impairments include poor balance, the presence of visual neglect, sensory loss, decreased muscle strength, increased muscle tone and fear of falling.[10-13] Falls can result in serious consequences such as fractures, which are two times more likely in people with stroke as compared to age-matched controls.[14, 15] Fractures are associated with decreased functional mobility and physical activity levels, and increased dependency in activities of daily living.[14] Other consequences of falls in post-stroke populations may include fear of falling and reduced confidence in mobility, which can have debilitating effects on the everyday life of people with stroke.[16]

In addition to the increased risk of falling, people with stroke have decreased mobility levels.[17] Mobility is defined by the World Health Organization as "the individual's ability to move about effectively in his/her surroundings".[18 (p.192)] Mobility impairments can persist in patients with stroke even at 1-3 years post-stroke.[17, 19] Mobility is vital for performing activities of daily living such as dressing, showering, walking or preparing meals.[20] In addition to the effects of normal age-related declines in mobility such as slower gait speed,[21] people with stroke over the age of 65 also have impaired mobility due to the effects of stroke, such as post-stroke fatigue and increased oxygen cost of walking as a result of asymmetric gait patterns.[22, 23] Several consequences of decreased mobility in this population include reduced independence in activities of daily living such as walking and dressing,[24] lower health-related quality of life,[25] sedentary lifestyles,[26] muscle atrophy and weakness[27] as well as bone loss particularly in the hemiparetic lower limb (hemi-osteoporosis).[28, 29]

It is therefore important to investigate the factors influencing falls, and mobility levels, as people with stroke have increased risk of falling and decreased mobility levels with subsequent detrimental effects. To date, there has been no consensus in the literature in determining the factors that increase the risk of falls in people with stroke, with studies listing different factors.[11, 12, 30] One possible reason for the inconsistent results could be because these studies were undertaken in populations with different stroke severities and at different time points. The first 12 months after rehabilitation is an important time period as first falls and repeat falls are common throughout this period.[31, 32]

A number of studies have examined factors which predict mobility outcomes in the first several years after returning home following stroke-related hospitalisation.[19, 33-35] There is considerable variability in the duration post hospitalisation used as the time point to predict outcomes (e.g. 6 months, 12 months, several years), outcome measures utilised, and predictor variables. It is rare that the important and associated predictor outcomes included both mobility and falls. The first 12 months post rehabilitation is a critical time point because it has allowed sufficient time for adjusting back to the physical, psychological and emotional demands of living at home with the impact of the stroke, recovery will have plateaued, and the negative impacts of reduced activity and falls will be emerging. While many falls by stroke patients are repeat falls, some first falls occur beyond the six month time point. For these reasons, 12 months is considered an important time point for predicting falls and mobility levels in people with stroke.[36, 37] To date there has been a paucity of research looking at the factors predicting both falls and mobility levels in people with stroke in the first 12 months after rehabilitation, using the same comprehensive baseline predictor dataset. The aim of this study was to identify factors predicting falls and mobility outcomes in people with stroke in the first 12 months after returning home from rehabilitation.

Methods

Study design

An observational cohort study was conducted using an existing dataset from a randomised controlled trial (RCT) carried out from October 2006 to November 2010.[38]

Participants

Study data were collected as part of a multi-centre RCT, which aimed to determine the effects of a multifactorial falls prevention program in people with stroke who were returning home after rehabilitation.[38] Rehabilitation is defined by the World Health Organization as "a set of measures that assist, individuals, who experience or are likely to experience disability, to achieve and maintain optimum functioning in interaction with their environments."[39 (p.96)] Rehabilitation for this study refers to the sub-acute in-patient environment, once the patient had been transferred from the acute setting, but it does not include residential care or long term care facilities. Participants were recruited from nine health rehabilitation services across Melbourne and Adelaide, Australia.[38] Full details of the published RCT protocol and results are available.[38, 40] Ethics approval for the current study was obtained from Melbourne Health and Curtin University Human Research Ethics Committees.

