

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

3 **Review Objective/ Questions**

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

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

10 **Background**

11 Falls, commonly defined as “inadvertently coming to rest on the ground, floor or other lower level,
12 excluding intentional change in position to rest in furniture, wall or other objects,”¹ are a major public
13 health concern. Worldwide, approximately 37.3 million falls require medical attention each year with
14 646,000 resulting in death.¹ Fatal falls are more common among older people and non-fatal falls are a
15 major cause of pain, disability, and loss of independence. ¹ With the predicted increase in the
16 proportion of the population aged 65 and over (e.g. approximately 25% in the United Kingdom by
17 2050² and nearing 2.1 billion globally by 2050³), the rate of falls can be expected to increase, as can
18 the associated personal, clinical and economic costs.

19 The economic cost of fall-related injuries are significant, and range from US\$ 3,476 per faller to US\$
20 10,749 per injurious fall, to US\$ 26,483 per fall requiring hospitalization.⁴ Prevention and management
21 of falls therefore remains an important research priority.¹

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

28 A large body of evidence exists on falls prevention interventions for community-dwelling adults,
29 particularly with respect to exercise-based and individually tailored multifactorial interventions. ¹⁰⁻¹²
30 These can be considered primary prevention interventions,¹³ where a number of intrinsic and extrinsic
31 risk factors are identified and interventions are designed to mitigate these risk factors to prevent future
32 falls. Secondary prevention is also important, not least in the in-patient setting, and includes detecting
33 a fall early and preventing /mitigating injury from a fall.¹³ This scoping review will be concerned with
34 both primary and secondary prevention (detection) of falls. Whilst prevention and detection of falls in

35 the adult in-patient population has received relatively less attention to date in comparison to the adult
36 community-dwelling population, there is a growing body of evidence that will be timely to review.

37 Technology is commonly thought of as scientific knowledge and increasingly as being concerned with
38 computer hardware, software, and other electronic devices. However, the definition of health
39 technology is much broader, defined by the World Health Organization as "... the application of
40 organized knowledge and skills in the form of devices, medicines, vaccines, procedures and systems
41 developed to solve a health problem and improve quality of lives".^{14(pg.106)} Thus, settings of care and
42 interventions are considered to be health technologies.¹⁵

43 Health technologies that have been utilised for the **prevention** of falls in the in-patient setting include
44 falls prevention toolkits¹⁶, personalised care plans¹⁷, patient-centred education¹⁷, intentional rounding,
45 ¹⁸ improving patients' environments (including patient-pathways)¹⁹, increasing nursing staff vigilance
46 (including provision of assistive devices or appropriate footwear),¹⁹ exercise-based interventions
47 focussing on balance retraining²⁰ and multi-component interventions (e.g. exercise and medication
48 review/environmental modification/staff education),²⁰ as well as devices such as alarms, sensors,
49 ²¹microphones and cameras.²²

50 Health technologies that have been used for the **detection** of falls in the in-patient setting are
51 predominantly devices such as wearable motion-detectors,^{23,24} alarms, sensors, microphones and
52 cameras.^{21,22}

53 The literature cited above demonstrates that there is a body of evidence pertaining to technologies for
54 the prevention and detection of falls in the in-patient setting, including primary quantitative^{16,18,19,23,24}
55 and qualitative research²¹, as well as evidence syntheses^{17,20,22}. In addition, a preliminary search
56 indicates a wide range of other material on falls prevention and detection from sources such as
57 government health departments, and the professional bodies for the medical, nursing and allied
58 health professions. Given the range of evidence available, it might be challenging to make
59 recommendations for policy makers and practitioners in relation to which falls prevention and
60 detection technologies to implement on a local, national or international level. Since scoping reviews
61 are ideal for examining a broad area in order to report on the types of evidence that address and
62 inform practice,²⁵ it is intended that this scoping review will map the evidence related to falls
63 prevention and detection in the in-patient setting. In doing so, it will also identify specific questions
64 that might be best addressed by future systematic reviews,²⁶ for example whether sufficient studies
65 have been conducted for an economic evidence-synthesis, for a qualitative synthesis of patients'
66 perceptions of the acceptability of technologies, or whether it might be appropriate to conduct a
67 network meta-analysis²⁷ to compare the relative effectiveness of different types of interventions. It is
68 also intended that this scoping review will clarify key concepts²⁸ and definitions related to technologies
69 for falls prevention and detection.

