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The Hospital Frailty Risk Score (HFRS) applied to primary data: protocol for a systematic review

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ABSTRACT

Introduction Frailty is characterised by vulnerability to adverse health outcomes and increases with age. Many frailty risk scores have been developed. One important example is the Hospital Frailty Risk Score (HFRS) which has the potential to be widely used and automatically calculated which will provide accurate assessment of frailty in a time/cost-effective manner. This systematic review, therefore, seeks to describe the HFRS use since its publication in 2018.

Methods and analysis The proposed systematic review will follow the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. We will include published original peer-reviewed articles, preprints, conference proceedings and letters to the editor reporting primary data where there is an English language abstract available from 1 January 2018 to 30 June 2022. Databases to be searched are MEDLINE, EMBASE and Web of Science. Additional studies from, for example, the reference of the included studies will be identified and assessed for potential inclusion. Two independent reviewers will perform and assess the following: (1) eligibility of the included studies, (2) critical appraisal using the Cochrane Risk of Bias in Non-randomized Studies of Interventions tool, and (3) data extraction using a predefined form. Disagreements will be resolved through discussions or by involvement of a third reviewer. It may be possible to undertake a meta-analysis if there are sufficient studies reporting effect measures in homogenous populations and/or settings. Effect sizes will be calculated using meta-analysis methods and expressed as risk ratios or ORs with 95% CIs.

Ethics and dissemination No ethical approval is required for this systematic review as it will use secondary data only. The results of the systematic review will be submitted for publication in recognised peer-reviewed journals related to frailty and geriatric care and will be widely disseminated through conferences, congresses, seminars, symposia and scientific meetings.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The publication of this protocol minimises the chance of duplicate work, clarifies the methods and analyses that will be used, reduces the risk of bias when assessing and reporting the included studies and allowed for peer review of the planned work.
⇒ This protocol follows the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols 2015 statement.
⇒ The study eligibility criteria will enable the systematic review to assess the use of the Hospital Frailty Risk Score since its introduction in 2018.
⇒ The methodological quality and the heterogeneity of the included studies of outcomes may be the main limitations of the proposed systematic review.

INTRODUCTION

The population of older adults is increasing worldwide, and this is expected to continue. The number of older adults aged ≥60 years rose by 48% from 607 million in 2000 to 901 million in 2015 and is expected to reach a total of 2.1 billion by 2050.[1] The oldest age groups are expanding disproportionately.[2]

As the population age is increasing worldwide, there will be more pressure on healthcare systems. Older people use healthcare services more than younger adults.[3–6] They are also more likely to have multiple comorbid medical conditions than younger adults and are at greater risk of complications.[7 8] Anatomical and physiological changes with increasing age for all body systems could adversely impact older adults' response to severe injury/illness.[9] The issue of polypharmacy could adversely impact the outcomes of older adults.[10 11] Thus, an ageing population will have a profound effect on healthcare system and delivery of care for older adults.

Functional decline, which is more commonly seen in older adults, is linked to the term 'frailty'. Frailty is associated with but independent of age; around 10% of older adults aged over 65 years are frail,[12] compared with 25%–50% of those aged over 85 years.[13 14] The prevalence of frailty is higher in women than in men.[15] Frailty is theoretically defined as 'a long-term condition associated with multiple diseases and ageing leading to decreased physiological reserve and poor

resilience in the person who easily decompensate from minor bio-psychosocial stressors'.[16]

People living with frailty have increased health needs. Therefore, accurate and reproducible measurement of frailty at an individual and system level is important. Frailty is not routinely captured in health record coding and so the Hospital Frailty Risk Score (HFRS) has an important role in quantifying frailty and thereby driving funding and emphasis of service provision.[17] The HFRS uses International Classification of Diseases 10th Revision (ICD-10) data to identify the risk of frailty and predicts 30-day mortality, long hospital stay and to a lesser extent 30-day readmissions.[17] The HFRS could be used to assess frailty risk in a subsequent admission (readmission) or in the present admission (whether or not previous admissions have occurred). It has the potential to identify cohorts with higher frailty and so improve service mapping and commissioning. It may be possible to identify individuals for whom an inpatient frailty-attuned approach would be most beneficial. This score can also be used to characterise populations of older adults in database research.

Strengths of the HFRS

The HFRS has several strengths compared with other widely used frailty scores such as the Clinical Frailty Scale (CFS), mostly due to its use of routinely collected data: it allows assessment of all service users; there is minimal time or cost burden on clinicians for manual implementation; and it minimises interuser variability.

