Factors influencing Fear of Falling in Community-Dwelling Older Adults in Singapore: A Cross-Sectional Study

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Abstract

Background

Falls in older adults is a common problem worldwide. Fear of falling (FoF) is a consequence of falls which has far-reaching implications including activity restriction, functional decline and reduced quality of life. This study aimed to determine the factors associated with FoF in a segment of Singapore's community-dwelling older adults.

Methods

This descriptive cross-sectional study recruited a convenience sample of adults aged 65 and above from 4 primary care clinics from September 2020 to March 2021. Data were collected on demographic factors and clinical factors including history of falls and frailty as determined by the Clinical Frailty Scale (CFS). FoF was measured using the Short Falls Efficacy Scale–International (Short FES-I), cut-off score of 14 and above indicated high FoF. Logistic regression was used to determine predictors of high FoF.

Results

Out of 360 older adults, 78.1% were Chinese and 59.7% females. The mean age was 78.3 years and 76 (21.1%) had a history of falls in the past six months. Almost half (43.1%) were mildly to moderately frail and most (80.6%) had three or more chronic conditions. The mean FoF score was 15.5 (SD 5.97) and 60.8% reported high FoF. Logistic regression found that Malay ethnicity (OR = 5.81, 95% CI 1.77 – 19.13), use of walking aids (OR = 3.67, 95% CI = 1.54 – 8.77) and increasing frailty were significant predictors for high FoF. The odds of high FoF were significantly higher in pre frail older adults (OR = 6.87, 95% CI = 2.66 – 17.37), mildly frail older adults (OR = 18.58, 95% CI = 4.88 – 70.34) and moderately frail older adults (OR = 144.78, 95% CI = 13.86 – 1512.60).

Conclusions

FoF is a prevalent and compelling issue in community-dwelling older adults, particularly those with frailty. The demographic and clinical factors identified in this study will be helpful to develop targeted and tailored interventions for FoF.

Background

Falls are a common problem in older adults with potentially serious complications and long-term sequelae post fall. Among community-dwelling older adults aged 70 years or older, 21.5% experienced at least one fall annually (1). Falls is the commonest mechanism of injury in older adult patients presenting to hospitals, and complications such as a hip fracture leads to increased disability in 20 to 60% of patients post fracture (2). Intrinsic factors like older age, increasing number of chronic diseases, analgesia use, use of mobility aids, eye diseases, and loss of foot sensation and environmental factors such as slippery bathrooms were associated with an increased fall risk (3).

Frailty is described as a clinical syndrome where a loss of physiological reserves leads to an increase in adverse events from relatively minor stresses (4). The prevalence of frailty increases with age, female gender, low education, low socioeconomic status, multi-morbidity, pain and polypharmacy (5, 6). Frail older adults are at a higher risk of falling (7, 8).

Fear of Falling (FoF) is an internal psychological phenomenon of concern or anxiety about falling (9). It may be sequelae of falling, and was originally called post-fall syndrome, but may also occur in the absence of fall history. FoF is common amongst older adults and has serious consequences. It leads to downward spiral of activity restriction and functional decline (10–12). A higher FoF was found to lower quality of life through increased social isolation over time (13).

Various demographic and clinical factors influence FoF. Notably, the risk of FoF is higher amongst patients aged 75 years or older, female, lower educational level, and medical conditions such as diabetes mellitus, arthritis or depression (14).

Falls, frailty and FoF share a complex relationship and their individual effect on fear of falling is not well described. Merchant et al demonstrated a positive association between frailty, previous falls and FoF (15). FoF is associated with higher risk of future falls (16, 17).

Methods

Aims and Hypothesis

The aim of the study was to determine the factors associated with high FoF in community-dwelling older adults, in particular, independent predictors of having a previous fall and frailty on high FoF. We hypothesized that a previous fall and increasing frailty independently predicted high FoF in older adults.

Study Design

This was a descriptive cross-sectional study utilizing interviewer-administered questionnaires.

Setting and Participants

Convenience sampling was used. Participants were recruited on a case encounter basis from four public primary care clinics in Singapore from October 2020 to March 2021.

Older adults aged 65 and above, followed up at the primary care clinics for any chronic condition and able to communicate in English or major local languages, Mandarin, Malay and Tamil were eligible. Participants unable to agree to participation or answer the questionnaire; severely frail or very severely frail with a Clinical Frailty Scale (CFS) score of 7 or more and terminally ill patients were excluded. The latter groups were excluded as their ability to participate in physical activity was expected to be limited.

