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Accuracy of self-perceived risk of falls among hospitalised adults in China: an observational study

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ABSTRACT

Objective To evaluate the accuracy of self-perceived risk of falls in hospitalised adults and explore factors associated with the differences.

Design Cross-sectional study.

Setting We conducted the study in two tertiary general hospitals located in Zhejiang province and Shandong province in China.

Participants 339 patients were recruited using convenient sampling. The majority of them were men (54%), aged 61–70 (40.1%) and had received secondary school education or lower (82%).

Outcome measures The Fall Risk Perception Questionnaire and the Morse Fall Scale (MFS) were used to measure patients' self-perceived risk of falls and nurses' assessment. Other risk factors of falls were assessed to identify the determinants of disparities.

Results Most patients (74.6%) had a high risk of falls according to MFS. Only 61.9% of the patients' perceived risk matched with the assessment of nurses. Nearly one-third (27.5%) underestimated their fall risk, while the remaining (10.6%) overestimated. Multivariable logistic regression analyses revealed that older age, lower number of comorbidities, not having fear of falling and emergency department were the significant factors associated with underestimated risk of falls ($p<0.05$). Besides, endocrine department and having fall-related injuries were significantly associated with overestimated risk of falls ($p<0.05$).

Conclusion Hospitalised patients were proven to be poor at recognising their risk of falls. Measurement of patients' self-perceived and health professionals' assessment of fall risk should be conducted to evaluate the disparity. This study provides a solid foundation to raise medical staff's awareness of the targeted population, identify the underlying factors and implement tailored fall prevention strategies and education.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This study compared the health professionals' and patients' assessment of fall risk among Chinese hospitalised adults.
- ⇒ This study identified the risk factors of self-perceived underestimated or overestimated fall risk in China.
- ⇒ This study was conducted with a sufficient sample size across two provinces in China.
- ⇒ There is a possibility of report bias in the collection of fall risk information with the questionnaire in this study.
- ⇒ The study used a cross-sectional design that could not interpret causal effect.

INTRODUCTION

Falls are the most common threat to patients' safety, accounting for 30%–40% of the adverse events in hospital.[1–3] Daily fall rate among hospitalised adults ranged from 3.6 ‰ to 12.6 ‰ all over the world.[4] The estimated incidence of falls varied between 1.4 ‰ and 18.2 ‰ in China.[5] This evidence highlighted that falls have become a major challenge globally. Moreover, over one-third of falls resulted in severe injuries such as soft tissue injury, fracture and even death.[6] WHO reported that 37.3 million people who fell each year required healthcare in medical institutions, which significantly increased the burden on healthcare providers.[7] In addition, falls can also cause various complications in patients such as fear of falling, delayed recovery and increased hospital expenditures.[8 9] Therefore, it is crucial to assess the risk of falls in clinical situations.

Fall risk can be assessed from the perspective of health professionals and patients. However, little attention was paid to the self-perceived risk of falls among hospitalised adults.[10 11] Studies showed that self-perception of fall risk had an association with actual falls. An accurate patient's self-perceived risk of falls was proved the first step in fall prevention[12] and could reduce fall rates by up to 50%.[13] Patients with higher self-perception were more likely to engage in fall prevention and had less high-risk performance.[14] It is true that patients' self-perceived risk of falls plays a vital role in fall prevention. However, a large number of research has shown that there is often a disparity between the self-perceived risk of falls and the actual risk.[14–16] Sonnad *et al*[15] indicated that 88% of the hospitalised patients underestimated their fall risks. In another study of 158 critical patients, approximately 87 (55.1%) of them did not see themselves at high risk of falls.[14] In contrast, Lim *et al*[16] found that 51% of elderly patients over 65 years old overestimated their fall

Table 1 Categorisation of the questionnaire scores

Fall Risk Perception Questionnaire	Morse Fall Scale	
	Low	High
Low	Accurate	Underestimated
High	Overestimated	Accurate

risk. Overall, patients can not accurately estimate their risk of falls in the hospital.

