Consultative team to assess manual handling and reduce the risk of occupational injury

P J W Carrivick, A H Lee, K K W Yau

Abstract

Objectives—To describe the formation of a consultative team to assess the risk of manual handling in the workplace that started in October 1992 within the cleaning services department of a 600 bed hospital, and to evaluate the effectiveness of its recommendations in reducing the rate and severity (time lost and cost) of workers’ compensation injury.

Methods—The consultative team identified, assessed, and recommended controls for manual handling and other injury risks. Data on injuries counted before and after implementation of the team’s recommendations were obtained for the cleaning services study group, an orderly services comparison group, as well as cleaners from a peer hospital and for the State of Western Australia. Evaluation of the four groups was undertaken 3 years after the end of the study period, to allow maturation of the costs of the claims (adjusted to July 1998 consumer price index) and hours lost from work.

Results—Statistical analysis showed that implementation of the recommendations significantly reduced numbers and rates of injury, but not the severity of injury, in the cleaning services study group. There was no difference in numbers or severity of injuries for the comparison groups before and after implementation of the recommendations.

Conclusions—The recommendation of the consultative team can produce a meaningful and sustained reduction in rates of injury within an at risk population. The results support a consultative approach to reducing workplace injuries from manual handling. The team process has potential for application to occupational groups at risk of exposure to other types of hazards. (Occup Environ Med 2001;58:339–344)

Keywords: injury; risk assessment; participatory; ergonomics; teams

The annual total (direct and indirect) cost of serious injuries to workers in Australia has been estimated at Aus$20 billion.1 Manual handling, defined as any activity requiring the use of force exerted by a person to lift, lower, push, pull, or carry, or to move, hold, or restrain a person, animal, or thing, is the most common mechanism of injury (38%) and accounts for almost half the economic burden (Aus$9.5 billion).2 Although national injury data were not available in 1989, a 600 bed teaching hospital in Western Australia, decided to consider two safety and health imperatives. The first was compliance with State legislation that imposed on employers a proactive duty of care for safety and health in their workplaces; and a requirement that they consult with employee representatives in meeting this obligation. The second was the need to redress a decade of increasing compensation costs for workers. The hospital started recording staff injuries according to a new Australian standard,3 under which the main events of interest were lost time injuries; defined as new compensable injuries resulting in the loss of a day or more from work. To each lost time injury was attributed the date and the type of injury, and a range of personal and occupational details. The standard encouraged the calculation of a frequency; defined as the number of lost time injuries per million hours worked by a given population of workers over a nominated period. The frequency provided potential for within group comparison (by occupation), between group comparison (between organisations), and monitoring over time.

The data from the 1990–1 financial year showed a hospital wide frequency that was 25% higher than the State average.4 Manual handling was the mechanism in over 60% of cases; twice the proportion for the State. Analysis by occupation showed that the frequency for both cleaners and orderlies was double that of nurses; and that manual handling was the main mechanism. A reduction in the risk of injury from manual handling became a corporate priority, but available empirical research indicated that fitness based worker selection and the training of staff in lifting techniques were ineffective risk control measures.5 There was, however, some evidence that ergonomic redesign of work environments and practice could reduce the likelihood of injuries from manual handling.6 In 1992, the Western Australian government released a code of practice for manual handling,7 which provided guidelines for identifying, assessing, and controlling risks from manual handling. The code encouraged employers to work with employees in considering the risk, although it was non-specific on the consultation process. The study hospital created a policy on manual handling based on the code of practice. It also sanctioned the trial of a consultative team to assess the workplace risks of manual handling within cleaning services, and to find whether the team would assist with implementation of policy in high risk areas. The team concept was based on an unevaluated 3 month pilot program undertaken within three public hospitals in the State of Victoria.8

This paper outlines the formation of the team, its recommendations on manual handling, and evaluates the team’s effectiveness in...
implementing solutions. 13 assessment on the effectiveness of this strategy is scant and mixed. A study of firefighters implied that employees might not be competent to prioritise the risks of injury from manual handling. 11 Within healthcare settings, one study found wide variation in the capacity of non-ergonomist staff, relative to ergonomists, to identify and prioritise hazards, and implement recommendations. 12 However, another study suggested that participatory ergonomics teams can be successful in identifying problems and implementing solutions. 13

Methods
THE WORK OF THE TEAM
The consultative team consisted of representatives from management and employees and the hospital’s ergonomist. It carried out a three stage process of identification, assessment, and control of workplace risks from manual handling. Recommendations of the team were applied to the workplace of cleaners within the study hospital. The aim was to achieve a sustained reduction in overall injuries, particularly injuries from manual handling, for all cleaning services staff. The team started activity in November 1992.