Data Collection

Potential participants were identified on a case encounter basis by their attending healthcare providers when they attended at the clinics for follow-up visits. Healthcare providers referred all potential participants who met the inclusion criteria to study team members. Questionnaires were administered by trained study team members proficient in participants' spoken language after study was explained and verbal consent taken. Study team members were trained to determine CFS score. No potential participants declined participation in the study. To reduce bias, study team members did not administer questionnaires for their own patients but referred them to other study team members instead. In view of the ongoing pandemic situation, participants were given the option of having the questionnaire administered via telephone at a mutually convenient time. All questionnaires were complete as they were interviewer-administered by study team and participants answered fully.

The questionnaires consisted of demographic and clinical data on participants' age, gender, ethnic group, marital status, co-morbidities and frailty status. The list of chronic conditions was derived from a list developed to document self-reported chronic conditions in primary care (18). Frailty status was determined by the Clinical Frailty Scale (CFS), a judgement-based tool to assess the overall level of fitness and function of older adults, with levels ranging from 1 (very fit) to 9 (terminally ill). Score 4 indicates vulnerable, score 5 indicates mildly frail and score 6 indicates moderately frail (19). A recent scoping review revealed that the CFS has been widely used in multiple settings and has good association with clinical outcomes (20).

Falls history and characteristics included number of falls in past six months, location of falls, reason for falls and any injuries sustained.

Fear of falling (FoF) was measured using the Short Falls Efficacy Scale – International (FES-I). The Short FES-I is a 7-item measure of "fear of falling" and has been demonstrated to have good reliability and validity (21). It was also evaluated in Malaysia and showed good internal consistency, test–retest reliability, construct validity, and responsiveness, with Cronbach alpha of 0.905 and intraclass correlation coefficient 0.997 for the English version (22). Scores are calculated by summing up responses for each item, with a range from minimum 7 (no concern about falling) to maximum 28 (severe concern about falling). A score of 7 to 8 points indicates low concern, 9 to 13 indicates moderate concern and 14 to 28 indicates high concern. Permission to use Short FES-I was obtained from Professor Chris Todd <https://sites.manchester.ac.uk/fes-i/>

The questionnaire was reviewed by an expert panel comprising multidisciplinary members of the Geriatrics Specialty Advisory Group including a physiotherapist, and external geriatric trained doctors and nurses. The questionnaire was piloted on community-dwelling older adults with chronic conditions attending the four participating clinics and at various levels of frailty prior to implementation.

Data Analysis

SPSS version 27 was used to analyze the data. Power analysis for logistic regression, calculated based on the work of Peduzzi et al. (23) for 17 covariates, assuming 0.5% of positive cases in the population

and 10% drop-out rate, at least 358 participants would be required.

Demographic and clinical characteristics, prevalence of falls and prevalence of FoF were reported using descriptive statistics. Chi-square was used to compare differences in FoF between categorical variables. However, if there is more than 20% of expected frequency less than 5 and for 2x2 table, Fisher exact test is used. Logistic regression was used to determine predictors of high FoF. Statistical significance was set at a P-value less than 0.05.

Ethical Considerations

Ethical approval was obtained from National Healthcare Group Domain Specific Review Board (DSRB Ref: 2020/00847). *All methods were performed in accordance with the relevant guidelines and regulations.* Potential participants were referred to study team members by attending healthcare professionals after consultation. Trained study team members proficient in participants' language explained the study and obtained verbal informed consent. Hardcopy data was stored in designated locked cabinets. Electronic data was stored in a secured electronic database. All hard copy or electronic data was accessible to authorized study team members only.

Results

Demographic characteristics and high Fear of Falling

The study recruited 360 older adults. The majority (78.1%) were Chinese and 59.7% were females. The mean age was 78.3 years and 76 (21.1%) had a history of falls in the past six months. There were 29.4% categorized as CFS 1 to 3 (well), 27.5% CFS 4 (pre-frail), 23.9% CFS 5 (mildly frail) and 19.2% CFS 6 (moderately frail). Most (80.6%) had three or more chronic conditions. 219 respondents (60.8%) had high FoF as defined by short FES-I score between 14 to 28. We found statistically significant differences in age, gender, ethnicity, marital status, educational level, use of walking aid, multi-morbidity, frailty status, and history of falls within six months between patients who had high FoF versus those who had moderate or low FoF.

