Intervention strategies to reduce musculoskeletal injuries associated with handling patients: a systematic review

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Intervention strategies to reduce musculoskeletal injuries associated with handling patients: a systematic review

S Hignett

Aims: To report, analyse, and discuss the results of a systematic review looking at intervention strategies to reduce the risk factors associated with patient handling activities.

Methods: A search strategy was devised to seek out research between 1960 and 2001. Inclusion/exclusion criteria limited the entry of papers into the review process. A checklist was selected and modified to include a wide range of study designs. Inter-rater reliability was established between six reviewers before the main review process commenced. Each paper was read by two reviewers and given a quality rating score, with any conflicts being resolved by a third reviewer. Papers were grouped by category: multifactor, single factor, and technique training based interventions.

Results: A total of 2796 papers were found, of which 880 were appraised. Sixty three papers relating to interventions are reported in this paper. The results are reported as summary statements with the associated evidence level (strong, moderate, limited, or poor).

Conclusion: There is strong evidence that interventions predominantly based on technique training have no impact on working practices or injury rates. Multifactor interventions, based on a risk assessment programme, are most likely to be successful in reducing risk factors related to patient handling activities. The seven most commonly used strategies are identified and it is suggested that these could be used to form the basis of a generic intervention programme, with additional local priorities identified through the risk assessment process. Health care providers should review their policies and procedures in light of these findings.

Patient handling activities have long been acknowledged as being a major contributor to the high incidence of musculoskeletal injury, in particular low back pain, in health care staff. A range of intervention strategies have been used over the years to try and reduce this problem, and professional bodies continue to produce guidance on patient handling. These guidance publications have tended to promote technique training as the main factor of the intervention programme, although more recently risk management programmes are evident.

This paper summarises a section of the results of a systematic review on patient handling tasks, equipment, and interventions that sought to develop a foundation from which evidence based guidelines could be developed. The following research questions were addressed:

1. Can research be found on patient handling tasks, equipment, and interventions?
2. What are the results from the research?
3. How do these results compare with the current guidance available?

Main messages

• An international systematic review found 63 papers relating to intervention strategies to reduce the risk of musculoskeletal injuries associated with patient handling.
• There is strong evidence that interventions for patient handling based on technique training have no impact on working practices or injury rates.
• Multifactor interventions, based on a risk assessment programme, are most likely to be successful in reducing risk factors associated with patient handling activities.
• Seven strategies are suggested for inclusion in a generic intervention programme.

Policy implications

• Health care providers should review their policies and procedures in light of this systematic review.
• Interventions predominantly based on technique training are unlikely to be successful in reducing musculoskeletal injuries, so an alternative strategy should be considered.
search which resulted in 30 papers being translated from Chinese, Danish, Dutch, French, German, Italian, Japanese, Norwegian, Portuguese, Slovakian, and Spanish.

The data extraction/critical appraisal tool used was developed by Downs and Black\(^8\) for randomised and non-randomised studies of health care interventions. This has four sections:

1. **General structure of paper to include 10 questions about the aims, sampling, method (description of intervention), outcome measures, confounders, findings, analysis, and discussion of adverse events.**

2. **External validity** is appraised using three questions about the representativeness of the sample and context of the study.

3. **Internal validity (bias)** includes seven questions to look at blinding of subjects/data collectors, compliance with the intervention, choice of outcome measures, and statistical tests.

4. **Internal validity (confounding, selection bias)** has six questions looking at the sampling strategy with respect to diversity within the recruitment population and chronology of the study. This section also addresses issues about the allocation to control/experimental groups and subject follow up.

