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# BMJ Open

## Protocol for a scoping review of patient-clinician digital health interventions for the hip fracture population

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## Protocol for a scoping review of patient-clinician digital health interventions for the hip fracture population

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## ABSTRACT

**Introduction:** Patient-clinician digital health interventions can potentially improve the care of hip fracture patients transitioning from hospital to rehabilitation to home. Assisting older patients with a hip fracture and their caregivers in managing their post-surgery care is crucial for ensuring the best rehabilitation outcomes. With the increased availability and wide uptake of mobile devices, the use of digital health to better assist patients in their care has become more common. Among the older adult population, hip fractures are a common occurrence and integrated post-surgery care is key for optimal recovery. The overall aims are to examine the available literature on the impact of hip fracture-specific patient-clinician digital health interventions on patient outcomes and health care delivery processes; and to identify the barriers and enablers to the uptake and implementation of these digital health interventions.

**Methods and Analysis:** We will conduct a scoping review using Arksey and O'Malley's methodology framework and following the PRISMA-ScR reporting format. A search strategy will be developed, and key databases will be searched. A two-step screening process and data extraction of included studies will be performed by two reviewers. Any disagreement will be resolved by consensus or by a third reviewer. For the included studies, a narrative data synthesis will be conducted.

**Ethics and Dissemination:** This review does not require ethics approval. The results will be presented at a scientific conference and published in a peer-reviewed journal. We will also involve relevant stakeholders to determine appropriate approaches for dissemination.

**Keywords:** digital health, targeted patient/client communication, hip fractures, scoping review protocol

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3 **Word count:** 1,746  
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## 8 **ARTICLE SUMMARY**

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### 10 **Strengths and limitations of this study**

- 11 • We will use an established scoping review methodology framework to summarize the  
12 existing evidence on patient-clinician digital health interventions for the hip fracture  
13 population.  
14  
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- 16 • We anticipate a large volume of peer-reviewed scientific articles; thus, the grey literature  
17 searching will be limited to clinical trial databases and key digital health technology  
18 websites.  
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- 20 • Due to time constraints, we will only consult with a small number of key experts to identify  
21 additional references for potential studies to include and to collect feedback about the  
22 findings identified by the review.  
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## INTRODUCTION

Patient-clinician digital health interventions can help guide patients and their informal caregivers understand their health care needs as they navigate our health care system. [1].

According to the World Health Organization [2], patient-clinician digital health interventions are classified as “targeted patient/client communication” technologies. This type of digital health intervention typically involves the use of communication and information technologies to support the exchange of information between clinicians and their patients regarding their care [2]. This includes patient education, discharge information, notifications and reminders for appointments or treatments, follow-up services, behaviour change communication, medication management, and communication on patient-specific health status or clinical history across the continuum of care [2].

A systematic review of 42 studies identified that technology interventions can help improve health care delivery processes by engaging patients in managing their care and preventing hospital readmissions [1]. Another recent review of 39 studies examined the role of digital health interventions for older patients with hip fractures and found that these interventions focused mainly on digital tools to support physicians providing clinical care [3]. With the increased availability and wide uptake of personal communication devices, digital health interventions to better engage patients in their care have become increasingly common [4]. Digital health interventions have shown to be an effective approach for patients with chronic illness and their clinicians. Specifically, they have been implemented to better engage patients in managing their own diabetes [5,6], cardiovascular disease [7], and chronic obstructive pulmonary disease [8].

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3 Similarly, hip fracture care can be complex. Hip fracture patients often require extensive  
4 post-surgery care across multiple sectors. This care can include pain control and management,  
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6 osteoporosis assessment and treatment, fall risk prevention interventions, physical rehabilitation,  
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8 assistive walking devices and/or home modifications, as well as follow-up visits with their  
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10 orthopaedic surgeon and their primary care provider. Enabling hip fracture patients and their  
11  
12 informal caregivers to participate in the coordination of their treatment along the complete  
13  
14 continuum of care from diagnosis to discharge is crucial for optimal patient outcomes.  
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19 The lack of or inadequate information about discharge instructions to patients,  
20  
21 specifically for older patients with a hip fracture, has been identified as an important care gap  
22  
23 during care transitions [9]. Some avoidable readmissions may result from a lack of patient- and  
24  
25 caregiver-centered solutions and other challenges faced during the transition from hospital to  
26  
27 home [10,11]. Emerging research highlights how patient engagement contributes to improved  
28  
29 care [12], and for many organizations, improving patient engagement and developing patient-  
30  
31 centred processes is a priority [13]. Other studies have highlighted the vulnerabilities of patients  
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33 during the post-discharge period and the poor retention of verbal instructions [14,15]. The  
34  
35 provision of high-quality teaching and written discharge instructions can be crucial in improving  
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37 a patient's understanding of their care, facilitating the transition from hospital to home and may  
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39 prevent avoidable readmissions [16-20].  
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45 Engagement in the discharge planning process includes making sure patients and their  
46  
47 informal caregivers: know the important aspects of their specific health conditions, understand  
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49 their medications, are able to self-manage common symptoms, have the ability to follow  
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51 discharge instructions, and are informed regarding what signs and symptoms indicate a need to  
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53 seek appropriate medical care. Despite improvement efforts, there is a need for more efficient  
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3 approaches to address the barriers patients and their informal caregivers' experience as they  
4 transfer through the health care system from hospital to geriatric rehabilitation to home. In  
5 particular, one aspect is *poor communication between clinicians and patients (including their*  
6 *informal caregivers) during transitions* has been noted as being an especially critical care gap  
7 [21,22]. Deficiencies in this area can leave patients and their informal caregivers lacking  
8 information regarding how to manage their care. Unlike paper-based forms or information  
9 packages, digital health can provide real-time guidance and support to patients and help them to  
10 better navigate our health care system.

11  
12 Despite the growing number of patients and informal caregivers who have access to  
13 technology (e.g., phone, tablet, laptop computer) and would like their discharge information to  
14 be more readily available to them [23], little is known about what patient-clinician digital health  
15 interventions are available for the hip fracture population. The primary aim is to examine the  
16 available literature on the impact of hip fracture-specific patient-clinician digital health  
17 interventions on patient outcomes and health care delivery processes. The secondary aim is to  
18 identify the barriers and enablers to the uptake and implementation of these digital health  
19 interventions.

## 20 21 22 **METHODS**

### 23 24 **Protocol design**

25 We will conduct a scoping review using Arksey and O'Malley's methodological  
26 framework [24] and following the Preferred Reporting Items for Systematic Reviews and Meta-  
27 Analyses Statement for the Scoping Reviews (PRISMA-ScR) reporting format [25]. This  
28 protocol is registered in Open Science Framework (<https://osf.io/w6a89>) [26].  
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This review will consist of the following stages: (1) identification of the research question; (2) identification of relevant studies; (3) selection of eligible studies; (4) charting the data; (5) collating, summarizing, and reporting of the results; and (6) consultation with stakeholders [24].