73.1% who were above 75 years old had high FoF as compared to 48.9% who were between 65 to 75 years old (Fisher exact, $p < 0.001$). 67.1% of females had high FoF as compared to 32.9% of males (Fisher exact, $p < 0.001$); and 87.7% of those who had three or more chronic conditions had high FoF compared to 12.3% of those with one to two chronic conditions (Fisher exact, $p < 0.001$). 84.2% of patients who had fallen in the past 6 months had a high fear of falling compared to 15.5% who had fallen in the past 6 months but did not exhibit high fear of falling (Fisher exact, $p < 0.001$).

High FoF was found in older adults of Malay ethnicity ($\chi^2 = 8.89$, $df = 3$, $p = 0.031$), separated or divorced ($\chi^2 = 27.23$, $df = 3$, $p < 0.001$), had no formal education ($\chi^2 = 28.58$, $df = 3$, $p < 0.001$), used walking aids (Fisher exact, $p < 0.001$) and were mildly to moderately frail ($\chi^2 = 175.94$, $df = 3$, $p < 0.001$).

Predictors for high Fear of Falling

A multi-variate analysis was performed to identify independent predictors for high FoF and to adjust for potential confounders. The logistic regression model to ascertain the effects of age, ethnicity, gender, marital status, educational level, multi-morbidity, CFS category, use of walking aid and falls within six months on the likelihood that participants had high FoF was statistically significant, $\chi^2(17) = 236.64$, $p < 0.001$. Nagelkerke R² indicated that this model explained 65.3% of the variance and correctly classified 85.6% of cases.

Compared to Chinese, Malay older adults had significantly higher odds of high FoF (OR = 5.81, 95% CI 1.77 – 19.13). Use of walking aid and frailty were significant predictors for high FoF. The odds of high FoF were significantly higher in older adults who used walking aids (OR = 3.67, 95% CI = 1.54 – 8.77). Compared to well older adults, the odds of high FoF were significantly higher in pre frail older adults (OR = 6.87, 95% CI = 2.66 – 17.37), mildly frail older adults (OR = 18.58, 95% CI = 4.88 – 70.34) and moderately frail older adults (OR = 144.78, 95% CI = 13.86 – 1512.60). The logistic regression model is described in Table 1.

Table 1 Predictors of high Fear of Falling from logistic regression model

Explanatory variables	High Fear of Falling		
	Exp(B)	Sig	95% CI for EXP (B)
Ethnicity			
Chinese	Reference		
Malay	5.817	0.004	1.769 - 19.125
Indian	0.871	0.813	0.277 - 2.735
Others	0.142	0.380	0.002 - 11.177
Age Category			
Old-old (75 years & above)	Reference		
Young-old (65 to 74 years)	0.860	0.682	0.418 - 1.770
Gender			
Female	Reference		
Male	1.117	0.768	0.535 - 2.334
Marital Status			
Never married	Reference		
Married	6.750	0.018	1.391 - 32.756
Separated/ divorced	10.400	0.039	1.130 - 95.760
Widowed	7.407	0.014	1.507 - 36.410
Educational Status			
Tertiary education	Reference		
No formal education	0.859	0.847	0.184 - 4.007
Primary education	0.446	0.290	0.100 - 1.992
Secondary education	0.606	0.522	0.131 - 2.806
Multimorbidity			
1 or 2 chronic conditions	Reference		
3 or more chronic conditions	1.149	0.754	0.483 - 2.730
Frailty Category (CFS)			
Well (CFS 1 to 3)	Reference		
Pre frail (CFS 4)	6.873	0.000	2.663 - 17.736

Mildly frail (CFS 5)	18.583	0.000	4.882 - 70.737
Moderately frail (CFS 6)	144.777	0.000	13.857 - 1512.600
Use of Walking Aid			
No	Reference		
Yes	3.673	0.003	1.539 - 8.765
Falls within 6 months			
No	Reference		
Yes	2.417	0.056	0.979 - 5.966

Demographic characteristics and frailty status

We observed that frailty status was a very significant predictor for high FoF and proceeded to investigate whether there were differences between groups for demographic characteristics and frailty status. We found significant differences in age, gender, marital status, educational level, multi-morbidity, use of walking aid, fall within six months and frailty status.

More mildly to moderately frail older adults were 75 years and above ($\chi^2 = 39.82$, $df=3$, $p<0.001$), female ($\chi^2 = 24.82$, $df=3$, $p<0.001$), widowed ($\chi^2 = 45.46$, $df=9$, $p<0.001$), had no formal education ($\chi^2 = 49.96$, $df=9$, $p<0.001$), had more than three or more chronic conditions ($\chi^2 = 35.94$, $df=3$, $p<0.001$), had falls within six months ($\chi^2 = 28.05$, $df=3$, $p<0.001$) and used walking aids ($\chi^2 = 243.09$, $df=3$, $p<0.001$).