This appraisal tool was further extended and modified to include observational studies without an intervention (cohort studies, case-control studies, cross sectional studies, surveys, and case series) and an additional section for qualitative studies. Before the review process started an inter-reliability study was carried out with the six reviewers. This resulted in an overall intra-class correlation (pairwise) of 0.95.\(^9\)

Each paper was sent to two reviewers following a screening process to ensure that reviewers did not receive their own publications. If the difference in the quality rating scores exceeded an established limit the paper was sent to a third reviewer for conflict resolution. Owing to the heterogeneity of the study types, interventions, settings, participants, outcome measures, and comparison groups a quantitative analysis (meta-analysis) was not appropriate.

The data were synthesised in two stages. The first involved grouping papers into tasks, equipment, and interventions, with some papers being allocated to more than one section. The second stage involved combining the papers to produce summary statements and then allocating evidence levels. The evidence levels (table 1) were developed using concepts from Bernard\(^10\) and the Faculty of Occupational Medicine.\(^1\)

![Table 1 Evidence levels](https://www.occenvmed.com/Table1.png)

A total of 2796 papers were located. These were then checked to eliminate duplications (from the different search strategies) and papers which were inappropriate to the research topic based on their title (for example, working postures of dentists). The remaining 880 papers were included, and sent to the project team for review. Subsequent eliminations were based on the following inclusion/exclusion criteria, whereby a paper or document was:

1. **Included if it described a named task, piece(s) of equipment, or intervention relating directly to patient handling.**

2. **Included as a professional opinion if it:**
   - had references
   - critically appraised the literature
   - provided a new interpretation of the literature.

3. **Excluded if it was related to epidemiology of musculoskeletal disorders (usually low back pain) and did not meet criterion (1) for the study.**

4. **Excluded if it was not the primary source of a study. The primary source was sought and included.**

5. **Excluded if it was a legal case law report.**

A total of 225 papers were included in the full project review,\(^1\) with the 63 papers relating to intervention strategies being reported in this paper.

### RESULTS

The findings of the 63 papers (table 2) have been grouped into three categories for the summary evidence statements.

1. **Multifactor interventions.**
2. **Single factor interventions.**
3. **Technique training based interventions.**

Any conflicting and negative evidence has been included in the evidence statement for categories (1) and (2). Category (3) is subdivided into three further subgroupings to present negative, mixed, and positive evidence.

#### Multifactor interventions

A decision was taken to present the data in this category as two groups to look at the role of risk assessment as part of an intervention strategy. This will be reviewed in the discussion.

- **+++** The evidence statement that **multifactor interventions based on risk assessment are successful** is supported at a moderate level by 10 studies,\(^11\) and at a limited level with an additional four studies.\(^12\)\(^13\)\(^1\)\(^2\)\(^3\)
- **+++** The evidence statement that **multifactor interventions (not based on risk assessment) can show improvements** is supported with moderate evidence from four studies.\(^14\)\(^15\) Additional limited evidence is available from five studies.\(^16\)\(^17\) However, there is also contradictory evidence from one high quality study\(^18\) which found no improvement using a multifactor intervention.

#### Single factor interventions

- **+++** The evidence statement that **single factor interventions based on the provision of equipment can be effective** is supported with moderate evidence from two studies.\(^19\)\(^20\)
- **+++** The evidence statement that **interventions using the lifting team approach can be effective** is supported with moderate evidence from three studies.\(^21\)\(^22\) Additional support is available at the limited evidence level from two studies.\(^23\)\(^24\)

#### Interventions predominantly based on technique training

- **++++** The evidence statement that **interventions based predominantly on technique training have no impact on working practices or injury rates** is supported with strong evidence from four studies.\(^25\)\(^26\)\(^27\)\(^28\) Eight additional studies give a moderate level of support.\(^29\)\(^30\)\(^31\) There are also five studies at the limited evidence level supporting this statement.\(^32\)\(^33\)\(^34\)\(^35\)
- **+++** The evidence statement that **interventions based on technique training can have mixed (positive and negative) short term...**

