

# What works? Interventions to reduce readmission after hip fracture: A rapid review of systematic reviews

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Author post-print (accepted) deposited by Coventry University's Repository

**Original citation & hyperlink:**

Sutton, EL & Kearney, RS 2021, 'What works? Interventions to reduce readmission after hip fracture: A rapid review of systematic reviews', *Injury*, vol. 52, no. 7, pp. 1851-1860.

<https://dx.doi.org/10.1016/j.injury.2021.04.049>

DOI 10.1016/j.injury.2021.04.049

ISSN 0020-1383

Publisher: Elsevier

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## **Abstract (248/300 words)**

**Background:** Hip fracture is a common serious injury in older people and reducing readmission after hip fracture is a priority in many healthcare systems. Interventions which significantly reduce readmission after hip fracture have been identified and the aim of this review is to collate and summarise the efficacy of these interventions in one place.

**Methods:** In a rapid review of systematic reviews one reviewer (ELS) searched the Ovid SP version of Medline and the Cochrane Database of Systematic Reviews. Titles and abstracts of 915 articles were reviewed. Nineteen systematic reviews were included. (ELS) used a data extraction sheet to capture data on interventions and their effect on readmission. A second reviewer (RK) verified data extraction in a random sample of four systematic reviews. Results were not meta-analysed. Odds and risk ratios are presented where available.

**Results:** Three interventions significantly reduce readmission in elderly populations after hip fracture: personalised discharge planning, self-care and regional anaesthesia. Three interventions are not conclusively supported by evidence: Oral Nutritional Supplementation, integration of care, and case management. Two interventions do not affect readmission after hip fracture: Enhanced Recovery pathways and comprehensive geriatric assessment.

**Conclusions:** Three interventions are most effective at reducing readmissions in older people: discharge planning, self-care, and regional anaesthesia. Further work is needed to optimise interventions and ensure the most at-risk populations benefit from them, and complete development work on interventions (e.g. interventions to reduce loneliness) and intervention components (e.g. adapting self-care interventions for dementia patients) which have not been fully tested yet.

## **What works? Interventions to reduce readmission after hip fracture: a rapid review of systematic reviews.**

Approximately 66,000 people sustained a hip fracture in 2018 in England, Wales and Northern Ireland<sup>1</sup> with a further 7,146 in Scotland.<sup>2</sup> Having a mean age of 81, 30% of them are very frail and live in residential or nursing homes.<sup>3</sup> While mortality rate is falling<sup>1</sup> – the readmission rate is rising every year.<sup>4</sup>

In 2018/19, 7,612 people in England (14.09%) were re-admitted within 30 days of their hip fracture<sup>5</sup> and 18.6% of them died during their readmission.<sup>6</sup> Readmission is also extremely expensive for the NHS, with an average length of stay for each readmission after hip fracture of 8.7 days,<sup>6</sup> costing approximately £14,701,816 annually.<sup>7</sup> Readmission is considered a priority by the National Clinical Guidelines for management of hip fracture in adults as highly relevant to the NHS.<sup>3</sup>

Readmission can be caused by post-operative complications, of which between 17%<sup>6</sup> and 38%<sup>8</sup> are thought to be avoidable.<sup>9</sup> Preventable causes of readmission can be medical – including constipation; C difficile infection; pressure ulcers; urinary tract infection; respiratory infection; sepsis; electrolyte imbalance and congestive heart failure, or surgical including surgical failures (e.g fixation failure); bleeding and wound infection.<sup>6,8,10</sup> Fourteen record-review studies together indicated that the causes of these adverse events include: error in operative management; monitoring errors; incorrect or delayed treatment; non-adherence to pathways; diagnostic error; medication error; anaesthesia error; and discharging too early.<sup>8</sup> Understanding the causes of preventable readmission can allow us to speculate what is needed to remedy systematic failures which may lead to readmission.

The aim of this review is to summarise the evidence to date for which interventions can effectively reduce emergency readmission for hip fracture patients.