Discussion

Prevalence of Fear of Falling

This study found a high prevalence of FoF amongst our respondents. 60.8% of respondents reported high FoF and 21.4% reported moderate FoF. Studies have used various scales to study the prevalence of FoF and reported a wide variation in prevalence of FoF among community-dwelling older adults in different countries, ranging from 19% in the United Kingdom (24) to 81% in China (25). In Singapore, a 69.2% prevalence of FoF as assessed by a single question was reported (15). This makes direct comparison across studies and countries challenging.

There are published articles that have used the Falls Efficacy Scale- International (FES-I) to study the prevalence of FoF. A cross-sectional observational study in Japan using the FES-I categorized FoF into three levels (low, moderate, and high) found that 27.3% were categorized as low concern, 47.9% as moderate concern and 24.8% as high FoF (26). A similar prevalence of FoF compared to our study was carried out in China. Qin et al found a 81% prevalence of FoF in 5 communities in China (25).

There were differences in demographics across studies which also makes direct comparison of FoF prevalence challenging. Our study population was of older age and comprised of more individuals who were frail and had multi-morbidity, which may have accounted for the differences in reported prevalence.

Relationship between Demographic Factors, Multimorbidity, Frailty and Fear of Falling

Our study identified several demographic factors that were significantly associated with high FoF on univariate analysis. Female gender, age more than 75 years, separated, or widowed marital status, and lack of formal education were associated with a higher proportion of respondents with high FoF.

These identified risk factors are also associated with a higher risk of frailty. He et al showed that increased age, female gender, presence of 3 or more chronic diseases and disability in activities in daily living were associated with an increased risk of frailty (27). Unmarried individuals had a 1.88-fold higher risk of being frail compared to married individuals (28). Similarly, Wang et al showed that married individuals were less likely to be frail compared to unmarried individuals (29). A high level of social engagement amongst unmarried individuals was associated with a lower frailty risk. Kang et al showed that having a frail spouse was associated with frailty (30). Taken together, one could hypothesise that a widowed individual would have been living with a frail spouse before his or her spouse's demise. Reduced social interaction after the spouse's death, leads to a higher prevalence of frailty amongst widowed individuals.

Our study showed that lower education was associated with higher frailty levels and significantly higher FoF scores. Li et al showed that persons with high school education or above had a 5.6% lower risk of frailty (31). The evidence for lower education levels and FoF is less clear. A lower educational level was associated with higher FoF (14, 24, 32, 33). On the other hand, a study in Singapore found no significant association between FoF and years of education (15). Interventions for FoF would need to be tailored to persons of varying educational levels, such as utilizing pictorial aids.

This study found that those with multimorbidity had significantly higher FoF than those without multimorbidity. Multimorbidity was also significantly associated with frailty. There is a significant overlap between multimorbidity and frailty, and between multimorbidity and FoF. Yarnall et al described similarities in the pathophysiology between multimorbidity and frailty, where a cumulative accumulation of deficits from multiple chronic diseases leads to failure of multiple physiological and behavioural factors, leading to increased risk of adverse outcomes from relatively minor stressors (34). Our findings are similar to several other studies which demonstrated that multimorbidity was associated with an increased risk of FoF (15, 32). There are specific medical conditions such as hypertension, stroke, diabetes, arthritis or depression which were associated with an increased risk of FoF (14, 33).

Given that most of the above factors were significantly associated with frailty but not associated with FoF on multivariate analysis, our study suggests that the abovementioned factors are associated with frailty, and in turn, frailty is associated with FoF amongst our respondents in our study.

Independent Predictors For Fear Of Falling

This study found a significant difference in FoF between ethnic groups in Singapore, with Malay ethnicity having significantly higher FoF than Chinese. Malay ethnicity was not found to be significantly different from other ethnicities in frailty status, thus other cultural reasons may account for this difference; which warrants further exploration to tailor interventions culturally. The effect of ethnicity on FoF is not well established. Merchant et al found no significant differences in FoF between ethnic groups (15). However, other studies in countries such as the United Kingdom have found that minority ethnic groups have higher risk for FoF (24).

