Review

Interventions to reduce injuries when transferring patients: A critical appraisal of reviews and a realist synthesis

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ABSTRACT

Objectives: There has been extensive investment in programmes to reduce injuries among health care staff caused by moving and handling patients or residents. Given conflicting evidence regarding the effectiveness of such programmes, the present paper conducted a critical appraisal of systematic reviews assessing the effectiveness of interventions in reducing back pain and injuries among healthcare staff. A realist synthesis was conducted on a second set of reports to identify best practices for moving and handling programmes.

Design: A critical appraisal of systematic reviews and a realist synthesis to identify best practices for moving and handling programmes.

Data sources: A literature search of five databases (Medline, EMBASE, CINAHL, PsycINFO and ScienceDirect) located 150 reports assessing programme outcomes published in refereed journals between 2000 and 2013.

Review methods: The critical appraisal included six systematic reviews. The realist synthesis included 47 studies that provided descriptive information about programme mechanisms.

Results: Five of the six systematic reviews covered interventions involving either staff training or training and equipment supply. One review covered multi-component interventions. All concluded that training staff by itself was ineffective. There were differing conclusions regarding the effectiveness of training and equipment interventions and multi-component programmes. The reviews provided little information about the content of programme components. The realist synthesis noted the need for management commitment and support, and six core programme components; a policy requiring safe transfer practices, ergonomic assessment of spaces where people are transferred, transfer equipment including lifts, specific risk assessment protocols, adequate training of all care staff, and coordinators coaches or resource staff. These programme components are likely to be synergistic; omitting one component weakens the impact of the other components.

Conclusions: Five systematic reviews provided little information regarding the core components of effective programmes. Given the absence of experimental trials for multi-component programmes, the best available evidence for the effectiveness of multi-component programmes is from pre-post studies and large-scale surveys. The realist synthesis provided detailed information about the core components for effective programmes. Further studies, which include qualitative data, are needed to provide evidence about the specific mechanisms through which components contribute to effective patient handling programmes.

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What is already known about the topic?

- Interventions based solely on training care staff do not reduce back pain or injuries resulting from patient transfers.
- There is conflicting evidence regarding interventions comprising training plus equipment and multi-component interventions.
- As moving and handling programmes are complex interventions, systematic reviews should assess the extent to which reported interventions are adequately described.

What this paper adds

- Most systematic reviews did not adequately assess descriptions of the interventions in the trials reviewed. This reduces the credibility of these reviews.
- A realist synthesis identified six core components or mechanisms needed for effective moving and handling programmes; a policy requiring safe transfer practices, ergonomic assessment of spaces where people are transferred, transfer equipment including lifts, specific risk assessment protocols, adequate training of all care staff, and coordinators coaches or resource staff.
- Given the absence of experimental trials for multi-component programmes, the best available evidence is from pre-post studies and large-scale surveys. Findings from these studies provide support for the effectiveness of multi-component programmes.

1. Introduction

Evidence from multiple research studies and reviews indicates that health carers, such as registered nurses, nurse aides and residential care staff, have high injury rates, particularly back pain and musculoskeletal injuries (Dawson et al., 2007; Haladay et al., 2012; Tullar et al., 2010). Injuries to health carers most commonly occur while moving or transferring patients (Alnaser, 2007; Engkvist, 2008; Waters et al., 2006). Findings from a Canadian study indicated that care aides had the highest annual injury rates in every setting, the highest rate being in nursing homes (37.0 injuries per 100 full time equivalent staff – FTE). For registered nurses, the highest injury rates (21.9 per 100 FTE) occurred in acute care. Musculoskeletal injuries comprised the largest proportion of total injuries among health care staff. Care aides have the highest risk of injuries as their jobs mostly involve transferring and repositioning tasks during patient care ( Alamgir et al., 2007).

Health care staff such as care aides and nurse aides, with less training, lower status and having less control or support in their workplace, have the highest rates of injuries (Eriksen et al., 2004; Pompei et al., 2008). Higher daily frequency of patient handling increases the risk of back pain among staff with existing sub-chronic lower back pain (Holtermann et al., 2013). These two factors could be interrelated; lower status and less trained staff are more likely to carry out patient handling tasks (Kim et al., 2012).

There are initiatives in many countries to reduce patient handling injuries and associated costs among staff in healthcare facilities. Moving and handling programmes usually include multiple components such as providing equipment, training health care staff, risk assessments and an organisational policy that requires staff to use equipment and low-risk techniques. Health and residential care facilities in countries such as the UK, Canada and Australia have implemented programmes. For example, in Wales the Manual Handling Training Passport and Information Scheme includes training as a requirement for all employees who transfer objects or clients, during their everyday work (Welsh Assembly Government, 2009). A recent survey of 361 critical care nurses in the United States indicated that 46% had patient lifting equipment in their workplace (Lee et al., 2013).

In the UK, Australia and some states in the USA, there is now legislative enforcement for implementing moving and handling programmes to reduce injuries (American Nurses Association, 2013; Hudson, 2005). In countries without specific legislation, health and safety standards for workplaces may lead to the implementation of safe patient handling programmes (Hignett et al., 2007).

Two key drivers for the development of programmes to reduce injuries to carers resulting from patient handling have been concerns about the costs of employee injuries and continuing development of specialised equipment for moving and handling people. Significant reductions in injuries costs, following interventions to reduce injuries, have been reported in several papers (Chhokar et al., 2005; Lahiri et al., 2013; Park et al., 2009). Interventions have included the introduction of ceiling lifts (Chhokar et al., 2005; Miller et al., 2006), mobile floor lifts (Li et al., 2004) and implementation of a safe resident handling programme that included lifts, employee training and evaluation in 110 nursing homes (Lahiri et al., 2013). One indicator used in studies of costs is ‘payback time,’ which is the time for savings from reduced injury costs to exceed the costs of implementing a moving and handling programme. Payback time has been reported to be around 2–3 years in several pre-post studies (Chhokar et al., 2005; Collins et al., 2004; Lahiri et al., 2013). The systematic review by Tompa and colleagues, with three health care studies, concluded that there was ‘moderate evidence that ergonomic interventions are worth undertaking for economic reasons’ in the health care sector (Tompa et al., 2010, p. 230).

