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Threat Appraisal for Harm from Falls: Insights for Development of Education-Based Intervention

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Abstract: *Objective*: This study aims to describe how patients perceive the threat of falls in hospitals, to identify patient characteristics that are associated with greater or lesser perceptions of the threat of falls, and to examine whether there is a discord between the risk that patients perceive in general and the risk that they perceive for themselves personally.

Method: A cross-sectional survey amongst geriatric rehabilitation inpatients in Brisbane, Australia, was implemented. The first component of the survey dealt with the 'general' nature of in-hospital falls and falls related risks while the second component of the survey was directed at identifying whether the patient held the same belief for themselves.

Results: A total of 21 out of 125 participants (17%) indicated that they felt that they were at risk of falling during their hospitalisation and 28 (22%) felt that they would injure themselves if they were to fall. Self-perceived risk of falls was associated with decreasing age and lower cognitive function (Functional Independence Measure Cognitive score). A majority of patients felt that falls most commonly occur in the bathroom [n=67 (54%)] and that if they were to fall, they would fall in the bathroom [n=56 (45%)].

Discussion: Patients generally do not think they are at risk of falling while in hospital and this may contribute to poor adherence to falls prevention strategies. It is possible that raising patient perception of the risk of falls and injury from falls in hospitals may help improve adherence to falls prevention strategies in this setting.

Keywords: Falls, hospital, education.

INTRODUCTION

Falls are a leading cause of morbidity complicating the hospital stay of older adults. Patient compliance with or adherence to advice and instruction provided by hospital staff may be a key factor in promoting the safety of older hospital patients [1]. The health-belief model has previously been forwarded as a model to explain patient adherence to falls prevention strategies both in general and in the hospital setting [2-4], while protection motivation theory (a subcomponent of the health belief model) has been used to guide development of an education program previously trialled with some success to prevent falls in this setting [1]. Common to both of these theories is the concept of threat appraisal. A more recent randomised trial of a multimedia patient education program with trained health professional follow-up, the content of which was guided by the health-belief model, has reduced the rate of falls by over 50% amongst cognitively intact older hospital patients [5].

Key domains of the Health Belief Model have been described as perceived susceptibility, perceived severity, perceived benefit, perceived barriers, self efficacy, and cues to action [6]. A model of adherence to a falls prevention strategy drawing from the health belief model is illustrated (Fig. **1**). In this model, adherence by a patient to the falls prevention advice or strategy is impacted upon by how they appraise their personal risk of falls and harm from falls (threat appraisal), their perception of how effective the advice or strategy is, their self-efficacy to follow the advice or strategy, their perception of costs associated with following the advice or strategy, and cues to prompt the particular action. Although no one specific intervention is mentioned in this model, it is likely that elements within the threat appraisal element of this model will remain constant, regardless of the intervention chosen, while the remaining elements will vary. Thus threat appraisal is a particularly useful element within this framework as it feeds into the motivation required to adhere to a range of strategies required to prevent falls.

Developing a greater understanding of factors that may impact upon participation in or adherence to falls prevention strategies may assist development and / or refinement of educational interventions aimed at preventing falls in this setting. Previous research has identified that many patient-related factors including gender [7], physical function [8], general health [9], depression [10], cognitive function [10], pain [11, 12], and age [9] influence adherence by older adults to geriatric health care and physical rehabilitation interventions. Appraisal of the threat of falls at its most basic level includes understanding the patient's perception of risk of falling and the risk of harm if a fall were to occur. These factors may vary depending on time of day or location. For