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<table>
<thead>
<tr>
<th>Author and Year</th>
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<th>Subjects</th>
<th>Outcome Measures</th>
<th>Results</th>
<th>QR</th>
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</thead>
<tbody>
<tr>
<td>Addington (1994)</td>
<td>USA</td>
<td>Operating room staff (n=7)</td>
<td>No. of reported back injuries</td>
<td>No decrease in injuries</td>
<td>37%</td>
</tr>
<tr>
<td>Aird (1988)</td>
<td>Canada</td>
<td>Hospital: 2, 5, 9, 12, 18, 20, 21</td>
<td>Last time injury claims (Workers Compensation Board)</td>
<td>Hospital: Back injuries reduced by (a) number (8.4%), (b) frequency (18.8%)</td>
<td>44%</td>
</tr>
<tr>
<td>Alavosius and Sulzer-Azaroff (1986)</td>
<td>USA</td>
<td>Direct care staff (n=6)</td>
<td>No. of safe transfers</td>
<td>No change</td>
<td>39%</td>
</tr>
<tr>
<td>Alexander (1996)</td>
<td>UK</td>
<td>Community nurses (n=42)</td>
<td>Relationship between implementation of recommendations and level of sickness absence</td>
<td>Significant relationship between implementation of recommendations and reduction in sickness absence</td>
<td>50%</td>
</tr>
<tr>
<td>Best (1997)</td>
<td>Australia</td>
<td>Direct care staff (n=6)</td>
<td>No. of safe transfers</td>
<td>All reduced but not significantly</td>
<td>70%</td>
</tr>
<tr>
<td>Billin (1998)</td>
<td>UK</td>
<td>Nurses, Occupational Therapists, Physiotherapists (n=7)</td>
<td>Effectiveness of lifting team</td>
<td>Reduction in no. of unsafe transfers from 13 to 4</td>
<td>39%</td>
</tr>
<tr>
<td>Caska et al (1998)</td>
<td>USA</td>
<td>Hospital staff (n=10 units)</td>
<td>Injury rate</td>
<td>Team completed 94% of scheduled and paged lifts</td>
<td>69%</td>
</tr>
<tr>
<td>Charney (1997)</td>
<td>USA</td>
<td>Hospital staff (n=10 units)</td>
<td>Incident rates</td>
<td>Reduction in incident rates (by 63%) and lost work days (by 90%)</td>
<td>72%</td>
</tr>
<tr>
<td>Charney et al (1993)</td>
<td>USA</td>
<td>Orderlies (n=2)</td>
<td>Accident rate</td>
<td>Year 2 data: No injuries or sick leave for lifting team</td>
<td>61%</td>
</tr>
<tr>
<td>Charney et al (1991)</td>
<td>USA</td>
<td>Orderlies (n=2)</td>
<td>Accident rate</td>
<td>Year 1 data: Reduced from 39 to 2.4 cases (62%) with a projected saving of $65,000 per annum</td>
<td>37%</td>
</tr>
<tr>
<td>Collins (1990)</td>
<td>Australia</td>
<td>Nurses (n=9)</td>
<td>Sickness absence</td>
<td>Reduced from 17 to 11 working days per claim</td>
<td>52%</td>
</tr>
<tr>
<td>Daws (1981)</td>
<td>UK</td>
<td>Nurses (n=2000)</td>
<td>Injury rate</td>
<td>No change</td>
<td>31%</td>
</tr>
<tr>
<td>Daynard et al (2001)</td>
<td>Canada</td>
<td>Hospital staff (n=36)</td>
<td>Compliance with intervention</td>
<td>Increased compliance</td>
<td>50%</td>
</tr>
<tr>
<td>Dietz and Baumann (2000)</td>
<td>France</td>
<td>Nurses and physiotherapists (n=103)</td>
<td>Biomechanical evaluation of spinal loading</td>
<td>Reduced spinal loading</td>
<td>33%</td>
</tr>
<tr>
<td>Dixon et al (1996)</td>
<td>UK</td>
<td>Ward staff (n=7)</td>
<td>Musculoskeletal sickness absence</td>
<td>No episodes of sickness absence after implementation</td>
<td>20%</td>
</tr>
<tr>
<td>Duggan (1995)</td>
<td>Ireland</td>
<td>Nurses (n=24)</td>
<td>Postural analysis</td>
<td>Significant reduction in harmful postures and RPE</td>
<td>74%</td>
</tr>
<tr>
<td>Engels et al (1998)</td>
<td>Netherlands</td>
<td>Nurses (n=24)</td>
<td>Postural load</td>
<td>Both postural load and errors decreased significantly</td>
<td>44%</td>
</tr>
<tr>
<td>Engkvist et al (2001)</td>
<td>Sweden</td>
<td>Nursing staff (n=292)</td>
<td>Interaction between risk factors for back injuries and training</td>
<td>No association with decreased risk of injury</td>
<td>100%</td>
</tr>
<tr>
<td>Entwhistle et al (1996)</td>
<td>UK</td>
<td>Nurses (n=900)</td>
<td>Lost working time</td>
<td>Reduction in certified illness from 35 to 8 episodes per annum</td>
<td>35%</td>
</tr>
<tr>
<td>Evanoff et al (1999)</td>
<td>USA</td>
<td>Hospital orderlies (n=67)</td>
<td>Reportable injuries (OSHA 200 log)</td>
<td>Reduction in injury rate from 32.5 per 100 FTE to 16.3 per 100 FTE</td>
<td>58%</td>
</tr>
<tr>
<td>Fanello et al (1999)</td>
<td>France</td>
<td>Non-clerical hospital staff (n=272)</td>
<td>Injury rate (musculoskeletal disorders)</td>
<td>No significant difference for all three measures</td>
<td>80%</td>
</tr>
<tr>
<td>Feldstein et al (1993)</td>
<td>USA</td>
<td>Nurses, aids and orderlies (n=55)</td>
<td>Back pain</td>
<td>Reduction (not significant)</td>
<td>68%</td>
</tr>
<tr>
<td>Paternoster et al (1999)</td>
<td>Italy</td>
<td>Hospital workers (n=80)</td>
<td>Quality of patient transfers</td>
<td>19% improvement in transfers</td>
<td>31%</td>
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</table>
Table 2 continued

