STUDY PROTOCOL

Screening instruments to predict adverse outcomes for undifferentiated older adults attending the emergency department: Protocol for a prospective cohort study [version 1; peer review: awaiting peer review]

Aoife Leahy¹,², Gillian Corey¹, Aoife O'Neill¹, Owen Higginbotham¹, Collette Devlin¹, Louise Barry¹,³, Niamh Cummins¹, Elaine Shanahan², Denys Shcheketkovsky⁴, Damien Ryan⁴, Margaret O'Connor², Rose Galvin¹

¹School of Allied Health, Faculty of Education and Health Sciences, Ageing Research Centre, Health Research Institute, University of Limerick, Limerick, Ireland
²Department of Ageing and Therapeutics, University Hospital Limerick, Limerick, Ireland
³School of Nursing and Midwifery, Faculty of Education and Health Sciences, University of Limerick, Limerick, Ireland
⁴Department of Emergency Medicine, University Hospital Limerick, Limerick, Ireland

Abstract

Background: The number of older adults with complex medical comorbidities and functional impairment is increasing throughout the world. Frail older adults frequently attend the Emergency Department (ED) and are at increased risk of adverse outcomes following presentation. A number of screening tools exist that aim to screen older adults for frailty and identify those at risk of functional decline, unscheduled readmission, institutionalisation and mortality. We propose to determine the predictive accuracy of four commonly used screening tools, namely the Identification of Seniors at Risk Screening (ISAR), Clinical Frailty Scale (CFS), Program of Research to Integrate Services for the Maintenance of Autonomy (PRISMA 7) and InterRAI ED, to determine adverse events at 30 days and six months among older adults who present to the ED.

Methods and analysis: This is a prospective cohort study where patients over the age of 65 will have four screening tools (ISAR, CFS, PRISMA 7, interRAI ED) performed by face-to-face interview with a research nurse during their index visit to one Irish ED. Older adults will be included if they are willing and able to provide written informed consent, have a Manchester Triage Category 2-5 and are resident in the hospital catchment area. Demographic information will be collected at the index visit. A telephone follow up will occur at 30 days and six months, completed by a research nurse who is blinded to the initial assessment. Outcome data will include mortality rates, ED
re-attendance, hospital readmission, functional decline and institutionalisation. We will analyse the risk of adverse outcomes using multivariable logistic regression and we will report adjusted risk ratios (RR) with 95% CI.

**Dissemination**: Study findings will be disseminated through publication in peer-reviewed journals and presentations at relevant academic and clinical conferences. National and International gerontology conferences will be targeted.

**Keywords**
Frailty, Emergency Department, Screening Tools, Older Patients

Corresponding author: Aoife Leahy (aoife.leahy@ul.ie)

Author roles: **Leahy A**: Conceptualization, Investigation, Methodology, Project Administration, Writing – Original Draft Preparation, Writing – Review & Editing; **Corey G**: Conceptualization, Methodology, Project Administration, Writing – Original Draft Preparation, Writing – Review & Editing; **O’Neill A**: Formal Analysis, Methodology, Writing – Original Draft Preparation, Writing – Review & Editing; **Higginbotham O**: Conceptualization, Methodology, Project Administration, Writing – Review & Editing; **Devlin C**: Conceptualization, Methodology, Project Administration, Writing – Review & Editing; **Barry L**: Conceptualization, Methodology, Project Administration, Writing – Review & Editing; **Cummins N**: Conceptualization, Methodology, Project Administration, Writing – Review & Editing; **Shanahan E**: Conceptualization, Methodology, Writing – Review & Editing; **Shchetkovsky D**: Conceptualization, Methodology, Writing – Review & Editing; **Ryan D**: Conceptualization, Methodology, Project Administration, Writing – Review & Editing; **O’Connor M**: Conceptualization, Methodology, Project Administration, Supervision, Writing – Original Draft Preparation, Writing – Review & Editing; **Galvin R**: Conceptualization, Funding Acquisition, Methodology, Project Administration, Supervision, Writing – Original Draft Preparation, Writing – Review & Editing

Competing interests: No competing interests were disclosed.

Grant information: Health Research Board [ILP-HSR-2017-014].