### **Stage 1: Identification of the research questions**

1. What is the impact of patient-clinician digital health interventions for older patients with a hip fracture on patient outcomes and health care delivery processes?
2. What are the barriers and enablers to the use of patient-clinician digital health interventions for older patients with a hip fracture transitioning from hospital to rehabilitation to home?
3. What strategies exist to improve the use of patient-clinician digital health interventions for hip fracture patients transitioning from hospital to rehabilitation to home?

### **Stage 2: Identification of relevant studies**

The inclusion and exclusion criteria will follow the Population, Concept, Context (PCC) format:

**Population:** Hip fracture patients 50 years of age or older who had surgical repair.

**Concept:** Post-surgery care (e.g., pain control and management, mobilization, follow-up appointments) using any patient-clinician digital health interventions such as mobile technology, web-based applications, digital communication tools.

**Context:** Care across various health care settings.

### **Stage 3: Selection of the eligible studies**

The search strategy will be developed by a senior information specialist using an iterative process in consultation with the review team. The MEDLINE strategy will be peer-reviewed

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3 prior to execution by another information specialist according to the Peer Review of Electronic  
4 Search Strategies (PRESS) guidelines [27]. The strategy will use a combination of controlled  
5  
6 Search Strategies (PRESS) guidelines [27]. The strategy will use a combination of controlled  
7  
8 vocabulary (e.g., “Hip Fractures”, “Telemedicine”, “Rehabilitation”) and keywords (e.g.,  
9  
10 “broken hip”, “digital health”, “post-surgical care”). There will be no dates or language limits on  
11  
12 any of the searches but where possible, animal-only records will be removed from the results.  
13  
14 Using the multifile option and deduplication tool available on the OVID platform, we will search  
15  
16 Ovid MEDLINE® ALL, Embase Classic+Embase, APA PsycINFO and EBM Reviews  
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18 (Cochrane Database of Systematic Reviews, CENTRAL, and DARE). We will also search  
19  
20 CINAHL on Ebsco. The MEDLINE search strategy is shown in Appendix 1.  
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24 Results will be downloaded and deduplicated using EndNote 9.3.3 (Clarivate Analytics)  
25  
26 and uploaded to Covidence [28], a citation screening software, where any further duplicates will  
27  
28 be identified and removed. We will perform a targeted grey literature search of clinical trial  
29  
30 databases (ClinicalTrials.gov and ICTRP Search Portal) and key digital health technology  
31  
32 websites. Finally, we will manually search the reference lists of all the included studies and  
33  
34 relevant systematic reviews.  
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38 A two-step screening process will be performed by two reviewers (CB, SH). Specifically,  
39  
40 two reviewers will independently screen titles and abstracts (level 1 screening) according to the  
41  
42 pre-determined eligibility criteria. For level 2 screening, two reviewers will independently screen  
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44 the full texts. Any disagreement will be resolved by consensus or by a third reviewer (SP). The  
45  
46 reasons for exclusion will be noted using the Preferred Reporting Items for Systematic Reviews  
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48 and Meta-Analyses Statement for the Scoping Reviews (PRISMA-ScR) reporting format [25].  
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#### 51 **Stage 4: Charting the data**

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Prior to starting the data extraction, we will pilot test our data extraction form in Microsoft Excel. Two reviewers (CB, SH) will independently extract the data from the eligible studies. This will include full reference, country, purpose, study design, type of participants (e.g., patients, caregivers, providers), number of participants, theoretical approach, description of the patient-clinician digital health intervention, data analysis, and study results/outcomes (e.g., patient outcomes, health care delivery processes, barriers/enablers). Any disagreement will be discussed and resolved by consensus.

### **Stage 5: Collating, summarizing, and reporting the results**

We will conduct a narrative data synthesis. Data will be grouped by intervention type, outcome, and study design. All data tables will contain data on setting, intervention and control, study sample, patient characteristics, study design and outcomes. In addition, the Theoretical Domain Framework (TDF) [29,30] will guide the analysis of the barriers and enablers to the uptake of digital health interventions. The TDF is a framework that consists of 14 domains: (1) Knowledge, (2) Skills, (3) Social/Professional role and identity, (4) Beliefs about capabilities, (5) Optimism, (6) Beliefs about consequences, (7) Reinforcement, (8) Intentions, (9) Goals, (10) Memory, attention, and decision processes, (11) Environmental context and resources, (12) Social influences (13) Emotion, and (14) Behavioural regulation.

Two reviewers will independently group the data extracted from the included studies into themes and code each theme as a barrier or an enabler. The themes will then be mapped to each of the TDF domains. If there are any themes that cannot be mapped to the TDF domains, we will report them separately. For each barrier and enabler, we will report the frequency and percentage to identify the top domains. Any disagreement will be discussed and resolved by consensus by the two reviewers (CB, SH) or by consulting a third reviewer (SP). Behavioral change techniques

[31] that align with the barriers and enablers will be selected to guide the uptake of future patient-clinician digital health interventions for older patients with a hip fracture transitioning from hospital to rehabilitation to home.

### **Stage 6: Consultation with stakeholders**

We will consult with a small number of clinical experts (n=2-3) and digital health developers (n=2-3) within the research team's networks to help us identify any additional studies to include and to collect feedback about the findings identified by the review. In addition, we will engage with stakeholders to determine possible approaches for dissemination and knowledge translation opportunities.

### **Patient and public involvement**

No patients were involved.

### **ETHICS AND DISSEMINATION**

This review does not require ethics approval. The results of this review will provide an overview of patient-clinician digital health interventions for hip fracture patients as well as the barriers and enablers for their uptake and implementation. The results will provide information for various stakeholders such as researchers, clinicians, administrators, and policymakers. For dissemination activities, the review will be presented at a scientific conference and published in a peer-reviewed journal.

### **DECLARATIONS**

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2  
3 **Conflicts of interest/Competing interests:** The authors have no relevant financial or non-  
4 financial interests to disclose.  
5

6 **Ethics approval:** Not applicable  
7

8 **Consent for publication:** Not applicable  
9

10 **Availability of data and material:** No additional data are available.  
11

12  
13 **Author contributions:** CB is first author who contributed to the first draft of the scoping review  
14 protocol. All authors (CB, SP, AH, SH, BS, SP, MG, SS, RB, PEB, VFM) were involved in the  
15 design of the scoping review. BS is responsible for the literature searching. CB and SH will  
16 conduct the literature searching and the data synthesis. All authors (CB, SP, AH, SH, BS, SP,  
17 MG, SS, RB, PEB, VFM) contributed to the revision of the manuscript. CB is the guarantor of  
18 the review.  
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## Appendix 1. MEDLINE search strategy

Database: Ovid MEDLINE(R) ALL <1946 to May 13, 2022>

Search Strategy:

- 
- 1 exp Hip Fractures/ (27207)
  - 2 ((hip or hips or femoral neck or (femur? adj2 neck?) or acetabul\* or intertrochanter\* or intertrochanter\* or pertrochanter\* or per-trochanter\* or subtrochanter\* or sub-trochanter\* or trochanter\*) adj3 (break\* or broke\* or fractur\*)).tw,kw,kf. (36304)
  - 3 or/1-2 [HIP FRACTURES] (41931)
  - 4 exp Telemedicine/ (40348)
  - 5 (telemed\* or tele-med\* or telecare or tele-care or teleconsult\* or tele-consult\* or teleconferenc\* or tele-conferenc\* or telecounsel\* or tele-counsel\* or telehealth\* or tele-health\* or telemonitor\* or tele-monitor\* or telepsychiatr\* or tele-psychiatr\* or telepsycholog\* or tele-psycholog\* or telerehab\* or tele-rehab\* or telesupport\* or tele-support\* or teletherap\* or tele-therap\* or teletreatment\* or tele-treatment\*).tw,kw,kf. (35770)
  - 6 (ehealth\* or e-health\* or mhealth\* or m-health\* or emental health\* or e-mental health\* or mmental health\* or m-mental health\* or epsychiatr\* or e-psychiatr\* or mpsychiatr\* or m-psychiatr\* or epsychol\* or e-psychol\* or mpsychol\* or m-psychol\* or erehab\* or e-rehab\* or mrehab\* or m-rehab\* or etherap\* or e-therap\* or esupport\* or e-support\* or msupport\* or m-support\* or evisit\* or e-visit\* or mvisit\* or m-visit\*).tw,kw,kf. (17831)
  - 7 (ecoach\* or e-coach\*).tw,kw,kf. (85)
  - 8 (emedicine\* or e-medicine\*).tw,kw,kf. (101)
  - 9 (mobile health\* or mobile care or mobile counsel\* or mobile medicine or mobile psychiatr\* or mobile psycholog\*).tw,kw,kf. (7275)
  - 10 ((digital\* or virtual\* or remote\*) adj3 (care or health\* or healthcare or health-care)).tw,kw,kf. (14232)
  - 11 ((digital\* or virtual\* or remote\*) adj3 (appointment\* or clinic or clinics or coach\* or communicat\* or conferenc\* or consult\* or followup or follow-up or hub or hubs or interven\* or manag\* or meet\* or monitor\* or rehab\* or support\* or therap\* or tool or tools or treatment? or visit\*)).tw,kw,kf. (33162)
  - 12 (e-provider? or e-clinician? or e-counsel?or? or e-doctor? or e-nurse? or e-physician? or e-practitioner? or e-therapist? or m-provider? or m-clinician? or m-counsel?or? or m-doctor? or m-nurse? or m-physician? or m-practitioner? or m-therapist?).tw,kw,kf. (99)
  - 13 (mobile provider? or mobile clinician? or mobile counsel?or? or mobile doctor? or mobile nurse? or mobile physician? or mobile practitioner? or mobile therapist?).tw,kw,kf. (60)
  - 14 Internet-Based Intervention/ (936)
  - 15 exp Therapy, Computer-Assisted/ (43927)
  - 16 ((internet\* or app or apps or computer\* or cyber\* or e-application? or e-mail\* or email\* or electronic mail\* or iphone? or i-phone? or (mobile adj2 application?) or mobile-based or mobile phone? or online or (patient? adj3 portal\*) or instant\* messag\* or (secure\* adj3 communicat\*) or (secure\* adj3 messag\*) or (secure\* adj3 platform\*) or (secure\* adj3 portal\*) or service or services or smarthome\* or smart-home\* or smarhub? or smart-hub? or smartphone\* or smart phone\* or technolog\* or telecommunicat\* or tele-communicat\* or telephon\* or textmessag\* or text-messag\* or video\* or web or webbased or web-based or webdeliver\* or web-deliver\* or "web 2.0") adj3 (care or health care or health-care or healthcare or appointment\* or coach\* or conferenc\* or consult\* or interven\* or manag\* or meet\* or monitor\* or rehab\* or support\* or therap\* or treatment? or visit\*)).tw,kw,kf. (229431)
  - 17 (internet\* or app or apps or computer\* or cyber\* or e-application? or e-mail\* or email\* or electronic mail\* or iphone? or i-phone? or (mobile adj2 application?) or mobile-based or mobile phone? or online or (patient? adj3 portal\*) or instant\* messag\* or (secure\* adj3 communicat\*) or (secure\* adj3 messag\*) or (secure\* adj3 platform\*) or (secure\* adj3 portal\*) or smarthome\* or smart-home\* or smarhub? or smart hub? or smartphone\* or smart phone\* or technolog\* or telecommunicat\* or tele-communicat\* or