<table>
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<tr>
<th>Author (year)</th>
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<th>Results</th>
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<tbody>
<tr>
<td>Foster (1996)</td>
<td>5 Nurses (n=100)</td>
<td>Change in practice</td>
<td>74% change in practice</td>
<td>57%</td>
</tr>
<tr>
<td>Garg and Owen (1992)</td>
<td>1, 2, 5 Nursing Homes (n=57)</td>
<td>Use of equipment</td>
<td>77% improved use of equipment</td>
<td>63%</td>
</tr>
<tr>
<td>Garrett and Perry (1996)</td>
<td>1, 5, 10, 12, 15 Nursing and therapy staff (n=700)</td>
<td>Incidence of back injuries</td>
<td>Reduced from 83 to 47 per 200,000 work hours</td>
<td>46%</td>
</tr>
<tr>
<td>Goodridge and Laurila (1997)</td>
<td>2, 13 Nurses (n=7)</td>
<td>Lost working time cases</td>
<td>Reduced from 42 to 23 per annum</td>
<td>44%</td>
</tr>
<tr>
<td>Gray et al (1996)</td>
<td>5 Nurses (n=14 units)</td>
<td>Injury rate</td>
<td>Reduction in injury rate from 6.7 to 4.1 patient handling injuries per staff member per month</td>
<td>43%</td>
</tr>
<tr>
<td>Griffith and McArthur (1999)</td>
<td>5 Health care assistants (n=502)</td>
<td>Knowledge of procedures</td>
<td>Significant improvement</td>
<td>42%</td>
</tr>
<tr>
<td>Harber et al (1994)</td>
<td>5 Newly qualified nurses (n=179)</td>
<td>Impact of training using questionnaire</td>
<td>No acquisition of transferable skills with respect to applying the techniques in different environments</td>
<td>73%</td>
</tr>
<tr>
<td>Head and Levick (1996)</td>
<td>1, 2, 3, 5 Nurses and ambulance workers (n=7)</td>
<td>No. of back injury claims</td>
<td>Reduction in number (by 23%), lost time (by 38%) and average cost (by 56%) of back injury claims</td>
<td>28%</td>
</tr>
<tr>
<td>Hellsing et al (1993)</td>
<td>5, 18, 19 Nursing students (n=51)</td>
<td>Nordic Questionnaire</td>
<td>No short term effects on musculoskeletal problems</td>
<td>58%</td>
</tr>
<tr>
<td>Hignett and Richardson (1995)</td>
<td>1, 3, 5, 6, 7, 10 Nurses (n=26)</td>
<td>Observation of standardised work tasks</td>
<td>Reduction of lifts (and shorter times) in extreme positions</td>
<td>81%</td>
</tr>
<tr>
<td>Holliday et al (1994)</td>
<td>2 Nursing staff (n=22)</td>
<td>Qualitative</td>
<td>Risk assessment model</td>
<td>42%</td>
</tr>
<tr>
<td>Johnston (1987)</td>
<td>5 Student nurses (n=7)</td>
<td>Application of training principles</td>
<td>Only 28% of lifts were planned</td>
<td>43%</td>
</tr>
<tr>
<td>Kilbom et al (1985)</td>