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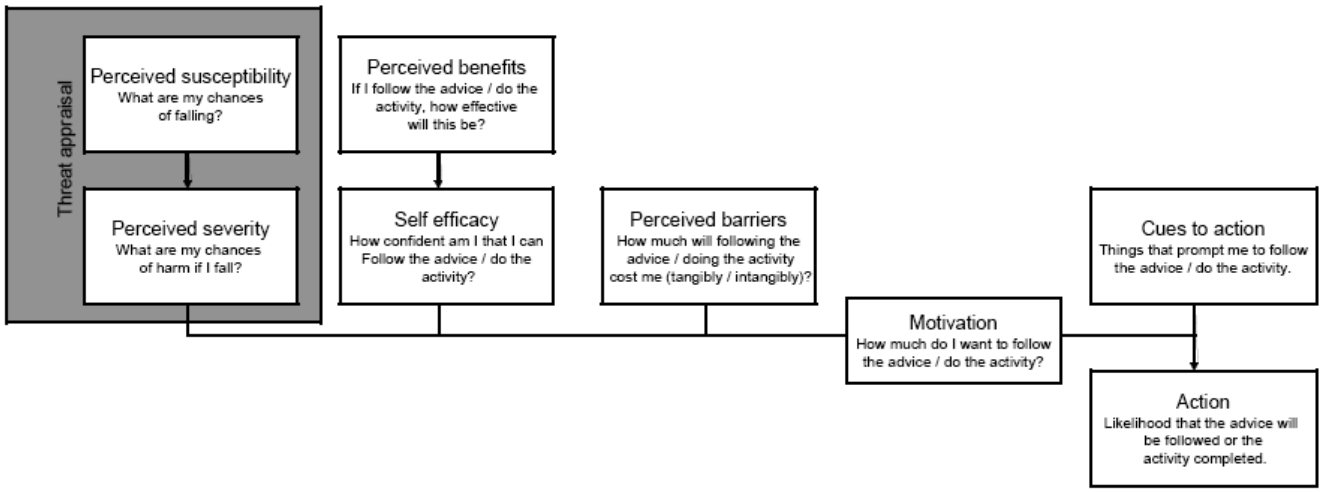

Fig. (1). Adaptation of the Health Belief Model to the prevention of falls in hospitals.

example, a patient may believe they are at risk of falling only when in the shower, and not when moving about their bedside. Further to this, patients may perceive a threat in general (ie. for people within this population) but not for themselves personally. Such a phenomena has previously been observed amongst older, community-dwelling adults who have reported falls prevention advice to be useful in principle but not personally relevant or appropriate [13]. When using an educational intervention to prevent falls in hospitals, it is important for the educator to understand how patients personally perceive their risk of falls so that motivational strategies can be tailored to patient needs. For example, a patient who does not feel that falls are a common problem in hospitals may simply need to be provided with information to demonstrate that it is, whereas this information may be useless to a person who thinks that falls are a common problem in hospitals in general, but not for them personally. Such a person may need to be shown why their personal risk of falls is elevated.

Little information has previously been published of investigations of threat appraisal for falls in hospitals. This study aims to describe how patients perceive the threat of falls in hospitals, to identify patient characteristics that are associated with greater or lesser perceptions of the threat of falls, and to examine whether there is a discord between the risk that patients perceive in general (i.e. for other patients) and the risk that they perceive for themselves personally. Addressing these aims will aid the planning and development of education programs to prevent falls so that the messages can be tailored to the individual needs of different patient groups.

MATERIALS AND METHODOLOGY

Design

Cross-Sectional Survey

Participants and Setting

Study participants were recruited from inpatients of the geriatric assessment and rehabilitation unit, Princess Alexandra Hospital, Brisbane, Australia. This unit provides multidisciplinary rehabilitation to older adults during the sub-acute period of their hospitalisation. Patients were approached for written consent within one week of their admission to this unit. Patients with receptive or expressive dysphasia, impaired cognitive function as determined by a Mini-Mental State Examination Score of $\leq$23 out of 30 [14], limited English language skills, or acute psychiatric illness were excluded from this study.