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5 18 (internet\* or app or apps or computer\* or cyber\* or e-application? or e-mail\* or email\* or electronic  
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10 telephon\* or textmessag\* or text-messag\* or video\* or web or webbased or web-based or webdeliver\* or  
11 web-deliver\* or "web 2.0").ab. /freq=2 (387856)  
12 19 or/4-18 [DIGITAL CARE, PT 1] (839671)  
13 20 exp Hip Fractures/pc, rh, su, th [Prevention, Rehabilitation, Surgery, Therapy] (17072)  
14 21 Delivery of Health Care/ (107762)  
15 22 exp \*Delivery of Health Care/ (713121)  
16 23 Delivery of Health Care, Integrated/ (13940)  
17 24 ((deliver\* or model or models or provid\* or provision) adj3 (care or health care or health-care or  
18 healthcare)).ti,kw,kf. (43570)  
19 25 Health Services/ (26750)  
20 26 Community Health Services/ (32796)  
21 27 Rural Health Services/ (13710)  
22 28 Suburban Health Services/ (183)  
23 29 Urban Health Services/ (3782)  
24 30 (healthservice\* or health service\* or healthcare service? or health care service?).ti,kw,kf. (58952)  
25 31 Geriatric Nursing/ (13802)  
26 32 Home Nursing/ (8650)  
27 33 ((geriatric\* or home) adj3 (care or health care or health-care or healthcare)).tw,kw,kf. (40450)  
28 34 ((after operati\* or after surger\* or postoperati\* or post-operati\* or postsurg\* or post-surg\*) adj3  
29 (care or health care or health-care or healthcare or followup or follow-up or rehab\* or therap\* or  
30 treatment\*)).tw,kw,kf. (77748)  
31 35 Rehabilitation/ (18651)  
32 36 Rehabilitation Nursing/ (1467)  
33 37 exp Exercise Therapy/ (59598)  
34 38 ((exercis\* or remedial\* or rehab\*) adj3 therap\*).tw,kw,kf. (20378)  
35 39 rh.fs. [Rehabilitation - Floating Subheading] (206541)  
36 40 rehab\*.ti,kw,kf. (94860)  
37 41 rehab\*.ab. /freq=2 (59746)  
38 42 Caregivers/ (45604)  
39 43 Family/ (82355)  
40 44 Ambulatory Care/ (45670)  
41 45 (ambulatory adj3 (care or health care or health-care or healthcare)).tw,kw,kf. (15067)  
42 46 Inpatients/ (27082)  
43 47 inpatient\*.tw,kw,kf. (127731)  
44 48 Outpatients/ (19592)  
45 49 (outpatient\* or out patient\*).tw,kw,kf. (210462)  
46 50 Communication/ (94560)  
47 51 communicat\*.ti,kw,kf. (95540)  
48 52 communicat\*.ab. /freq=2 (82225)  
49 53 (miscommunicat\* or mis-communicat\*).tw,kw,kf. (1065)  
50 54 (misunderstand\* or mis-understand\*).tw,kw,kf. (6476)  
51 55 (misinform\* or mis-inform\*).tw,kw,kf. (4984)  
52 56 Information Seeking Behavior/ (3051)  
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3 57 ((communicat\* or provid\* or provision\* or seek\* or search\* or shar\* or sought) adj3  
4 information).tw,kw,kf. (281864)  
5 58 ((care or health care or health-care or healthcare) adj (educat\* or communicat\* or inform\* or  
6 instruct\*).tw,kw,kf. (12146)  
7 59 exp Patient Education as Topic/ (88355)  
8 60 ((caregiver? or care giver? or client? or family or families or patient? or person\$2 or personally or  
9 user?) adj3 (communicat\* or educat\* or inform\* or instruct\* or resourc\* or teach\*).tw,kw,kf. (212301)  
10 61 exp Patient-Centered Care/ (23177)  
11 62 ((patient-centered or patient-centred or patient-focus?ed) adj3 (approach or approaches or care or  
12 healthcare or health care or model or models or rehab\*).tw,kw,kf. (15266)  
13 63 ((client-centered or client-centred or client-focus?ed) adj3 (approach or approaches or care or  
14 healthcare or health care or model or models or rehab\*).tw,kw,kf. (670)  
15 64 Patient Participation/ (28570)  
16 65 ((caregiver\* or care giver? or client\* or family or families or patient\* or person\$2 or personally or  
17 user?) adj3 (activat\* or engag\* or empower\* or involv\* or participat\*).tw,kw,kf. (180848)  
18 66 Self Care/ (35300)  
19 67 Self-Management/ (4535)  
20 68 ((person\* or self) adj3 (manag\* or care)).tw,kw,kf. (84309)  
21 69 Aftercare/ (11724)  
22 70 aftercare.tw,kw,kf. (3604)  
23 71 ((after or followup or follow-up) adj (care or hospital\* or treatment)).tw,kw,kf. (209016)  
24 72 Patient Discharge/ (36442)  
25 73 ((client\* or patient or patients or facility or facilities or hospital or hospitals) adj3  
26 discharg\*).tw,kw,kf. (99327)  
27 74 Continuity of Patient Care/ (20361)  
28 75 Patient Transfer/ (9413)  
29 76 Transitional Care/ (1129)  
30 77 ((continuit\* or continuum or path or paths or pathway\* or transition\*) adj (care or health care or  
31 health-care or healthcare)).tw,kw,kf. (2562)  
32 78 Professional-Patient Relations/ (28340)  
33 79 Nurse-Patient Relations/ (35948)  
34 80 Physician-Patient Relations/ (75482)  
35 81 (((professional\* or clinician\* or doctor\* or nurse or nurses\* or physician\* or practitioner\* or  
36 therapist\*) adj3 (caregiver\* or care giver? or client\* or family or families or patient or patients)) and  
37 relations\*).tw,kw,kf. (43621)  
38 82 Therapeutic Alliance/ (385)  
39 83 therapeutic alliance?.tw,kw,kf. (3147)  
40 84 or/20-83 [HEALTH CARE DELIVERY, REHAB, TRANSITIONAL CARE, ETC] (2721148)  
41 85 Biomedical Technology/ (7127)  
42 86 (technolog\* adj3 (care or health or health care or health-care or healthcare)).tw,kw,kf. (26882)  
43 87 exp Cell Phone/ (20326)  
44 88 "Cell Phone Use"/ (338)  
45 89 exp Computers/ (83691)  
46 90 Digital Technology/ (454)  
47 91 Electronic Mail/ (2893)  
48 92 Internet/ (79164)  
49 93 Internet Access/ (136)  
50 94 "Internet Use"/ (340)  
51 95 Mobile Applications/ (10004)  
52 96 Telecommunications/ (5010)  
53 97 Telephone/ (12962)  
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3 98 exp Videoconferencing/ (2633)

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7 (secure\* adj3 messag\*) or (secure\* adj3 platform\*) or (secure\* adj3 portal\*) or smarthome\* or smart-  
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9 tele-communicat\* or telephon\* or textmessag\* or text-messag\* or video\* or web or webbased or web-  
10 based or webdeliver\* or web-deliver\* or "web 2.0").tw,kw,kf. (1583184)

11 100 or/85-99 [DIGITAL TECHNOLOGY] (1651055)

12 101 84 and 100 [DIGITAL CARE, PT 2] (289340)

13 102 19 or 101 [DIGITAL CARE, PTS 1-2] (970283)

14 103 3 and 102 [HIP FRACTURES - DIGITAL CARE] (1456)

15 104 exp Animals/ not Humans/ (5007245)

16 105 103 not 104 [ANIMAL-ONLY REMOVED] (1449)

17 106 (Adolescent/ or exp Child/ or exp Infant/) not exp Adult/ (2051574)

18 107 105 not 106 [ADOLESCENT-, CHILD-, INFANT-ONLY REMOVED] (1436)

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## Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
<b>TITLE</b>			
Title	1	Identify the report as a scoping review.	
<b>ABSTRACT</b>			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	
<b>INTRODUCTION</b>			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	
<b>METHODS</b>			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	



SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
<b>RESULTS</b>			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	
<b>DISCUSSION</b>			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	
Limitations	20	Discuss the limitations of the scoping review process.	
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	
<b>FUNDING</b>			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

\* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med.* 2018;169:467–473. doi: [10.7326/M18-0850](https://doi.org/10.7326/M18-0850).



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# BMJ Open

## Protocol for a scoping review of patient-clinician digital health interventions for the hip fracture population

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Article Type:	Protocol
Date Submitted by the Author:	08-Sep-2022
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<b>Primary Subject Heading</b>:	Health informatics
Secondary Subject Heading:	Health services research
Keywords:	Hip < ORTHOPAEDIC & TRAUMA SURGERY, Information technology < BIOTECHNOLOGY & BIOINFORMATICS, Quality in health care < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

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Manuscripts

## Protocol for a scoping review of patient-clinician digital health interventions for the hip fracture population

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## ABSTRACT

**Introduction:** Patient-clinician digital health interventions can potentially improve the care of hip fracture patients transitioning from hospital to rehabilitation to home. Assisting older patients with a hip fracture and their caregivers in managing their post-surgery care is crucial for ensuring the best rehabilitation outcomes. With the increased availability and wide uptake of mobile devices, the use of digital health to better assist patients in their care has become more common. Among the older adult population, hip fractures are a common occurrence and integrated post-surgery care is key for optimal recovery. The overall aims are to examine the available literature on the impact of hip fracture-specific patient-clinician digital health interventions on patient outcomes and health care delivery processes; to identify the barriers and enablers to the uptake and implementation of these digital health interventions; and to provide strategies for improved use of digital health technologies.