### **Methods**

This is a rapid review<sup>11</sup> using two databases (the Ovid SP version of Medline and Cochrane Database of Systematic Reviews), and one reviewer (ES) for article selection. A second reviewer (RK) verified data extraction from a random selection of four included articles. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement provided a framework for us to follow to ensure quality of reporting.

#### *Eligibility criteria:*

- Systematic reviews (published at any time and on-line ahead of print) reporting an intervention to reduce avoidable readmissions of elderly patients (over 60 years) with a surgically managed hip fracture (As defined by the National Hip Fracture Database).

#### *Exclusions:*

- Protocols for systematic reviews
- Reviews where the median age of patients in included studies is less than 60.

- Non-English language

### *Search strategy:*

We searched the Ovid SP version of Medline and the Cochrane Database of Systematic Reviews on 13<sup>th</sup> June 2020 (supplementary file 1).

### *Analysis:*

Included reviews are described narratively. A pre-defined data extraction table was used (Table 1). Pooled relative risk ratios (and odds ratios) of individual systematic reviews were extracted. When hip fracture patients represented a proportion of patients within the included review, we did not re-calculate odds ratios to apply them only to the hip fracture population. Where pooled odds ratios (OR) and risk ratios (RR) are presented they represent pooled data from *all* included papers. We have reported separate RR's for included trials reporting on hip fracture populations when they are available.

### **Results**

The titles and abstracts of 915 studies were searched. The full text of 137 articles were retrieved and 19 systematic reviews were included. The PRISMA diagram reports the phases of article identification and selection (figure 1).

### *Description of studies*

Eighteen reviews were included. Four were Cochrane reviews<sup>12,13,14,15</sup> and three reviews exclusively included studies which recruited hip fracture patients.<sup>15,16,17</sup> The 19 included reviews were published between 2007 and 2020. A total of 156 randomised and non-randomised controlled trials which evaluated readmission data were included and 33 other studies (retrospective cohort studies, before and after studies and time series). Included studies were conducted in 18 countries: United States, Canada, Australia, New Zealand, United Kingdom, Spain, France, Belgium, Denmark, The Netherlands, Sweden, Switzerland, Germany, China, Taiwan, Israel, UAE and Hong Kong. Data extraction for included reviews can be viewed: table 1.

### *Timing of readmission*

We have defined early readmission as within 30 days of discharge.<sup>18</sup> Late readmissions are after 30 days. Early and late outcomes are reported in table 1.

### *Number of interventions and type of staff*

Leppin et al<sup>18</sup> concluded that self-care interventions with at least five unique, component activities reduce readmission to a greater degree [RR 0.63, 95% CI 0.53 to 0.76] than those which did not [RR 0.91, 95% CI 0.81 to 1.01]. Interventions delivered by a multi-disciplinary team of at least two individuals were more effective at reducing readmission.<sup>18</sup> Similarly, Radowski et al (2017) report multi-component discharge planning interventions are more likely to reduce readmission as 14/15 included studies had two components and 9/15 had

more than two components. When interventions were implemented by teams (which included the patients and their family and specialist staff members), they were more likely to reduce readmission.<sup>19,20</sup>

*What interventions reduce readmission for older people?*

### **Individualised discharge planning**

Discharge planning was evaluated in six reviews, which analysed 21 unique clinical trials. A significant reduction in readmission was found in:

- 12 trials evaluated by Shepheard et al<sup>13</sup> (RR 0.82, 95% CI 0.73 to 0.92)
- 15 RCTs evaluated by GonCalves-Bradley et al<sup>14</sup> (RR 0.87, 95% CI 0.79 to 0.97)
- Seven RCTs reported by Fox et al<sup>21</sup> (RR 0.78, 95% CI 0.69 – 0.90 - pooled data includes two trials on hip fracture: Choong et al (2000) OR 0.34 95% CI [0.07- 1.61] and Lin et al (2009) OR 0.92 95% CI [0.14- 6.05])
- Nine trials analysed by Rodakowski et al<sup>19</sup> (overall [RR] 0.75 [95% CI, 0.62-0.91], pooled results include two trials on hip fracture: Shyu et al (2005) RR 0.56 95% CI [0.20-1.57] Huang et al RR 0.29 95% CI [0.10 -0.83].)
- Two trials analysed by Morilla-Herrera et al<sup>22</sup> (Naylor et al<sup>23</sup> and Naylor et al<sup>24</sup>(P: 0.047).