<td>2, 6, 7 Home care nurses (n=12)</td>
<td>Vertical force and duration of lift, weight distribution and no. of steps while carrying</td>
<td>Assistance was used for 50% of lifts</td>
<td>27%</td>
</tr>
<tr>
<td>Knibbe and Friele (1999)</td>
<td>2 Home care nurses (n=378)</td>
<td>Prevalence of back pain (12 months)</td>
<td>Significant reduction in back pain (from 74 to 64%)</td>
<td>83%</td>
</tr>
<tr>
<td>Lagerström and Hagberg (1997)</td>
<td>2, 15, 18, 19 Nurses (n=348)</td>
<td>Questionnaire on musculoskeletal symptoms, physical fitness and physical workload</td>
<td>No reduction in neck, shoulder and back symptoms, increase in hip and upper back problems. Reduction in physical fitness. Increase in perception of work as physically strenuous</td>
<td>76%</td>
</tr>
<tr>
<td>Ljungberg et al (1989)</td>
<td>2, 6, 7 Nursing staff (n=24)</td>
<td>Lifting rates, cumulative force, total lifting time, and no. of steps while carrying</td>
<td>Modern ward showed a reduction in lifting rates (50%); cumulative force (57%); total lifting time (78%); no. of steps while carrying (72%)</td>
<td>65%</td>
</tr>
<tr>
<td>Lynch and Freund (2000)</td>
<td>5 Nursing staff (n=374)</td>
<td>Knowledge about back injury risk factors</td>
<td>No change in level of knowledge</td>
<td>50%</td>
</tr>
<tr>
<td>Menckel et al (1997)</td>
<td>1, 2, 5, 8 Health care staff (n=122)</td>
<td>Change in work practices</td>
<td>Repositioning in-bed tasks reduced</td>
<td>65%</td>
</tr>
<tr>
<td>Miller and Johnson (1992)</td>
<td>1, 5, 10 Home care staff (n=10)</td>
<td>Lost time back injuries</td>
<td>30% reduction in lost time back injuries over previous 3 years</td>
<td>42%</td>
</tr>
<tr>
<td>Monaghan et al (1998)</td>
<td>1, 2, 5, 10, 13 Nurses (n=28)</td>
<td>Knowledge of back injury risk factors</td>
<td>Increase in qualitative measures of carer confidence and feeling of control of situation</td>
<td>50%</td>
</tr>
<tr>
<td>Nussbaum and Torres (2001)</td>
<td>5 Nurses (n=24)</td>
<td>Knowledge about back injury risk factors</td>
<td>No significant change</td>
<td>59%</td>
</tr>
<tr>
<td>Nyran (1991)</td>
<td>1, 2, 4, 5 Nursing Homes (n=48)</td>
<td>Questionnaire</td>
<td>Increase in qualitative measures of carer confidence and feeling of control of situation</td>
<td>50%</td>
</tr>
<tr>
<td>Oddy (1993)</td>
<td>3, 6, 10, 13 Continuing care ward (n=24)</td>
<td>Elimination of drag lift</td>
<td>Net saving of $57,439</td>
<td>65%</td>
</tr>
</tbody>
</table>
### Table 2 continued

