Multicomponent hospital-led interventions to reduce hospital stay for older adults following elective surgery: a systematic review

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Declared competing interests of authors: Rob Anderson is a member of the National Institute for Health Research Health Services and Delivery Research (Researcher-Led) Prioritisation Panel.

Published December 2019
DOI: 10.3310/hsdr07400

Scientific summary

Interventions to reduce hospital stay in older adults after surgery

Health Services and Delivery Research 2019; Vol. 7: No. 40
DOI: 10.3310/hsdr07400

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Scientific summary

Background

Globally, life expectancy is increasing, and so is the population of older adults. The Office for National Statistics forecasts that the population of adults aged ≥ 75 years in the UK will rise from around 5.8 million to 10 million over the next 20 years. The mean age of hospital inpatients in the UK increased from 49 to 53 from 2006 to 2016; in the same period, the number of 60- to 65-year-olds admitted to hospital increased by 57%. The needs of older adults undergoing planned admissions may differ significantly from those of their younger counterparts. They may present with multimorbidity, polypharmacy, cognitive impairment and social challenges, and are at increased risk of adverse events during and after surgery.

Such difficulties can prolong the inpatient stay or prevent discharge to home altogether. Lengthy hospital stays can increase the risk of complications such as falls, sarcopenia, hospital-acquired infections and cognitive decline. These complications also increase demand on bed space, resources and increased cost of care. It is therefore important for hospitals to optimise the time that older adults spend in hospital. An opportunity exists to develop strategies to achieve this for planned procedures.

Hospital-led, multicomponent organisational strategies to accelerate recovery and reduce inpatient length of stay after planned admissions have been evaluated in some surgical specialties in working-age adults in particular. However, it is not known whether or not such interventions are effective and cost-effective in older adults.

Objectives

This review aimed to answer two questions:

1. What is the effectiveness of hospital-led multicomponent interventions to reduce length of stay for older adults following planned admission?
2. What is the cost-effectiveness of hospital-led multicomponent interventions to reduce length of stay for older adults following planned admission?

Methods

Data sources

The methods to identify and select evidence followed best practice. We identified effectiveness studies by searching bibliographic databases including MEDLINE (via Ovid), MEDLINE In-Process & Other Non-Indexed Citations (via Ovid), EMBASE (via Ovid), HMIC (Health Management Information Consortium) (via Ovid), CENTRAL (Cochrane Central Register of Controlled Trials) (via The Cochrane Library), CINAHL (Cumulative Index to Nursing and Allied Health Literature) (via EBSCO*host*) and AMED (Allied and Complementary Medicine Database) (via EBSCO*host*); forwards and backwards citation searching included studies; inspecting reference lists of topically similar systematic reviews; carrying out web searches; consulting stakeholders; contacting authors of potentially relevant conference abstracts and carrying out cost-effectiveness searches. No English-language filter was used; however, we limited retrospectively the search results to studies published from 2000. This strategy was duplicated, with the use of a cost study design filter, to identify cost-effectiveness evidence.

Study selection

The following inclusion criteria were applied to records identified by both the effectiveness and the cost-effectiveness searches.

Population

Older adults (i.e. the mean or median age of the sample was at least 60 years), undergoing planned (i.e. elective) hospital treatment requiring inpatient admission.

Intervention

Any multicomponent, hospital-based intervention for inpatients receiving planned procedures, aiming to reduce length of stay in hospital or improve recovery.

Comparator

Any comparator.

Outcomes

Any metric of length of stay in hospital.

Study design

We included any comparative study design. For the cost-effectiveness evidence, studies had to be economic evaluations or comparative cost studies.

Geographical context

High-income countries as defined by the World Bank list of economies [*World Bank List of Economies* (*June 2017*). URL: http://iccmoot.com/wp-content/uploads/2017/07/World-Bank-List-of-Economies.pdf (accessed 20 September 2018)].

Study selection

The inclusion and exclusion criteria were independently applied to the title and abstract of each citation by two reviewers, with disagreement resolved through discussion. This process was repeated for the full text of each paper provisionally meeting the inclusion criteria.