The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Copyright: © 2021 Leahy A et al. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

How to cite this article: Leahy A, Corey G, O’Neill A et al. Screening instruments to predict adverse outcomes for undifferentiated older adults attending the emergency department: Protocol for a prospective cohort study [version 1; peer review: awaiting peer review] HRB Open Research 2021, 4:2 https://doi.org/10.12688/hrbopenres.13131.1

First published: 05 Jan 2021, 4:2 https://doi.org/10.12688/hrbopenres.13131.1
**Introduction**

The number of people over the age of 60 is predicted to double by 2050 as per the World Health Organisation (United Nations, Department of Economic and Social Affairs, Population Division, 2019). The rise in an older population will increase pressures on an already overcrowded ED system. Older adults are frequent attenders in the ED and have increased 30-day mortality compared with their younger counterparts (Shen et al., 2018). A recent systematic review by Morley et al. (2018) explored the causes and consequences of, and solutions to, ED crowding. They found that the presentation of older adults with urgent and complex needs are one key causal factor of ED overcrowding. Early physician assessment was associated with decreased length of stay in the ED. It is difficult to resource an ED with early physician assessment for all ED attendees, particularly in departments with long waiting times for assessment (Morley et al., 2018). It is necessary to target these resource intensive assessments to those most at risk of adverse outcomes. Frailty identification may provide an efficient and effective means to highlight older adults most likely to benefit from urgent ED physician assessment.

Frailty is a common condition affecting community dwelling adults over the age of 65 (Roe et al., 2017). Frail older people are at increased risk of adverse outcomes including mortality and institutionalisation (Fried et al., 2001; Rockwood & Mitnitski, 2007). Frail older patients are at greater risk of presenting to ED, having longer length of stay in hospital, and have a higher rate of adverse outcomes following hospital attendance (Hoeck et al., 2012; Roe et al., 2017; Rochat et al., 2010). Ellis et al. (2011) have shown the benefits of comprehensive geriatric assessment in this population with patients more likely to be alive and in their own homes after this intervention. Healthcare organisations should target this resource-intensive intervention at older frail patients who have been identified at the highest risk of future adverse events. Frailty screening tools are one such method to identify those who are frail and require more robust and detailed assessment which may not be routinely performed in the busy ED setting. There has been a number of observational studies validating various frailty screening tools. A recent systematic review by Jørgensen & Brabrand (2017) including four studies on older people in the ED examined the predictive accuracy of the CFS, Deficit Accumulation Index, ISAR and The Study of Osteoporotic Fracture frailty index. These screening tools used did not accurately predict those who were at risk of ED re-attendance at 30 days Jørgensen & Brabrand (2017). Lewis et al. (2019) have reviewed the Fried, CFS and SUHB (Stable, Unstable, Help to walk, Bedbound) Scales in an older population who presented to ED in Australia. These tools predicted future adverse outcomes for patients (death, poor self-reported health and quality of life, requirement for community services post discharge and readtendance to ED) although each tool identified a different prevalence of frailty (Lewis et al., 2019). O’Caonmih et al. (2019) completed a cross-sectional study comparing the diagnostic accuracy of the CFS, ISAR and PRISMA-7 frailty screening tools in the ED setting when compared to comprehensive geriatric assessment. They found that the area under the ROC curve (AUC) ranged from 0.78 for ISAR to 0.88 for Prisma 7. However, there has been no study which longitudinally investigates commonly used frailty screening tools in the Irish ED population. We propose to assess the predictive accuracy of four screening tools which are in use in the Irish healthcare setting to predict adverse outcomes in older adults at 30 days and six months; the CFS, ISAR, PRISMA 7 and InterRAI ED.

**Methods**

**Study design**

This is a prospective cohort study which will adhere to the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) standardised reporting guidelines to ensure the standardised conduct and reporting of this research (Von Elm et al., 2007). Data collection and follow-up will take place during the period of September 2019 to November 2020 (inclusive). Data will be entered on Excel Version (2016). The hard copies of the questionnaires and consent forms will be kept in a locked cabinet in a building and office requiring swipe card access.