Over the last 15 years or so there have been major developments in specialised equipment for moving and handling people. These include; electric beds, mobile lifts (hoists), ceiling lifts and sit-to-stand lifts (Darragh et al., 2013; Kim et al., 2009). Other equipment includes lateral transfer devices, such as transfer boards, slide sheets and air-assisted devices (Baptiste et al., 2006). Many interventions in health care and residential care facilities have had a primary focus on providing equipment such as ceiling lifts and/or mobile lifts to reduce physical strain on staff while transferring patients or residents (Collins et al., 2004; Evanoff et al., 2003; Koppelar et al., 2012; Miller et al., 2006). One of the key indicators associated with reduced injuries is the availability of lifting equipment.
when it is needed (D’Arcy et al., 2012). Given the increasing emphasis on the use of equipment for moving and handling people with impaired mobility, equipment provision is a core component for multiple-component interventions (Hignett, 2003a).

Conclusions from several systematic reviews – regarding the ineffectiveness of training-based interventions – stand in contrast to the widespread adoption of moving and handling programmes, many of which include a training component. Two reviews concluded that while interventions based on training or advice alone have no effect in reducing back pain and musculoskeletal injuries among healthcare staff, multifactor interventions may be effective (Hignett, 2003a; Tullar et al., 2010). Two other reviews concluded that training by itself is ineffective, and that there is no evidence (Martimo et al., 2008), or conflicting evidence (Dawson et al., 2007), that interventions combining training with lifting equipment prevent back pain or injuries.

Given extensive investment in programmes to prevent work-related injuries associated with patient moving and handling, there is a need to assess the apparent conflicting evidence regarding the effectiveness of specific programme components, especially in relation to training staff and providing equipment.

1.1. Evaluation of complex interventions

Most initiatives to prevent back pain and injuries are complex interventions with multiple components (Hignett, 2003a). Complex interventions may include multiple behaviours by those delivering or receiving the intervention, multiple groups and organizational levels involved in delivering the intervention and flexibility or tailoring of the intervention within specific organisations (Craig et al., 2008). Programmes for moving and handling people typically involve two or more components requiring a range of different behaviours. These include; an organisational or management policy supporting safe moving practices (e.g. a no-lift policy), specialised equipment (e.g., slide sheets, ceiling lifts, mobile or floor lifts), risk assessment requirements, training of staff, and use of specific transfer techniques.

There are substantial limitations with systematic reviews where neither the individual studies included nor the reviews adequately describe the components or mechanisms comprising the interventions (Campbell et al., 2007; Oakley et al., 2006). Trials or studies which fail to describe the intervention have been referred to as ‘black box’ evaluations, where the specific features of the intervention are not described in sufficient detail for replication (Astbury and Leeuw, 2010; Campbell et al., 2007).

There is a growing literature discussing strategies for the evaluation of complex interventions (Campbell et al., 2007). In 2008, the Medical Research Council (MRC) in the UK provided updated guidance for the evaluation of complex interventions (Craig et al., 2008, 2013). The MRC Guidance noted that non-experimental evaluation designs may be appropriate and that reports “should include a detailed description of the intervention to enable replication, evidence synthesis, and wider implementation” (Craig et al., 2013). Trials need to document programme mechanisms when assessing complex interventions and address reporting guidelines for such interventions (Glasiou et al., 2008; Möhlen et al., 2012). For example;

- Unless the trials illuminate processes and mechanisms they often fail to provide useful information. If the result is negative, we are left wondering whether the intervention is inherently ineffective (either because the intervention was inadequately developed or because all similar interventions are ineffective), whether it was inadequately applied or applied in an inappropriate context, or whether the trial used an inappropriate design, comparison groups or outcomes (Campbell et al., 2007).

A notable feature of reports evaluating outcomes from patient handling training and interventions that include training has been sparse or absent descriptions of the key features of interventions. Such features include; the types of equipment provided, details of training provided (e.g., duration of training, hands-on training involving trainee practice), whether a “no-lift” or similar organisational policy was implemented and whether patient assessments and risk assessments were required. For example, a report of a training intervention failed to note the extent to which equipment was provided (Peterson et al., 2004). In equipment-focussed interventions, reports often fail to state whether the training provided included both demonstration and practice by trainees in the use of equipment (e.g., Martin et al., 2009; Miller et al., 2006; Ronald et al., 2002). The problem of inadequate description of complex interventions is a widespread problem in both individual study trials and systematic reviews (Glasiou et al., 2008).

1.2. Review objectives

The specific objectives of the present review were to:

1. To provide a critical appraisal of evidence from multiple systematic reviews on the effectiveness of single and multi-component interventions for reducing patient handling injuries among health care staff.
2. To conduct a realist synthesis to identify the ‘mechanisms’ (specific components) that make programmes effective or ineffective.

Patient handling, moving and lifting patients, patient transfers and patient repositioning are commonly used terms to refer to manual handling activities involving patients in health care. We use the term ‘patient handling’ generically to refer activities involving manual handling of people in any setting, including health care and residential care settings, both paid employees and unpaid carers.

Pawson and colleagues have described a ‘realist synthesis’ strategy for integrating findings from studies with diverse research designs using qualitative synthesis techniques (Pawson et al., 2004; Pawson and Manzano-Santaella, 2012). The purpose of realist synthesies is to
identify the specific contexts and mechanisms that influence outcomes in interventions. Realist synthesis has been used in systematic reviews and evaluations of interventions to explicate mechanisms using diverse sources (Byng et al., 2008; O’Campo et al., 2011). It is one of a number of strategies that can be used for qualitative synthesis (Barnett-Page and Thomas, 2009; Candy et al., 2011; Thomas and Harden, 2008).