Data extraction

Data extraction was performed by one reviewer and checked by a second, with disagreements settled through discussion. Extracted data included relevant details about the study population, setting/context, intervention, comparator and clinical and patient-reported outcome data, plus costs or cost-effectiveness if reported.

Quality assessment strategy

Each prioritised study (see *Synthesis methods*) was assessed independently by two reviewers using the Effective Public Health Practice Project Quality Assessment Tool for Quantitative Studies, and additionally with the Consensus Health Economic Criteria list for cost-effectiveness studies. Any disagreements were resolved through discussion. Quality assessment informed the interpretation of evidence, and was not used to exclude studies.

Synthesis methods

We prioritised the following categories of includable effectiveness studies for synthesis: (1) randomised controlled trials conducted in any high-income country; and (2) any includable study design conducted in the UK. This facilitated a manageable synthesis based on both the highest-quality and the most relevant evidence available. Cost-effectiveness evidence was synthesised if it related to studies in group (1) or (2) above.

Studies were categorised based on the anatomical location of the procedures (all of which were surgical): cardiac, colorectal, lower limb arthroplasty, pelvic, thoracic, tumour removal at various locations, upper abdominal, vascular, and mixed/various procedures. Interventions were classified into broad categories:

1. Enhanced recovery protocols: consisting of components at multiple stages of the care pathway, such as minimal preoperative fasting, standard anaesthetic protocols, early mobilisation and early oral nutrition.
2. Prehabilitation (prehab): focusing on preoperative (usually pre-admission) components preparing patients for surgery, such as exercise programmes or nutritional optimisation.
3. Preoperative assessment with care plan: assessment prior to hospital admission, with subsequent care plan, such as comprehensive geriatric assessment.
4. Rehabilitation (rehab): focusing on postoperative components to improve or speed up recovery, such as a programme of physical exercises to improve strength and flexibility.
5. Specialist ward: patients recover in a procedure-specific and/or ring-fenced ward, with features such as restricted opening times, specialist staff or extra infection control measures.
6. Staff mix: the main active ingredient is the provision of particular numbers or types of staff, such as a team of geriatricians.

Comparators were grouped in the same way, with an additional category of 'usual care'.

Outcomes were considered as 'clinical' or 'patient-reported'. 'Clinical' outcomes included length of stay, re-admissions, complications, use of additional care, surgical process outcomes, morbidity and mortality. 'Patient-reported' outcomes included mental health, quality of life, satisfaction and markers of physical recovery. Effectiveness and cost-effectiveness outcomes of interest were tabulated and summarised in order of procedural group.

Randomised controlled trials conducted in any high-income country were considered separately from studies of any design that were conducted in the UK.

Between-group differences were analysed where possible, with data imputed where appropriate. A random-effects meta-analysis was performed with data from randomised controlled trials when the procedure group, intervention type, comparator type, and outcomes were similar and the data were available. The relative effectiveness of different interventions was explored further with a narrative synthesis.

Publication bias was assessed across all procedure and intervention categories from randomised controlled trials by visual inspection of funnel plots.

Expert clinical advisors and patient and public involvement

Expert clinical advisors were involved throughout the review, from development of the protocol to interpreting preliminary results, identifying key messages for dissemination and supporting the preparation of the final report and other outputs. We also consulted regularly with a group of older adults who had experience of being admitted to hospital overnight for a planned procedure.

Findings

We identified 10,448 unique records. The full texts of 583 papers were sought for further consideration. In total, 218 articles met the inclusion criteria for this review.

Seventy-three studies, reported in 80 articles, containing data for 26,365 patients, met the criteria for further synthesis. Thirty-four randomised controlled trials were conducted outside the UK in a total of 15 countries, and 39 studies were from the UK, of which 12 were randomised controlled trials. The remaining 138 articles were tabulated and summarised.

