Health technologies for falls prevention and detection in adult hospital in-patients: a scoping review protocol. [Protocol].

ALEXANDER, L., SWINTON, P., KIRKPATRICK, P., STEPHEN, A., MITCHELHILL, F., SIMPSON, S. and COOPER, K.

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Title: Technologies for falls prevention and detection in adult hospital in-patients: a scoping review protocol.

Review Objective/ Questions

The objective of this scoping review is to map the evidence relating to the reporting and evaluation of technologies for the prevention and detection of falls in adult hospital in-patients. The following questions will guide this scoping review:

1. What falls prevention and detection technologies have been reported in the literature?
2. What outcomes have been reported that measure falls prevention and detection technologies in terms of clinical effectiveness, cost-effectiveness, acceptability and feasibility of use?

Background

Falls, commonly defined as “inaudently coming to rest on the ground, floor or other lower level, excluding intentional change in position to rest in furniture, wall or other objects,”1 are a major public health concern. Worldwide, approximately 37.3 million falls require medical attention each year with 646,000 resulting in death.1 Fatal falls are more common among older people and non-fatal falls are a major cause of pain, disability, and loss of independence.1 With the predicted increase in the proportion of the population aged 65 and over (e.g. approximately 25% in the United Kingdom by 20502 and nearing 2.1 billion globally by 20503), the rate of falls can be expected to increase, as can the associated personal, clinical and economic costs.

The economic cost of fall-related injuries are significant, and range from US$ 3,476 per faller to US$ 10,749 per injurious fall, to US$ 26,483 per fall requiring hospitalization.4 Prevention and management of falls therefore remains an important research priority.1

Several risk factors for falls have been reported in the literature including age, race, gender, and history of chronic health conditions such as stroke, kidney disease, arthritis, depression and diabetes.1,5-7 In the hospital setting risk factors such as muscle weakness, cardiovascular problems, dementia, delirium, toileting and medication contribute to in-patient falls; hence guidelines recommend multifactorial falls risk assessments to be conducted8 using appropriate falls risk assessment tools9. However, risk assessment does not in itself prevent falls from occurring.

A large body of evidence exists on falls prevention interventions for community-dwelling adults, particularly with respect to exercise-based and individually tailored multifactorial interventions.10-12 These can be considered primary prevention interventions,13 where a number of intrinsic and extrinsic risk factors are identified and interventions are designed to mitigate these risk factors to prevent future falls. Secondary prevention is also important, not least in the in-patient setting, and includes detecting a fall early and preventing/mitigating injury from a fall.13 This scoping review will be concerned with both primary and secondary prevention (detection) of falls. Whilst prevention and detection of falls in
the adult in-patient population has received relatively less attention to date in comparison to the adult community-dwelling population, there is a growing body of evidence that will be timely to review.

Technology is commonly thought of as scientific knowledge and increasingly as being concerned with computer hardware, software, and other electronic devices. However, the definition of health technology is much broader, defined by the World Health Organization as “… the application of organized knowledge and skills in the form of devices, medicines, vaccines, procedures and systems developed to solve a health problem and improve quality of lives”. Thus, settings of care and interventions are considered to be health technologies.

Health technologies that have been utilised for the prevention of falls in the in-patient setting include falls prevention toolkits, personalised care plans, patient-centred education, intentional rounding, improving patients' environments (including patient-pathways), increasing nursing staff vigilance (including provision of assistive devices or appropriate footwear), exercise-based interventions focussing on balance retraining and multi-component interventions (e.g. exercise and medication review/environmental modification/staff education), as well as devices such as alarms, sensors, microphones and cameras.

Health technologies that have been used for the detection of falls in the in-patient setting are predominantly devices such as wearable motion-detectors, alarms, sensors, microphones and cameras.

The literature cited above demonstrates that there is a body of evidence pertaining to technologies for the prevention and detection of falls in the in-patient setting, including primary quantitative and qualitative research, as well as evidence syntheses. In addition, a preliminary search indicates a wide range of other material on falls prevention and detection from sources such as government health departments, and the professional bodies for the medical, nursing and allied health professions. Given the range of evidence available, it might be challenging to make recommendations for policy makers and practitioners in relation to which falls prevention and detection technologies to implement on a local, national or international level. Since scoping reviews are ideal for examining a broad area in order to report on the types of evidence that address and inform practice, it is intended that this scoping review will map the evidence related to falls prevention and detection in the in-patient setting. In doing so, it will also identify specific questions that might be best addressed by future systematic reviews, for example whether sufficient studies have been conducted for an economic evidence-synthesis, for a qualitative synthesis of patients’ perceptions of the acceptability of technologies, or whether it might be appropriate to conduct a network meta-analysis to compare the relative effectiveness of different types of interventions. It is also intended that this scoping review will clarify key concepts and definitions related to technologies for falls prevention and detection.