Measurements

A series of questions were provided to study participants dealing with the nature of in-hospital falls and patients' self perceived falls risk. These questions were successfully developed and piloted prior to the commencement of this investigation [15]. The first four questions related to the general nature of falls in the hospital: 1) “For every 100 patients in this ward how many do you think would fall before they leave?” 2) “For every 100 falls that occur on this ward, how many do you think would result in a physical injury, such as a bruise, a cut, a head injury, or even a broken bone?” 3) “Where do you think most falls on this ward occur?” Question three response options included bedside / bathroom / toilet / hallway / other. 4) “What time of day or night do you think most falls occur?” Question four response options included 6am-10 am / 10am-2pm / 2pm-6pm / 6pm-10pm / 10pm-2am / 2am-6am.

The following 4 questions were then designed to examine participants’ personal perception of risk: 5) “Do you think that you will have a fall while you are here?” 6. “If you were to fall, do you think that you would incur an injury such as a bruise, a cut, a head injury, or even a broken bone?” Responses to questions five and six were recorded as yes or no. 7. “If you were to fall, where do you think that you would be most likely to fall” 8. “If you were to fall, when do you think that you would be most likely to fall?” Response options for questions 7 and 8 were the same as questions 3 and 4 respectively.

Measurements employed to identify patient characteristics that are associated with greater or lesser perceptions of the threat of falls included measurements in health domains that have been shown to be associated with falls. These included domains of physical function (Functional Independence Measure Motor score [16], EQ-5D (formerly EuroQoL or the European Quality of Life instrument) usual activities

and self-care items [17]), mobility (modified Elderly Mobility Scale [18], EQ-5D mobility item [17]), cognitive function (Mini-Mental State Examination [14], Functional Independence Measure Cognitive score [16]), emotional health (EQ-5D anxiety/depression item [17]), and pain (pain and discomfort item of EQ-5D [17]). Participant demographics (participant age, gender, admission diagnosis) were also examined along with history of falls prior to survey administration during this hospitalisation. Participant diagnosis was collated from the participant's medical record where their treating hospital medical officer had recorded the primary reason for admission. Given the recent change in functional status of participants due to surgery or illness coupled with the limited validity of retrospective recall over an extended period for collection of falls history data [19, 20], we measured falls since hospitalisation by reviewing patients' medical records.

Analysis

The self perceived risks of falls and of injury if one were to fall were examined for associations with other variables using logistic regression analysis. Multiple logistic regression models were then built using a "backwards" procedure whereby each variable with a univariate analysis p-value<0.10 commenced inside the model. Variables were sequentially removed on the basis of having the highest p-value and the model being re-calculated until all variables remaining in the model had a p-value <0.05.

Questions relating to where and when patients felt falls most often occurred were presented descriptively. The proportion of participants who did not provide the same response to the "general" question as they did to equivalent "personal" question (for example questions three and seven respectively) was presented descriptively and the overall proportions within each category were analysed using logistic regression clustered by individual participant using each response category as an individual dummy outcome variable and perspective (general versus individual) as the independent variable.

All analyses were conducted using STATA I/C version 10.0.

Table 1. Association Between Baseline Variables and Self-Perceived Risk of Falling, or Injury if One were to Fall