It has been noted that both underestimating and overestimating the risk of falls can be detrimental.[17] Patients who underestimated their risks tended not to demonstrate good compliance with fall prevention instruction.[18] Conversely, patients who overestimated their risk tend to have excessive fear and reduce their physical activities.[19] Therefore, it is necessary to understand the accuracy of self-perceived risk of falls among hospitalised adults in China. Previous studies mainly focused on the elderly who were at a high risk of falls. However, young or middle-aged adults may be at risk of falls as well due to the condition of illness, specific medications or fasting before surgical procedures.[20] So we included this population in our sample. This study aimed to compare the inpatients' self-perceived and actual risk of falls in the hospital and explore the factors associated with the disparity. The hypothesis was that the disparity between health professionals' and patients' assessment of fall risk was related to various demographic characteristics. The results would be helpful to provide personalised fall prevention education and strategies as well as lay a solid foundation for further research to reduce the fall rate in China.

METHOD

Study design and participants

A cross-sectional study was conducted in two tertiary general hospitals located in Zhejiang province and Shandong province, China, from December 2021 to April 2022. Convenient sampling was used to recruit the participants who were aged above 18 years, admitted to the inpatient wards within 24 hours and able to complete the questionnaires. Those who were critically ill and those who had cognitive impairment or psychiatric issues were excluded. The sample size was determined by the formula N≥50+8 m (m is the number of independent variables) to test multiple correlations.[21 22] In our study, a total of 11 demographic factors and 9 scale-related dimensions were considered independent variables, thus at least 210 participants were needed. Taking practical conditions into account, we finally recruited 339 participants.

Measurements

Demographic data

Demographic data were obtained including age, gender, educational level, comorbidities, caregiver, current medication, clinical department, fear of falling, falls within 1 year prior to the study, previous fall-related injuries and

Table 2 Participants' characteristics

Characteristics	N (%)
Gender	
Male	183 (54.0%)
Female	156 (46.0%)
Age (year)	
18–60	51 (15.0%)
61–70	136 (40.1%)
71–80	89 (26.3%)
> 80	63 (18.6%)
Education level	
Illiteracy	88 (25.9%)
Primary school	83 (24.5%)
Secondary school	107 (31.6%)
High school	53 (15.6%)
University or college	8 (2.4%)
Comorbidities (number)	
0	123 (36.3%)
1–2	173 (51.0%)
≥3	43 (12.7%)
Medication	
Nothing	88 (26.0%)
Sleeping pills	23 (6.8%)
Hypoglycaemic	92 (27.1%)
Antihypertensive	109 (32.2%)
Other	79 (23.3%)
Caregiver	
Self-care	21 (6.2%)
Spouse	169 (49.9%)
Children or parents	138 (40.7%)
Social worker	11 (3.2%)
Fear of falling	
Yes	233 (68.7%)
No	106 (31.3%)
Falls in last 1 year (number)	
0	266 (78.5%)
1	60 (17.7%)
≥2	13 (3.8%)
Fall-related injuries	
Yes	40 (11.8%)
No	299 (88.2%)
Fall prevention training	
Yes	245 (72.3%)
No	94 (24.7%)
Department	
Emergency	117 (34.5%)
Endocrine	68 (20.1%)
Neurology	154 (45.4%)

Table 3 Actual and self-perceived risk of falls

	Fall Risk Perception Questionnaire		
Morse Fall Scale	Low	High	N (%)
Low	50	36	86 (25.4%)
High	93	160	253 (74.6%)
N (%)	143 (42.2%)	196 (57.8%)	

fall prevention training. Fear of falling was assessed by a global single-item question: 'Are you afraid of falling?' The dichotomous answer was 'yes' or 'no'. This item had acceptable reliability and validity.[23]

Morse Fall Scale (MFS)

The MFS was adopted to assess the actual risk of falls.[24] It is a commonly used assessment tool consisting of six variables: a history of falling within 3 months, secondary medical diagnosis, ambulatory aids, intravenous therapy, gait and mental status. The total score of the scale ranges from 0 to 125. Higher scores indicate greater risk of falls. The cut-off value was determined at 45.[25] The MFS had a reported Cronbach's α coefficient of 0.96, sensitivity of 0.78 and specificity of 0.83.[24] It was completed by ward nurses in our study.