Inclusion criteria

People with stroke (any type, except sub-dural stroke and malignancy related infarct or malignancy related haemorrhage) aged 45 years and above, who had been discharged home from rehabilitation and were evaluated to have increased falls risk, were included in the study (discharge from rehabilitation to other settings such as residential care was an exclusion criteria).[38] The inclusion age was originally 60 years and over, however due to slow recruitment it was extended to include participants aged 45 years and over. Increased falls risk was determined by a score of less than 49 on the Berg Balance Scale or a score of less than seven on the Step Test (lowest score between legs), or if the person had fallen during hospital admission.[38] These variables were shown in a previous study to predict multiple falls within the first six months after discharge from rehabilitation.[12] To manage costs of travel associated with home visits, people with stroke were excluded if they lived more than 100 kilometres from study sites.[38]

In the primary RCT study, 156 participants were randomised into one of two groups: control (falls education booklet and usual care) or intervention (home-based exercise program, falls risk minimisation strategies, injury risk minimisation strategies for those at high risk of fractures and a multifactorial intervention based on falls risk assessment findings, a falls education booklet and usual care).[38] A physiotherapist with more than five years' experience in neurology/gerontology delivered the intervention, which included the home-based exercise program which was based on the Otago Exercise Program (OEP),[41, 42] but it was modified as required by the physiotherapist. The OEP has been shown to reduce falls in older people and the exercises address balance and

mobility issues.[38, 43, 44] The physiotherapist was trained in delivering the OEP. The falls risk minimisation strategies were aimed at directly preventing falls, such as improving footwear or safety in the home environment, whereas injury minimisation strategies were aimed at preventing injury if a fall occurred, for example by using hip protectors.[38, 40] Multifactorial interventions were based on a falls risk assessment and may have included referral for continence management strategies, medication review or a home safety assessment.[38, 40] As there was no significant difference in falls outcomes between the intervention and control groups for the RCT,[38] data for the full sample (intervention and control group) were included in this study analysis.

Variables

The primary outcome measures in this study were fall status (faller versus non-faller), measured using the gold standard of prospective monthly calendar records by participants,[38] and mobility (high or low mobility) at 12 months after discharge home from stroke rehabilitation. Falling is often defined as "an unexpected event in which the person involved comes to rest on the ground, floor or lower level".[45 (p.1619)] Fallers included participants who fell at least once and non-fallers were participants who did not fall within the first 12 months after returning home from rehabilitation respectively. Mobility was measured by comfortable gait speed score over five metres in metres per second (m/sec), using 0.8m/s as the cut-off point for categorisation of participants into high mobility (>0.8m/s) or low mobility (≤0.8m/s).[46] Participants used their usual indoor walking aid for this assessment.

Independent variables were the baseline factors considered as potentially influencing factors on longer term falls and low mobility outcomes (measured at a home visit occurring on average within two weeks [median 13.0 days, Inter-Quartile range 10 days] of discharge from rehabilitation). Variables included age, sex, type of stroke, side of body symptoms, time between stroke to baseline measurement, balance (Step Test),[47] strength (Sit-To-Stand test),[48] visuo-spatial hemi-neglect (Baking Tray Task and Star Cancellation Test),[49, 50] fear of falling (Falls Efficacy Scale – Swedish Modification),[51, 52] visual field deficit (confrontation visual field testing),[53], level of disability (London Handicap Scale),[54] physical activity level (Human Activity Profile),[55, 56] executive level function (Frontal Assessment Battery),[57] functional independence (Functional Independence Measure),[58] falls risk grade (Falls Risk for Older People in the Community: FROP-Com)[59] and functional mobility level (Timed Up and Go single and dual-task test).[60] All measures have been determined to be valid and reliable in this population.[47-50, 53-55, 57-60]