Discharge planning was described differently across all studies. Common components included: a member of staff to 'champion' the discharge process (a discharge advocate or case manager); a patient held discharge plan (with calendar for appointments, medication schedule, contact phone numbers; discharge plan faxed/sent to the primary care team; a monitoring team to check adherence to discharge plan). Telephone calls for outreach or monitoring were conducted between 24 hours and 4 days after discharge. Rodakowski<sup>19</sup> concluded that involving carers promotes better organisation of post-discharge care; adherence to care plans; and relationships with healthcare professionals.

Patient and carer involvement includes: giving training to informal care-givers, providing opportunity for carers to ask questions about wound care and medicines, and connecting patients and carers to community NHS and charity resources.

Preyde et al<sup>25</sup> found discharge planning to have no effect on readmission ([OR 0.73 (95% CI = 0.53–1.01, p = 0.06 – 15 trials).<sup>25</sup> However, removing one RCT from the analysis alters the OR to suggest that discharge planning does reduce readmissions. Additionally, when GonCalves-Bradley et al<sup>14</sup> adjust their odds ratios to calculate the impact on readmission for people are readmitted after a fall, their results are less convincing (RR 1.36, 95% CI 0.46 to 4.01).

### **Self-care**

In a review of 42 RCT's (36 of them unique to the 21 trials identified above), Leppin et al<sup>18</sup> found that self-care lowered readmission rate [RR 0.68, 95% CI 0.53 to 0.86]. Self-care was not described, except that it is burdensome and would be enhanced by highly supportive discharge procedures because after a traumatic event patient's capacity for self-care is often low.

### **Regional anaesthetic**

Chen et al<sup>17</sup> describe a significant reduction in readmission rate in geriatric patients undergoing surgery for hip fracture who received regional anaesthetic (OR=1.09; 95% CI 1.01–1.18; P=0.03 – 3 trials). Regional anaesthesia involves a spinal, epidural or nerve block and was compared against general anaesthesia or combined local anaesthesia and spinal/epidural anaesthesia.

### ***Mixed assessment and rehabilitation units (geriatric orthopaedic rehabilitation units (GORU) and Nurse led-inpatient units (NLU's)***

NLU's and GORU's are both in-patient rehabilitation units where nurses assume the management and leadership. Emphasis is placed on 'therapeutic activities' and there can be high involvement from physiotherapy, occupational therapy and social work. In an analysis of five RCTs Halbert concluded that GORU's do not reduce readmission rates when compared with usual care for elderly patients with hip fracture.<sup>16</sup> However, in a review by Griffiths et al,<sup>26</sup> nurse-led inpatient units during post-acute intermediate care have been shown to be effective – the pooled results of nine random or quasi random controlled trials (n=1669) showed reduced odds of readmission (OR 0.52 95% CI 0.34–0.80), as did the one trial on hip fracture (Hall et al OR 0.37 [0.18-0.74]).

### ***Oral nutritional supplements (ONS)***

Stratton et al<sup>27</sup> examined 8 RCTs to show that ONS in hospital and in the community can significantly reduce readmissions to hospital in patients with a mean age of 77 – 85 (OR 0.59, 95% CI 0.43–0.80, P = 0.001). In 1/8 trials readmission after hip fracture patients was examined (Miller et al 2006 OR 0.47 [8 0.07 - 2.879] P = 0.421).<sup>27</sup> Recruited patients were malnourished or at risk of becoming malnourished and there was no significant effect of amount of supplement (475 – 1200 Kcal), or duration (6 weeks to 1 year).