2. Methods

2.1. Identification of systematic reviews for the critical appraisal

A literature search covered peer-reviewed journal articles published between January 2000 and July 2013. Given developments in equipment for moving people, and multi-component intervention programmes, over the last 10 years a focus on papers published since 2000 was appropriate for this review. Other systematic reviews, included in this analysis, have extensively covered studies published before 2000 (Dawson et al., 2007; Hignett, 2003a). Also, the initial MRC Guidance on complex interventions was published in 2000 (Campbell et al., 2000).

The keywords used in the search strings were:

(patient handling OR patient transfers OR manual handling) AND (injuries, musculoskeletal disorders, MSD) AND (intervention OR trial OR training OR evaluation)

Literature databases searched included; Medline, Embase, CINAHL, PsycINFO and ScienceDirect.

Further reports were manually located from reference lists of recently published papers. After screening to remove studies that did not include health care staff or did not assess intervention outcomes, there were 150 journal articles which reported on interventions to reduce back pain and musculoskeletal injuries in the health care sector.

Systematic reviews were included if they focused on primarily on studies reporting interventions to reduce injuries or musculoskeletal disorders (MSD) such as back pain among health care workers or included moving and handling among health care workers as an identified subgroup in analyses of manual handling interventions. Only reviews in English were included. Ten systematic reviews were located among the studies on patient handling.

Three systematic reviews on moving and handling programmes were excluded as their primary focus was not on outcomes from interventions. One focused on barriers and facilitators (Koppelaar et al., 2009). The second had a broader focus on workplace ergonomic interventions with economic evaluations (Tompa et al., 2010) and included only three studies in the health care sector, all which were included in other reviews. The third review (Hignett, 2003b) focussed on evidence for using specific patient handling techniques for patients starting in lying, sitting and standing positions. This review focused the forces involved when using specific techniques and equipment and did not focus on overall programmes or staff injuries as outcomes.

There were seven systematic reviews in the final set (Bos et al., 2006; Clemes et al., 2010; Dawson et al., 2007; Hignett, 2003a; Martimo et al., 2008; Tullar et al., 2010; Verbeek et al., 2012). The 2012 Verbeek review updated an earlier review by Martimo et al., leaving six independent reviews for inclusion in the critical analysis. Details of the methods for the Verbeek et al. (2012) brief summary review were published in an earlier Cochrane Review (Verbeek et al., 2011). Both the 2011 and 2012 Verbeek papers were included as a single review. The systematic reviews all used quality assurance criteria to screen studies for inclusion.

Some reviews included interventions involving exercise training for staff. Conclusions for interventions focused primarily on exercise training were not covered in the critical appraisal, as exercise training is a different type of intervention from training or multi-component interventions to reduce injuries resulting from patient handling.

2.2. Selection of studies for the realist qualitative synthesis

We used the framework for the process of a realist synthesis described by Pawson et al. (2004, Fig. 7). This framework involves the following stages:

- Define the scope of the review
- Search for and appraise the evidence
- Extract and synthesise findings
- Draw conclusions and make recommendations

Several appraisal approaches for selecting quantitative, mixed method and qualitative research studies were reviewed (e.g., Pluye et al., 2009) but none was suitable for the screening of studies for the realist synthesis as they did not include description of the intervention as one of the quality criteria. In a review of three quality appraisal methods for screening the quality of qualitative studies, it was reported that there was little agreement among the three methods (Dixon-Woods et al., 2007). The primary focus was on description of intervention components, similar to that reported in a previous realist reviews (e.g., O’Campo et al., 2011; Jagosh et al., 2011). O’Campo et al. used the presence or absence of ‘thick’ description of the intervention and its components as a key quality criterion. A paper on publication standards for realist syntheses also contained useful information and the selection approach described below was consistent with their recommendations for ‘Item 9, selection and appraisal of documents’ (Wong et al., 2013).

For the realist synthesis the original 150 reports (published between 2000 and 2013) were reviewed for inclusion or exclusion using two independent screening criteria. The first screening used two assessment phases described in previous realist analyses of published reports (Jagosh et al., 2011). The initial phase was identification of relevant reports, selected evaluations of patient handling intervention designed to reduce injuries to carers. In the second phase, descriptive quality assessment, papers were selected if they provided sufficient detail to identify features of the main intervention components. Using the identification criteria, 54 reports were selected for which the full-text paper was accessible. Following descriptive quality assessment, 34 of these reports were included in the analysis. Among the 20 excluded reports 16 contained
insufficient information about the intervention to be useful for the realist analysis, 2 did not focus on staff injuries as an outcome and 2 were redundant (reports of the same intervention as papers already included).

A second type of screening criteria was to select papers, not included during the first screening, reporting potentially usable qualitative or descriptive data about programme contexts and mechanisms for the realist synthesis. Only a few of the 34 studies included from the first screening explicitly collected qualitative or ‘descriptive’ data (e.g. Schoenfisch et al., 2011a). Additional papers were selected based on the extent to which they provided descriptive or qualitative details about programme context and operations, (e.g., Cornish and Jones, 2010; de Ruijer and Liaschenko, 2011). A further 13 reports, which contained information relevant to programme components and mechanisms, were included in the analysis making a total of 47 reports. Only six of the 47 reports explicitly used qualitative methods (as described in the data their collection procedures), three of these from the same research group (Schoenfisch et al., 2011a).

2.3. Analyses

For the critical analysis of the six systematic reviews a table was prepared collating the aims, study design and samples, types of interventions covered, primary outcome measures used in the studies reviewed and conclusions reached from the systematic review. Following this, the quality assurance criteria reported to assess studies included in the reviews, were described and appraised. A specific focus was the extent to which description of the intervention was included in quality assurance criteria.

The 47 reports for the realist synthesis were analysed using the NVivo (v10) qualitative analysis software. The analysis focussed on the contexts and mechanisms that were likely to influence staff behaviours when moving people, and their impacts on injuries to staff or patients. While the top-level categories were already evident (e.g., equipment, training, policy, risk assessment), a general inductive approach (Thomas, 2006) was used to identify specific programme mechanisms and contexts that were likely to reduce work-related patient-handling injuries, and to develop the ‘middle-range theories’ to describe these mechanisms.