Most of these measures are widely utilised, but we provide additional detail for two of the measures which are less commonly used in stroke research. The Human Activity Profile (HAP) is a valid and reliable tool for measuring activity levels in patients with stroke.[55] It comprises 94 activities including self-care, physical exercises, transportation, home maintenance, entertainment or social activities, which are hierarchically ordered according to their required metabolic equivalents (score range 0-94).[56] Two scores are derived: the Maximum Activity Score (MAS), which is the highest numbered activity rated as still being performed, and the Adjusted Activity Score (AAS), which is the MAS less the number of lower numbered activities rated as "have stopped doing".[56]

Falls risk grade was assessed using the FROP-Com falls risk assessment tool, which is a validated tool designed to identify the level of falls risk associated with common falls risk factors for older people living in the community.[40, 59] The FROP-Com assessment tool consists of 28 items which are used to inform the delivery of potential interventions, for example improving footwear, continence strategies, medication management (score range 0-63; cut-off score ≥19 indicating high falls risk).[59]

Data analysis

Data analyses were conducted using Statistical Package for the Social Sciences (SPSS for Windows, version 23.0, IBM, New York, USA). Two binary primary outcome variables were examined: 1) fall status (fallers versus non-fallers over the 12 month study) and 2) mobility level (high mobility level versus low mobility level determined by gait speed scores at the 12 month post discharge assessment). Descriptive statistics were generated for all demographic, baseline and 12 month data. For continuous measures, data were checked for normal distribution. For non-normally distributed continuous measures, non-parametric analyses were used (Mann-Whitney U test). Comparisons were undertaken between groups for the primary outcome binary variables, using Chi-squared for independent (categorical) variables and *t*-tests for continuous independent variables.

Initial univariate analysis involved identifying between-group (fallers versus non-fallers, high versus low mobility) differences. Demographic, stroke data, falls risk (FROP-Com), medication, function, confidence, activity, handicap and cognitive

(Frontal Assessment Battery) measures were all included in the initial analysis as factors that may influence faller status and mobility (gait speed) (see Table 2 for all factors included). Variables with $p \leq 0.1$, in conjunction with examination of confidence intervals, were included in the multivariable logistic regression model.[61, 62] Potentially correlated covariates were checked using Spearman's rank-order correlation or Pearson's product-moment correlation dependent on the normality distribution of the data. Correlated variables were not placed together in the same multivariable logistic regression model. If two or more variables were highly correlated ($r > 0.7$),[63] the variable with the highest univariate odds ratio was utilised. Multivariable regression analyses were undertaken using the hierarchical model, entering covariates into the model in a stepwise fashion.[64] Potential confounders such as age and gender were adjusted for as appropriate, in both univariate and multivariable logistic regression models. A p-value of ≤ 0.05 was considered statistically significant for the multivariable models.

Results

The falls analyses consisted of 144 participants; 75 fallers and 69 non-fallers. Gait speed data were available for 132 participants as 24 participants dropped out of the study before the final assessment. Reasons for dropping out included deceased (n=8), no longer interested (n=8), unwell (n=2), too busy (n=3), unable to contact (n=1), moved overseas (n=1) and family reasons (n=1). There was no significant difference between those who remained in the study and those who withdrew, except for FROP-Com. For

those in the study, 75 participants had low gait speed <0.8m/s and 57 participants had high gait speed ≥0.8m/s.

Table 1 shows the characteristics of the study population based on falls status and mobility levels (gait speed). The mean age for all participants was 71.5 (SD:10.6) years, with males making up 63.5% of the total sample. Time between discharge and baseline was analysed with non-parametric statistics as it was not normally distributed. There was a significant difference between fallers and non-fallers in the number of falls in the 12 months prior to stroke, with 55.9% of fallers falling two or more times in this period. Seventy-one per cent of participants with low mobility levels had high falls risk (as measured by the Falls Risk for Older People in the Community assessment tool score ≥19), compared to 29.8% of participants with high mobility ($p<0.001$). There were significant differences for both the faller and mobility status groups for taking centrally acting drugs, with non-fallers and those with high mobility taking fewer drugs respectively.