70 A search of Medline, CINAHL, The Joanna Briggs Institute Database of Systematic Reviews and
71 Implementation Reports, The Cochrane Library (Reviews; Protocols), PEDro, EPPI (DoPHER) and

72 Epistemonikos identified a number of systematic reviews on specific aspects of falls prevention and
73 detection technologies, in specific populations and settings, mostly in relation to community-dwelling
74 older adults. One recent scoping review was identified which mapped the literature on technologies
75 for fall detection.²⁹ The definition of technology used was restricted to "... information processing
76 involving both computer hardware and software"³⁰ and the authors reported on various types of
77 ambient and wearable sensors. The findings from their scoping review²⁸ will be a useful addition to
78 the current proposed scoping review, which intends to conduct a much broader mapping exercise
79 using a more inclusive definition of technologies for falls prevention and detection. The search of the
80 databases listed above did not find evidence of any scoping reviews in progress on the topic of
81 technologies for falls prevention and detection in adult in-patients.

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

84 **Keywords**

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

86 **Inclusion Criteria Scoping Review**

87 **Participants**

88 This review will consider literature that includes adult (aged 18+) in-patients, defined as being
89 admitted to a setting for patient care activity which takes place in a hospital setting. These settings
90 include elective, non-elective (emergency admission/Accident & Emergency), day-case and
91 secondary care (community hospital) care settings.³¹ Literature that includes residential settings will
92 be excluded from this review as this area has been included in a recent systematic review.³²

93 **Concept**

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

102 **Context**

103 This review will consider literature that reports on falls prevention and detection in adult patients in
104 any hospital ward setting. This might include large secondary care or small community rehabilitation
105 facilities, and any area of clinical specialism. In order that the results of this review can inform UK

106 practice, literature conducted within countries demonstrating very high human development (The
107 Human Development Index)³³ will be included. The HDI is a composite index that measures three
108 dimensions of human development – a long and healthy life, knowledge and a decent standard of
109 living.³³

110 **Study Types**

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

121 **Methods**

122 This scoping review will be conducted according to the Joanna Briggs Institute methodology for
123 scoping reviews.²⁶

124 **Search Strategy**

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

131 Information Sources: The databases to be searched include: Medline, CINAHL, EmBASE, EPPI-
132 Centre (DoPHER and TRoPHI), AMED, The Joanna Briggs Institute of Systematic Reviews and
133 Implementation Reports, Cochrane Library (controlled trials and systematic reviews), PEDro, and
134 Epistemonikos. The trial registers to be searched include: Clinicaltrials.gov, ISRCTN Registry, The
135 Research Registry, European Union Clinical Trials Registry (EU-CTR), and Australia New Zealand
136 Clinical Trials Registry (ANZCTR). The search for unpublished studies will include: OpenGrey,
137 Mednar, The New York Academy Grey Literature Report, Ethos, CORE, and Google Scholar. In
138 addition, government health department websites and websites of professional bodies such as, but
139 not limited to, the Department of Health and Social Care, UK; Scottish Government; The United
140 States Department of Health and Human Services, USA; Health Resources and Services
141 Administration, USA; Australian Government Department of Health, Australia; Royal College of

142 General Practitioners (UK); Australian Medical Association; American Medical Association; Royal
143 College of Nursing; American Nurses Association and the Chartered Society of Physiotherapy (UK),
144 will be searched for information relating to falls prevention and detection. A research librarian will be
145 consulted in order to tailor the search strategy to each database appropriately.

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

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

149 **Study Selection**

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

160 **Data Extraction**

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

168 **Data Presentation**

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

175 **Conflicts of Interest**

176 All authors can confirm that there is no actual or potential conflict of interest.

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178 **References**

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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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188 **Appendix II: Draft data extraction form**

189 **Title: Technologies for falls prevention and detection in adult hospital in-patients: a scoping**
190 **review**

191 Reviewer_____ Date_____

192 Author_____ Year_____

193 Journal_____ Record N°_____

194 Country of Origin_____

195 Aims/Purpose_____ -
196 _____

197 **Study Type (tick & state design)**

198 Quantitative_____

199 Qualitative_____

200 Systematic Review_____

201 Other (describe)_____

202 **Fall prevention/detection technology – description**

203 **Population & Sample**

204 (Description of population & sample e.g. age/pathology/sample size)

205 **Setting**

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

207 **Outcomes Reported**

208 **Effectiveness**

209 (Description/definitions of effectiveness outcomes)

210 **Cost-effectiveness**

211 (Description/definitions of cost-effectiveness outcomes)

212 **Feasibility/Acceptability**

213 (Description/definition of feasibility/acceptability outcomes)

214

Findings/Conclusions/Recommendations

215

(Summary of findings/conclusions/recommendations)

216

Comments

217

(Reviewer Comments)

218

Appendix III: Draft Results Tables

Technologies for falls Prevention/Detection

Author & Year	Prevention/ Detection	Population	Setting	Technology	Comments

221

Outcomes for assessing falls Prevention/Detection Technologies

I: Effectiveness

Author & Year	Technology	Population & Setting	Outcome	Properties	Comments

224

II: Cost-effectiveness

Author & Year	Technology	Population & Setting	Outcome	Properties	Comments

226

III: Acceptability & Feasibility

Author & Year	Technology	Population & Setting	Outcome	Properties	Comments

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