<table>
<thead>
<tr>
<th>Author</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Paternoster et al (1999)</td>
<td>Hospital workers (n=80)</td>
<td>Postural analysis</td>
<td>Incorrect postures reduced from 68% to 38%</td>
<td>31%</td>
</tr>
<tr>
<td>Peers (1998)</td>
<td>5, 10, 13, 15, 20</td>
<td>Lost time and modified work duties</td>
<td>Lost time reduced from 249 to 30 days Modified work days reduced from 246 to 184</td>
<td>37%</td>
</tr>
<tr>
<td>Pohjonen et al (1998)</td>
<td>Nursing home staff (n=131)</td>
<td>Postural analysis</td>
<td>Significant increase in proportion of straight back positions (from 59 to 75%)</td>
<td>58%</td>
</tr>
<tr>
<td>Rodgers (1985)</td>
<td>5 Ward staff (n=4 wards)</td>
<td>Psychosocial questionnaire (Work Ability Index)</td>
<td>No change in heart rate data or psychosocial data for intervention group Shoulder lift not used 30% of 2-person lifts carried out by one person 90% of lifts achieved</td>
<td>38%</td>
</tr>
<tr>
<td>Santos (1994)</td>
<td>Neurology staff (n=65)</td>
<td>Use of taught lifting techniques</td>
<td>Effectiveness of lifting team</td>
<td>35%</td>
</tr>
<tr>
<td>Scopa (1993)</td>
<td>Nurses (n=4)</td>
<td>Intra abdominal pressure (IAP)</td>
<td>Significant reduction in IAP 78%</td>
<td>78%</td>
</tr>
<tr>
<td>St Vincent et al (1989)</td>
<td>Student nurses (n=2)</td>
<td>Use of taught handling methods (6 principles)</td>
<td>Application of all 6 principles only in 1% of sample. Frequency of use of individual principles ranged between 11–33% Application of all 6 principles only in 1% of sample. Frequency of use of individual principles ranged between 11–33%</td>
<td>70%</td>
</tr>
<tr>
<td>Torri et al (1999)</td>
<td>Hospital staff (n=approx. 900)</td>
<td>Sickness absence</td>
<td>Reduction in sickness absence (39%) 71% used hoists regularly and correctly Little change</td>
<td>50%</td>
</tr>
<tr>
<td>Troup and Rauhala (1987)</td>
<td>Rehabilitation ward staff (n=7)</td>
<td>Reported injuries</td>
<td>No significant difference for any of the measures</td>
<td>78%</td>
</tr>
<tr>
<td>Tuffnell (1989)</td>
<td>Nurses (n=7)</td>
<td>Type of lifts</td>
<td>Increase in use of shoulder lift from 6 to 50% Improvement in skills for techniques (63%) and lifting aids (53%) used</td>
<td>55%</td>
</tr>
<tr>
<td>Vidman et al (1989)</td>
<td>Student nurses (n=200)</td>
<td>Skill assessment</td>
<td>No significant difference in prevalence or incidence of back pain and injuries No significant difference in prevalence or incidence of back pain and injuries</td>
<td>86%</td>
</tr>
<tr>
<td>Wachs and Parker (1987)</td>
<td>Nursing staff (n=178)</td>
<td>13 point skills checklist (environmental factors and postural assessment)</td>
<td>Low level of prescribed lifting behaviours (17%), only 2% completed all 13 prescribed behaviours. 23% of postures were labelled ‘at risk’ Prescribed techniques were performed 68% of the time 37% of bedside information was accurate</td>
<td>46%</td>
</tr>
<tr>
<td>Wood et al (2000)</td>
<td>Nursing assistants (n=90)</td>
<td>Evaluation of transfer skills</td>
<td>No significant difference between expt. and control groups (both reduced)</td>
<td>56%</td>
</tr>
<tr>
<td>Wood (1987)</td>
<td>Nursing staff (n=3 units)</td>
<td>No. of wage loss claims for back injuries caused by interactions with residents</td>
<td>Increase in use of shoulder lift from 6 to 50% Improvement in skills for techniques (63%) and lifting aids (53%) used</td>
<td>30%</td>
</tr>
</tbody>
</table>