**Methods and Analysis:** We will conduct a scoping review using Arksey and O'Malley's methodology framework and following the PRISMA-ScR reporting format. A search strategy will be developed, and key databases will be searched until approximately May 2022. A two-step screening process and data extraction of included studies will be performed by two reviewers. Any disagreement will be resolved by consensus or by a third reviewer. For the included studies, a narrative data synthesis will be conducted. Barriers and enablers identified will be mapped to the domains of the Theoretical Domains Framework and related strategies will be provided to guide the uptake of future patient-clinician digital health interventions.

**Ethics and Dissemination:** This review does not require ethics approval. The results will be presented at a scientific conference and published in a peer-reviewed journal. We will also involve relevant stakeholders to determine appropriate approaches for dissemination.

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5 **Keywords:** digital health, targeted patient/client communication, hip fractures, scoping review  
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8 protocol

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10 **Word count:** 1,831  
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## 13 14 15 **ARTICLE SUMMARY**

### 16 17 **Strengths and limitations of this study**

- 18  
19 • We will use an established scoping review methodology framework to summarize the  
20 existing evidence on patient-clinician digital health interventions for the hip fracture  
21 population.  
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- 24 • We anticipate a large volume of peer-reviewed scientific articles; thus, the grey literature  
25 searching will be limited to clinical trial databases and key digital health technology  
26 websites.  
27  
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- 29 • Due to time constraints, we will only consult with a small number of key experts to identify  
30 additional references for potential studies to include and to collect feedback about the  
31 findings identified by the review.  
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## INTRODUCTION

Patient-clinician digital health interventions can help guide patients and their informal caregivers understand their health care needs as they navigate our health care system [1]. According to the World Health Organization [2], patient-clinician digital health interventions are classified as “targeted patient/client communication” technologies. This type of digital health intervention typically involves the use of communication and information technologies to support the exchange of information between clinicians and their patients regarding their care [2]. This includes patient education, discharge information, notifications and reminders for appointments or treatments, follow-up services, behaviour change communication, medication management, and communication on patient-specific health status or clinical history across the continuum of care [2]. A recent meta-analysis showed that select digital health interventions (n=5) for patients with fragility fractures were two times more effective to prevent secondary fractures than usual care [3]. However, components of the digital health interventions often vary making comparison between these technologies difficult. A recent review of 39 studies examined the role of digital health interventions for older patients with hip fractures and found that these interventions focused mainly on digital tools to support physicians providing clinical care [4]. Nonetheless, a systematic review of 42 studies identified that technology interventions can help improve health care delivery processes by engaging patients in managing their care and preventing hospital readmissions [1].

With the increased availability and wide uptake of personal communication devices, digital health interventions to better engage patients in their care have become increasingly common [5]. Digital health interventions have shown to be an effective approach for patients with chronic illness and their clinicians. Specifically, they have been implemented to better

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2  
3 engage patients in managing their own diabetes [6,7], cardiovascular disease [8], and chronic  
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5 obstructive pulmonary disease [9].  
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8 Similarly, hip fracture care can be complex. Hip fracture patients often require extensive  
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10 post-surgery care across multiple sectors. This care can include pain control and management,  
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12 osteoporosis assessment and treatment, fall risk prevention interventions, physical rehabilitation,  
13  
14 assistive walking devices and/or home modifications, as well as follow-up visits with their  
15  
16 orthopaedic surgeon and their primary care provider. Enabling hip fracture patients and their  
17  
18 informal caregivers to participate in the coordination of their treatment along the complete  
19  
20 continuum of care from diagnosis to discharge is crucial for optimal patient outcomes.  
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22

23  
24 The lack of or inadequate information about discharge instructions to patients, specifically for  
25  
26 older patients with a hip fracture, has been identified as an important care gap during care  
27  
28 transitions [10]. Some avoidable readmissions may result from a lack of patient- and caregiver-  
29  
30 centered solutions and other challenges faced during the transition from hospital to home  
31  
32 [11,12]. Emerging research highlights how patient engagement contributes to improved care  
33  
34 [13], and for many organizations, improving patient engagement and developing patient-centred  
35  
36 processes is a priority [14]. Other studies have highlighted the vulnerabilities of patients during  
37  
38 the post-discharge period and the poor retention of verbal instructions [15,16]. The provision of  
39  
40 high-quality teaching and written discharge instructions can be crucial in improving a patient's  
41  
42 understanding of their care, facilitating the transition from hospital to home and may prevent  
43  
44 avoidable readmissions [17-21].  
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49  
50 Engagement in the discharge planning process includes making sure patients and their  
51  
52 informal caregivers: know the important aspects of their specific health conditions, understand  
53  
54 their medications, are able to self-manage common symptoms, have the ability to follow  
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1  
2  
3 discharge instructions, and are informed regarding what signs and symptoms indicate a need to  
4 seek appropriate medical care. Despite improvement efforts, there is a need for more efficient  
5 approaches to address the barriers patients and their informal caregivers' experience as they  
6 transfer through the health care system from hospital to geriatric rehabilitation to home. In  
7 particular, one aspect is *poor communication between clinicians and patients (including their*  
8 *informal caregivers) during transitions* has been noted as being an especially critical care gap  
9 [22,23]. Deficiencies in this area can leave patients and their informal caregivers lacking  
10 information regarding how to manage their care. Unlike paper-based forms or information  
11 packages, digital health can provide real-time guidance and support to patients and help them to  
12 better navigate our health care system.

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Despite the growing number of patients and informal caregivers who have access to  
technology (e.g., phone, tablet, laptop computer) and would like their discharge information to  
be more readily available to them [24], little is known about what patient-clinician digital health  
interventions are available for the hip fracture population. The primary aim is to examine the  
available literature on the impact of hip fracture-specific patient-clinician digital health  
interventions on patient outcomes and health care delivery processes. The secondary aim is to  
identify the barriers and enablers to the uptake and implementation of these digital health  
interventions. The third aim is to provide strategies to improve the use of these digital health  
technologies.