Variable	Self-Perceived Risk of Falling	Self-Perceived Risk of Injury
Age (years)	0.95 (0.89, 1.01), p=0.07	1.02 (0.97, 1.07), p=0.45
Gender (male)	1.44 (0.56, 3.69), p=0.45	0.92 (0.40, 2.14), p=0.85
Diagnosis – Neurological	1.40 (0.41, 4.72), p=0.59	1.10 (0.33, 3.62), p=0.88
Diagnosis – Orthopaedic / musculoskeletal	0.43 (0.13, 1.36), p=0.15	3.7 (1.19, 11.51), p=0.02
Diagnosis – Amputation	1.91 (0.65, 5.60), p=0.24	0.39 (0.15, 1.01), p=0.05
Diagnosis – Pulmonary	1.11 (0.22, 5.55), p=0.90	0.75 (0.18, 3.03), p=0.69
Mini-mental state examination score (/30, higher score better cognitive function)	0.87 (0.70, 1.07), p=0.19	1.11 (0.92, 1.33), p=0.28
Functional independence measure cognitive component (/35, higher score better cognitive function)	0.85 (0.74, 0.98), p=0.02	1.00 (0.87, 1.14), p=0.95
Functional independence measure motor component (/91, higher score better motor function)	0.98 (0.95, 1.01), p=0.14	0.96 (0.93, 0.99), p=0.009
Modified elderly mobility scale (/23, higher score better mobility)	0.96 (0.89, 1.04), p=0.33	0.95 (0.89, 1.02), p=0.13
EQ-5D mobility self-rating (/3, higher score more problems)	2.19 (0.78, 6.16), p=0.14	1.93 (0.80, 4.64), p=0.14
EQ-5D personal care self-rating (/3, higher score more problems)	1.20 (0.59, 2.47), p=0.61	3.10 (1.46, 6.58), p=0.003
EQ-5D usual activities self-rating (/3, higher score more problems)	1.64 (0.74, 3.60), p=0.22	2.08 (1.01, 4.27), p=0.04
EQ-5D pain and discomfort self-rating (/3, higher score more problems)	0.87 (0.42, 1.82), p=0.72	1.40 (0.72, 2.74), p=0.32
EQ-5D depression and anxiety self-rating (/3, higher score more problems)	0.95 (0.47, 1.99), p=0.92	1.21 (0.62, 2.33), p=0.58
Perceived percentage of patients who fall in hospital	1.01 (1.00, 1.03), p=0.06	0.99 (0.97, 1.00), p=0.03
Perceived percentage of falls that result in patient injury	1.00 (0.99, 1.02), p=0.91	1.01 (1.00, 1.03), p=0.05
Self-perceived risk of falling	N/A	0.91 (0.30, 2.75), p=0.87
Self-perceived risk of injury if one were to fall	0.91 (0.30, 2.75), p=0.87	N/A
Has participant fallen during hospital admission prior to survey (binary)	5.10 (1.39, 18.71), p=0.01	0.30 (0.09, 1.08), p=0.07
Length of time in acute hospital prior to rehabilitation admission	1.00 (0.98, 1.03), p=0.71	1.00 (0.97, 1.02), p=0.81

Data presented are odds ratio (95% CI), p-value.

RESULTS

A total of 262 patients were admitted during the recruitment period of whom 111 did not meet the inclusion criteria and 26 of those refused to participate. Of the n=125 patients who consented to participate, the mean (standard deviation) age was 79 (8) years, 56 (45%) were male, the mean (sd) Functional Independence Measure Motor score was 58 (16) out of 91 and the mean Mini-Mental State Examination Score was 27 (2) out of 30 (lower scores indicate more cognitive impairment). Participants were most commonly admitted to rehabilitation for general diagnostic categories of "orthopaedic / musculoskeletal" n (%) = 41 (33%), "amputation" = 24 (19%), "neurological" = 19 (15%), and "respiratory" = 11 (9%). The median (IQR) length of stay on an acute ward prior to admission to the rehabilitation ward for these participants was 13 (7, 22) days, the length of stay on rehabilitation wards was 39 (21.5, 67) days, and number of days between admission to ward and survey administration was 4 (3, 6) days.

Only 21 of 125 participants (17%) indicated that they felt that they were at risk of falling during their hospitalisation and 28 (22%) felt that they would injure themselves if they were to fall. The associations between these variables and other variables collected in this study are presented (Table **1**). An intriguing pattern emerged for several variables where the apparent relationships were reversed when considering self-perceived risk of falls and self-perceived risk of injury. Those participants admitted with an orthopaedic / musculoskeletal diagnosis were more likely to think they were at risk of injury from falls, but had a trend towards a lower self-perceived risk of falling as did patients who had fallen in hospital prior to the survey being undertaken. Trends in the opposite direction were evident for patients with a diagnosis of amputation. Similarly, participants with a higher general rating of the proportion of hospital patients who will fall during hospitalisation were more likely to rate their risk of falling highly, while these same patients were less likely to rate the risk of injury from falling highly.