3. Results

3.1. Systematic reviews: studies reviewed and conclusions reached

Table 1 lists the six systematic reviews included in the analyses. Only one review included a range of non-experimental studies (Hignett, 2003a). The other five reviews focussed only on RCTs or NCTs (non-controlled trials or cohort studies). Two reviews focussed primarily on “training” or “advice” interventions, covering training for handling both people and objects (Clemes et al., 2010; Verbeek et al., 2011). The Verbeek et al. review included both types of studies in a single analysis.

Four reviews included studies using physical exercise training (to increase the fitness of carers) as an intervention. Three reported separate analyses for interventions which included exercise training for health care workers (Bos et al., 2006; Dawson et al., 2007; Tullar et al., 2010) and one reported exercise training outcomes for manual handling across multiple occupations (Clemes et al., 2010).

The reviews by Bos et al., Hignett and Tullar et al. analysed multi-component intervention studies separately from single component studies and the Dawson et al. review analysed equipment provision plus training separately from interventions providing only training. In the Tullar et al. review, the multi-component interventions included three key components: an organizational policy aimed at reducing injuries associated with patient handling, purchase of lift or transfer equipment and a broad-based ergonomic training including safe patient handling and/or equipment usage. The Verbeek et al. study specifically excluded multi-component interventions except those where the primary focus was on training with equipment (assistive devices) provided.

There was moderate consensus on core outcome indicators, for which common generic descriptors were ‘musculoskeletal injuries’ and ‘back pain.’ Common specific measures reported in the reviews and study trials included:

- Self-reported back injuries or back pain
- Self-reported physical discomfort or fatigue
- Number of injuries taken from organisational records (whether a claim was made or not)
- Injury rates from organisational records over a specified time period (injury data adjusted for number of employees)
- Injury claim numbers from organisational records
- Injury claim costs (e.g. workers compensation) from organisational records
- Lost working days or restricted work days from organisational records or self-report
- Incident rates (injuries and other reported incidents such as near-misses)

Best practice when using injuries as an outcome measure is to use injury rates (adjusted for number of eligible employees) over a specified time period, in addition to reporting raw injury data (Tullar et al., 2010). Accurate comparisons across studies are not possible unless injury or back pain rates are reported. Four reviews (Clemes et al., Dawson et al., Hignett, Tullar et al.) noted that some studies did not report sample sizes in the intervention and control arms of experimental studies. This was particularly evident in studies where work groups or units were assigned to intervention or control arms.

Other measures related to intermediate outcomes from training and multifactor interventions included:

- Use of equipment (reported or observed)
- Observation of patient handling tasks
- Postural analysis of patient handling tasks
- Staff knowledge of low-risk transfer procedures

All the reviews concluded that there was little or no evidence that manual handling training by itself for health
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<th>Authors</th>
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<th>Study samples and interventions</th>
<th>Outcome measures</th>
<th>Conclusions</th>
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<tr>
<td>Bos et al. (2006)</td>
<td>Effects of interventions for preventing MS symptoms in health-care</td>
<td>13 studies; (3 RCT, 10 non-RCT) 6 using training alone, 7 training + ergonomic intervention</td>
<td>15 different outcomes most relating to MS symptoms</td>
<td>Training alone does not decrease MS (musculoskeletal) symptoms. Training combined with ergonomic interventions (equipment) can lead to a decrease in MS symptoms</td>
</tr>
<tr>
<td>Clemes et al. (2010)</td>
<td>Effectiveness of different approaches to training in manual handling</td>
<td>15 (of 53) studies involved health care staff (4 RCT, 11 NCT). Multiple types of training</td>
<td>Multiple, including back pain and injuries, observations of posture and technique</td>
<td>Manual handling training is largely ineffective in reducing back pain and back injury. Little evidence of the effectiveness of training for safe patient handling, either in nursing schools or qualified staff in the workplace</td>
</tr>
<tr>
<td>Dawson et al. (2007)</td>
<td>Assess the effectiveness of interventions to prevent back pain and back injury in nurses</td>
<td>8 studies (2 RCTs, 6 non-RCTs) of training for nurses, aides at workplaces/study. Training with or without equipment</td>
<td>Back pain and back injury</td>
<td>Manual handling training in isolation is not effective. There is conflicting evidence regarding manual handling equipment and training for preventing back pain and injury in nurses</td>
</tr>
<tr>
<td>Hignett (2003a)</td>
<td>To report intervention strategies to reduce risks associated with patient handling</td>
<td>63 studies of patient handling interventions (multiple designs). Categories were multifactor interventions, single factor interventions, and technique training</td>
<td>Working practices, absence from work, and injury rates</td>
<td>Interventions based predominantly on training have no impact on working practices or injury rates. Multifactor interventions, based on risk assessment, most likely to be successful. Seven strategies could form a generic programme. Patient handling training alone has no effect on MS health. Exercise interventions and multi-component patient handling interventions were recommended as practices to consider.</td>
</tr>
<tr>
<td>Tullar et al. (2010)</td>
<td>Effect of occupational health &amp; safety interventions in health care on musculoskeletal health status</td>
<td>6 studies on patient handling (2 RFTs, 3 non-RFTs, 1 pre-post). Separate analyses of multi-component and training programs</td>
<td>Musculoskeletal (MS) health status</td>
<td>None of the RCTs and cohort studies provided evidence that training and provision of assistive devices prevented low back pain when compared to no intervention or another intervention</td>
</tr>
<tr>
<td>Verbeek et al. (2011, 2012)</td>
<td>Effectiveness of advice, training and assistive devices in preventing and treating back pain in multiple occupations</td>
<td>18 studies (9 RCTs, 9 cohort) of which 12 included healthcare staff. Interventions from a single advice session to weekly training for 2 years.</td>
<td>Back pain, back pain-related disability or sickness absence</td>
<td>None of the RCTs and cohort studies provided evidence that training and provision of assistive devices prevented low back pain when compared to no intervention or another intervention</td>
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</table>
Table 2
Quality appraisal of studies: Description of interventions.