Fall Risk Perception Questionnaire (FRPQ)

The FRPQ was used to measure patients' self-perceived risk of falls.[26] The 27-item scale contains 3 dimensions: personal mobility, personal chronic condition and environmental factors. All items were rated on a 4-point Likert scale ranging from 0 (absolutely not true) to 3 (absolutely true). Higher scores represent a higher perceived fall risk. The Cronbach's α coefficient was 0.948 ranging from 0.828 to 0.917 for the subscales and the content validity index was 0.924, indicating sound reliability and validity. Since there was not a valid cut-off point for this scale, we determined the cut-off point using area under the curve (AUC)/receiver operating characteristic (ROC) analysis. By using MFS category outcome as a determiner, the area under the ROC curve (AUC) for discriminating high-risk people from the low risk was 0.732. The cut-off point was 28.5, with 72.3% sensitivity and 68.1% specificity. The Cronbach's α in our study was 0.940.

Data collection

Ten nurses were trained with the same standard to collect the data. They explained the purpose and content of the survey to the patients and obtained their written informed consent. The ethical principles of voluntary participation, anonymity and confidentiality were guaranteed. The demographic data and the FRPQ were distributed in written forms and completed by patients on their admission day. Nurses made explanations to those who had poor eyesight or had difficulty understanding the items and helped them complete the questionnaires. The MFS was obtained from the medical records collected by the nurses at the time of admission. In total, 360 questionnaires were collected. We removed the questionnaires that did not include all the data. Finally, 339 questionnaires were analysed, with an effective response rate of 94.17%.

Statistical analysis

We employed SPSS V.25.0 software for statistical analysis. Descriptive statistics were used to describe demographic data, self-perceived and actual risk of falls. Frequencies and percentages were shown to facilitate the understanding of the results. We conducted the correlation analysis between the continuous score of MFS and the continuous score of FRPQ. The correlation (r value) is interpreted as negligible for ≤0.10, weak for 0.10–0.39, moderate for 0.40–0.69, strong for 0.70–0.89 and very strong for ≥0.90.[27] Then, the differences between self-perceived and actual risk of falls were compared. Patients were categorised into three subgroups labelled as 'accurate', 'underestimate' and 'overestimate' (table 1). Differences in categorical variables were tested using the χ^2 test. Independent variables with a p value less than 0.20 in the univariate analysis were entered into the multivariate logistic regression analyses to test the relationship between demographic factors and the accuracy.[28] The level of significance was set as p≤0.05. We followed the Strengthening the Reporting of Observational Studies in Epidemiology guideline to report the study.

Patient and public involvement

Patients or the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

RESULTS

Participants' characteristics

Among 339 patients, most of them were men (54%), aged 61–70 (40.1%) and had received secondary school education or lower (82%). The number of patients who had comorbidities was 216 (63.7%). The most common medication that they were taking was antihypertensive (n=109, 32.2%). More than two-thirds (68.7%) of the patients were afraid of falling. Overall, 21.5% fell in the past year prior to the study. Patients were mainly recruited from neurology department (45.4%), followed by emergency department (34.5%) and endocrine department (20.1%). Further detailed information is presented in table 2.

Actual and self-perceived risk of falls

On admission, the majority of patients (n=253, 74.6%) were at high risk of falls according to MFS. The median (25th–75th quartiles) of the FRPQ was 32 (20–44) Based on the categorisation of the questionnaire score, less than two-thirds of the patients (n=210, 61.9%) accurately assessed their risk of falls. A total of 93 patients (27.5%) underestimated their fall risk, while 36 of them (10.6%) overestimated it (table 3). The correlation analysis between the continuous score of MFS and the continuous score of FRPQ was 0.499 (p=0.001). This indicated

