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The effectiveness and usability of wearable devices in the prevention of hospital readmission in patients with chronic conditions: a comprehensive literature review

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Review question(s)

What kind of wearable devices can be applied to the prevention of hospital readmission?

Are there any obstacles or barriers for patients with chronic conditions to using wearable devices everyday?

Is wearable technology to prevent hospital readmission useful for patients with chronic conditions?

Can wearable devices be effectively used for improving safety in the home-care setting?

Searches

A preliminary electronic search of databases in the healthcare field was performed in November 2016 and will be updated in January 2017. The following databases were searched: The Cochrane Database of Systematic Reviews, the Cumulative Index to Nursing and Allied Health Literature (CINAHL), Pub Med, EMBASE and MEDLINE.

Hand searching and/or electronic searches of the reference lists of included studies will also be undertaken.

In the initial search, these databases were searched for quantitative and qualitative studies with an abstract, a publication date within the last ten years, and involving humans only, which focus on the use and effectiveness of wearable devices in health monitoring and on interventions relating to data gathered on individuals.

The following keywords were used:

Wearable devices OR wearable technology AND chronic conditions OR chronic diseases AND hospital admission OR hospital admission prevention OR hospital readmission OR hospital readmission prevention.

Wearable devices OR wearable technology AND elderly AND safety AND barriers OR obstacles OR changes.

An updated search will consider specific terms such as “cardiac”, “diabetes”, “stroke” to identify more focused patient groups.

Types of study to be included

Randomized controlled trials, cohort studies, non-randomized controlled trials, case studies, qualitative studies.

Condition or domain being studied

Chronic conditions including cardiovascular and respiratory diseases, stroke and diabetes.

Wearable devices or wearable technology.

Participants/ population

Adults with chronic conditions.

Intervention(s), exposure(s)

Wearable technology as a monitoring device for the prevention of hospital readmission in chronic patients and for improving safety and quality of life in the home-care setting.

Comparator(s)/ control

Traditional monitoring devices and implantable technologies.

Context

Studies in the community- and home-care settings only will be included.

Outcome(s)

Primary outcomes

Hospital readmission rates.

Secondary outcomes

Safety and quality of life.

Data extraction, (selection and coding)

The titles and/or abstracts of studies retrieved using the search strategy and those from additional sources will be screened independently by two review authors to identify studies that potentially meet the inclusion criteria outlined above. The full texts of these potentially eligible studies will then be retrieved and independently assessed for eligibility by two review team members. Any disagreements between them over the eligibility of particular studies will be resolved through discussion with a third reviewer.

A standardised, pre-piloted form will be used to extract data from the included studies for the assessment of study quality and for evidence synthesis. Extracted information will include: study setting; study population and participant demographics and baseline characteristics; details of the intervention and control conditions; study methodology; recruitment and study completion rates; outcomes and times of measurement; indicators of acceptability to users; suggested mechanisms of intervention action; information for assessment of the risk of bias. Two review authors will extract data independently, discrepancies will be identified and resolved through discussion (with a third author where necessary). Missing data will be requested from study authors.

Risk of bias (quality) assessment

The Cochrane risk of bias tool will be used to assess quality. Two review authors will independently apply this tool to assess the risk of bias by considering the following characteristics:

Randomisation sequence generation: was the allocation sequence adequately generated?

Treatment allocation concealment: was the allocated treatment adequately concealed from study participants and clinicians and other healthcare or research staff at the enrolment stage?

Blinding: were the personnel assessing outcomes and analysing data sufficiently blinded to the intervention allocation throughout the trial?

Completeness of outcome data: were participant exclusions, attrition and incomplete outcome data adequately addressed in the published report?

Selective outcome reporting: is there evidence of selective outcome reporting and might this have affected the study results?

Other sources of bias: was the trial apparently free of any other problems that could produce a high risk of bias?

Disagreements between the review authors over the risk of bias in particular studies will be resolved by discussion, with involvement of a third review author if necessary.

Strategy for data synthesis

We will provide a narrative synthesis of the findings from the included studies, structured around the type of intervention, target population characteristics, type of outcome and intervention content. We will provide summaries of intervention effects for each study by calculating risk ratios (for dichotomous outcomes) or standardised mean differences (for continuous outcomes).

We anticipate that there will be limited scope for meta-analysis because of the range of different outcomes measured across the small number of existing trials. However, where studies have used the same type of intervention and comparator, with the same outcome measure, we will pool the results using a random-effects meta-analysis, with standardised mean differences for continuous outcomes and risk ratios for binary outcomes, and calculate 95% confidence intervals and two sided P values for each outcome. In studies where the effects of clustering have not been taken into account, we will adjust the standard deviations for the design effect. Heterogeneity between the studies in effect measures will be assessed using both the chi-square test and the I-squared statistic. We will consider an I-squared value greater than 50% as indicative of substantial heterogeneity, and we will conduct sensitivity analyses based on study quality. Stratified meta-analyses will be used to explore heterogeneity in effect estimates according to: study quality; study populations; the logistics of intervention provision; and intervention content, and evidence for publication bias will also be assessed.

Finding from qualitative studies will be synthesised using meta-aggregation and reported as synthesised findings.

Analysis of subgroups or subsets
None.

Dissemination plans
A report, a poster presentation and a paper will be submitted to a peer-reviewed journal.

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Conflicts of interest
None known

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English

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England

Subject index terms status
Subject indexing assigned by CRD

Subject index terms
Chronic Disease; Delivery of Health Care; Humans; Monitoring, Ambulatory; Monitoring, Physiologic; Patient Admission; Patient-Centered Care; Patient Readmission; Residence Characteristics; Technology; Telemedicine; Treatment Outcome

Any other information
The findings from this review will inform the design of a randomised controlled trial in the future.

Stage of review
Ongoing

Date of registration in PROSPERO
11 April 2017

Date of publication of this revision
11 April 2017

Stage of review at time of this submission	Started	Completed
Preliminary searches	Yes	No
Piloting of the study selection process	Yes	No
Formal screening of search results against eligibility criteria	Yes	No
Data extraction	Yes	No
Risk of bias (quality) assessment	No	No
Data analysis	No	No