**Ethics**

Ethical approval for the study has been granted by the Research Ethics Committee, Quality and Safety Department, University of Limerick Hospital Group (Ref. 062/19). Written informed consent will be obtained from all participants prior to recruitment to the study, in line with the Data Protection Act 2018 (Section 36(2)) (Health Research Board, 2018) Regulations 2018.

**Setting**

The study will take place at the ED of the University Hospital Limerick (UHL). UHL is a Model 4 university teaching hospital which caters for the general medical, surgical, and emergency treatment of patients in the catchment areas of Limerick, Clare and North Tipperary. Model 4 hospitals have a 24/7 ED which functions 365 days a year and are tertiary referral centres for the relevant region. UHL has 438 inpatient beds and serves a population of approximately 400,000 people.

**Population of interest**

All adults aged ≥65 years who present to the ED at UHL between September 2019 and April 2020 (inclusive) will be considered eligible for participation in the study provided that they meet the following criteria:

**Inclusion criteria.** We will include patients over the age of 65 who have a Manchester Triage Category of 2 to 5 (Mackway-Jones, 1997). They must have capacity and willingness to provide written informed consent to take part in the study. We will obtain consent from a nominated carer or next of kin for those with a suspected or documented cognitive impairment. This assessment may be recorded in the patients chart or otherwise will be performed with the baseline Montreal Cognitive Assessment (MOCA) by the research nurse (Nasreddine et al., 2005). They must be a resident in the hospital catchment area and not enrolled in other related studies.

**Exclusion criteria.** Patients will be excluded if neither the patient nor the carer can communicate in English sufficiently to...
complete consent or baseline assessment. Patients will be excluded if they present outside of research nurse (RN) operational hours. Similar to other studies, the RN is operational between the hours of 8am and 5pm Monday - Friday. Therefore, individuals who present to the ED and are discharged outside of these hours will not be included in the study. Patients who are acutely unwell and unable to answer the questionnaire will also be excluded.

**Index visit to the ED**
The RN will complete a baseline demographic questionnaire which will include age, sex, and socioeconomic status. Baseline comorbidities will be obtained as part of the Charlson Comorbidity Index which is a 21-item condition checklist (Charlson et al., 1994). Functional status will be documented in the form of the Barthel Index which is a 10-item questionnaire relating to functional ability (Mahoney & Barthel, 1965).

**Frailty screening tools**
Four frailty screening tools will be administered at the index visit.

**CFS.** The CFS was developed by Rockwood in Dalhousie and classifies patients on a scale from robust to severely frail as assessed by the healthcare professional (Rockwood et al., 2005). It is one of the most widely used frailty screening scales. It was initially a seven-point scale which was revised to a nine-point scale in 2007. The nine-point scale will be administered in our study.

**PRISMA 7.** The PRISMA 7 consists of seven questions which are completed by the patient or a family member. A score of 3 or more indicates frailty (Raîche et al., 2008). It is a common screening tool that is recommended by the British Geriatric Society and Asia-Pacific Clinical Practice Guidelines for the Management of Frailty (Dent et al., 2017).

**InterRAI ED.** The InterRAI ED is a standardised clinical data assessment tool which is performed electronically based on the InterRAI Care Systems. It assesses the patient with regard to their cognitive, psychological, and physical function prior to admission with particular emphasis placed on falls, dyspnoea, and pain (Gray et al., 2013).

**ISAR.** The ISAR is a six-question screening tool which is completed by the patient or a family member. A cut-off of more than 2 identifies those at higher risk of adverse outcomes. (McCusker et al. (1999)). A recent systematic review found that this tool had a modest predictive accuracy at predicting ED return and emergency hospitalisation at six months following the index visit (Galvin et al., 2017).

**Follow-up assessment**
Follow up telephone interviews at 30 days and six months will be completed by the RN who will be blinded to the baseline assessment. All withdrawals will be reported. Participants will be asked via telephone to complete a follow up questionnaire (see Extended data) (Leahy et al. (2020)) including the Barthel Index and healthcare utilisation (GP visits, home care support, public health nurse visit, allied health use etc). Hospital admission, ED re-presentation will be ascertained from the hospital database. Deaths and admission to nursing home will be documented.