Table 4 Comparison of risk factors and subgroups

	Accurate, n=210	Underestimate, n=93	Overestimate, n=36	χ2	P value
Gender				1.450	0.484
Male	108 (51.4%)	54 (58.1%)	21 (58.3%)		
Female	102 (48.6%)	39 (41.9%)	15 (41.7%)		
Age (year)				11.545	0.034*
18–60	37 (17.6%)	9 (9.7%)	5 (13.9%)		
61–70	79 (37.6%)	36 (38.7%)	21 (58.3%)		
71–80	56 (26.7%)	25 (26.9%)	8 (22.2%)		
>80	38 (18.1%)	23 (24.7%)	2 (5.6%)		
Education level				9.275	0.320
Illiteracy	55 (26.2%)	25 (26.9%)	8 (22.2%)		
Primary school	41 (19.5%)	34 (36.5%)	8 (22.2%)		
Secondary school	70 (33.3%)	25 (26.9%)	12 (33.3%)		
High school	38 (18.1%)	8 (8.6%)	7 (19.5%)		
University or college	6 (2.9%)	1 (1.1%)	1 (2.8%)		
Caregiver				8.792	0.186
Self-care	11 (5.2%)	8 (8.6%)	2 (5.5%)		
Spouse	89 (42.4%)	35 (37.6%)	14 (38.9%)		
Children or parent	100 (47.6%)	50 (53.8%)	19 (52.8%)		
Social worker	10 (4.8%)	0	1 (2.8%)		
Comorbidities (number)				9.083	0.049*
0	72 (34.3%)	35 (37.6%)	16 (44.4%)		
1–2	107 (51.0%)	53 (57.0%)	13 (36.1%)		
≥3	31 (14.7%)	5 (5.4%)	7 (19.5%)		
Hypoglycaemic or antihypertensive				2.430	0.297
Yes	98 (46.7%)	39 (41.9%)	12 (33.3%)		
No	112 (53.3%)	54 (58.1%)	24 (66.7%)		
Fear of falling				8.639	0.013*
Yes	152 (72.4%)	53 (57.0%)	28 (77.8%)		
No	58 (27.6%)	40 (43.0%)	8 (22.2%)		
Falls in last year (number)				7.610	0.107
0	162 (77.1%)	73 (78.5%)	31 (86.1%)		
1	38 (18.1%)	19 (20.4%)	2 (5.6%)		
≥2	10 (4.8%)	1 (1.1%)	3 (8.3%)		
Fall-related injuries				5.500	0.064
Yes	31 (14.8%)	8 (8.6%)	1 (2.8%)		
No	179 (85.2%)	85 (91.4%)	35 (97.2%)		
Fall prevention training				0.806	0.668
Yes	154 (73.3%)	64 (68.9%)	27 (75.0%)		
No	56 (26.7%)	29 (31.1%)	9 (25.0%)		
Department				49.232	0.000*
Emergency	63 (30.0%)	54 (58.0%)	0		
Endocrine	42 (20.0%)	10 (10.8%)	16 (44.4%)		
Neurology	105 (50.0%)	29 (31.2%)	20 (55.6%)		

*P value≤0.05.

Table 5 Multivariable logistic regression of risk factors with self-perceived underestimated or overestimated fall risk (compared with being accurate)

	Underestimate		Overestimate	
	OR (95% CI)	P value	OR (95% CI)	P value
Intercept		0.024		0.001
Age				
18–60	0.257 (0.095 to 0.693)	0.007*	2.589 (0.426 to 15.727)	0.301
61–70	0.544 (0.266 to 1.114)	0.096	5.393 (1.134 to 25.643)	0.034*
71–80	0.671 (0.314 to 1.431)	0.302	2.885 (0.552 to 15.065)	0.209
>80	Ref		Ref	
Comorbidities				
0	3.659 (1.211 to 11.052)	0.021*	0.916 (0.311 to 2.698)	0.874
1–2	3.102 (1.080 to 8.910)	0.035*	0.546 (0.186 to 1.601)	0.270
≥3	Ref		Ref	
Fear of falling				
Yes	0.449 (0.255 to 0.789)	0.005*	1.713 (0.685 to 4.286)	0.250
No	Ref		Ref	
Department				
Emergency	3.263 (1.839 to 5.790)	0.000*	NA	NA
Endocrine	0.877 (0.379 to 2.026)	0.758	2.194 (0.987 to 4.877)	0.054
Neurology	Ref		Ref	

*P value≤0.05.

the concurrent validity between the two outcomes as moderate.

Comparisons of risk factors and the subgroups

Age, comorbidities, fear of falling and the clinical department had significant influences on the accuracy of fall risk (p<0.05, table 4). The results of multivariate logistic regression showed that patients who had fewer comorbidities were more likely to underestimate their fall risk (OR 3.659 CI (1.211 to 11.052), p=0.021). Patients aged below 60 were less likely to underestimate compared with those aged above 80 (OR 0.257 CI (0.095 to 0.639), p=0.007). Patients who were afraid of falling were also less prone to underestimate the risk of falls (OR 0.449 CI (0.255 to 0.789), p=0.005), whereas patients in the emergency department were more likely to underestimate compared with those in neurology department (OR 3.263 CI (1.839 to 5.790), p=0.000). However, patients aged 61–70 were more likely to overestimate the fall risk compared with their counterparts aged above 80 (OR 5.393 CI (1.134 to 25.643), p=0.034) (table 5).