This study found that frailty was associated with FoF. This was similar to other studies. A study of 183 older adults in Spain who had history of falls in past 1 year found that 88.8% of frail older adults had FoF compared to 62.4% of those who were not frail. Frail participants had 3.18-fold higher risk of FoF than those not frail (35). Another study of 165 community-dwelling older adults in China found that 60% of participants were frail and 81% reported FoF. Participants with FoF were 7.2 times more likely to be frail (25). The study in Singapore, which included 493 community dwelling adults above 60 years old, of which 47.9% were prefrail and only 3.4% were frail, found that those who were prefrail or frail were 2.17 times more likely to have FoF (15).

Those who used a walking aid had significantly higher odds of high FoF in this study. Similarly, use of walking aid was associated with FoF in a systematic review and a large scale study in UK (24, 36). Denkinger et al also showed that the use of a walking aid was significantly associated with fall related activity restriction and falls related self-efficacy. The perspectives of patients using walking aids could be further explored in future studies to further understand the significance of walking aid use and its relation to FoF.

This study found that history of falls was associated with FoF, although it was not an independent predictor in multivariate analysis. History of falls is a well-known risk factor as persons who have fallen before are likely to develop fear. History of falls was associated with FoF in a systematic review (36), and recent studies in Singapore (15), Vietnam (37), Brazil (38), Korea (32), Thailand (33) and Canada (39).

FoF and falls also have bidirectional relationship, where FoF predicts future falls. A study of community dwelling older adults in Serbia found that the average Falls Efficacy Scale score was significantly higher in fallers and FoF was an independent risk factor for falling (40). A longitudinal, prospective study of community-dwelling adults aged above 75 years old in Spain found that 41.7% of those who had reported FoF at baseline had suffered at least one fall 24 months later and that FoF was a risk factor for falls (17).

More than half (54.6%) of those with no history of falls reported high FoF. Similarly, three-quarters of those with FoF had never experienced a fall in the another study (15). This raises the possibility of a psychological component to FoF. Older adults may also have other reasons for FoF such as history of near falls increasing anxiety levels, frailty or medical conditions reducing their perceived self-efficacy or

self-rated health. This may warrant further investigation, and would also suggest a need for psychological-based interventions for FoF.

Strengths

This study utilized a validated tool to assess FoF scores, thus allowing comparison of scores between groups and across studies where the FES-I was used. This study also recruited a multi-ethnic Asian population which provided insights on FoF scores among different ethnic groups and identified a potential association between Malay ethnicity and FoF which would warrant further exploration. The recruitment of older adults with varying levels of frailty also enabled representation of FoF among different frailty levels. By analyzing various risk factors for FoF with frailty we have established a complex relationship between various risk factors and frailty and demonstrated the importance of frailty as a risk factor for FoF.

Limitations

This study utilized a cross-sectional design, thus temporality of associations such as those between FoF and future falls could not be determined. Longitudinal studies would be better able to determine this. Another limitation of this study is that information was self-reported and based on recall. The use of judgment-based tool CFS may have resulted in some variability in assessing frailty levels, however, this was minimized by training the study team prior to use. The study population had a higher proportion of Chinese compared to Singapore's local population. The proportion of persons in various stages of frailty are not representative of our local population and therefore caution is advised in generalizing the data to the wider population. Lastly, psychological factors such as self-rated health, anxiety and depression levels were not elicited from patients, which might have provided a more in-depth knowledge on the psychological factors affecting fear of falling in our respondents.

Conclusion

FoF is a prevalent issue in older adults. The high prevalence indicates an urgent need for interventions to address FoF in older adults to minimize a vicious cycle of activity limitation, social isolation, functional decline and future falls. This study added to the body of evidence of the demographic and clinical factors that influence FoF and addressed the association between various risk factors, frailty and FoF. We have found a strong association between FoF and frailty. The study also found novel findings such as differences in FoF between ethnic groups. Our study's findings suggest that interventions for FoF should be tailored to one's educational level and be culturally relevant to the person with high FoF. The relatively high FoF scores in non-fallers and pre-frail older adults suggests that interventions may also be required and customised to improve their self-efficacy levels and psychological well-being.

Abbreviations

Clinical Frailty Scale (CFS)

FES-I: Falls Efficacy Scale – International

FoF: Fear of falling

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from National Healthcare Group Domain Specific Review Board (DSRB Ref: 2020/00847). Verbal informed consent was obtained from all participants.

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

All authors declare that they have no competing interest.

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This study did not receive any funding.

Authors' contributions

DJG, DNWL, BKM, TJ, GLJ, WCY, CSSC, and GKC were involved in study conceptualization and implementation. DJG, DNWL and GLJ analyzed and interpreted the data. DJG, DNWL and GKC wrote the manuscript. All authors reviewed the manuscript.

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