Key findings: randomised controlled trials

The majority of randomised controlled trials were evaluations of interventions to improve recovery from colorectal surgery ($n = 17$) or lower limb arthroplasty ($n = 13$). Within the colorectal surgery evidence, the majority of trials ($n = 10$) evaluated enhanced recovery protocol interventions, with pooled evidence indicating a beneficial reduction in length of stay of around 1.5 days (Cohen's $d = -0.51$, 95% confidence interval –0.78 to –0.24, $p < 0.001$; $n = 10$ groups pooled). There was evidence that various markers of physical recovery after colorectal surgery (mobilisation goals, passage of flatus or stool, pain control goals) were achieved earlier in patients receiving enhanced recovery protocols than in those receiving usual care. All other outcomes were either improved with enhanced recovery protocols or similar between enhanced recovery protocols and usual care.

Most evidence for strategies to improve recovery from lower limb arthroplasty came from five randomised controlled trials evaluating enhanced recovery protocol interventions and five evaluating prehab interventions. However, only two studies in each intervention category provided length of stay data that could be meta-analysed. In each category, the intervention was associated with a reduction in length of stay. This effect was large and associated with a decreased stay of 3.3 days with enhanced recovery protocols (Cohen's $d = -1.26$, 95% confidence interval –1.62 to –0.89, $p < 0.001$, $n = 2$ groups pooled), and of medium size and associated with a stay 2.5 days shorter with prehab (Cohen's $d = -0.53$, 95% confidence interval –0.77 to –0.28, $p < 0.001$, $n = 2$ groups pooled). Evidence for other outcomes was scarce in enhanced recovery protocol trials but usually indicated no difference between groups or improvements with enhanced recovery protocols. Studies evaluating prehab interventions collected more evidence about patient-reported outcomes, which either were similar to those from usual care or improved with the intervention.

Evidence from randomised controlled trials for other procedures was spread between cardiac ($n = 6$ randomised controlled trials), upper abdominal ($n = 5$), pelvic ($n = 2$), vascular ($n = 2$) and thoracic ($n = 1$) surgeries, with one trial focusing on operations to remove tumours at various sites. The evidence was dominated by enhanced recovery protocol ($n = 8$) and prehab ($n = 5$) interventions.

Where meta-analysis was performed within these procedure groups, enhanced recovery protocol interventions were associated with a reduced length of stay of just over 5 days in patients receiving upper abdominal surgery ($d = -1.04$, 95% confidence interval –1.55 to –0.53, $p < 0.001$; $n = 5$ groups pooled), with 61% lower odds of sustaining complications in the same five studies (odds ratio 0.39, 95% confidence interval 0.24 to 0.64; $p < 0.001$); Prehab interventions were associated with a reduction in length of stay of 0.7 days in patients undergoing cardiac surgery ($d = -0.35$, 95% confidence interval –0.68 to –0.02, $p = 0.04$; $n = 3$ studies pooled).

The quality of evidence available was usually 'moderate' or 'weak' overall, with particular concerns over the methods used to collect data, lack of a definition of length of stay, and unclear reporting of blinding of assessors and participants. Despite these limitations, evidence from randomised controlled trials indicated that interventions, particularly enhanced recovery protocols, either improved outcomes and reduced length of stay, or did not cause detrimental effects to patients, compared with usual care.

Evidence from the UK: key findings

Twelve randomised controlled trials, three controlled trials and 24 uncontrolled before-and-after studies were from the UK. The largest groups of evidence from the UK were concerned with recovery from lower limb arthroplasty ($n = 15$ studies) and colorectal ($n = 7$) or upper abdominal ($n = 6$) surgery.

Enhanced recovery protocol interventions dominated the UK evidence for lower limb arthroplasty, with 13 studies evaluating this type of strategy to improve recovery. Although six of these studies did not report useable variance data, precluding secondary analysis of length of stay, all of the other seven studies evaluating enhanced recovery protocol interventions reported a statistically significant reduction in length of stay. Reductions in length of stay ranged from under 1 day to nearly 4.5 days. Reporting of additional outcomes was generally poor in these studies, but there was no evidence of a detrimental effect with enhanced recovery protocols, and some studies showed statistically significant improvements in markers of recovery in particular.

All trials seeking to improve recovery from colorectal surgery evaluated enhanced recovery protocol interventions. Evidence for length of stay came from only three studies, two of which indicated a statistically significant reduction with enhanced recovery protocols. Complications were usually similar between enhanced recovery protocol and usual care groups, except for two studies, in which the odds of experiencing complications were reduced with the enhanced recovery protocol. Other outcomes were unaffected by the intervention.