After putting previous fall-related injuries into the regression model, we found patients with fall-related injuries were less likely to overestimate their fall risk (OR 0.079 CI (0.009 to 0.708), p=0.023) and patients in the endocrine department were more likely to overestimate compared with those in the neurology department (OR 3.960 CI (1.605 to 9.772), p=0.003). However, the effect of age became insignificant (online supplemental table 1). After putting falls within 1 year prior to the study and caregivers into the model, there was no major difference in the effect (online supplemental table 2 and 3). The final regression model including all possible variables showed that older age, lower number of comorbidities, not having fear of falling and emergency department were the significant factors associated with underestimated risk of falls (p<0.05). Besides, endocrine department and having fall-related injuries were significantly associated with overestimated risk of falls (p<0.05).

DISCUSSION

To the best of our knowledge, this is the first study on the accuracy of self-perceived risk of falls among hospitalised adults in mainland China. We found that only around 60% of the population perceived their risk of falls accurately in hospital. Nearly one-third of them underestimated their risk while the rest overestimated it. The disparity between self-perceived risk of falls and health professionals' assessment was confirmed in previous study, though there were slight differences in the proportion of underestimated or overestimated risk of falls.[14 16] Overall, 55.1% of the patients from a US hospital did not perceive a high likelihood of falling,[14] while half of the subjects from Singapore had a higher perception of risk level.[16] According to the theory of behaviour change, self-perception of disease risk is an important factor in behaviour change. Patients' intentions to engage in fall prevention behaviours vary with their self-perceived risk

of falls.[29] Inaccurate self-perceived risk level may hinder patients' engagement. Therefore, identifying the determinants of the disparity plays a pivotal role in health promotion.

The result showed that patients with lower number of comorbidities were more likely to underestimate the risk of falls. The factor may lie in the scarcity of awareness among these patients. They did not necessarily relate their fall risk to their current health status. However, studies showed that syncope and dizziness were possible causes of falls that happened to inpatients regardless of age.[30 31] Due to the sudden occurrence, patients with lower number of comorbidities would become less aware of their risk of falls. It is worth mentioning that patients in the emergency department are more prone to underestimate their fall risk. This may stem from the complicated situations in the emergency department. Patients tend to have acute diseases, which may develop rapidly, leading to a high risk of falls.[32] In addition, older patients and those who had no fear of falling were more likely to underestimate their fall risk. They paid less attention to the prevention of falls and had a lower perception of fall risk. This highlighted the target population for fall prevention when hospitalised. It is necessary for health professionals (ie, nurses) to regularly inform the risk of falls to the risk-taking patients.[33 34]

It is interesting to note that patients aged 61–70 were more likely to overestimate their risk of falls compared with those aged above 80. This may be explained by their attitudes towards hospitalisation. Given that hospital seems to be a new environment for patients in their 60s, this probably made them anxious and increased their self-perceived fall risk.[35] However, taking fall-related injuries into consideration, age appeared to be an insignificant factor. The mediating effect of fall-related injuries in the model may be attributed to this. Older patients were more likely to sustain injuries after a fall. Moreover, age plays a more important role in providing tailored intervention in clinical nursing scenarios. Therefore, we preserved age in the model while discarding the fall-related injuries. We did not find a significant effect of education level in our study, which was inconsistent with Turner *et al*.[36] Since one-fourth of our subjects were illiterate, they completed the questionnaires with the help of nurses who spoke out the content of the survey. Even though there was no instructive information given to the patients, measurement bias may also occur among patients with low education level. It is true that overestimating the risk of falls was also very disadvantageous for patients. Fall prevention programmes should be delivered to this population to help them develop an accurate perception of their risk of falls.[11 37]

It is worth mentioning that the MSF itself may be subject to the skill of assessors in its accuracy especially when it comes to assessing mental status, so the unified training among the assessors was needed. Besides, there were some factors relevant to falls but not captured in this scale such as urinary or other catheters. Even though the MFS is a 'valid method' in terms of falls, future research still needs to take other important factors into consideration to develop a comprehensive understanding of fall risk. Another consideration was about study population. We recruited the patients from three medical departments which were reported to have relatively high incidence rate.[12 26] However, the patient characteristics possibly showed some disparities in a surgical ward where patients may be under influence of pain medications and have more intravenous lines. This population was also at risk of falls but they may be more prone to underestimate self-perceived fall risk due to the lack of professional knowledge. Hence, it is necessary to conduct the research in surgical departments to identify the possible differences in the future.