<table>
<thead>
<tr>
<th>Authors</th>
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<th>Quality rating used for description of intervention</th>
<th>Information about quality ratings for individual studies</th>
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<tr>
<td>Bos et al. (2006)</td>
<td>Criterion checklist based on van Tulder et al. (1997).</td>
<td>One of the 18 items in the checklist was “Explicitly described intervention”</td>
<td>Weighting of items not reported. Quality scores were not reported</td>
</tr>
<tr>
<td>Clemes et al. (2010)</td>
<td>27 item checklist developed by Downs and Black. 26 items were scored yes (1) or no (0). Total score out of 32, converted to a percentage score</td>
<td>A rating of 0 or 1 was given to the item, Are the interventions of interest clearly described? This comprised 1/32 of the quality rating</td>
<td>Overall quality ratings for the 15 healthcare personnel studies ranged from 41 to 81/100. Ratings for intervention description were not reported</td>
</tr>
<tr>
<td>Dawson et al. (2007)</td>
<td>Quality of studies evaluated using criteria recommended in relevant guidelines and adapted for the review. Total score out of 12.</td>
<td>A rating of 1 (yes) or 0 (no) was given for the item, index and control interventions clearly described, comprising 1/12 of quality score</td>
<td>Four of the 8 studies on manual handling training were given a rating of 1 (yes) for describing the intervention</td>
</tr>
<tr>
<td>Hignett (2003a)</td>
<td>Used modified critical appraisal tool developed by Downs and Black. Extended to suit observational studies</td>
<td>Not described in detail Assumed to be 1/32 from criteria described by Downs and Black</td>
<td>Overall quality rating reported as percentages (20%–100%). Description ratings not reported</td>
</tr>
<tr>
<td>Tullar et al. (2010)</td>
<td>19 quality appraisal criteria developed by review team giving a total score out of 47. This was converted to a percentage score</td>
<td>A rating from 0 to 3 was given for the description of the intervention, comprising 3/47 of the total rating</td>
<td>All 16 included studies were rated as 1 (low) on the scale from 0 to 3 for intervention description</td>
</tr>
<tr>
<td>Verbeek et al. (2011)</td>
<td>Used the ‘risk of bias’ criteria recommended by the Cochrane back review group (12 items scored yes/no/don’t know).</td>
<td>No rating for description of intervention. The 2008 review rated training methods as; A = least engaging B = moderately engaging C = most engaging (Martimo et al., 2008)</td>
<td>‘Risk of bias’ items scores reported. The reported training ratings in the 2008 review were: A – 1 study B – 6 studies C – 0 studies ‘unclear’ – 4 studies</td>
</tr>
</tbody>
</table>

care staff (patient handling training) was effective in reducing the outcomes of interest (back pain or injuries among staff). Three of the reviews (Bos et al., Hignett, Tullar et al.) concluded that there was moderate support for multi-component interventions (that include training) reducing the injury outcomes, one review reported conflicting evidence regarding ‘manual handling equipment and training’ (Dawson et al.), one review concluded there was no evidence supporting the effectiveness of “training and assistive devices (Verbeek et al.) and one review did not include assessment of multi-component interventions (Clemes et al.).

3.1.1. Quality appraisal criteria used in reviews

Table 2 shows the quality appraisal criteria used to select papers for inclusion in the final set of studies included in the six reviews. It includes information about the extent to which description of the training or other intervention components formed part of the quality appraisal and whether any information was reported about the quality of the description ratings.

All reviews used quality appraisal criteria to screen out studies with low quality ratings and provide a quality score for the studies reviewed. Three reviews included details about the weighting given to the description of the intervention as part of the quality appraisal of selected studies (Clemes et al., Dawson et al., Tullar et al.). In these reviews, the weighting of the description ranged from 1/12 to 1/32 of the total quality rating score. Two reviews reported specific quality scores for descriptions of the intervention. As shown in the right-hand column in Table 2, these quality scores were reported as either all of ‘low quality’ (Tullar et al.) or absent for 4 out of 8 studies (Dawson et al.). The Clemes et al. study did not report ratings for the intervention description. The Verbeek et al. review used a ‘risk of bias’ quality appraisal and did not report inclusion of description of the intervention. The Bos et al. review did not provide any information for weightings used in the quality appraisal or any quality scores. The Hignett review reported the types of intervention components used in each of the included studies but did not report ratings for the quality of the intervention description.

The systematic review by Dawson and colleagues reported description ratings. For the subset of eight trials on manual handling interventions, four were rated as ‘yes’ on the item ‘index and control interventions clearly described’ (Dawson et al., 2007). Some studies rated as ‘yes’ on the intervention description contained relatively little detail about the training included in the intervention.

In summary five of the six reviews included an item in the quality appraisal regarding description of the intervention. Only two reviews reported the description quality ratings for the individual studies included in the review. Lack of an ‘adequate’ description of the intervention was not used in any of the reviews to exclude studies from the final set included in these reviews.

3.2. Critical appraisal of the systematic reviews

Most studies included in the six reviews were black box evaluations. None of the six reviews provided criteria for the core components of a programme, to reduce injury risks from patient handling. In most cases, papers included in the final set of studies reviewed failed to provide adequate descriptions of the interventions, and most
reviews did not provide detailed quality ratings for the descriptions of the interventions. There are published criteria for assessing reporting of complex interventions when conducting quality appraisals for studies included in systematic reviews (Mohler et al., 2011; Shepperd et al., 2009). An example is provided in a systematic review on partner violence screening programmes in health care settings (O’Campo et al., 2011).

3.3. Realist synthesis: evidence for programme mechanisms

The realist synthesis was based on published reports identified during the literature review. Its focus was to identify contexts and mechanisms (processes) in patient handling programmes that reduce physical loads on staff when handling patients and reduce the risk of injury to staff. Table 3 shows the working model developed from the synthesis, using the realist framework. Specific programme components were located in the context-mechanism-outcome framework. Most papers referred to the combined components as a ‘programme,’ the term used in this synthesis.

3.3.1. Context

Several context factors were evident from the literature review: management commitment to supporting the programme, organisational culture, levels of patient dependency, staff and patient turnover rates, staffing levels and time pressures.