Rasmussen et al<sup>28</sup> found that increasing ONS with multi-disciplinary in hospital support did not significantly reduce readmission for patients with a mean age of 72 – 85 during the intervention (OR 1.04 (0.40, 2.70)) or at 26 weeks (OR 0.84 (0.18, 3.82)). In a Cochrane review by Avenell et al<sup>15</sup> on nutritional supplementation for hip fracture patients, 2/41 RCTs examined readmission. Interventions included: testing education from a dietician, phone calls after discharge, a protein enriched diet and two bottles of ONS daily between main meals (Wyers et al)<sup>29</sup> and supplementation at breakfast with cholecalciferol (vitamin D3) and calcium carbonate capsules (Bischoff-Ferrari et al.)<sup>30</sup> Wyers<sup>29,31</sup> show a non-significant effect of ONS on readmission at 6 months. However, Bischoff-Ferrari et al<sup>30</sup> show a significant (39%) reduction in readmission in patients taking a 2000 IU/d dosage of cholecalciferol (95% CI, –62% to –1%).

### ***Integration of care (also called continuity of care and transitional care)***

Integration of care involves co-ordinating care over time between acute and community settings. Interventions are usually carried out by specialised staff such as advanced or geriatric nurses and can include tailored (individualised) hospital care which continues into the community post discharge. Strategies used to deploy the intervention can include:

communication aids, home visits, telephone follow up, self-care, a transitional care models, and complete and accurate discharge summaries. Hickman et al report a lower rate of readmission at 3 months post discharge in 2/3 RCT's (pooled results not provided).<sup>20</sup>

### ***Case management***

A case manager is a person who is involved in a single patient's entire episode of care<sup>32</sup> but it can also involve multiple professionals who work collaboratively<sup>33</sup> which can involve individualising each patients management.<sup>22</sup> Morilla-Herrera et al<sup>22</sup> describe three clinical trials. Naylor et al<sup>23</sup> (an RCT including 363 patients) describe a multifaceted intervention which included case management but also health screening, discharge planning, telephone follow up, program design, support for patients and carers and health education. Intervention patients time to first readmission was longer (Cox regression incidence density ratio: 1.65 95%CI: 1.13–2.40) and readmissions were lower (104 vs 162, P: 0.047.) Rosted et al<sup>34</sup> (an RCT with 271 patients) describe nurse led case management consisting of an assessment and problem solving intervention. While they don't name this activity as case management, it is recognised as this by Morilla-Herrera et al.<sup>22</sup> In the third study, Naylor et al<sup>24</sup> (an RCT with 239 patients) describe an intervention given to older patients with heart failure which included the same items listed in their 1999 study (see above). Patients receiving case management experienced longer time to readmission (Cox regression incidence density ratio: 1.65, 95% CI: 1.13–2.40) and fewer readmissions (104vs162, P: 0.047). In all three trials case management was implemented by specialist nurses.

*Which interventions do not effect readmission?*

### ***Fast-track or Enhanced Recovery After Surgery (ERAS)***

One review included six observational/quasi experimental studies<sup>35</sup> with 5/6 reporting on an elective elderly surgery population and 1/6 reporting on emergency admission for hip fracture.<sup>36</sup> There was no significant difference in readmission between ERAS and the control group [OR, 1.06; 95% CI, 0.92 to 1.22].<sup>35</sup>

### ***Comprehensive geriatric Assessment (CGA)***

CGA is defined as a multi-disciplinary team approach to address medical illness, physical decline, and social factors which may slow recovery. Three reviews<sup>37,38,39</sup> showed that CGA makes little or no difference to readmission rates (for OR's see table 1).