Limitation

While there seems to be existing evidence showing the discrepancy between healthcare providers' and patients' assessment of fall risk, the research in China is scarce. Falls are still an important patient safety issue and therefore in scope for us. However, there are also several limitations in our study. First, the cross-sectional study design cannot infer causality. Further research can establish a cohort study to draw causal inferences of fall risk and consider more related risk factors. Second, patients' answering of the self-perception questionnaire via a nurse may lead to reporting bias. Since different assessment scales were used by the patients and the nurses, the disparity may be related to the difference between patients versus nurses, or the two scales, or an interaction among them. However, all the nurses were trained to collect the data without giving any leading information. We rated the two scales on the same admission day and used the sensitivity and specificity of MFS to determine the cut-off point of FRPQ, so that the measurement bias can be avoided to some extent. Thirdly, due to the limited resources, we conducted the study in two tertiary general hospitals in China. Larger sample size is needed to reduce the sampling bias and investigate the confounding effect of risk factors in the future.[38]

CONCLUSION

Hospitalised patients tended to be poor at perceiving their risk of falls. The disparity can be attributed to various factors such as age, comorbidities, fear of falling and clinical department. This study provides a solid foundation to raise medical staff's awareness of the targeted population and implement tailored fall prevention strategies and education.

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Patient consent for publication Consent obtained directly from patient(s)

Ethics approval This study involves human participants and was approved by The Second Affiliated Hospital, Zhejiang University School of Medicine (number: 2021-0727). Participants gave informed consent to participate in the study before taking part.

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Data availability statement Data are available upon reasonable request.