Management commitment includes: establishment of a policy on mandatory use of equipment and low-risk patient handling techniques, providing funding for equipment, providing a maintenance system for equipment, funding training for all staff, funding positions for patient handling coordinators or resource nurse or coaches, setting up an audit system, and monitoring programme effectiveness (Garg and Kapellusch, 2012; Koppelaar et al., 2011, 2013; Schoenfisch et al., 2011b).

Organisational culture includes knowledge and views of managers and staff that affect work practices. Organisational (or workplace) culture influences the use of patient handling equipment (Hess and Enos, 2010; Lee et al., 2010; Myers et al., 2012). Student nurses trained in appropriate moving and handling techniques reported being unable to use these techniques when working in locations where unsafe techniques were used (Kneafsey et al., 2012), especially where supervisors or medical staff expected nurses to manually lift patients (Cornish and Jones, 2010; Schoenfisch et al., 2011a). Interventions need to develop a ‘safety culture’ as part of the organisational culture so that there are positive views towards the use of safe practices and negative views towards unsafe practices. Part of an effective culture change strategy is promotion of a ‘supportive management climate’ which requires and facilitates use of equipment and patient assessment protocols (Koppelaar et al., 2009, 2011).

Turnover of staff and patients (or residents) affects patient handling practices. With high staff turnover, ongoing training is required to ensure new staff are trained and know how to use appropriate transfer techniques and equipment. With high patient turnover, additional work is required for updating patient profiles and handling plans and ensuring risk assessments are carried out before patient transfers (Koppelaar et al., 2013; Kurowski et al., 2012a). Where temporary (agency) staff are used, they are less likely to be familiar with patient handling needs, policies on patient handling, and using equipment compared to regular staff. High rates of staff turnover are associated with higher injuries rates and back pain among staff (Lahiri et al., 2013). In contrast, staff turnover decreases following interventions to reduce injury rates among staff (Kurowski et al., 2012b; Lahiri et al., 2013).

Disability levels of patients or residents in a facility affect the amount of transferring required by staff. Facilities with higher numbers of patient with impaired mobility (patients who are non-weight bearing) will require more staff-assisted transfers (Restrepo et al., 2013).

Staffing levels and time pressures affect transfer procedures. Understaffing and time pressures increase the likelihood that staff are reluctant to access and use equipment, if equipment use is seen as more time-consuming than manual techniques (de Ruiter and Liaschenko, 2011; Evanoff et al., 2003; Kurowski et al., 2012b; Matz et al., 2008; Schoenfisch et al., 2011a).

3.3.2. Programme components or mechanisms

For effective programmes, multiple components were evident from the reports reviewed. Based on the frequency of inclusion in multi-component programmes and their reported links to injury outcomes, six components were selected for detailed analysis. These components were: (i) a clearly-communicated policy requiring safe transfer practices including use of equipment and risk assessments

<table>
<thead>
<tr>
<th>Context</th>
<th>Programme (mechanism)</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Management commitment to the programme</td>
<td>• Management policy</td>
<td>• Staff use of safer handling techniques</td>
</tr>
<tr>
<td>• Organisational culture</td>
<td>• Equipment</td>
<td>• Safety culture developed</td>
</tr>
<tr>
<td>• Staff turnover</td>
<td>• Training of all staff</td>
<td>• Reduced rates of injuries and work days lost due to injury</td>
</tr>
<tr>
<td>• Patient/resident turnover</td>
<td>• Risk assessment protocol</td>
<td>• Lower injury claims costs</td>
</tr>
<tr>
<td>• Patient/resident dependency levels</td>
<td>• Programme coordinator, coaches and/or advocates</td>
<td></td>
</tr>
<tr>
<td>• Staffing levels and time pressures</td>
<td>• Assessment and modification of the physical work environment to support use of transfer equipment and techniques</td>
<td></td>
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</tbody>
</table>

Table 3
Working model for patient handling programmes.
prior to moving patients, (ii) ergonomic assessment of spaces where patients are transferred, (iii) transfer equipment including lifts, (iv) specific risk assessment protocols, (v) adequate training of all staff involved in patient care, and (vi) coordinators coaches or resource staff. These six components were the most commonly reported components in the systematic review by Hignett (2003a), (Table 3) – taking risk assessment protocols as combining the components of ‘risk assessment’ and ‘patient assessment system’ which were reported in that review. Programmes having most or all of these components are likely to have lower injury rates and injury compensation costs (Restrepo et al., 2013).

**Policy:** An effective policy is a key part of moving and handling programmes (Hignett, 2003a, Restrepo et al., 2013). Having a mandatory policy signals commitment from management. It requires staff to use risk assessment protocols prior to transfers and to use appropriate equipment such as lifts where a patient has impaired mobility. Policy needs clear communication to managers and staff, including medical staff, and be visible in the work environment (Collins et al., 2004; Evanoff et al., 2003; Koppelaar et al., 2011). A visible policy also lets patients know that they cannot expect staff to manually lift them. Having a ‘policy’ that is implemented at the discretion of unit managers is less likely to be effective (Schoenfisch et al., 2011a). A policy in a residential care facility was described as follows:

The “zero lift” policy provided written guidelines for assessing each resident’s transferring needs and procedures for the safe handling and movement of residents. The term “zero lift” implied there should be no manual lifting of residents. However, there were residents who could be safely transferred with limited manual assistance and mechanical lifts were used when a resident could not be safely transferred by any other means. The charge nurse was responsible for ensuring all transfers were done in accordance with the written policy, and the nursing home administrator had the final responsibility for enforcing the policy (Collins et al., 2004).

**Ergonomic assessment and modification of spaces:** Several papers have reported the need ergonomic assessment of spaces where patients or residents are transferred, and modification made where needed (Collins et al., 2010; Hignett, 2003a; Fray and Hignett, 2013; Koppelaar et al., 2013; Schoenfisch et al., 2011a). Floor lifts require sufficient space around beds and other furniture. Equipment storage areas should be close to where the equipment is used to ensure lifts, slings and other equipment are easily accessible. Bed transfers using slide sheets often require staff to have access to both sides of the bed.