Other factors demonstrated an association with just one of the outcomes and not the other. These included patients with a higher Functional Independence Measure Cognitive score being less likely to rate their risk of falling highly, and a higher perceived percentage of hospital falls that result in patient injury being more likely to rate their risk of injury if they fall highly. Variables relating to physical function (Functional Independence Measure Motor score, modified Elderly Mobility Scale, EQ-5D mobility, self-care and usual activities items) each demonstrated trends that were consistent between the two outcomes (ie. higher physical function was associated with lower self-perceived risk of falls and injury).

The initial and final multiple logistic regression models developed to predict self-perceived risk of falling are presented (Tables **2** & **3**). The initial model included four variables of which two (perceived percentage of patients who fall in hospital and participant has fallen in hospital prior to survey) were eliminated before arriving at the final model. Both of these variables eliminated from the initial model were of borderline statistical significance.

The initial and final multiple logistic regression models developed to explain self-perceived risk of injury if a patient were to fall are presented (Tables **4** & **5**). The initial model included eight variables of which five (diagnosis – orthopaedic / musculoskeletal, diagnosis – amputation, EQ-5D personal care self-rating, EQ-5D usual activities self-rating, and participant has fallen in hospital prior to survey) were eliminated before arriving at the final model. The only variable of borderline statistical significance to be dropped from the initial model was the variable participant has fallen in hospital prior to survey. The final models to predict self-perceived risk of falling and self-perceived risk of injury shared no explanatory variables in common.

A majority of participants responded that most falls in hospitals occur in the bathroom [n=67 (54%)], followed by bedside [n=34 (27%)], toilet [n=17 (14%)], hallway [n=6 (5%)], and other [n=1 (1%)]. Similarly the location that most people felt they would fall if they were to fall was the bathroom [n=56 (45%)], followed by bedside [n=43 (34%)], toilet [n=18 (14%)], hallway [n=5 (4%)], and other [n=3 (2%)]. Although this ordinal ranking was the same, the total number

Table 2. Multiple Logistic Regression Results for the Initial Model to Predict Self Perception of Risk of Falling

Variable	Odds Ratio	95% Confidence Interval	p-Value
Age	0.93	(0.88, 0.99)	0.04
Admission Functional Independence Measure Cognitive score	0.84	(0.71, 0.99)	0.04
Perceived percentage of patients who fall in hospital	1.02	(0.99, 1.03)	0.05
Participant has fallen in hospital prior to survey	3.79	(0.92, 15.61)	0.07

PseudoR^2 = 0.149, p = 0.002.

Table 3. Multiple Logistic Regression Results for the Final Model to Predict Self Perception of Risk of Falling

Variable	Odds Ratio	95% Confidence Interval	p-Value
Age	0.93	(0.88, 0.99)	0.03
Admission Functional Independence Measure Cognitive score	0.83	(0.71, 0.96)	0.01

PseudoR^2 = 0.091, p = 0.006.

Table 4. Multiple Logistic Regression Results for Initial Model to Predict Self Perception of Risk of Injury from Fall

Variable	Odds Ratio	95% Confidence Interval	p-Value
Admission Functional Independent Measure Motor score	0.96	(0.93, 1.00)	0.08
Perceived percentage of patients who fall in hospital	0.98	(0.96, 0.99)	0.02
Perceived percentage of falls that result in patient injury	1.02	(1.00,1.04)	0.02
Diagnosis – Orthopaedic / musculoskeletal	1.71	(0.46, 6.33)	0.42
Diagnosis – Amputation	0.65	(0.20, 2.11)	0.47
EQ-5D personal care self-rating	1.54	(0.58, 4.13)	0.39
EQ-5D usual activities self-rating	1.47	(0.56, 3.87)	0.44
Participant has fallen in hospital prior to survey	0.24	(0.04, 1.36)	0.11

PseudoR^2 = 0.22, $p < 0.001$.