A search of Medline, CINAHL, The Joanna Briggs Institute Database of Systematic Reviews and Implementation Reports, The Cochrane Library (Reviews; Protocols), PEDro, EPPI (DoPHER) and
Epistemonikos identified a number of systematic reviews on specific aspects of falls prevention and detection technologies, in specific populations and settings, mostly in relation to community-dwelling older adults. One recent scoping review was identified which mapped the literature on technologies for fall detection. The definition of technology used was restricted to “… information processing involving both computer hardware and software” and the authors reported on various types of ambient and wearable sensors. The findings from their scoping review will be a useful addition to the current proposed scoping review, which intends to conduct a much broader mapping exercise using a more inclusive definition of technologies for falls prevention and detection. The search of the databases listed above did not find evidence of any scoping reviews in progress on the topic of technologies for falls prevention and detection in adult in-patients.

The objective of this review is therefore to map the available evidence to provide an overview of the evidence on technologies used for falls detection and prevention in adult hospital in-patients.

Keywords
Accidental falls; fall prevention; fall detection; health technology; adults

Inclusion Criteria Scoping Review

Participants
This review will consider literature that includes adult (aged 18+) in-patients, defined as being admitted to a setting for patient care activity which takes place in a hospital setting. These settings include elective, non-elective (emergency admission/Accident & Emergency), day-case and secondary care (community hospital) care settings. Literature that includes residential settings will be excluded from this review as this area has been included in a recent systematic review.

Concept
This review will consider literature that reports on the use of falls prevention or detection technologies and also literature that reports the clinical effectiveness, cost-effectiveness, acceptability and feasibility of falls prevention or detection technologies in the adult in-patient setting. Literature that reports on one or more of these aspects will be considered for inclusion. For the purpose of this scoping review, the World Health Organization definition of technology will be used: "A health technology is the application of organized knowledge and skills in the form of devices, medicines, vaccines, procedures and systems developed to solve a health problem and improve quality of lives."[14](pg.106)

Context
This review will consider literature that reports on falls prevention and detection in adult patients in any hospital ward setting. This might include large secondary care or small community rehabilitation facilities, and any area of clinical specialism. In order that the results of this review can inform UK
practice, literature conducted within countries demonstrating very high human development (The Human Development Index)\textsuperscript{33} will be included. The HDI is a composite index that measures three dimensions of human development – a long and healthy life, knowledge and a decent standard of living.\textsuperscript{33}

\textbf{Study Types}

This review will consider a broad range of published and unpublished literature including primary research studies, systematic reviews, reports and expert opinion. Quantitative study designs including experimental, quasi-experimental, descriptive and observational studies where any information on clinical or cost-effectiveness outcomes is reported will be considered. We will also consider studies that focus on qualitative data including, but not limited to, designs such as phenomenology, grounded theory, ethnography and action research, in order to report on feasibility and acceptability outcome measures used. Systematic reviews (all types) which have synthesised evidence on any aspect of falls prevention and detection relevant to the review objectives will also be considered for inclusion. Finally, we will also consider government reports, expert opinion, discussion papers, position papers, and other forms of text, as they may be relevant to the review objectives.

\textbf{Methods}

This scoping review will be conducted according to the Joanna Briggs Institute methodology for scoping reviews.\textsuperscript{26}

\textbf{Search Strategy}

The search strategy will aim to find both published and unpublished studies. An initial limited search of Medline and CINAHL has been undertaken followed by analysis of the text words contained in the title and abstract, and of the index terms used to describe articles. This informed the development of a search strategy which will be tailored for each information source. A full search strategy for Medline is detailed in Appendix I. The reference list of all studies selected for inclusion will be screened for additional studies.