Insert Table 1 here

Fallers Outcomes

A univariate logistic regression was conducted to identify which factors predicted the faller status of participants at 12 months (Table 2). Having high falls risk was found to

significantly predict falls in both the non-adjusted and adjusted univariate analysis. Taking centrally acting drugs, the Functional Independence Measure (FIM), Falls Risk for Older People in the Community (FROP-Com), Falls Efficacy Scale-Swedish Modification (FES-S), Human Activity Profile Adjusted Activity Score (HAPAAS) and gait speed over five metres were also significant in predicting falls in both the non-adjusted and adjusted univariate analysis. As both comfortable and fast gait speed scores and high falls risk and FROP-Com total score were highly correlated ($r>0.7$), comfortable gait speed score and FROP-Com total score were excluded in the multivariable logistic regression in the falls analysis due to lower univariate odds ratios.

Insert Table 2 here

The multivariable logistic regression model correctly classified 52.6% of faller cases and 65% of overall cases and was statistically significant, $\chi^2(4)=10.764$, p-value=0.029. High falls risk as measured by the FROP-Com assessment tool score (≥ 19) was the only factor found to significantly predict those more likely to fall (OR:4.506, 95% CI:1.71-11.86, p-value:0.002) (Table 2).

Mobility Levels Outcomes

A univariate logistic regression was also conducted to determine factors influencing mobility (comfortable gait speed) (Table 3). Having moderate or high falls risk was found to significantly predict the mobility levels of participants in both the non-adjusted and adjusted univariate analysis. Taking centrally acting drugs, time from stroke to baseline in months, FIM, FROP-Com, FES-S, HAPAAS, London Handicap Scale (LHS), Frontal Assessment Battery (FAB), Timed Up and Go (TUG) single and dual-task tests and the five time sit-to-stand test also significantly predicted mobility levels in both the non-adjusted and adjusted univariate analysis. As both TUG single and dual-task tests, and risk of falling and FROP-Com total score respectively were highly correlated ($r>0.7$), the TUG single task test and the risk of falling were excluded in the multivariable logistic regression due to lower univariate odds ratios.

Insert Table 3 here

The multivariable regression model was statistically significant, $\chi^2(6)=66.58$, $p\leq0.001$. The model classified 86.8% of high mobility cases correctly and 82.2% of overall cases. Factors significantly associated with lower mobility (<0.8m/s) at 12 months were age (OR:1.07, 95% CI=1.01–1.14, p-value=0.033), HAPAAS score (OR:1.09, 95% CI=1.03-1.17, p-value = 0.007) and TUG dual-task test score (OR:0.83, 95% CI=0.75-0.93, p-value=0.001) (Table 3).

Discussion

This study is the first to identify factors predicting both falls and mobility levels in people with stroke in the first 12 months after returning home from rehabilitation. Multivariable analysis indicated that being assessed as high falls risk (FROP-Com≥19) increased the likelihood of falling by 4.5 times in people with stroke in the first 12 months after discharge from rehabilitation, compared to those assessed as medium to low falls risk.

Previous research has shown that falls history and poor balance predict falls in people with stroke in the first six months after rehabilitation.[12] Cho and Lee also found that impaired dynamic balance was associated with falls in people with stroke.[65] The FROP-Com assessment tool, which was used to determine falls risk status in the current study covers a variety of factors, including falls history and balance,[59] functional independence, gait and physical activity in determining falls risk.[59] These factors were significant in predicting falls in the univariate analysis, and when utilised in the falls risk tool (FROP-Com) highlighted that those with high falls risk were 4.5 more likely to fall in the 12 months post rehabilitation. While there have been other studies that have shown that falls risk is predictive of falls in people with stroke, this is the first to use a comprehensive assessment tool such as the FROP-Com as a measure of falls risk.