Five of the six studies in the upper abdominal category were enhanced recovery protocol interventions. There were statistically significant reductions in length of stay in three of the four groups providing relevant data, ranging from 3 to over 5 days with enhanced recovery protocols. Other outcomes were largely similar between enhanced recovery protocol and usual care groups, but three of the four studies reporting markers of recovery observed a statistically significant improvement with enhanced recovery protocols in at least one outcome.

As with the evidence from randomised controlled trials, the evidence from the UK either favoured the intervention or showed no difference from usual care. Study quality was usually rated as ‘moderate’ or ‘weak’. The large number of non-randomised studies automatically downgraded the quality rating of these studies.

Key findings: cost-effectiveness

Only 15 prioritised studies included cost data or cost-effectiveness evaluations. Costs were largely driven by length of stay and thus cost-effectiveness evidence broadly reflected effectiveness findings, effective interventions being associated with reduced costs. However, the evidence was generally of low quality and highly heterogeneous. The best evidence came from four evaluations of enhanced recovery protocols in lower limb arthroplasty patients, all of which suggested that the intervention saved money compared with usual care.

Summary

The findings were generally in favour of interventions to reduce length of stay and/or improve recovery in older adults undergoing elective surgery requiring inpatient admission. The evidence was particularly focused around colorectal surgery and lower limb arthroplasty, and enhanced recovery protocol or prehab interventions. Enhanced recovery protocol and prehab interventions often led to improved recovery, including reduced length of stay, or had no detrimental effect on reported wider outcomes. However, broader outcomes, particularly relating to patient satisfaction and experiences after discharge, were lacking.

Strengths and limitations

This is the first systematic review to bring together and evaluate evidence about multicomponent interventions of any type aiming to improve recovery and reduce length of stay following planned admissions in older adults. We used best practice methods to identify, select, appraise and synthesise the evidence and throughout the review process we have incorporated the views of both clinical experts in the field and patients with experience. Our findings are based on both the highest-quality (i.e. randomised controlled trials) and most relevant (i.e. UK-based) evidence for the UK audience.

The quality of included studies was mostly 'weak' or 'moderate', and some interventions and procedures remain under-researched. Outcomes were often reported in a format that precluded analysis, preventing a large number of studies from contributing to pooled analyses of length of stay. The impact of interventions on long-term patient outcomes or implications for the wider health and social care system were not reported in the majority of included studies.

Conclusions

Multicomponent interventions to reduce length of stay and improve recovery in older adults undergoing elective surgeries requiring inpatient admission were often effective and/or did not adversely affect clinical or patient outcomes. There is clear evidence of the effectiveness of enhanced recovery protocol interventions in colorectal surgery, lower limb arthroplasty and, to a lesser extent, upper abdominal surgery to support this.

Research recommendations

Although the combinations of components within enhanced recovery protocol interventions may yet be refined, this review suggests that the focus of future studies could move away from whether or not a protocol is effective compared with usual care, and focus on factors that may affect the implementation and uptake of interventions with consistency across institutions. Furthermore, effectiveness studies should consider the longer-term implications of reduced length of stay for patient recovery and the health-care system, and seek to integrate the patient voice into evaluations.

Study registration

This study is registered as PROSPERO CRD42017080637.

Funding

Funding for this study was provided by the Health Services and Delivery Research programme of the National Institute for Health Research.

Health Services and Delivery Research

ISSN 2050-4349 (Print)

ISSN 2050-4357 (Online)

This journal is a member of and subscribes to the principles of the Committee on Publication Ethics (COPE) (www.publicationethics.org/).

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The research reported in this issue of the journal was funded by the HS&DR programme or one of its preceding programmes as project number 16/47/22. The contractual start date was in September 2018. The final report began editorial review in October 2018 and was accepted for publication in March 2019. The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The HS&DR editors and production house have tried to ensure the accuracy of the authors' report and would like to thank the reviewers for their constructive comments on the final report document. However, they do not accept liability for damages or losses arising from material published in this report.

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