## METHODS

### Protocol design

We will conduct a scoping review using Arksey and O'Malley's methodological  
framework [25,26] and following the Preferred Reporting Items for Systematic Reviews and

1  
2  
3 Meta-Analyses Statement for the Scoping Reviews (PRISMA-ScR) reporting format [27]. This  
4  
5 protocol is registered in Open Science Framework (<https://osf.io/w6a89>) [28].  
6  
7

8 This review will consist of the following stages: (1) identification of the research  
9  
10 question; (2) identification of relevant studies; (3) selection of eligible studies; (4) charting the  
11  
12 data; (5) collating, summarizing, and reporting of the results; and (6) consultation with  
13  
14 stakeholders [25,26].  
15  
16

### 17 **Stage 1: Identification of the research questions**

- 18  
19 1. What is the impact of patient-clinician digital health interventions for older patients with  
20  
21 a hip fracture on patient outcomes and health care delivery processes?  
22  
23
- 24 2. What are the barriers and enablers to the use of patient-clinician digital health  
25  
26 interventions for older patients with a hip fracture transitioning from hospital to  
27  
28 rehabilitation to home?  
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30
- 31 3. What strategies exist to improve the use of patient-clinician digital health interventions  
32  
33 for hip fracture patients transitioning from hospital to rehabilitation to home?  
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35

### 36 **Stage 2: Identification of relevant studies**

37  
38 The search strategy will be developed by a senior information specialist using an iterative  
39  
40 process in consultation with the review team. The MEDLINE strategy will be peer-reviewed  
41  
42 prior to execution by another information specialist according to the Peer Review of Electronic  
43  
44 Search Strategies (PRESS) guidelines [29]. The strategy will use a combination of controlled  
45  
46 vocabulary (e.g., “Hip Fractures”, “Telemedicine”, “Rehabilitation”) and keywords (e.g.,  
47  
48 “broken hip”, “digital health”, “post-surgical care”). There will be no dates or language limits on  
49  
50 any of the searches but where possible, animal-only records will be removed from the results.  
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53  
54 Using the multifile option and deduplication tool available on the OVID platform, we will search  
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Ovid MEDLINE® ALL, Embase Classic+Embase, APA PsycINFO and EBM Reviews (Cochrane Database of Systematic Reviews, CENTRAL, and DARE). We will also search CINAHL on Ebsco. The MEDLINE search strategy is shown in Appendix 1.

Results will be downloaded and deduplicated using EndNote 9.3.3 (Clarivate Analytics) and uploaded to Covidence [30], a citation screening software, where any further duplicates will be identified and removed. We will perform a targeted grey literature search of clinical trial databases (ClinicalTrials.gov and ICTRP Search Portal) and key digital health technology websites. Finally, we will manually search the reference lists of all the included studies and relevant systematic reviews.

### Stage 3: Selection of the eligible studies

The inclusion and exclusion criteria will follow the Population, Concept, Context (PCC) format: **Population:** Hip fracture patients 50 years of age or older who had surgical repair; **Concept:** Post-surgery care (e.g., pain control and management, mobilization, follow-up appointments) using any patient-clinician digital health interventions such as mobile technology, web-based applications, digital communication tools; **Context:** Care across various health care settings.

A two-step screening process will be performed by two reviewers (CB, SH). Specifically, two reviewers will independently screen titles and abstracts (level 1 screening) according to the pre-determined eligibility criteria. For level 2 screening, two reviewers will independently screen the full texts. Any disagreement will be resolved by consensus or by a third reviewer (SP). The reasons for exclusion will be noted using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Statement for the Scoping Reviews (PRISMA-ScR) reporting format [27].

### Stage 4: Charting the data



Prior to starting the data extraction, we will pilot test our data extraction form in Microsoft Excel. Two reviewers (CB, SH) will independently extract the data from the eligible studies. This will include full reference, country, purpose, study design, type of participants (e.g., patients, caregivers, providers), number of participants, theoretical approach, description of the patient-clinician digital health intervention, data analysis, and study results/outcomes (e.g., patient outcomes, health care delivery processes, barriers/enablers). Any disagreement will be discussed and resolved by consensus.

### **Stage 5: Collating, summarizing, and reporting the results**

We will conduct a narrative data synthesis. Data will be grouped by intervention type, outcome, and study design. All data tables will contain data on setting, intervention and control, study sample, patient characteristics, study design and outcomes. In addition, the Theoretical Domain Framework (TDF) [31,32] will guide the analysis of the barriers and enablers to the uptake of digital health interventions. The TDF is a framework that consists of 14 domains: (1) Knowledge, (2) Skills, (3) Social/Professional role and identity, (4) Beliefs about capabilities, (5) Optimism, (6) Beliefs about consequences, (7) Reinforcement, (8) Intentions, (9) Goals, (10) Memory, attention, and decision processes, (11) Environmental context and resources, (12) Social influences (13) Emotion, and (14) Behavioural regulation.

Two reviewers will independently group the data extracted from the included studies into themes and code each theme as a barrier or an enabler. The themes will then be mapped to each of the TDF domains. If there are any themes that cannot be mapped to the TDF domains, we will report them separately. For each barrier and enabler, we will report the frequency and percentage to identify the top domains. Any disagreement will be discussed and resolved by consensus by the two reviewers (CB, SH) or by consulting a third reviewer (SP). Behavioral change techniques

[33] that align with the barriers and enablers will be selected to guide the uptake of future patient-clinician digital health interventions for older patients with a hip fracture transitioning from hospital to rehabilitation to home.

### **Stage 6: Consultation with stakeholders**

Our research team is comprised of clinicians that will participate in the research process and will provide ongoing consultation. Following the recommendations by Levac et al. [26], we will also consult with a small number of digital health developers (n=2-3) within the research team's networks to help us identify any additional studies to include and to collect feedback about the findings identified by the review. In addition, we will also engage with stakeholders to determine possible approaches for dissemination and knowledge translation opportunities.

### **Patient and public involvement**

No patients were involved.

### **ETHICS AND DISSEMINATION**

This review does not require ethics approval. The results of this review will provide an overview of patient-clinician digital health interventions for hip fracture patients as well as the barriers and enablers for their uptake and implementation. The results will provide information for various stakeholders such as researchers, clinicians, administrators, and policymakers. For dissemination activities, the review will be presented at a scientific conference and published in a peer-reviewed journal.

### **DECLARATIONS**

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3  
4 **Conflicts of interest/Competing interests:** The authors have no relevant financial or non-  
5 financial interests to disclose.  
6

7  
8 **Ethics approval:** Not applicable  
9

10 **Consent for publication:** Not applicable  
11

12 **Availability of data and material:** No additional data are available.  
13

14  
15 **Author contributions:** CB is first author who contributed to the first draft of the scoping review  
16 protocol. All authors (CB, SP, AH, SH, BS, SP, MG, SS, RB, PEB, VFM) were involved in the  
17 design of the scoping review. BS is responsible for the literature searching. CB and SH will  
18 conduct the literature searching and the data synthesis. All authors (CB, SP, AH, SH, BS, SP,  
19 MG, SS, RB, PEB, VFM) contributed to the revision of the manuscript. CB is the guarantor of  
20 the review.  
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## Appendix 1. MEDLINE search strategy

Database: Ovid MEDLINE(R) ALL <1946 to May 13, 2022>

Search Strategy:

- 
- 1 exp Hip Fractures/ (27207)
  - 2 ((hip or hips or femoral neck or (femur? adj2 neck?) or acetabul\* or intertrochanter\* or intertrochanter\* or pertrochanter\* or per-trochanter\* or subtrochanter\* or sub-trochanter\* or trochanter\*) adj3 (break\* or broke\* or fractur\*)).tw,kw,kf. (36304)
  - 3 or/1-2 [HIP FRACTURES] (41931)
  - 4 exp Telemedicine/ (40348)
  - 5 (telemed\* or tele-med\* or telecare or tele-care or teleconsult\* or tele-consult\* or teleconferenc\* or tele-conferenc\* or telecounsel\* or tele-counsel\* or telehealth\* or tele-health\* or telemonitor\* or tele-monitor\* or telepsychiatr\* or tele-psychiatr\* or telepsycholog\* or tele-psycholog\* or telerehab\* or tele-rehab\* or telesupport\* or tele-support\* or teletherap\* or tele-therap\* or teletreatment\* or tele-treatment\*).tw,kw,kf. (35770)
  - 6 (ehealth\* or e-health\* or mhealth\* or m-health\* or emental health\* or e-mental health\* or mmental health\* or m-mental health\* or epsychiatr\* or e-psychiatr\* or mpsychiatr\* or m-psychiatr\* or epsychol\* or e-psychol\* or mpsychol\* or m-psychol\* or erehab\* or e-rehab\* or mrehab\* or m-rehab\* or etherap\* or e-therap\* or esupport\* or e-support\* or msupport\* or m-support\* or evisit\* or e-visit\* or mvisit\* or m-visit\*).tw,kw,kf. (17831)
  - 7 (ecoach\* or e-coach\*).tw,kw,kf. (85)
  - 8 (emedicine\* or e-medicine\*).tw,kw,kf. (101)
  - 9 (mobile health\* or mobile care or mobile counsel\* or mobile medicine or mobile psychiatr\* or mobile psycholog\*).tw,kw,kf. (7275)
  - 10 ((digital\* or virtual\* or remote\*) adj3 (care or health\* or healthcare or health-care)).tw,kw,kf. (14232)
  - 11 ((digital\* or virtual\* or remote\*) adj3 (appointment\* or clinic or clinics or coach\* or communicat\* or conferenc\* or consult\* or followup or follow-up or hub or hubs or interven\* or manag\* or meet\* or monitor\* or rehab\* or support\* or therap\* or tool or tools or treatment? or visit\*)).tw,kw,kf. (33162)
  - 12 (e-provider? or e-clinician? or e-counsel?or? or e-doctor? or e-nurse? or e-physician? or e-practitioner? or e-therapist? or m-provider? or m-clinician? or m-counsel?or? or m-doctor? or m-nurse? or m-physician? or m-practitioner? or m-therapist?).tw,kw,kf. (99)
  - 13 (mobile provider? or mobile clinician? or mobile counsel?or? or mobile doctor? or mobile nurse? or mobile physician? or mobile practitioner? or mobile therapist?).tw,kw,kf. (60)
  - 14 Internet-Based Intervention/ (936)
  - 15 exp Therapy, Computer-Assisted/ (43927)
  - 16 ((internet\* or app or apps or computer\* or cyber\* or e-application? or e-mail\* or email\* or electronic mail\* or iphone? or i-phone? or (mobile adj2 application?) or mobile-based or mobile phone? or online or (patient? adj3 portal\*) or instant\* messag\* or (secure\* adj3 communicat\*) or (secure\* adj3 messag\*) or (secure\* adj3 platform\*) or (secure\* adj3 portal\*) or service or services or smarthome\* or smart-home\* or smarhub? or smart-hub? or smartphone\* or smart phone\* or technolog\* or telecommunicat\* or tele-communicat\* or telephon\* or textmessag\* or text-messag\* or video\* or web or webbased or web-based or webdeliver\* or web-deliver\* or "web 2.0") adj3 (care or health care or health-care or healthcare or appointment\* or coach\* or conferenc\* or consult\* or interven\* or manag\* or meet\* or monitor\* or rehab\* or support\* or therap\* or treatment? or visit\*)).tw,kw,kf. (229431)
  - 17 (internet\* or app or apps or computer\* or cyber\* or e-application? or e-mail\* or email\* or electronic mail\* or iphone? or i-phone? or (mobile adj2 application?) or mobile-based or mobile phone? or online or (patient? adj3 portal\*) or instant\* messag\* or (secure\* adj3 communicat\*) or (secure\* adj3 messag\*) or (secure\* adj3 platform\*) or (secure\* adj3 portal\*) or smarthome\* or smart-home\* or smarhub? or smart hub? or smartphone\* or smart phone\* or technolog\* or telecommunicat\* or tele-communicat\* or