**Key**

Intervention strategy included:

1 = Risk assessment 12 = Injury monitoring system with follow up. Return to work programme
2 = Equipment provision or/and purchase (including training in new equipment) 13 = Change/introduction of patient assessment system
3 = Equipment design/evaluation 14 = Introduction of hazard register
4 = Equipment maintenance 15 = Audit of working practices/risk assessments
5 = Education and training 16 = Review of staffing levels. Increase in staffing levels
6 = Work environment redesign, space constraints addressed 17 = Introduction of lifting team programme
7 = Work organisation/practices changed 18 = Physical Fitness training
8 = Feedback 19 = Stress management
9 = Group problem solving/team building 20 = Medical examination and lifting skill assessment
10 = Review and change of policies and procedures/safe systems of work 21 = Task analysis, job design analysis
11 = Discussion of goals with clients 22 = Change in uniforms

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results is supported with moderate evidence from two studies.60, 61 Additional support is given at the limited level from four studies.62–65

++ The evidence statement that interventions based on technique training can have short term positive outcomes is supported with moderate evidence from four studies.66–69 Limited evidence is available from another five studies.70–74 However, all these studies reported either procedural difficulties with a lack of control groups, use of different workers and/or patients pre/post intervention, or that statistical significance was not achieved.

DISCUSSION
International evidence was found for a range of intervention strategies. The results have been summarised as evidence statements to group the papers into three categories: multifactor interventions, single factor interventions, and interventions based on technique training.

Multifactor interventions
The multifactor intervention strategies included risk assessment, equipment provision, equipment evaluation/design, equipment maintenance, education and training, work environment redesign, work organisation/practices changed, feedback, group problem solving/team building, review and change of policies and procedures, discussion of goals with clients, injury monitoring systems (return to work programme), risk assessment programmes, patient assessment systems, hazard registers, audit of working practices/risk assessments, physical fitness training, and medical examinations.

The papers in this category were subgrouped to look at whether they included a risk assessment programme which, although not an intervention in itself, has an important role to play as an integral part of an intervention. The evidence statement for interventions, including a risk assessment is supported by 14 studies at the moderate and limited levels. The risk assessment programme could include feedback to staff and supervisors and the discussion of goals with clients. Some also gave evidence of audit of either working practices and/or the risk assessment programme. It is suggested that risk assessment (in the context of interventions to reduce risks associated with patient handling) provides the framework which is needed for an intervention to be embedded within an organisation’s structure and culture.75, 76

The second subgroup (no risk assessment) includes 10 studies, with an overall lower level of evidence (only four studies at the moderate level) and one contradictory high quality study.77 These interventions were generally preplanned or expert led. Both subgroups included programmes as short as 6 months and as long as 3–5 years, so the duration of the intervention is unlikely to contribute to the different findings. The conclusion for this category is that although multifactor interventions may show some improvements, they are more likely to succeed if they are based on a risk assessment programme (involving the staff).