This study also investigated factors predicting mobility levels in people with stroke in the first 12 months after rehabilitation. The multivariable analysis found that age, HAPAAS and TUG dual-task test scores were significant in predicting lower mobility levels in people with stroke. The TUG dual-task test is a measure that evaluates physical performance (including speed of sit to stand to sit, and gait speed, both straight walking

and turning) under conditions of competing cognitive demand from the dual task component of the test, that has been shown to be reliable and valid in stroke patients.[66] Reduced gait speed and increased energy expenditure per metre walked in older people,[67] increased energy costs of walking and other mobility related tasks due to stroke-related impairments such as hemiparesis on the affected side and reduced muscle power on the unaffected side,[23, 68-70] as well as reduced ability to dual-task, all contribute to the reduced performance by stoke patients on the TUG dual-task test. This combination of factors may account for the lower mobility levels in older people with stroke.[67]

Dual-task walking in people with stroke adversely affects gait speed and balance due to the competing demands for attention to both tasks.[71, 72] The increased burden on the already limited cognitive resources available after stroke results in slower gait speeds and poorer mobility.[73] Yang et al. suggested that dual-tasking exercises can improve gait ability in people with stroke.[74] It may therefore be beneficial to use the TUG dual-task test in clinical settings to identify people with stroke who are likely to have low mobility levels and who may benefit from dual-tasking exercises during stroke rehabilitation.

The literature also suggests that lower physical activity levels in people with stroke are associated with poorer walking abilities in terms of mobility.[75] This study used the HAP to predict mobility levels in people with stroke because it covers a variety of physical activities including walking and stairs use.[56] This result reinforces findings of another study which reported that the HAP was significantly related to comfortable gait speed in people with stroke.[55]

Study Limitations

The main limitation of this study was that only participants with increased risk of falling at the end of rehabilitation were included in this study. Therefore, the results cannot be generalised to the entire stroke population, such as those not at high falls risk or aged under 45 years. Slow recruitment also resulted in the decision to lower the inclusion criteria age from 60 to 45, which may have led to more heterogeneity in mobility outcomes. However, 85% of participants were aged 60 or older, so the impact of the lowered age was minimal. The study was also undertaken in two cities in Australia and therefore may not be generalisable to stroke survivors who do not receive medical assistance or rehabilitation after leaving hospital, unlike the participants in this current study. Also there was a small amount of 12 month mobility data missing (<16%), due to 24 patients not completing the final assessment. Another limitation was the small number of cases with an unknown type of stroke (n=6). These were the result of details not being available to the researchers. However, the small number of participants where this occurred suggests it is unlikely to have had much effect on the results. Given the high proportion of people with stroke who fall, receive medical assistance and the negative effects of falls in people with stroke, the results are still clinically relevant for much of this population.

Conclusion

Falls and limited mobility are common negative outcomes that can each contribute to other short and longer term poor health outcomes (eg injuries, reduced confidence, curtailed activity) in the 12 months following in-patient rehabilitation for stroke patients. The results of this study highlight the potential value of using the FROP-Com assessment to target interventions during and post rehabilitation aiming to reduce longer term falls risk, and the use of activity level and functional mobility (measured using dual task TUG) similarly to target greater emphasis of interventions during and post rehabilitation to improve mobility at 12 months.

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Table 1: Study characteristics of participants

Characteristic	Faller (n=75)	Non-Faller (n=69)	Low Mobility (n=75)	High Mobility (n=57)
Mean age, years (SD)	71.5 (10.5)	71.2 (10.8)	69.9 (11.2)	72.5 (9.7)
Age median (73 years) – N (%)				
Under 73 years	37 (49.3)	33 (47.8)	41 (54.7)	26 (45.6)
73 years and older	38 (50.7)	36 (52.2)	34 (45.3)	31 (54.4)
Gender N (%)				
Male	49 (65.3)	42 (60.9)	47 (62.7)	37 (64.9)
Female	26 (34.7)	27 (39.1)	28 (37.3)	20 (35.1)
Stroke Type N (%)				
Infarct	60 (80.0)	55 (79.7)	61 (81.3)	45 (78.9)
Intracerebral Haemorrhage	13 (17.3)	10 (14.5)	11 (14.7)	10 (17.5)
Sub-Arachnoid haemorrhage	0 (0.0)	3 (4.3)	1 (1.3)	1 (1.8)