Cleaning services were selected for the trial because, relative to orderlies, cleaners’ duties were autonomous from other staff. Team members, all cleaners, were selected by their head of department and comprised four general staff, two safety and health representatives, and two supervisors. To be considered for membership, staff were required to be committed to safety and to be familiar with the duties, physical environments, equipment, and policies and procedures relating to the work of cleaners. The ergonomist’s role included team training, the provision of data on injuries, the development of a checklist for risk assessment, assistance with presentations to management, and professional support. Team training consisted of three 2 hour sessions covering the principles of safe manual handling, and the identification, assessment, and control of hazards. The terms of reference of the team covered procedure of the meetings, and the reporting process to cleaning services management.

IDENTIFICATION OF RISKS
Items for assessment of risk—namely, workplaces, specific equipment, or tasks—were targets for selection in view of historical injury records, longstanding concern about safety, or the item was often associated with manual handling.

ASSESSMENT OF RISKS
Risk assessment occurred in two phases. The first involved using the checklist in the workplace to consider the 10 main risk areas of the selected item—namely, (a) actions and movements, (b) workplace and workstation layout, (c) working posture and position, (d) duration and frequency of manual handling, location of loads, and distance moved, (e) weight and forces, (f) characteristics of loads and equipment, (g) work organisation, (h) work environment, (i) skills and experience, (j) age and clothing. In the second phase, regular team meetings considered completed checklists, injury data, and communication from non-team staff. To assist in the prioritisation of remedial action, risk was considered on the likelihood (low, medium, or high) and severity (minor, moderate, or severe) of injury, and the number of cleaners at risk of injury.

Risks of injury not from manual handling were often revealed during the assessment process. The risk might be directly associated with the item being assessed; for example, pulling on a particularly heavy bed presented a hazard of laceration due to the sharp metal edges of the bed frame. Alternatively, team members in the workplace noticed other hazards not directly related to the item being assessed—for example, torn carpets representing a trip hazard were coincidentally noted when assessing the dusting of high objects. The team therefore decided to assess all risks of injury about which it became aware.

RISK CONTROL
Where possible, the team recommended that hazards were not introduced into the workplace of the cleaners. Hospital purchasing criteria, for example, were changed so that replacement floor coverings were easier to clean and required cleaning less often. Where a hazard already existed, consideration was given to the hierarchy of controls. That is, in descending order of priority, elimination, substitution, engineering control, administrative control, and personal protective equipment. Examples of implemented controls include the elimination of the double handling of rubbish; the replacement of heavy steam cleaning hoses used for the cleaning of soiled furniture with light metal warm water spray wands (simultaneously reducing the risk of burns, slips, and exposure to hazardous noise); the modification of cleaners’ trolleys, by engineering services, to reduce the pushing forces required and to normalise the postures required to access cleaning equipment; rotation of the daily job repetitive tasks such as mopping, buffing, and dusting more often; and improved training for new employees on safe manual handling.

GROUPS ASSESSED
Cleaning services were assessed for risk and severity of injuries before and after implementation of the recommendations. As it was impractical to randomly allocate cleaners to implementation or not of the team’s recommendations, three groups unaffected by the recommendations were used for comparison. The first group, orderlies from the same hospital, was used to help control for risk factors for injury within the hospital. As the sex and duty profile of orderlies was different from the study group, cleaners from a similar sized public hospital formed the second comparison group.
The final group were all cleaners (hospital and non-hospital) in the State, to allow for factors such as changes to safety and workers’ compensation legislation, or the economic and employment environment. Ethical permission was obtained from the study hospital and the authors’ institutions. Confidentiality of records was maintained.

**Study hospital**

All cleaners and all orderlies ever employed during the study period were assessed. Both cleaning services and orderly services reported to hotel services, and had the same line management extending up to the chief executive officer. The same industrial award covered staff in each group, and both groups were within the occupational category Labourer under the classification of the Australian Bureau of Statistics. The average age of subjects in both groups at the start of the study was 37. The mean numbers of cleaners (145) and orderlies (140) during the study period were relatively stable, but the cleaners experienced a higher turnover (507 people ever employed) compared with the orderlies (279). Of cleaners ever employed, 65% were women by contrast with 5% for orderlies. Orderly duties, although predominantly manual handling, comprised patient handling, pushing of trolleys, and courier work. Cleaners had more part time workers, and averaged 20% fewer hours a week than orderlies. The risk controls implemented through the team were unlikely to have impacted on orderlies. Although orderlies were not exposed to the team, they did continue with their usual induction training and had ongoing access to safety and health representatives, the department of occupational health, and to processes to resolve safety issues.