\textbf{Information Sources:} The databases to be searched include: Medline, CINAHL, EmBASE, EPPI-Centre (DoPHER and TRoPHI), AMED, The Joanna Briggs Institute of Systematic Reviews and Implementation Reports, Cochrane Library (controlled trials and systematic reviews), PEDro, and Epistemonikos. The trial registers to be searched include: Clinicaltrials.gov, ISRCTN Registry, The Research Registry, European Union Clinical Trials Registry (EU-CTR), and Australia New Zealand Clinical Trials Registry (ANZCTR). The search for unpublished studies will include: OpenGrey, Mednar, The New York Academy Grey Literature Report, Ethos, CORE, and Google Scholar. In addition, government health department websites and websites of professional bodies such as, but not limited to, the Department of Health and Social Care, UK; Scottish Government; The United States Department of Health and Human Services, USA; Health Resources and Services Administration, USA; Australian Government Department of Health, Australia; Royal College of
General Practitioners (UK); Australian Medical Association; American Medical Association; Royal College of Nursing; American Nurses Association and the Chartered Society of Physiotherapy (UK), will be searched for information relating to falls prevention and detection. A research librarian will be consulted in order to tailor the search strategy to each database appropriately.

Due to time and resource limitations, only studies published in English will be considered.

Due to the manageable numbers of studies identified in preliminary searching, and the aim of providing a broad and comprehensive overview of the topic, no lower date limit will be applied.

**Study Selection**

Following the search, all identified citations will be collated and uploaded into ProQuest Refworks© reference managing software and duplicates removed. Titles and abstracts will then be screened by two independent reviewers for assessment against the inclusion criteria for the review. Studies that may meet the inclusion criteria will be retrieved in full and their details imported into SUMARI. The full text of selected studies will be retrieved and assessed in detail against the inclusion criteria by two independent reviewers. Full text studies that do not meet the inclusion criteria will be excluded and reasons for exclusion will be provided in an appendix in the final scoping review report. The results of the search will be reported in full in the final report and presented in a PRISMA flow diagram. Any disagreements that arise between the reviewers will be resolved through discussion, or with a third reviewer.

**Data Extraction**

Data relevant to the review questions will be extracted from the included studies by two independent reviewers using methods recommended by Peters et al.26 The data extracted will include: authors, publication year, source, study or article type, description of falls prevention and/or detection technology reported, population, setting, outcomes reported. Where relevant, authors of included studies will be contacted for clarification or missing information. A draft data extraction form is available in Appendix II; this will be tested on three articles and may be subsequently refined depending on the data available for extraction.

**Data Presentation**

The results will be presented as a map of the data extracted from the included articles in tabular form for each review question. Each table will present the different results for each review question with a narrative summary to accompany the tabulated results. Each table will include author, date of publication, country of origin, as well as data relevant to the review questions. Appendix III details draft results tables; as with the data extraction tool, these will be piloted and may be subject to amendment during the review process.

**Conflicts of Interest**
All authors can confirm that there is no actual or potential conflict of interest.

References


12. Stubbs B, Brefka S, Denkinger MD. What works to prevent falls in community-dwelling older adults?


Appendix I - Search Strategy

MEDLINE (EBSCO host)

1. mh hospitals OR kw hospital*

2. mh Accidental falls OR kw "fall* prevention" OR kw "fall* detection" OR kw fall*

3. mh Delivery of healthcare OR mh Biomedical technology OR kw Technolog* OR kw device* OR kw intervention* OR kw strateg* OR kw program* OR kw system* OR kw organiz* OR kw organis*

4. 1 AND 2 AND 3

Limits: Adults; English language
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<td>Journal__________________________  Record No____________________</td>
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| Aims/Purpose______________________________ |}

**Study Type (tick & state design)**
- Quantitative_____________________________________________________
- Qualitative_______________________________________________________
- Systematic Review_______________________________________________
- Other (describe)_________________________________________________

**Fall prevention/detection technology – description**

**Population & Sample**
(Description of population & sample e.g. age/pathology/sample size)

**Setting**
(Description of setting e.g. hospital type/clinical speciality)

**Outcomes Reported**

**Effectiveness**
(Description/definitions of effectiveness outcomes)

**Cost-effectiveness**
(Description/definitions of cost-effectiveness outcomes)

**Feasibility/Acceptability**
(Description/definition of feasibility/acceptability outcomes)
## Appendix III: Draft Results Tables

### Technologies for falls Prevention/Detection

<table>
<thead>
<tr>
<th>Author &amp; Year</th>
<th>Prevention/Detection</th>
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### Outcomes for assessing falls Prevention/Detection Technologies

#### I: Effectiveness

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#### II: Cost-effectiveness

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#### III: Acceptability & Feasibility

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