Unknown	2 (2.7)	1 (1.4)	2 (2.7)	1 (1.8)
Side of symptoms N (%)				
Right	31 (41.3)	28 (40.6)	34 (45.3)	19 (33.3)
Left	41 (54.7)	38 (55.1)	39 (52.0)	34 (59.6)
Bilateral	2 (2.7)	2 (2.9)	1 (1.3)	3 (5.3)
Unknown	1 (1.3)	1 (1.4)	1 (1.3)	1 (1.8)
Mean time from stroke to baseline, months (SD)	2.9 (1.6)	2.9 (1.5)	3.5 (2.0)	2.6 (1.4)
Living Arrangements N (%)				
Alone	17 (22.7)	15 (21.7)	15 (20.0)	13 (22.8)
Spouse / Carer (person providing informal care)	47 (62.7)	35 (50.7)	40 (53.3)	36 (63.2)
Family	11 (14.7)	19 (27.5)	20 (26.7)	8 (14.0)
Number of falls in 12 months prior to stroke N (%)				

Nil	5 (7.4) ‡	56 (87.5) ‡	33 (44.0)	28 (49.1)
One	18 (26.5) ‡	5 (7.8) ‡	16 (21.3)	7 (12.3)
Two or more	38 (55.9)‡	2 (3.1)‡	21 (28.0)	19 (33.3)
One or more requiring hospitalization	7 (10.3)‡	1 (1.6)‡	5 (6.7)	3 (5.3)
Median time between discharge and baseline, days (IQR: between the 25th and 75th percentile)	13.0 (9)	13.0 (11)	14.0 (9)	12.0 (8)
Falls Risk N (%)				
Low (FROP-Com score ≤11)	10 (13.3)	14 (20.3)	6 (8.0) ‡	16 (28.1)‡
Moderate (FROP-Com score 12-18)	18 (24.0)	25 (36.2)	16 (21.3)‡	24 (42.1)‡
High (FROP-Com score ≥19)	47 (62.7)	30 (43.5)	53 (70.7)‡	17 (29.8)‡
Visual field confrontation N (%)				
No deficit	49 (70.0)	43 (64.2)	44 (62.0)	40 (71.4)

Right deficit	9 (12.9)	5 (7.5)	8 (11.3)	5 (8.9)
Left deficit	7 (10.0)	9 (13.4)	10 (14.1)	5 (8.9)
Other	5 (7.1)	10 (14.9)	9 (12.7)	6 (10.7)
Taking centrally acting drugs N (%)				
Yes	35 (46.7)*	18 (26.1)*	39 (52.0)†	14 (24.6)†
No	40 (53.3)*	51 (73.9)*	36 (48.0)†	43 (75.4)†

NOTE. Centrally acting drugs include sedatives, antidepressants, centrally acting analgesics, other psychotropics and vestibular suppressants.

Abbreviation. FROP-Com -Falls Risk for Older People in the Community.

* $p < 0.05$, † $p < 0.01$, ‡ $p < 0.001$.

Table 2: Analysis of factors influencing falls

	Univariate analysis (no adjustments)			Univariate analysis (adjusted for age and gender)			Multivariable analysis (adjusted for age and gender)		
Variables	**Odds ratio**	**95% CI**	**p-value**	**Odds ratio**	**95% CI**	**p-value**	**Odds ratio**	**95% CI**	**p-value**
Age	1.01	0.97-1.04	0.617	1.00	0.97-1.04	0.849	1.00	0.97-1.04	0.864
Age mid point	0.94	0.49-1.81	0.857						
Gender	0.83	0.42-1.63	0.579	0.94	0.47-1.88	0.86	0.74	0.32-1.69	0.470
Type of stroke – Infarct		Reference			Reference				

