



Research

Downton Fall Risk Index during hospitalisation is associated with fall-related injuries after discharge: a longitudinal observational study

Mahnaz Mojtaba^a, Hassan Alinaghizadeh^{b,c}, Elisabeth Rydwick^{d,e}

^aJakobsberg's Geriatric Clinic; ^bAcademic Primary Care Center, Stockholm County Council, Stockholm; ^cDepartment of Medical Sciences, Occupational and Environmental Medicine, Uppsala University, Uppsala; ^dFOU nu Research and Development Center for the Elderly, Stockholm County Council, Stockholm; ^eDepartment of Neurobiology, Care Sciences and Society, Division of Physiotherapy, Karolinska Institutet, Huddinge, Sweden

KEY WORDS

Elderly
Previous falls
Unsafe gait
Medication
Gender

ABSTRACT

Questions: Among older people who are hospitalised, what is the predictive validity of the Downton Fall Risk Index (DFRI) in relation to fall-related injury after discharge? What is the predictive validity of the DFRI among males and females in this setting? **Design:** Prospective, longitudinal, observational study. **Participants:** All hospital admissions during 2012 at three geriatric clinics in the Stockholm County Council were monitored. Patients aged > 65 years who did not die during the admission and who lived in the Stockholm County Council region were included. **Outcome measures:** The DFRI consists of five modules: previous falls, medication, sensory deficits, mental state, and gait. Three or more points indicate an increased fall risk. Data on DFRI, health status and medications were collected prior to discharge. Data regarding fall-related injuries were collected up to 6 months after discharge. Poisson multivariate regression analyses were conducted to evaluate the association between DFRI and fall-related injuries. **Results:** In total, 6650 patients were analysed. The cut-off ≥ 3 points in the DFRI was significantly associated with fall-related injury when confounding variables were controlled for (IRR 1.94, 95% CI 1.60 to 2.38). Among individual modules, only previous falls (IRR 2.58, 95% CI 2.22 to 3.01) and unsafe gait (IRR 1.79, 95% CI 1.53 to 2.09) were associated with fall-related injuries. Stratified analyses showed a higher risk ratio for men compared to women regarding the DFRI, but the test for an interaction effect was not significant. **Conclusion:** The risk of post-discharge fall-related injury is increased among older hospitalised people with an increased fall risk, according to the DFRI, especially those who had previous falls or unsafe gait. Although the DFRI tool is predictive, previous falls and gait are the measures that are most worthy of focus. [Mojtaba M, Alinaghizadeh H, Rydwick E (2018) Downton Fall Risk Index during hospitalisation is associated with fall-related injuries after discharge: a longitudinal observational study. *Journal of Physiotherapy XX: XX-XX*]

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Introduction

Older people who are discharged from hospital are at risk of falling. Two studies have shown that 13 to 15% fall within 4 weeks of discharge.^{1,2} The risk of a fall after discharge is associated with impairment in activities of daily living, decreased mobility, use of assistive devices, and pre-admission falls.^{1,2} Falling once or more during hospitalisation is also associated with increased likelihood of falls after discharge.³

Risk factors for fall-related injuries (eg, fractures) are similar to risk factors for falls.^{4,5} However, additional risk factors are important in regard to fall-related injuries: low bone mineral density, reaction time, amount of soft tissue padding, previous fractures, the characteristics of the fall (such as falling backwards or sideways), and the energy of the fall.⁶ Women have a higher risk of falls than men, and this has been shown to be related to higher gait variability during dual-task activities.⁷ They are also more likely to be multiple fallers than men.⁸ Risk factors for falls also differ between men and women. For example, incontinence and

frailty are risk factors for women, while older age, depression and standing balance are risk factors for men.⁹

Fall prevention actions during hospitalisation might include the use of a fall screening instrument and frequent fall-risk meetings with an interdisciplinary approach.¹⁰ Several fall screening instruments are available.¹¹ The Downton Fall Risk Index (DFRI) is a validated screening instrument used in a Swedish quality register and is recommended to be used in hospitals, geriatric clinics, care of the elderly, and primary care in Sweden. Several studies have shown that the DFRI can predict falls in residential care,¹² among community-dwellers,¹³ and in hospitals.¹⁴ However, it is believed that no studies have evaluated the DFRI in relation to clinically relevant outcomes such as fall-related injuries after hospital discharge. The DFRI has been shown to have higher sensitivity than other instruments,¹¹ although several studies have also shown low specificity.¹¹⁻¹⁴ In addition, results from several studies have indicated that the nursing staff's clinical assessment might be as accurate as existing screening tools.^{15,16} Since the existing literature shows diverse results and no studies have

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evaluated the DFRI in a hospital setting related to fall-related injuries after discharge or investigated differences between men and women, it requires further evaluation. Thus, the primary aim of this study was to evaluate the predictive validity of DFRI in relation to post-discharge fall-related injury and the secondary aim was to investigate this separately in men and women.

Therefore, the research questions for this prospective, longitudinal, observational study were:

1. Among older people who are hospitalised, what is the predictive validity of the DFRI in relation to fall-related injury after discharge?
2. What is the predictive validity of the DFRI among males and females in this setting?