**Equipment for moving and handling:** Multiple studies support the view that equipment is essential for repositioning of non-weight bearing patients to keep loads on staff within safe levels (Collins et al., 2004; Hignett, 2003a, 2003b; Kurowski et al., 2012b). The types of equipment commonly used for moving people include ceiling lifts (hoists), floor lifts (and the associated lift slings), standing lifts, slide sheets, electric beds, transfer boards and handling belts. This equipment list is a minimum requirement for facilities where patient handling occurs on a regular basis (Hignett, 2003b). As well as equipment, facilities need suitable locations for equipment storage, monitoring of equipment, and a maintenance system (de Ruiter and Lisachenko, 2011; Hunter et al., 2010; Matz et al., 2008).

**Risk assessment protocols:** The published evidence supports the view that an assessment of each patient’s mobility is needed at admission and repeated frequently enough to detect changes in mobility. The mobility assessment should determine what transfer techniques and equipment are required to move the patient. Risk assessment information is usually recorded on a patient profile or ‘patient care protocol’ (Koppelaar et al., 2013; Matz et al., 2008) that is visible to staff. Prior to moving a patient, the organising staff member checks the patient’s profile and ensures that information on the profile is current. Part of the risk assessment is ensuring up-to-date patient mobility information is available to everyone who may move a patient. Kurowski and colleagues provided an example of a risk assessment.

Assessments for safe patient handling indicated whether a resident was ambulatory, required a sit-stand lift, or required a total body lift of either 204-kilogram or 272-kilogram capacity (floor-based portable lifts). Assessment results were documented in care plans, aide sheets, and electronically. In addition, stickers were applied to residents’ nameplates to indicate the type of equipment to be used (if any), the size of the sling needed, and the number of staff required for turning and repositioning activities (Kurowski et al., 2012a).

In programmes without a risk assessment protocol, staff are less likely to use equipment, even if equipment is provided with other programme components (Hignett et al., 2003; Koppelaar et al., 2011).

**Training:** The evidenced reviewed clearly indicates that providing competency-based training for all care staff is a core programme component. Training provided to staff in their workplaces is likely to have more impact than training that has no direct connection to workplace practices (D’Arcy et al., 2012). Assessing the quality of training programmes requires a review of: (a) training content, (b) training procedures and (c) confirmation of staff knowledge and skills following training. Training content should include using multiple types of equipment, assessing patient mobility, risk assessment prior to transfers and specific techniques for moving patients (Berthelette et al., 2012; Carta et al., 2010). It should also include the risks of injuries to carers when moving people, organisational policies and health and safety legislation.

Staff use of equipment depends on having the knowledge and specific skills required to use multiple types of equipment (de Ruiter and Lisachenko, 2011; Koppelaar et al., 2013). A study of home carers provided with training and ‘low-tech’ equipment such as slide sheets, but not lifting equipment, showed no reduction in low back pain (Hartvigsen et al., 2005).
Competency-based training requires demonstration of transfer techniques using equipment, opportunities for trainees to practice the techniques, and provision of feedback regarding trainee competence (Carta et al., 2010; Resnick and Sanchez, 2009). All care staff need to attend training to avoid situations where some staff do not know how to use low-risk transfer techniques or equipment and to prevent trained staff being pressured into using manual lifting by untrained staff (Cornish and Jones, 2010; Schoenfisch et al., 2011a). Minimum initial training typically consists of a one-day workshop. Brief training sessions focussed only on how to use equipment are insufficient.

Initially, training consisted of 10–20 nursing staff receiving 30 minutes of knowledge based training and demonstration of the use of the lifting equipment by the trainers. It was determined that the initial training method did not adequately prepare nursing staff to use the lifting equipment on all residents. Subsequently, the training was refined to provide 45 minutes of additional skill based training to two nursing staff at a time. The enhanced training program .... required nursing personnel to identify the type of transfer and procedures required for each resident, and to demonstrate hands-on competency for each type of lifting equipment on actual residents with a range of disabilities (Collins et al., 2004).

Programmes that do not include such training report less positive outcomes. Programmes are also less successful where training is delegated to coaches or resource staff with other duties, who provided occasional transfer training to staff (Berthelette et al., 2012; Schoenfisch et al., 2011a; Smedley et al., 2003; Warming et al., 2008). Implementation of competency-based training also helps develop safety culture behaviour among nurses (Hignett and Crumpton, 2007).

Coordinators, coaches and resource staff: Many programmes described in the literature report having coordinators who had direct responsibility for ensuring the moving and handling programme operated effectively. These positions were given various job titles including back injury resource nurses (Nelson et al., 2006), coaches (Schoenfisch et al., 2011a), ergocoaches (Koppelaar et al., 2011), manual handling teams (Bird, 2009), peer leaders (Collins et al., 2010) and staff development coordinators (Garg and Kapellusch, 2012). In some programmes unit managers (Schoenfisch et al., 2011a) or directors of nursing (Restrepo et al., 2013) were also directly responsible for programme implementation.

Details about the specific roles or activities of resource staff were rarely included in reports. Responsibilities typically included training new staff, problem-solving, communication about policies, ensuring equipment availability and storage, equipment maintenance, conducting audits and being advocates for the programme (Bird, 2009; Garg and Kapellusch, 2012; Koppelaar et al., 2011). Some programmes also emphasised the general involvement of care staff such as in selecting and evaluating equipment for a ward or unit (Collins et al., 2004; Garg and Kapellusch, 2012). Expecting resource staff with other commitments, to provide occasional training to staff is not effective in ensuring all staff are adequately trained (Berthelette et al., 2012; Schoenfisch et al., 2011a).

3.3. Outcomes

The outcomes of interest for moving and handling programmes are that; staff use low-risk transfer techniques, the work culture supports staff safety, rates of injuries to staff decrease and fewer workdays are lost due to injuries (Black et al., 2011; Collins et al., 2004, 2010; Garg and Kapellusch, 2012). Where injury claims costs are monitored, lower costs from staff injuries would be expected (Restrepo et al., 2013).