Table 3 Most commonly used strategies in multifactor interventions

<table>
<thead>
<tr>
<th>Intervention strategy (key reference number)</th>
<th>No. of occurrences</th>
<th>Average QR of studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment provision/purchase (2)</td>
<td>18</td>
<td>50%</td>
</tr>
<tr>
<td>Education and training (e.g. risk assessment, use of equipment, patient assessment) (5)</td>
<td>18</td>
<td>54%</td>
</tr>
<tr>
<td>Risk assessment (1)</td>
<td>13</td>
<td>55%</td>
</tr>
<tr>
<td>Policies and procedures (10)</td>
<td>10</td>
<td>50%</td>
</tr>
<tr>
<td>Patient assessment system (13)</td>
<td>8</td>
<td>43%</td>
</tr>
<tr>
<td>Work environment redesign (6)</td>
<td>7</td>
<td>58%</td>
</tr>
<tr>
<td>Work organisation/practices changed (7)</td>
<td>7</td>
<td>63%</td>
</tr>
</tbody>
</table>

Single factor interventions
The single factor interventions are divided into the provision of equipment (moderate evidence from only two studies) and the lifting team approach. Although it is unusual to find only equipment provision without other factors, if the provision of hoisting equipment can be shown, in future high quality research, to have a significant impact on robust outcome measures (for example, local measures of physiological changes as well as organisational measures looking at sickness absence and incident reports), single factor interventions based on equipment provision might prove to be more cost effective than multifactor interventions.

The second single factor intervention is the lifting team approach which has an evidence statement supported at the moderate level. Currently the research for this approach is only available from the USA, so it might be interesting to see if the results can be replicated in other countries.

Technique training based interventions
Finally the third category, interventions predominantly based on technique training, has also been divided into three subgroups. The strongest support is for the evidence statement that interventions predominantly based on technique training have no impact on working practices or injury rates. This is supported with the highest level of evidence (strong) from four studies with an additional 13 studies at the moderate and limited levels. However, evidence was also found supporting the opposing statement for the use of training, but only to achieve short term changes, with four studies at a moderate level and five studies at the limited level.

Generic multifactor intervention programme
The 22 multifactor interventions from categories (1) and (2) included 19 strategies, in different combinations. These have been further analysed as shown in table 3, listing the seven most commonly used. The average QR score is given for each intervention strategy. Studies using work organisation/practice change have the highest average score (63%) and those incorporating a patient assessment system, the lowest (43%).

It is suggested that these top seven factors could form the basis of a generic programme, although it is likely that an intervention strategy and programme will need to be further developed and extended in order to be responsive to local organisational and cultural factors. The risk assessment process could facilitate the detailed design of the programme, and identification of additional appropriate strategies, with the allocation of priorities based on local negotiation with managers and staff.

Cost effectiveness
The cost effectiveness of interventions was only reported for two studies,21, 22 with $55 000–65 000 annual savings. These used a multifactor intervention programme, including risk assessment7 and the lifting team22 strategy.
Conclusion
This systematic review has drawn together international data relating to patient handling interventions from 1960 to 2001. There is strong evidence against interventions predominantly based on technique training. It is suggested that the seven most commonly used strategies from the multifacto

Interventions (hoisting equipment and lifting teams) also provided a moderate level of evidence and it may be, with more high quality research, that these may be shown to offer more cost effective strategies. Unfortunately, as only two studies from the USA reported data on financial savings, it will be more difficult for health care managers to draw conclusions from these data as the financial accounting systems (for example, workers’ compensation and insurance) may be different.

The main recommendation from these findings is that health care providers should review their current approach to managing risks and injuries associated with patient handling activities. If their approach is predominantly based on technique training it is unlikely to be successful in reducing musculoskeletal injuries, and an alternative intervention strategy should be considered.

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