## **Discussion**

This review has identified nine interventions that have been evaluated to reduce emergency readmission for hip fracture patients. Of those identified, individualised discharge planning, self-care and regional anaesthesia are all operating across the NHS and the evidence to date supports these interventions. Significant reductions in readmission were found after implementing personalised discharge planning (meta-analysis of 21 unique clinical trials), self-care (42 trials) and Regional anaesthesia (3 trials). The National Institute for Health and Care Excellence (NICE) regards discharge planning and self-care as a central part of hip



fracture patients' rehabilitation.<sup>3</sup> NHS England's discharge to assess process<sup>40</sup> encourages all discharges to include: a discharge plan tailored to the individual, transfer of discharge plan to primary care provider, a single co-ordinator to secure timely discharge on the appropriate pathway, and monitoring of adherence to discharge plan. NICE also recommends that patients are offered a choice between spinal or general anaesthesia, because systematic review (Guay et al)<sup>41</sup> shows they may both be effective for hip fracture patients.

Other interventions are not conclusively supported by evidence. Older people with a hip fracture are often malnourished and the NICE hip fracture management guidance<sup>3</sup> recommends using the NICE nutrition support guidelines. Yet the literature on the use of ONS in both hip fracture and general elderly populations show mixed results. Gomes et al<sup>42</sup> (in an updated version of the review we presented by Stratton et al<sup>27</sup>) evaluated 27 trials with elderly populations (not hip fracture patients) and ONS was still found to reduce readmission (RR 0.76; 95%CI, 0.60-0.96). However, a Cochrane review by Avenell et al found no significant difference between groups receiving ONS and usual care.<sup>43</sup> Similarly when integrated care has been tested in general elderly populations, some reviews demonstrate a significant effect on readmission,<sup>44,45,46</sup> and others do not.<sup>47,48</sup> While the evidence for nutritional support is mixed, we believe there are methodological issues which could be addressed within future research to create a stronger evidence base. For example, the literature is not yet clear on which intervention type is achieving the effect (ONS, dietary counselling, phone calls, or vitamin D3.) Also, methodological problems including selective reporting and small sample sizes could be resolved in future trials

Hip fracture is one of many reasons for elderly people to be admitted to hospital. We identified 39 systematic reviews which describe interventions to reduce readmission in a more general elderly population (Supplementary file 2). It may be useful for service providers, commissioners and researchers to consider these interventions before designing an implementation program to solve the problem of readmission after hip fracture. For example, the prevalence of pre-operative heart failure is 27% in the hip fracture population (with 21.3% of hip fracture patients expected to have heart failure at one year).<sup>49</sup> Two systematic reviews show that telephone support for heart failure patients (non-invasive tele-monitoring and structured tele-monitoring) can significantly reduce readmission.<sup>50,51</sup> Additionally, hip fracture patients may present with multiple medications. Medicines adherence (which include patient education, not monitoring of medicine taking behaviours) has a significant effect on readmission.<sup>52</sup> However, medicines reconciliation (creating an accurate list of all medicines at all transition points to ensure the correct medication is given) has a weak effect on readmission in general elderly populations (RR 0.72, 95% CI 0.44 to 1.18)<sup>53</sup> RR 0.95 (95% CI 0.87 to 1.04.)<sup>54</sup>

When deciding which interventions to implement, they should be considered in a broader context. First, their impact across other metrics. For example, in the elderly, discharge planning reduces readmission and length of stay, but not mortality,<sup>13,14</sup> but self-care can reduce readmission, and mortality for elderly heart failure patients.<sup>55</sup> Second, the local context in which the intervention is operating. Interventions may fail due to: lack of staff engagement, training and leadership, which can be avoided by: educational tools;



empowerment of staff; and specialised staff such as pharmacists and advanced nurses.<sup>10,22</sup> Third, the national context in which the intervention is operating. In the UK, the Best Practice Tariff (BPT) uses financial incentives to encourage hospitals to meet key performance criteria such as prompt orthogeriatric assessment and prompt surgery. The BPT has reduced the annual trend of increasing 30-day readmissions by 1.3 percentage points,<sup>9</sup> but readmission rates, at 14.09% are still too high and local work to remedy this must be prioritised. This local work could be implemented through improvement projects as well as research to identify what needs to change and support and speed up that change.<sup>56</sup> However, to create and sustain local change, practitioners must be supported by host organisations who are proactive, forward thinking and nurture entrepreneurial thinking.<sup>57</sup>