Haemorrhage	0.84	0.34-2.07	0.703	0.83	0.33-2.08	0.698
Sub arachnoid§	N/A	N/A	N/A	N/A	N/A	N/A
Unknown	1.54	0.12-19.47	0.739	1.52	0.12-19.37	0.746
Side of hemiparesis – Right		Reference			Reference	
Side of hemiparesis - Left	0.98	0.50-1.91	0.94	1.00	0.51-1.98	0.993
Side of hemiparesis - Bilateral	0.90	0.12-6.85	0.922	1.03	0.13-8.08	0.979
Side of hemiparesis - Unknown	0.90	0.05-15.13	0.944	1.07	0.06-18.91	0.964

Living status -Live alone		Reference			Reference				
Live with spouse/carer	1.19	0.52-2.69	0.685	1.14	0.483-2.71	0.760			
Live with family	0.51	0.19-1.41	0.195	0.51	0.18-1.46	0.209			
Falls risk – Low (FROP-Com score ≤ 11)		Reference			Reference				
Falls risk – Moderate (FROP-Com score 12 -18)	1.59	0.66-3.87	0.303	1.76	0.69-4.50	0.236			
Falls risk – High (FROP-Com score ≥ 19)	4.55	1.91-10.86	0.001†	4.70	1.95-11.32	0.001†	4.51	1.71-11.86	0.002
Centrally acting drugs	2.48	1.23-5.01	0.011*	2.57	1.26-5.23	0.009†			

Time from stroke to baseline, months	1.11	0.92-1.34	0.284	1.16	0.94-1.44	0.175
FIM total score	0.97	0.95-0.99	0.017*	0.97*	0.946-0.99*	0.019*
Days from discharge to assessment	0.98	0.95-1.01	0.246	0.98	0.95-1.01	0.239
FROP-Com score (revised)	1.17	1.09-1.25	<0.001‡	1.17	1.09-1.25	<0.001‡
FESS total score	0.98	0.97-0.99	0.001†	0.98	0.96-0.99	0.001†
HAP AAS score	0.98	0.96-0.99	0.023*	0.98	0.96-0.99	0.021*

LHS total score	1.03	0.95-1.12	0.467	1.03	0.95-1.11	0.496
FAB total score	1.01	0.92-1.10	0.893	1.01	0.92-1.11	0.826
Comfortable gait speed (average)	0.98	0.96-0.99	0.029*	0.98	0.96-0.99	0.031*
Fast gait speed (average)	0.98	0.97-0.99	0.022*	0.98	0.97-0.99	0.022*
TUG single task time	1.02	0.99-1.05	0.073	1.02	0.99-1.05	0.079
TUG dual-task time	1.02	0.99-1.04	0.080	1.02	0.99-1.04	0.086

5 time Sit-To-Stand test	1.00	0.97-1.03	0.927	1.00	0.97-1.03	0.926

NOTE. Centrally acting drugs include sedatives, antidepressants, centrally acting analgesics, other psychotropics and vestibular suppressants.

Abbreviations. FIM -Functional Independence Measure, FROP-Com -Falls Risk for Older People in the Community, FESS -Falls Efficacy Scale – Swedish Modification, HAP AAS -Human Activity Profile Adjusted Activity Score, LHS -London Handicap Scale, FAB -Frontal Assessment Battery, TUG -Timed Up and Go test.

*$p < 0.05$, †$p < 0.01$, ‡$p < 0.001$

§No participant in the faller group had a sub-arachnoid stroke.

Table 3: Analysis of factors influencing mobility levels (gait speed)

	Univariate analysis (no adjustments)			Univariate analysis (adjusted for age and gender)			Multivariable analysis (adjusted for age and gender)		
Variables	**Odds ratio**	**95% CI**	**p-value**	**Odds ratio**	**95% CI**	**p-value**	**Odds ratio**	**95% CI**	**p-value**
Age	1.02	0.99-1.06	0.173	1.03	0.99-1.07	0.129	1.07	1.01-1.14	0.033*
Age mid point	1.44	0.72-2.87	0.303						
Gender	0.91	0.44-1.86	0.791	0.91	0.44-1.91	0.809	1.09	0.33-3.65	0.885
Type of stroke- Infarct		Reference			Reference				
Haemorrhage	0.81	0.32-2.08	0.663	0.71	0.27-1.88	0.484			