Limitations of the HFRS

There are some critiques about the use of the HFRS that should be highlighted and discussed. Several factors, from the definition of frailty, could contribute to reduced ability to respond to stressors—advancing age and/or diagnoses, and could include genetics, epigenetics and environmental and social factors. The cumulative impact of such factors could lead to reduced physiological reserve—negatively affecting all organ systems. Therefore, a multidimensional approach to assess frailty should be incorporated. However, the HFRS is based on the assessment of comorbidities as it assesses frailty risk of patients based on electronically available ICD-10 codes assigned to patients from current and previous hospital admissions.[17] The HFRS is potentially limited by incomplete or possibly incorrect data from patient records and the inability of the ICD-10 codes to reflect disease severity as they are only used for reimbursement. The HFRS assesses frailty risk (ie, not frailty itself) unlike other frailty assessment tools such as the CFS, therefore may not be as useful for individual patients requiring acute care.[18]

There are a number of tools in existence designed to assess frailty. However, these tools do not always succeed in achieving widespread use, which questions their utility. The HFRS has the potential to be widely used and automatically calculated which will provide accurate assessment of frailty in a time/cost-effective manner. However, no systematic review, up to our knowledge, has assessed the HFRS use for older adults. This systematic review, therefore, seeks to describe how the HFRS has been used since its publication in 2018.

Table 1 PICO format and information

PICO format	Information
P—Population	Adults aged ≥18 years for whom the HFRS has been calculated
I—Intervention	HFRS
C—Comparison	N/A
O—Outcome	30-day mortality, long hospital stay and 30-day readmissions

HFRS, Hospital Frailty Risk Score.

Review objectives

The objectives of this systematic review are as follows:

1. Provide an overview of the use of the HFRS since its introduction since 2018.
2. Assess and describe the HFRS use according to the different settings and populations.

METHODS AND ANALYSIS

This protocol follows the Preferred Reporting Items for Systematic Review and Meta-analysis Protocols (PRISMA-P) 2015 statement.[19] The review protocol will be preregistered with the International Prospective Register of Systematic Review. The findings of the proposed systematic review will follow the PRISMA guidelines to enhance comprehensive and transparent reporting of the findings.[20]

Eligibility criteria

A research question was initially developed based on the Patient, Intervention, Comparison and Outcome (PICO) format[21] (table 1) as follows: how has the HFRS been used for adults since its publication in 2018?

The systematic review will include all studies reporting on the use of the HFRS and published since the introduction of the HFRS from 1 January 2018 to 30 June 2022. Published original peer-reviewed articles, preprints, conference proceedings and letters to the editor reporting primary data where there is an English language abstract available will be included in this systematic review. The participants in the included studies of this systematic review must be aged ≥18 years. Studies that are assessing other frailty scores will be excluded.

Information sources and search strategy

Databases to be searched for this systematic review are MEDLINE, EMBASE and Web of Science. The search terms are ('hospital frailty risk score' OR 'frailty risk score' OR 'HFRS') NOT ('hemorrhagic fever with renal syndrome' OR 'haemorrhagic fever with renal syndrome') NOT ('flame retardants'). Search strategies will be adapted for the different databases and will be

applied from 1 January 2018 to 30 June 2022. Search strategy and results using the listed databases are available in online supplemental appendix 1. Additional studies, from other sources such as the reference list of the included studies, will be identified and assessed for potential inclusion in the systematic review. This source will be recognised in the systematic review results as additional studies from the reference list of included studies through database search.

Study selection

To identify possible studies for inclusion in this systematic review, a three-step process will be applied. First, all identified studies from the database search will be exported into a reference management software (ie, EndNote) and duplicates will be removed. Second, two independent reviewers will assess the eligibility of the identified studies based on the established inclusion and exclusion criteria through title and abstract screening. Third, the two independent reviewers will screen full texts to identify a final list of studies to be included. Disagreement between the two reviewers will be resolved through consensus discussion and/or a third reviewer. Following identification of all relevant studies, a PRISMA flow diagram will be generated including reasons for study exclusion. Studies primarily reporting the HFRS of any quality will be included in the systematic review.

Data extraction

Data will be extracted by applying a previously used data extraction form,[22] which includes four domains: (1) identifying the study (study title; title of the journal; impact factor of the journal; names of the authors; study country; years of publication; institution hosting the study (hospital; university; research centre); and study setting (single centre; multiple centres)), (2) clarifying the methods (design of the study; the objectives or question or hypothesis of the study; characteristics of the sample (sample size; sex; and age); and statistical analyses), (3) presenting the main findings of the study, and (4) reporting study conclusions. The authors of the original studies will not be contacted for clarification or to provide missing data information. The main outcomes that we are looking for in the included studies of the systematic review include 30-day mortality, long in-hospital stay and 30-day readmission. This is because the HFRS was validated based on the assessment of these outcomes.[17] We will also assess and describe if the HFRS was assessed for other outcomes. Two independent reviewers will generate two Excel spreadsheets to summarise the data from the included studies in the systematic review. After that, the spreadsheets will be combined into one spreadsheet for each included study in the systematic review. Disagreement between the two reviewers will be resolved through discussion between the two reviewers and/or a third reviewer.