Data for both groups (including hours worked) were obtained from fortnightly financial records (about 50,000), personnel records, incident data sheets, hospital workers’ compensation files, and workers’ compensation records held by the insurer.

**Comparison hospital**

All cleaners ever injured during the study period within an 800 bed public adult teaching hospital located in the same city were included. The cleaning staff were employed under the same industrial award, had similar duties as the study hospital cleaners, and used the same insurer. Lost time injury details (names excluded) incurred during the study period were provided by the comparison hospital. The lost time injury mechanism (manual handling or not) was not available. Although staffing numbers were considered to have remained stable, demographic data and total hours worked by all cleaners (injured or not) were not available.

**State comparison group**

All lost time injuries among all cleaners (not just hospital cleaners) in Western Australia (unpublished data, courtesy of WorkCover Western Australia) were identified. State data were available only from the beginning of the 1991–2 financial year (about 1 year before implementation of the recommendations). Injury data were grouped by calendar month (whereas all other groups recorded data for the day of occurrence), and lost time injury mechanism (manual handling or not) was not assessed. The number of hours worked by all cleaners in the State over time was unavailable.

**STUDY PERIOD**

All groups were followed up from the start of the implementation of the recommendations until 31 October 1995; when the orderly services were contracted to an external company. This 36 months is called the period after implementation. With the exception of State cleaners, data from before then were able to be retrieved back 52 months to the beginning of the 1988–9 financial year (1 July 1988).

**OUTCOME VARIABLES**

- **Lost time injury**—A new workers’ compensation injury resulting in one shift or more off work during the study period.
- **Claim cost**—Total cost of compensation for a lost time injury includes lost salary, medical costs, legal costs, travel costs, rehabilitation costs, settlement, and common law costs.
- **Duration**—Duration was the working hours ever lost from a lost time injury.
- **Partially fit workers**—Return to work programmes, remained on full workers’ compensation and accrued costs and hours lost as if they had remained at home. Once on full duties, salary support ended but treatment and other costs might continue. For claims to be finalised, either the workers had been declared fit by their doctor and sustained their fitness for some months, or they were unlikely to ever return to work because of the injury and a financial settlement had been made (after which costs and duration stopped accruing). Claim cost and duration accrued after the study period that would have been attributable to a lost time injury were included. The data were collated in 1999 by which time all claims were deemed finalised by the insurer. Final costs were adjusted to the Australian July 1998 cost price index.
- **Hours worked**—Hours worked were the number of hours actually worked (not including leave, extra payment for overtime, etc) by a group (study hospital cleaners and orderlies only).
- **Frequency**—Frequency was lost time injury per hours worked.
- **Duration rate**—Duration rate was the total duration divided by hours worked.
- **Claim cost rate**—Claim cost rate was the total cost of compensation claims of the workers divided by hours worked.

**DATA ANALYSIS**

Data for all groups from lost time injuries were analysed first. Descriptive data before and after implementation of the recommendations on numbers of lost time injuries, duration, and cost were of initial interest. Next, the relation over time between implementation of the recommendations and the numbers of injuries was examined. State data were recorded in calendar months, but as some monthly periods for
the study hospital recorded no lost time injury, it was considered appropriate to undertake analysis of quarterly injury numbers. With notable outcomes being rare events Poisson regression was used. As quarterly data were in chronological order, a trend effect and two seasonal terms were added as covariates to adjust for possible systematic time trend and seasonal pattern of the mean injury number series. To gain an indication of injury data on severity over time, quarterly mean cost, and mean duration were then analyzed. This was undertaken by fitting a linear regression model on (log transformed) cost and duration per lost time injury with seasonal, time trend, and intervention terms.

The intervention and orderly groups were analyzed further; as aggregate fortnightly hours worked, and the date and mechanism of injury for all lost time injuries, were known for both groups. The pattern of numbers of lost time injuries of staff in both groups was first cross tabulated by the period before and after implementation of the recommendations, and the χ² test of association performed. Then, after dichotomous classification, according to whether or not manual handling was the mechanism of injury, frequency and severity rates of lost time injuries were analysed. Aggregate frequencies before and after implementation of the recommendations were calculated, followed by regression analysis on sequenced 16 week periods. An identical process was followed for duration rate and claim cost rates; except that data on duration and cost were first log transformed to attain the normality assumption.

### Results

#### Summary data

Aggregate data before (4.25 years) and after implementation of the recommendations (3 years) are given at table 1.