Method

Design

This was a multi-centre, prospective, longitudinal, observational study conducted in Stockholm County, Sweden. All hospital admissions in 2012 were monitored at three geriatric clinics in Stockholm County Council. If a participant had more than one hospital admission during the data collection period, the last admission was used in the analysis. Participants were followed for 6 months after discharge from hospital to observe for fall-related injury.

Participants

All admitted patients were screened for eligibility. To be eligible for inclusion, patients were required to be aged ≥ 65 years.

Data collection

Data were retrieved from two different data sources and then merged into one dataset for analyses. Baseline characteristics collected during each participant's last admission to the geriatric clinics during 2012 were retrieved from the medical records. Follow-up data on fall-related injuries (such as fractures, contusions and fall accidents) were retrieved from the Stockholm County Council Health Care Consumption database within 6 months after discharge from the geriatric clinic. All healthcare providers within the Stockholm County Council – including both hospitals and outpatient clinics (primary care) – were obliged to report the data digitally. The Stockholm County Council Health Care Consumption database covers 99% of all care in Stockholm. The first clinically relevant diagnosis of a fall-related injury that was found was recorded as an event. All observations with no event followed were censored at 6 months. Data regarding falls could not be retrieved from this data source, so data on non-injurious falls were unobtainable.

Dependent variable

The dependent variable was fall-related injury. The International Classification of Diseases (ICD)-10 codes (S, T and W) based on the World Health Organization's International Classification of Diseases were used to extract information about diagnoses related to fall-related injuries from the Stockholm County Council Health Care Consumption database. Specific information about the ICD codes used is presented in Appendix 1 (see eAddenda).

A total of 1146 participants had a fall-related injury. Among these participants, 117 sustained a fracture, 37 sustained a contusion, 145 had a fall accident and 847 had some combination of the three; the most common combination was fracture and fall accident ($n = 630$).

Independent variable

The DFRI was used to assess risk of falls.^{12,13} Fall risk was assessed at admission by the responsible nurse and registered in the medical records. The instrument consists of five modules: previous falls, medication, sensory deficits, mental state, and gait. This results in 11 different risk factors, which are summarised into a score between 0 and 11. Scores ≥ 3 points indicate an increased fall risk.^{12,13}

Potentially confounding variables

The following information was extracted from the medical records from each participant's last hospital stay in 2012. Age, gender, and number of diagnoses were recorded. The number and type of medications were also extracted from the medication record.

Mini Nutritional Assessment was used to measure nutritional status.¹⁷ The instrument is based on scores between 0 and 14 points, where 0 to 7 points is regarded as malnutrition, 8 to 11 points is regarded as at risk of malnutrition, and 12 to 14 points is regarded as normal nutritional status. In the regression analyses, this variable was dichotomised as 1 for malnutrition or 0 for at risk of malnutrition or normal nutritional status. Body mass index was used to classify underweight (< 18.5), overweight (25.0 to 29.9) and obesity (≥ 30.0). Information about body mass index was extracted from the Mini Nutritional Assessment. The variable was dichotomised and a cut-off for underweight $< 23 \text{ kg/m}^2$ was used.¹⁸

Haemoglobin was used to classify anaemia. This variable was dichotomised using a cut-off for anaemia set at $< 115 \text{ g/l}$.¹⁹ Data on blood pressure were dichotomised according Klein et al,¹⁹ where a low blood pressure can increase the risk of falling. The cut-off for low blood pressure was set to $< 120 \text{ mmHg}$ for systolic and $< 80 \text{ mmHg}$ for diastolic.²⁰

C-reactive protein was used to estimate inflammatory levels. The variable was dichotomised and a level of $> 10 \text{ g/l}$ was used as a cut-off indicating a high inflammatory level.²¹

Data analysis

Demographic and background factors at baseline were presented as mean, standard deviation and frequencies. Between-group comparison was carried out by *t*-test for continuous data and Chi-squared test for nominal data, where statistical assumptions were not violated. When normality assumptions for continuous data were not met, the Mann-Whitney test was used to compare differences between groups. For between-group analysis in relation to the DFRI, the Kruskal-Wallis equality-of-populations rank test was used.

Poisson regression was used to assess how strongly the outcome of fall-related injury was associated with the DFRI and its individual modules. The analysis treated fall-related injury dichotomously and therefore did not allow for the possibility of more than one injury per participant. Due to multicollinearity, all of the DFRI modules were used as exposures and a separate model was applied for the full DFRI (dichotomised based on the cut-off ≥ 3 points) as well as each module. Apart from the potential confounding variables described above, an interaction term with gender and the DFRI module was added in each model. For those models where a significant association was found, bootstrapping with 1000 replications and Jackknife estimation were applied.²²

Complementary analyses were also conducted among specific medications that have been shown to be associated with an increased risk of falls and fall-related injuries.²³ The following medications were chosen for further analyses: diuretics, antihypertensives (not diuretics), antiparkinsonian drugs, neuroleptics, antidepressants, tramadol, Propavan, benzodiazepine (long-lasting), and Nozinan.

All statistical analyses were performed using SAS software^a. A 5% significance level was chosen to reject the null hypothesis.

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