Table 5. Multiple Logistic Regression Results for Final Model to Predict Self Perception of Risk of Injury from Fall

Variable	Odds Ratio	95% Confidence Interval	p-Value
Admission Functional Independent Measure Motor score	0.953	(0.921, 0.986)	0.006
Perceived percentage of patients who fall in hospital	0.974	(0.956, 0.991)	0.004
Perceived percentage of falls that result in patient injury	1.026	(1.001,1.044)	0.004

PseudoR^2 = 0.17, $p < 0.001$.

of participants who provided a different response to the general form of this question compared to the personal form was.45 (36%). There were trends evident for the proportion of participants who identified the bathroom as being the most common location for falls in general to be higher than the proportion who felt that this location was the most likely for them personally [Odds ratio (robust 95%CI), p-value: 1.42 (0.96, 2.11), p=0.08), and though the direction of this trend was reversed for the bedside location [Odds ratio (robust 95%CI), p-value: 0.71 (0.48, 1.06), p=0.09].

A majority of participants responded that most falls in hospitals occur from 6am to 10am [n=51 (41%)], followed by 6pm to 10 pm [n=20 (16%)], 10pm to 2am and 2am to 6am [n=15 (12%) for both], 10am to 2pm [n=12 (10%)] then 2pm to 4pm [n=11 (9%)]. These results were generally similar to the times that participants believed that they would fall if they were to fall. The most common of these was 6am to 10am [n=63 (51%)], 6pm to 10pm [n=17 (14%)], 2am to 6am [n=16 (13%)], 2pm to 4pm [n=11 (9%)], 10pm to 2 am [n=9 (7%)], and 10am to 2pm [n=8 (6%)]. However, the total number of participants who provided a different response to the general form of this question as to the personal form was 46 (37%). The proportion of participants who identified the 6am to 10am time period as being the most common time period for falls in general was significantly lower than the proportion who felt that this time period was the most likely for them personally [odds ratio (robust95%CI), p-value: 0.68 (0.50, 0.92), p=0.01].

DISCUSSION

Self-perceived risk of falls and injury arising from falls are important concepts when applying a health-belief model or protection motivation theory model to the prevention of falls. Without these elements, theoretically there is little intrinsic reason for older adults to want to participate in falls prevention activities. This study has for the first time examined these concepts in the hospital setting and found that a minority of patients think they will fall or think they would injure themselves if they were to fall in the hospital setting. Given the importance of threat appraisal in the health belief model and protection motivation theory models, this finding indicates that low levels of threat appraisal may contribute to poor adherence to falls prevention advice / strategies in the hospital setting.

Arguably, the most surprising finding of this study was the identification of several factors which have opposing effects on patient self-perceived risk of falls and injury. It is difficult to hypothesise exactly why this was the case for some of these factors, though easier for others. For people who had fallen already during their hospitalisation prior to the survey being conducted, it is understandable that they would consider themselves to be at high risk of falls for the remainder of their stay. It is likely that a majority of these participants would not have hurt themselves as a result of this fall as approximately 30% have been found to result in injury, and a survival bias in recruitment would have meant that we would not have recruited those who had died or seriously injured themselves as a result of an earlier in-hospital fall. Thus, an experience of falling and not injuring while in hospital for this majority resulted in a lower identified risk of injury if the patient were to fall. The effect of these factors on overall threat appraisal for falls in hospitals may council each other out if one conceptualises that self-perceived risk of injury from falls equals the product of self-perceived risk of falls with self-perceived risk of injury if one were to fall.