**Sample size**
When considering sample size for logistic regression, a recommended rule of thumb is n=100+50i, where i is the number of predictor variables in the final logistic regression model (Bujang et al. (2018)). Therefore, a sample size of at least 400 is necessary, based on the number of independent variables to be included in the model.

**Statistical analyses**
Descriptive statistics will be used to describe the baseline characteristics of the cohort. These will include proportions, percentages, ranges, means and standard deviations and medians and interquartile ranges (where data are not normally distributed). We will analyse risk of adverse outcomes using multivariate logistic regression and we will report adjusted risk ratios (RR) with 95% CI. SPSS Software Version 26 and R Software will be used in the analysis.

**Dissemination**
Study findings will be disseminated through publication in peer-reviewed journals and presentations at relevant academic and clinical conferences. National and International gerontology conferences will be targeted. Lay findings will be disseminated via our recently established PPI group (Conneely et al., 2020). Anonymised data will be available in a data repository to enable accessibility.

**Study status**
Data collection and follow-up is ongoing. Study completion is expected in October 2021.

**Discussion**
Older patients are at higher risk of adverse outcomes after presentation / admission to the ED. It is necessary to streamline services to ensure that older patients most at need obtain comprehensive geriatric assessment in a timely fashion. Therefore, it is essential that a quick but accurate screening process is available to stratify these patients and predict those who are at greater risk of adverse outcomes.

We propose a prospective cohort study to determine the predictive accuracy of four frailty screening tools, the CFS, ISAR, PRISMA-7 and Inter-Rai ED, which are already commonly used in the Irish healthcare setting. These tools need to be feasible for non-specialists to complete rapidly in a busy, time restrained ED environment.

The major strength of this study is its prospective and longitudinal nature. It focuses on an area of key importance to healthcare planning. The outcome measures for the study will include future adverse events (death, rehospitalisation, falls, institutionalisation). These are of key importance to patients and healthcare organisations. Data on adverse outcomes will be directly...
identified by an RN via telephone conversation with the patient or next of kin or from hospital records. The RN will be blinded to the initial frailty screening tool results when identifying the outcome measures. All frailty screening will be carried out during the same assessment period so that a change in the status of the patient is not likely. Limitations of the study also need to be acknowledged. While the study participants are representative of the general ED older adult population, subgroups including those with acute confusion, dementia and the critically unwell were excluded. Furthermore, the population are recruited during weekday operational hours. Finally, the RN has experience in frailty screening so the screening process may not be entirely reflective of an ED nurse population.

Data availability
Underlying data
No underlying data are associated with this article.

Extended data
Open Science Framework: SOAED- Screening instruments to predict adverse outcomes for undifferentiated older adults attending the emergency department. https://doi.org/10.17605/OSF.IO/XR3S6 (Leahy et al. (2020)).

Data are available under the terms of the Creative Commons Zero “No rights reserved” data waiver (CC0 1.0 Public domain dedication).

References


PubMed Abstract | Publisher Full Text


PubMed Abstract | Publisher Full Text | Free Full Text


PubMed Abstract | Publisher Full Text


PubMed Abstract | Publisher Full Text | Free Full Text


PubMed Abstract | Publisher Full Text


PubMed Abstract | Publisher Full Text


PubMed Abstract | Publisher Full Text


PubMed Abstract | Publisher Full Text


Reference Source


PubMed Abstract | Publisher Full Text


PubMed Abstract | Publisher Full Text


http://www.doi.org/10.17605/OSF.IO/XR3S6


PubMed Abstract | Publisher Full Text


Reference Source


PubMed Abstract | Publisher Full Text


PubMed Abstract | Publisher Full Text | Free Full Text


PubMed Abstract | Publisher Full Text


PubMed Abstract | Publisher Full Text | Free Full Text


PubMed Abstract | Publisher Full Text | Free Full Text


PubMed Abstract | Publisher Full Text


PubMed Abstract | Publisher Full Text | Free Full Text

Waltz J, Rockwood K, Mitnitski A: SOAED- Screening instruments to predict adverse outcomes for undifferentiated older adults attending the emergency department. 2020.

http://www.doi.org/10.17605/OSF.IO/XR3S6


PubMed Abstract | Publisher Full Text