Several studies have investigated increases in staff competence and use of transfer equipment following implementation of programmes. These include observation of equipment accessibility during facility visits (Schoenfisch et al., 2011b), surveys of nurses and managers in nursing homes and hospitals regarding use of lifting devices (Koppelaar et al., 2011, 2013) and assessing competencies in using equipment as part of the staff member’s annual evaluation (Hunter et al., 2010). Developing an organisational safety culture has been recommended for sustaining low-risk patient handling (Lee et al., 2010). Unit managers are influential in developing support for staff safety (Schoenfisch et al., 2011a).

3.4. Synthesis

The specific mechanisms identified in the analysis were consolidated into a series of ‘middle-range’ theories or hypotheses. Middle-range theories refer to those that retain their relevance across multiple cases and differing contexts (Jagosh et al., 2011, p.7; Shepperd et al., 2009, Box 2). The process has been described as ‘synthesising data to achieve refinement of programme theory’ (Pawson et al., 2004). Table 4 shows the theories that explicate programme mechanisms. The evidence reviewed supports the general theory that multi-component moving and handling programmes are necessary to reduce injury rates and costs. An essential context feature is the presence of management commitment and support. The core programme components are; a policy regarding patient handling procedures, equipment, ergonomic assessment of spaces, staff training, risk assessment protocols, and coordinators and resource staff. Based on the published information used in the realist synthesis, the specific programme components are likely to be synergistic; omitting core components is likely to weaken the impact of the other components This is consistent with the conclusion from a study of the individual and organisational factors influencing use of patient handling equipment;

The appropriate implementation of ergonomic devices is a complex phenomenon that can be influenced by various factors at different levels in a healthcare organisation. Individual as well as organisational factors were associated with nurses’ behaviour to use lifting devices. The organisational factors were present
at three different levels, i.e. the room, the ward, and the institution. Since there is a hierarchical structure (rooms within ward and wards within the institute), these organisational factors cannot be analysed simultaneously on the classical regression models... (Koppeelaar et al., 2013).

4. Discussion

Most experimental studies evaluating interventions to reduce moving and handling injuries do not provide adequate descriptions of the components of the interventions. This is a substantial limitation for systematic reviews of complex interventions. There is an untested assumption that components given the same label (e.g., ‘training’ or ‘advice’) are similar. Commentaries on the evaluation of complex interventions have noted that failure to describe the details of such interventions prevents credible conclusions being drawn from these studies and from systematic reviews which include these complex interventions (Campbell et al., 2007; Möhler et al., 2012; Shepperd et al., 2009).

Given that patient handling programmes, and training for patient handling, are complex interventions, the failure of most trials to describe the intervention, and the low weighting given to appropriate description of interventions by the systematic reviews, limits the validity of conclusions from these reviews. A commentary on systematic reviews of complex interventions noted that,

A major threat to validity from an imprecise definition of an intervention is the non-standardised and potentially non-reproducible selection of studies for inclusion in a review. Based on the available information, considerable judgement may be required when assessing how similar any given intervention is to the intervention of interest... (Shepperd et al., 2009).

The apparent contradiction between the negative findings from systemic reviews of primarily training-based interventions and the continuing development of patient handling programmes in health care facilities, can be explained by the emerging body of evidence that multi-component programmes can be effective in reducing injuries, lost work days and claims costs resulting from injuries. A recent review has developed and trialled a comprehensive set of measures for outcomes relating to patient handling injury prevention initiatives (Fray and Hignett, 2013). The authors note this tool is intended for patient handling practitioners to measure outcomes and compare performances between intervention strategies.

Six systematic reviews reporting findings from randomised controlled trials (RCTs) or controlled trials concluded that training interventions are not likely to reduce injuries. There was conflicting evidence for interventions comprising training and equipment supply. We found no RCTs that evaluated comprehensive programmes, probably because of the challenges and costs in conducting experimental trials, especially RCTs for complex programmes. Given the absence of experimental trials for multi-component programmes, the strongest evidence for such programmes is from pre-post studies (Bird, 2009; Chhokar et al., 2005; Collins et al., 2004; Garg and Kapellusch, 2012; Nelson et al., 2006), a few pre-post studies with comparison groups (Black et al., 2011) and large-scale surveys (D’Arcy et al., 2012; Restrepo et al., 2013). Many facility managers will find the evidence regarding reduced injuries and claims costs from pre-post studies sufficiently convincing to develop their own programme. There have been multiple initiatives to promote comprehensive safe patient handling programmes (Collins et al., 2010; Engkvist, 2006; Waters et al., 2006) and development of comprehensive indicators for assessing the effectiveness of programme implementation (Fray and Hignett, 2013; Restrepo et al., 2013).

It is clear that injury prevention interventions for moving people involve specialised techniques and equipment, which are different from moving inanimate objects. Findings from reviews involving both people and objects should be reported separately.

The realist synthesis highlighted specific features likely to make moving and handling programmes effective in reducing injuries. Training of all care staff is a core part of these programmes. Further qualitative studies, which include high quality and detailed data about how multi-component programmes operate (e.g., Cornish and Jones, 2010; Schoenfisch et al., 2011a), are needed to provide better evidence for the specific mechanisms through
which core components contribute to effective moving and handling programmes.

The specific programme components needed for multi-component programmes to be effective, which were identified in the realist synthesis, need to be validated with suitable mixed method studies collecting both qualitative and quantitative data.RCTs and non-controlled trials, without supporting qualitative evidence regarding programme implementation, will not be suitable for such validation.

5. Conclusions

Based on a critical appraisal of six systematic reviews and a realist synthesis of information relating to multi-component interventions, there is no need for more rigorous studies or systematic reviews evaluating the effectiveness of training or advice by itself or with equipment. Future studies and reviews should focus on assessing multi-component interventions with training as one component of such interventions. To be credible, evaluations of multi-component interventions need to provide a sufficiently detailed description of the delivery of each of the programme components to allow assessment of programme operation and fidelity. Trials based on single component programmes will not provide this information.

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