Risk of bias in the included studies

The critical appraisal will be performed by two independent reviewers and the quality of methods of each included study in the systematic review will be assessed using the Cochrane Risk of Bias in Non-randomized Studies of Interventions (ROBINS-I) tool by two independent reviewers.[23] The quality level of each included study in the systematic review according to ROBINS-I will be discussed and agreed on by the two reviewers.[23] Disagreement will be resolved by a third reviewer. The findings from the critical appraisal will be presented in a table and discussed narratively.

Selective reporting of the results within the included studies in the systematic review will be assessed by comparing the protocol (if available) or the methods section of the included studies with their results.

Data synthesis and meta-analysis

We anticipate identifying two main types of studies, which will be treated differently:

1. Studies that have used the HFRS as a prognostic marker on primary data.
2. Studies that have used the HFRS for descriptive purposes.

For group 1, we will summarise the HFRS use according to the different settings and populations in which it has been applied. It may be possible to undertake a meta-analysis if there are sufficient studies reporting effect measures in homogenous populations and/or settings. The findings of the included studies in the systematic review in group 1 will be pooled, if possible, in a statistical meta-analysis software—Review Manager V.5.4 (RevMan) (The Cochrane Collaboration, 2020). We will explore both fixed and random-effects assumptions. Effect sizes will be calculated as risk ratios or ORs with corresponding 95% CIs. Forest plots will be created to visually explore effect sizes and associated uncertainty across studies. In case of substantial heterogeneity in group 1 of the included studies in the systematic review, the findings will be presented in a narrative format and tables and/or figures may be used to explain the findings.

For group 2, we will summarise the use of the HFRS narratively. Tables and/or figures may be used to present the findings of these studies. We will also report whether the magnitude of the score has been used by any author beyond a binomial categorisation function.

Assessing certainty of evidence

The certainty of evidence of the included studies in the systematic review will be assessed using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach.[24] Two independent reviewers will use the GRADE approach for each included study and resolve any disagreement through discussions or by involvement of a third reviewer.

Amendments

Any amendments to this systematic review protocol will be carefully documented. Saved database searches, study selection and PRISMA flow diagram, data extraction and critical appraisal that will be recorded in bibliographic databases (eg, Ovid), EndNote and Excel spreadsheets will be documented for any amendments.

Patient and public involvement

None.

ETHICS AND DISSEMINATION

No ethical approval is required for this systematic review as it will use secondary data in the public domain only. The results of the systematic review will be submitted for publication in recognised peer-reviewed journals related to frailty and geriatric care and will be also disseminated through conferences, congresses, seminars, symposia and scientific meetings.

DISCUSSION

This systematic review will describe use of the HFRS since its introduction in 2018. The HFRS computes existing data to determine risk of frailty with validated use in predicting mortality, length of hospital and readmissions and the potential for use in service mapping and commissioning. There is no internationally recognised standard measurement for frailty,[25] even though it has been shown to be an independent predictor of adverse outcomes.[26 27] Different frailty tools have been validated and used in clinical practice, which vary in quality.[25] The HFRS has the potential to embed identification of frailty using existing data in a timely and cost-effective manner with projected benefit to clinicians, researchers and policymakers.

This protocol is the first, up to our knowledge, to focus on the HFRS use; providing a base for systematic reviews investigating the HFRS use. It has defined the research question using PICO format (ie, identifying the participants, interventions and outcomes), determined the inclusion/exclusion criteria and described information sources and search strategy, data extraction, critical appraisal, assessment of quality and data synthesis.[28] Publishing this protocol will enhance the clarity of the systematic review strategy, transparency of reporting, reduce research waste and minimise the risk of bias specifically the risk of selective outcome reporting.[29]

Potential limitations of this systematic review include heterogeneity of the included studies including differences in the populations, settings and reported outcomes, which could reduce the number of included studies in the pooled analysis, negatively influencing the statistical power of the meta-analysis. Furthermore, there may be some heterogeneity in the way HFRS has been constructed across studies, which may impact the performances of the score and also limit our capacity for pooling the studies in a meta-analysis. In a previous study, Street *et al* showed that the optimal construction was to use the index admission data as well as two previous hospitalisations going back 2 years.[30] This timely review of the HFRS use to date will provide a platform from which new research can build on systematic identification of frailty from hospital data with wide-reaching applicability.

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Contributors AA drafted, reviewed and edited the manuscript. BW, RKO, AM, TG and SC had substantial involvement in this manuscript and were involved in developing the design of this study protocol. SC supervised the development of the manuscript and critically reviewed it. All authors read and approved the final manuscript.

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Competing interests RKO is a member of the National Institute for Health and Care Excellence (NICE) Technology Appraisal Committee, member of the NICE Decision Support Unit (DSU) and associate member of the NICE Technical Support Unit (TSU). She has served as a paid consultant to the pharmaceutical industry, providing unrelated methodological advice. She reports teaching fees from the Association of British Pharmaceutical Industry (ABPI) and the University of Bristol.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting or dissemination plans of this research.

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