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3 telephon\* or textmessag\* or text-messag\* or video\* or web or webbased or web-based or webdeliver\* or  
4 web-deliver\* or "web 2.0").ti,kw,kf. (362795)  
5 18 (internet\* or app or apps or computer\* or cyber\* or e-application? or e-mail\* or email\* or electronic  
6 mail\* or iphone? or i-phone? or (mobile adj2 application?) or mobile-based or mobile phone? or online or  
7 (patient? adj3 portal\*) or instant\* messag\* or (secure\* adj3 communicat\*) or (secure\* adj3 messag\*) or  
8 (secure\* adj3 platform\*) or (secure\* adj3 portal\*) or smarthome\* or smart-home\* or smarthub? or smart  
9 hub? or smartphone\* or smart phone\* or technolog\* or telecommunicat\* or tele-communicat\* or  
10 telephon\* or textmessag\* or text-messag\* or video\* or web or webbased or web-based or webdeliver\* or  
11 web-deliver\* or "web 2.0").ab. /freq=2 (387856)  
12 19 or/4-18 [DIGITAL CARE, PT 1] (839671)  
13 20 exp Hip Fractures/pc, rh, su, th [Prevention, Rehabilitation, Surgery, Therapy] (17072)  
14 21 Delivery of Health Care/ (107762)  
15 22 exp \*Delivery of Health Care/ (713121)  
16 23 Delivery of Health Care, Integrated/ (13940)  
17 24 ((deliver\* or model or models or provid\* or provision) adj3 (care or health care or health-care or  
18 healthcare)).ti,kw,kf. (43570)  
19 25 Health Services/ (26750)  
20 26 Community Health Services/ (32796)  
21 27 Rural Health Services/ (13710)  
22 28 Suburban Health Services/ (183)  
23 29 Urban Health Services/ (3782)  
24 30 (healthservice\* or health service\* or healthcare service? or health care service?).ti,kw,kf. (58952)  
25 31 Geriatric Nursing/ (13802)  
26 32 Home Nursing/ (8650)  
27 33 ((geriatric\* or home) adj3 (care or health care or health-care or healthcare)).tw,kw,kf. (40450)  
28 34 ((after operati\* or after surger\* or postoperati\* or post-operati\* or postsurg\* or post-surg\*) adj3  
29 (care or health care or health-care or healthcare or followup or follow-up or rehab\* or therap\* or  
30 treatment\*)).tw,kw,kf. (77748)  
31 35 Rehabilitation/ (18651)  
32 36 Rehabilitation Nursing/ (1467)  
33 37 exp Exercise Therapy/ (59598)  
34 38 ((exercis\* or remedial\* or rehab\*) adj3 therap\*).tw,kw,kf. (20378)  
35 39 rh.fs. [Rehabilitation - Floating Subheading] (206541)  
36 40 rehab\*.ti,kw,kf. (94860)  
37 41 rehab\*.ab. /freq=2 (59746)  
38 42 Caregivers/ (45604)  
39 43 Family/ (82355)  
40 44 Ambulatory Care/ (45670)  
41 45 (ambulatory adj3 (care or health care or health-care or healthcare)).tw,kw,kf. (15067)  
42 46 Inpatients/ (27082)  
43 47 inpatient\*.tw,kw,kf. (127731)  
44 48 Outpatients/ (19592)  
45 49 (outpatient\* or out patient\*).tw,kw,kf. (210462)  
46 50 Communication/ (94560)  
47 51 communicat\*.ti,kw,kf. (95540)  
48 52 communicat\*.ab. /freq=2 (82225)  
49 53 (miscommunicat\* or mis-communicat\*).tw,kw,kf. (1065)  
50 54 (misunderstand\* or mis-understand\*).tw,kw,kf. (6476)  
51 55 (misinform\* or mis-inform\*).tw,kw,kf. (4984)  
52 56 Information Seeking Behavior/ (3051)  
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3 57 ((communicat\* or provid\* or provision\* or seek\* or search\* or shar\* or sought) adj3  
4 information).tw,kw,kf. (281864)  
5 58 ((care or health care or health-care or healthcare) adj (educat\* or communicat\* or inform\* or  
6 instruct\*).tw,kw,kf. (12146)  
7 59 exp Patient Education as Topic/ (88355)  
8 60 ((caregiver? or care giver? or client? or family or families or patient? or person\$2 or personally or  
9 user?) adj3 (communicat\* or educat\* or inform\* or instruct\* or resourc\* or teach\*).tw,kw,kf. (212301)  
10 61 exp Patient-Centered Care/ (23177)  
11 62 ((patient-centered or patient-centred or patient-focus?ed) adj3 (approach or approaches or care or  
12 healthcare or health care or model or models or rehab\*).tw,kw,kf. (15266)  
13 63 ((client-centered or client-centred or client-focus?ed) adj3 (approach or approaches or care or  
14 healthcare or health care or model or models or rehab\*).tw,kw,kf. (670)  
15 64 Patient Participation/ (28570)  
16 65 ((caregiver\* or care giver? or client\* or family or families or patient\* or person\$2 or personally or  
17 user?) adj3 (activat\* or engag\* or empower\* or involv\* or participat\*).tw,kw,kf. (180848)  
18 66 Self Care/ (35300)  
19 67 Self-Management/ (4535)  
20 68 ((person\* or self) adj3 (manag\* or care)).tw,kw,kf. (84309)  
21 69 Aftercare/ (11724)  
22 70 aftercare.tw,kw,kf. (3604)  
23 71 ((after or followup or follow-up) adj (care or hospital\* or treatment)).tw,kw,kf. (209016)  
24 72 Patient Discharge/ (36442)  
25 73 ((client\* or patient or patients or facility or facilities or hospital or hospitals) adj3  
26 discharg\*).tw,kw,kf. (99327)  
27 74 Continuity of Patient Care/ (20361)  
28 75 Patient Transfer/ (9413)  
29 76 Transitional Care/ (1129)  
30 77 ((continuit\* or continuum or path or paths or pathway\* or transition\*) adj (care or health care or  
31 health-care or healthcare)).tw,kw,kf. (2562)  
32 78 Professional-Patient Relations/ (28340)  
33 79 Nurse-Patient Relations/ (35948)  
34 80 Physician-Patient Relations/ (75482)  
35 81 (((professional\* or clinician\* or doctor\* or nurse or nurses\* or physician\* or practitioner\* or  
36 therapist\*) adj3 (caregiver\* or care giver? or client\* or family or families or patient or patients)) and  
37 relations\*).tw,kw,kf. (43621)  
38 82 Therapeutic Alliance/ (385)  
39 83 therapeutic alliance?.tw,kw,kf. (3147)  
40 84 or/20-83 [HEALTH CARE DELIVERY, REHAB, TRANSITIONAL CARE, ETC] (2721148)  
41 85 Biomedical Technology/ (7127)  
42 86 (technolog\* adj3 (care or health or health care or health-care or healthcare)).tw,kw,kf. (26882)  
43 87 exp Cell Phone/ (20326)  
44 88 "Cell Phone Use"/ (338)  
45 89 exp Computers/ (83691)  
46 90 Digital Technology/ (454)  
47 91 Electronic Mail/ (2893)  
48 92 Internet/ (79164)  
49 93 Internet Access/ (136)  
50 94 "Internet Use"/ (340)  
51 95 Mobile Applications/ (10004)  
52 96 Telecommunications/ (5010)  
53 97 Telephone/ (12962)  
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3 98 exp Videoconferencing/ (2633)

4 99 (internet\* or app or apps or computer\* or cyber\* or digital\* or e-application? or e-mail\* or email\*  
5 or electronic mail\* or iphone? or i-phone? or (mobile adj2 application?) or mobile-based or mobile  
6 phone? or online or (patient? adj3 portal\*) or instant\* messag\* or (secure\* adj3 communicat\*) or  
7 (secure\* adj3 messag\*) or (secure\* adj3 platform\*) or (secure\* adj3 portal\*) or smarthome\* or smart-  
8 home\* or smarhub? or smart hub? or smartphone\* or smart phone\* or technolog\* or telecommunicat\* or  
9 tele-communicat\* or telephon\* or textmessag\* or text-messag\* or video\* or web or webbased or web-  
10 based or webdeliver\* or web-deliver\* or "web 2.0").tw,kw,kf. (1583184)

11 100 or/85-99 [DIGITAL TECHNOLOGY] (1651055)

12 101 84 and 100 [DIGITAL CARE, PT 2] (289340)

13 102 19 or 101 [DIGITAL CARE, PTS 1-2] (970283)

14 103 3 and 102 [HIP FRACTURES - DIGITAL CARE] (1456)

15 104 exp Animals/ not Humans/ (5007245)

16 105 103 not 104 [ANIMAL-ONLY REMOVED] (1449)

17 106 (Adolescent/ or exp Child/ or exp Infant/) not exp Adult/ (2051574)

18 107 105 not 106 [ADOLESCENT-, CHILD-, INFANT-ONLY REMOVED] (1436)

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## Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
<b>TITLE</b>			
Title	1	Identify the report as a scoping review.	
<b>ABSTRACT</b>			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	
<b>INTRODUCTION</b>			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	
<b>METHODS</b>			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	



SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
<b>RESULTS</b>			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	
<b>DISCUSSION</b>			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	
Limitations	20	Discuss the limitations of the scoping review process.	
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	
<b>FUNDING</b>			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

\* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med.* 2018;169:467–473. doi: [10.7326/M18-0850](https://doi.org/10.7326/M18-0850).



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