Service providers also need to know *how* to implement effective interventions – what should be included and how should its components be combined? For example, four components of self-care can reduce readmission in elderly populations: 1) education/coaching for medicines continuity;<sup>58</sup> 2) dieting;<sup>59</sup> 3) education (signs and symptoms of heart failure, medication adherence and daily weighing);<sup>60</sup> and 4) ‘life-style modification’ (goal setting, planning, self-monitoring and feedback). Greatest impact on life-style was achieved when all four ‘life-style’ strategies were implemented.<sup>55</sup> Some components may need further development – for example, adaptations for dementia patients is severely lacking.<sup>61</sup> We must also heed the warning being a patient creates work (seeking out extra information and support). Therefore care must be taken to avoid unintended consequences of poorer health by implementing self-care packages which may be burdensome.<sup>18</sup>

Service providers must also be clear which interventions do not affect readmission. Enhanced Recovery pathways,<sup>62</sup> comprehensive geriatric assessment (CGA),<sup>12,63,64</sup> hospital at home<sup>65,66,67</sup> and community rehabilitation interventions<sup>68</sup> do not impact readmission for elderly patients. However, it is possible that small sample sizes and heterogeneity has caused the outcome of no effect, and further studies may be required. Some interventions have not been fully tested yet. It is not known whether increasing GP practice size, employing GPs in the Emergency Department, implementing rapid response teams, rehabilitation programmes, employing community pharmacists, orthogeriatrician involvement, non-paid carers, early supported discharge, ‘Home first’ and ‘Discharge to assess (D2A)’ programs, and interventions to address loneliness (smaller social networks are associated with higher readmission rates)<sup>69</sup> effect readmission for older people.<sup>3,51,69</sup> There is more work to be done to understand which combination of interventions can effectively keep patients who do not need to be in hospital, out of hospital.

Who would benefit most from an intervention is also an important question. The root cause of avoidable readmissions involves hard to capture events relating to the culture of the organisation, case load of the staff, handover techniques and teamwork.<sup>70</sup> Ninety-four predictive models exist to estimate readmission risk across all surgical patients.<sup>71</sup> However, further innovation is needed to ensure practitioners can use these models appropriately. Therefore, rather than targeting specific patient groups, it may be better to design interventions which can be delivered to all hip fracture patients.

There are limitations to our rapid review. Fifteen reviews were excluded based on the included studies having a median age lower than 60. This is a rapid review and we needed the majority of papers to target the elderly population so that the labour intensive process of re-calculating RR/OR's to include only the studies with an appropriate mean age could be avoided. There is some possibility that articles would have been missed by using only two data bases and limiting to the English language. We limited the article selection and data extraction to a single reviewer, with the exception of four papers which were verified by R.K.S. However, we believe that our method is reasonably comprehensive for a review which was needed to complete within a tight timescale and we are prepared to tolerate that when rapid reviews are compared to full reviews, conclusions change between 8 and 27% of cases.<sup>11</sup> We also acknowledge that methodology used by the trialists to capture readmission data is variable and this may create inaccuracies. For example, Bischoff-Ferrari et al<sup>30</sup> used a combination of monthly phone calls and a patient diary to collect readmission data. Other studies used readmission data from the coding teams at each hospital site.

## **Conclusion**

Elderly patients with a hip fracture account for more orthopaedic bed days than all other fractures combined.<sup>1</sup> Therefore, reversing a trend towards rising readmission rates is especially important at this time of unprecedented pressure to maintain effective orthopaedic services. We have identified three interventions to be most effective at reducing readmissions in older people: discharge planning, self-care, and regional anaesthesia. Interventions which are not conclusively supported by the evidence include: rehabilitation units, oral nutritional supplements and integrated care. Further work is needed at ward level to optimise local interventions and ensure the most at-risk populations benefit from them.

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