Sub-arachnoid	1.10	0.06-20.01	0.949	1.43	0.07-27.83	0.814
Unknown	0.55	0.04-7.03	0.646	0.46	0.04-6.07	0.557
Side of hemiparesis – Right		Reference			Reference	
Side of hemiparesis – Left	1.56	0.76-3.22	0.23	1.64	0.78-3.43	0.190
Side of hemiparesis - Bilateral	5.37	0.52-55.27	0.158	7.13	0.64-79.17	0.110
Side of hemiparesis - Unknown	1.79	0.11-30.27	0.687	2.99	0.17-54.11	0.459
Living status - Live alone		Reference			Reference	
Live with spouse/carer	1.04	0.44-2.48	0.932	1.07	0.43-2.67	0.890

Live with family	0.46	0.15-1.40	0.171	0.52	0.17-1.66	0.271
Fallen in last 12 months	0.58	0.28-1.21	0.147	0.61	0.29-1.28	0.188
Falls risk – Low (FROP-Com score ≤11)		Reference			Reference	
Falls risk – Moderate (FROP-Com score 12 -18)	0.33	0.13-0.81	0.016*	0.34	0.13-0.88	0.026*
Falls risk – High (FROP-Com score ≥19)	0.144	0.06-0.36	<0.001‡	0.13	0.05-0.33	<0.001‡
Centrally acting drugs combined	0.30	0.14-0.64	0.002†	0.31	0.14-0.66	0.002†
No. of falls in last 12 months – Nil		Reference			Reference	

No. of falls in last 12 months - One	0.52	0.19-1.43	0.204	0.56	0.20-1.57	0.266
No. of falls in last 12 months - ≥ Two	1.07	0.48-2.37	0.875	1.04	0.46-2.34	0.926
No. of falls in last 12 months ≥ One or more requiring hospitalization	0.71	0.16-3.23	0.654	0.75	0.16-3.43	0.706
Time from stroke to baseline, months	0.70	0.54-0.92	0.009†	0.71	0.53-0.94	0.018*
FIM total score	1.10	1.05-1.15	<0.001‡	1.10	1.05-1.15	<0.001‡
Days from discharge to assessment	0.97	0.94-1.01	0.106	0.97	0.94-1.01	0.098

FROP-Com score (after revisions)	0.87	0.82-0.94	<0.001‡	0.87	0.82-0.93	<0.001‡			
FESS total score	1.04	1.02-1.06	<0.001‡	1.04	1.03-1.06	<0.001‡			
HAP AAS score	1.08	1.05-1.11	<0.001‡	1.09	1.06-1.12	<0.001‡	1.09	1.03-1.17	0.007†
LHS total score	0.78	0.70-0.87	<0.001‡	0.78	0.70-0.87	<0.001‡			
FAB total score	1.17	1.05-1.29	0.003†	1.22	1.09-1.36	0.001†			
TUG single task time	0.72	0.64-0.82	<0.001‡	0.72	0.63-0.81	<0.001‡			

TUG dual-task time	0.88	0.83-0.93	<0.001‡	0.87	0.81-0.92	<0.001‡	0.83	0.75-0.93	0.001†
5 time Sit-To-Stand test	0.93	0.88-0.98	0.004†	0.92	0.87-0.98	0.004†			

NOTE. Centrally acting drugs include sedatives, antidepressants, centrally analgesics, other psychotropics and vestibular suppressants.

Abbreviations. FIM -Functional Independence Measure, FROP-Com -Falls Risk for Older People in the Community, FESS -Falls Efficacy Scale – Swedish Modification, HAP AAS -Human Activity Profile Adjusted Activity Score, LHS -London Handicap Scale, FAB -Frontal Assessment Battery, TUG -Timed Up and Go test.
*p < 0.05, †p < 0.01, ‡p <0.001