A salient finding for the construction of in-hospital falls prevention education programs was that the general perception of risk of falls and injury were associated with self-perceived risk of falls and injury if one were to fall respectively. Hence it is possible that raising patient perception of the general risk of falls and injury from falls in hospitals may raise patient self-perceived risk of falls and injury from falls. The present study was limited however in its ability to determine whether the level of perceived risk by an individual was equivalent to the level of perceived risk they felt was held by other older hospital patients (ie. whether they felt they were at higher or lower risk of falling than the average hospital patient). Further to this was the inability of the present study to identify whether an individual's self perceived risk of falls was "appropriate". There are several difficulties with attempting such an investigation, the first being that falls risk screening /assessment tools tend to have at best only moderate predictive accuracy for falls in hospitals when subjected to methodologically rigorous investigation [21]. The second being that through the health belief model framework, it is advantageous for patients to perceive a threat from falls regardless of actual threat levels in order to help motivate patients to adhere to falls prevention advice and strategies. When providing education to prevent falls in hospitals, the authors would argue that it is appropriate to ensure patients perceive a sufficient level of threat from falls to facilitate participation in falls prevention activity. Ideally, individual patients would perceive a level of threat commensurate with their actual risk of falling, though it may be necessary to enhance perceived threat above this level in order to encourage participation in falls prevention activities for those a low to medium risk of falls. A concern here may be that patients perceive such a high level of threat as to unnecessarily raise anxiety which may in turn inhibit participation in therapeutic rehabilitation activities or activities of daily living during or after discharge. Indeed, there appears four generalised categories; those who perceive high risk and are at high risk (self-aware fallers), those who perceive high risk but are at low risk (worriers), those who perceive low risk but are at high risk (fallers without awareness), and those who perceive low risk and are at low risk (self-aware non-fallers). Further research is required to identify the relative proportion of hospital patients who fit into each of these categories, and to examine whether changing levels of threat appraisal impacts upon participation in falls prevention activities.

A majority of survey respondents held misconceptions as to the most common location of falls. Previous research has identified the bedside environment as the most common location for falls in hospitals [22, 23], though most in our sample identified the bathroom as the most likely location. Interestingly, a considerable proportion (36%) of participants did not feel that the place they identified as being the most likely in general was the same location that they identified for them personally. This was similar for respondents when classifying times of day most likely for falls.

The role of threat appraisal in the prevention of falls is controversial. A cross-sectional survey of 558 older adults at risk of falls has previously found that factors related to threat appraisal, including self perceived risk of falls and injury, were not strongly associated with stated intention to participate in strength and balance training [2]. The authors of this study found that factors classified under a "coping appraisal" framework (eg. Does a person think they could undertake strength and balance training if they wanted to) were more strongly associated with intention to perform strength and balance training. A limitation of that study was that actual participation was not investigated (as was also the case in the present study) and only one intervention was investigated. From the perspective of developing education materials to promote participation in falls prevention activities in hospitals, the role of threat appraisal can still be justified even if its association with intention to participate with a specific intervention is weak to moderate as this element is relevant to every possible intervention that may require active patient participation.

This study was limited in that it investigated associations between self-perceived risk of falls and injury with only a limited number of factors that may influence adherence to geriatric health care and physical rehabilitation interventions. Consideration could also have been given to associations with a greater number of factors that are risk factors for falls. Use of psychoactive medications, falls prior to hospitalisation, and specific visual impairments (such as presence of cataracts) are factors that could be considered in future investigations. This study also did not consider the association between survey responses and falls that occurred during hospitalisation subsequent to the survey. Such an investigation would need to consider a range of confounding factors, such as the level of intervention to prevent falls provided by hospital staff. Given the potential difficulty in collecting this information, it may be better to focus on the relationship between self-perceived risk of falls and fall injury with adherence to interventions prescribed to prevent falls.

Patient education for the prevention of falls presently appears to be a viable approach for preventing falls in hospitals for patients who are cognitively intact [5]. Further research is required to refine its content and delivery approach to optimise its effect. Studies similar to the present could identify other areas of misconception held by patients that could be easily incorporated into education programs. It would also be valuable to examine whether people who fall in hospital do so in the places and times of day they think they will. This would clarify whether these patient perceptions protect or enhance the risk of falling at these times and in these places. Further work could also probe more deeply patients' awareness of their falls risk and mobility deficits to elucidate whether patients who underestimate their risk are simply unaware of their risk factors and mobility deficits, that they do not recognise that these factors increase their risk of falls, or that they deny these connections.

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