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REFERENCES

1 Silkworth AL, Baker J, Ferrara J, *et al*. Nursing staff develop a video to prevent falls: a quality improvement project. *J Nurs Care Qual* 2016;31:40–5.
2 Moe K, Brockopp D, McCowan D, *et al*. Major predictors of inpatient falls: a multisite study. *J Nurs Adm* 2015;45:498–502.
3 Opsahl AG, Ebright P, Cangany M, *et al*. Outcomes of adding patient and family engagement education to fall prevention bundled interventions. *J Nurs Care Qual* 2017;32:252–8.
4 Abreu HCdeA, Reiners AAO, Azevedo RCdeS, *et al*. Incidence and predicting factors of falls of older inpatients. *Rev Saude Publica* 2015;49:37.
5 Zhang J, Wang M, Liu Y. Psychometric validation of the Chinese version of the Johns Hopkins fall risk assessment tool for older Chinese inpatients. *J Clin Nurs* 2016;25:2846–53.
6 Fields J, Alturkistani T, Kumar N. Prevalence and cost of imaging in inpatient falls: the rising cost of falling. *Clinicoecon Outcomes Res* 2015;3:281–6.
7 Phelan EA, Ritchey K. Fall prevention in community-dwelling older adults. *Ann Intern Med* 2018;169:ITC81–-ITC96..
8 Hemsley B, Steel J, Worrall L, *et al*. A systematic review of falls in hospital for patients with communication disability: highlighting an invisible population. *J Safety Res* 2019;68:89–105.
9 LeCuyer M, Lockwood B, Locklin M. Development of a Fall Prevention Program in the Ambulatory Surgery Setting. *J Perianesth Nurs* 2017;32:472–9.
10 Ambrose AF, Paul G, Hausdorff JM. Risk factors for falls among older adults: a review of the literature. *Maturitas* 2013;75:51–61.
11 Kuhlenschmidt ML, Reeber C, Wallace C, *et al*. Tailoring education to perceived fall risk in hospitalized patients with cancer: a randomized, controlled trial. *Clin J Oncol Nurs* 2016;20:84–9.
12 Gravesande J, Richardson J, Griffith L, *et al*. Test-Retest reliability, internal consistency, construct validity and factor structure of a falls risk perception questionnaire in older adults with type 2 diabetes mellitus: a prospective cohort study. *Arch Physiother* 2019;9:14.
13 Christiansen TL, Lipsitz S, Scanlan M, *et al*. Patient activation related to fall prevention: a multisite study. *Jt Comm J Qual Patient Saf* 2020;46:129–35.
14 Twibell RS, Siela D, Sproat T, *et al*. Perceptions related to falls and fall prevention among hospitalized adults. *Am J Crit Care* 2015;24:e78–85.
15 Sonnad SS, Mascioli S, Cunningham J, *et al*. Do patients accurately perceive their fall risk? *Nursing* 2014;44:58–62.
16 Lim ML, Seow JP, Ang SY, *et al*. Disparity between perceived and physiological risks of falling among older patients in an acute care hospital. *Appl Nurs Res* 2018;42:77–82.
17 Aycock DM, Clark PC, Araya S. Measurement and outcomes of the perceived risk of stroke: a review. *West J Nurs Res* 2019;41:134–54.
18 Yardley L, Bishop FL, Beyer N, *et al*. Older people's views of falls-prevention interventions in six European countries. *Gerontologist* 2006;46:650–60.
19 Delbaere K, Crombez G, Vanderstraeten G, *et al*. Fear-related avoidance of activities, falls and physical frailty. A prospective community-based cohort study. *Age Ageing* 2004;33:368–73.
20 Najafpour Z, Godarzi Z, Arab M, *et al*. Risk factors for falls in hospital in-patients: a prospective nested case control study. *Int J Health Policy Manag* 2019;8:300–6.
21 Green SB. How many subjects does it take to do a regression analysis. *Multivariate Behav Res* 1991;26:499–510.
22 Tabachnick BG, Fidell LS. *Using multivariate statistics*. 6th. Boston, MA: Allyn & Bacon, 2012.
23 Foran S, McCarron M, McCallion P. Expanding assessment of fear of falling among older adults with an intellectual disability: a pilot study to assess the value of proxy responses. *ISRN Geriatrics* 2013;2013:1–9.
24 Morse JM, Black C, Oberle K, *et al*. A prospective study to identify the fall-prone patient. *Soc Sci Med* 1989;28:81–6.
25 Chow SKY, Lai CKY, Wong TKS, *et al*. Evaluation of the Morse fall scale: applicability in Chinese Hospital populations. *Int J Nurs Stud* 2007;44:556–65.
26 Choi J, Choi SM, Lee JS, *et al*. Development and validation of the fall risk perception questionnaire for patients in acute care hospitals. *J Clin Nurs* 2021;30:406–14.
27 Schober P, Boer C, Schwarte LA. Correlation coefficients: appropriate use and interpretation. *Anesth Analg* 2018;126:1763–8.
28 Maldonado G, Greenland S. Simulation study of confounder-selection strategies. *Am J Epidemiol* 1993;138:923–36.
29 Kreuter MW, Strecher VJ. Changing inaccurate perceptions of health risk: results from a randomized trial. *Health Psychol* 1995;14:56–63.
30 Perego F, De Maria B, Bagnara L, *et al*. The dilemma of falls in older persons: never forget to investigate the syncope. *Medicina* 2021;57:623.
31 Jusmanova K, Rice C, Bourke R. Impact of a specialist service in the emergency department on admission, length of stay and readmission of patients presenting with falls, syncope and dizziness. *QJM* 2021;18:32–8.
32 Yoo S-H, Kim SR, Shin YS. A prediction model of falls for patients with neurological disorder in acute care hospital. *J Neurol Sci* 2015;356:113–7.
33 Carroll DL, Dykes PC, Hurley AC. Patients' perspectives of falling while in an acute care hospital and suggestions for prevention. *Appl Nurs Res* 2010;23:238–41.
34 Boltz M, Resnick B, Capezuti E, *et al*. Activity restriction vs. self-direction: hospitalised older adults' response to fear of falling. *Int J Older People Nurs* 2014;9:44–53.
35 Dolan H, Slebodnik M, Taylor-Piliae R. Older adults' perceptions of their fall risk in the hospital: an integrative review. *J Clin Nurs* 2022;31:2418–36.
36 Turner N, Jones D, Dawson P, *et al*. The perceptions and rehabilitation experience of older people after falling in the hospital. *Rehabil Nurs* 2019;44:141–50.
37 Gettens S, Fulbrook P, Jessup M, *et al*. The patients' perspective of sustaining a fall in hospital: a qualitative study. *J Clin Nurs* 2018;27:743–52.
38 Steyerberg EW, Eijkemans MJ, Harrell FE, *et al*. Prognostic modelling with logistic regression analysis: a comparison of selection and estimation methods in small data sets. *Stat Med* 2000;19:1059–79.