#### Injury count

The adjusted ratios after versus before (exponential of the coefficients of the implementation of the recommendations) for the Poisson regression model are given in the first column of table 2. The effect of implementation, as reflected by the 95% confidence interval (95% CI), was significant for study hospital cleaners only. The implementation of the recommendations was associated with a reduction of greater than 50% in incidence of injury for this group. No significant trend was found. No seasonal term was significant except for the data for State cleaners.

#### Severity of injury: mean cost and duration

After logarithmic transformation the mean cost and duration (per lost time injury) had roughly normal distributions as confirmed by the one sample Kolmogorov-Smirnov Z statistic and other tests of normality. Adjusted ratios after versus before implementation of the recommendations are shown in columns 2 and 3 of table 2. The implementation term is not significant for the data on severity, except for the comparison hospital cleaners in the third column of table 2, which suggests an apparent increase in duration of injury for this group after implementation of the recommendations. No significant trend or seasonal effect was found.

### Study hospital groups

#### Patterns of numbers of all lost time injuries

The patterns of numbers of injuries sustained by cleaners and orderlies before and after implementation of the recommendations are tabulated in table 3. For cleaners the Pearson χ² statistic (2 df) of 14.48 had a value of p=0.001, implying significant association with implementation. For orderlies, the Pearson χ² statistic (2 df) of 0.708 was not significant (p=0.702).

#### Frequency

Table 4 details the frequencies before and after implementation of the recommendations for cleaners and orderlies. For cleaners, both the manual handling and the total frequency decreased by about two thirds, whereas for orderlies the respective frequencies increased by about one third.

### Table 1 Summary data before and after intervention (implementation of the recommendations)*

<table>
<thead>
<tr>
<th>Group</th>
<th>Before intervention</th>
<th>After intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lost time injuries(n):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study hospital cleaners</td>
<td>112</td>
<td>25</td>
</tr>
<tr>
<td>Orderlies</td>
<td>106</td>
<td>88</td>
</tr>
<tr>
<td>Comparison hospital cleaners</td>
<td>143</td>
<td>76</td>
</tr>
<tr>
<td>State cleaners†</td>
<td>1297</td>
<td>2913</td>
</tr>
<tr>
<td>Total duration (average duration)(h):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study hospital cleaners</td>
<td>75861 (677)</td>
<td>17760 (710)</td>
</tr>
<tr>
<td>Orderlies</td>
<td>27282 (257)</td>
<td>43739 (497)</td>
</tr>
<tr>
<td>Comparison hospital cleaners</td>
<td>18723</td>
<td>9917 (130)</td>
</tr>
<tr>
<td>State cleaners†</td>
<td>603533 (465)</td>
<td>174694 (600)</td>
</tr>
<tr>
<td>Total claims cost (average claims cost)‡:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study hospital cleaners</td>
<td>1506544 (13451)</td>
<td>451993 (18080)</td>
</tr>
<tr>
<td>Orderlies</td>
<td>339755 (23355)</td>
<td>12463 (16325)</td>
</tr>
<tr>
<td>Comparison hospital cleaners</td>
<td>75861</td>
<td>17760 (710)</td>
</tr>
<tr>
<td>State cleaners†</td>
<td>15410992 (11882)</td>
<td>39927996 (13707)</td>
</tr>
</tbody>
</table>

*Allowance must be made for the different time spans before and after intervention.
†Data before 1 July 1991 are not available.
‡Australian dollars, adjusted to July 1998 consumer price index.

### Table 2 Adjusted ratios after versus before intervention (implementation of the recommendations) for quarterly injury count, average cost, and average duration

<table>
<thead>
<tr>
<th>Group</th>
<th>Adjusted ratios after versus before intervention (95% CIs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Quarterly injury count</td>
</tr>
<tr>
<td>Study hospital cleaners</td>
<td>0.486* (0.241 to 0.979)</td>
</tr>
<tr>
<td>Orderlies</td>
<td>1.149 (0.694 to 2.018)</td>
</tr>
<tr>
<td>Comparison hospital cleaners</td>
<td>1.234 (0.720 to 2.101)</td>
</tr>
<tr>
<td>State cleaners</td>
<td>0.948 (0.890 to 1.123)</td>
</tr>
</tbody>
</table>

*p<0.05
The regression coefficients of the sequenced 16 week regression show a significant reduction after implementation in frequencies of total, manual handling, and other injuries for cleaners (table 5). By contrast, orderlies experienced a significant increase in overall frequencies, although after splitting the lost time injuries by mechanism the increases in frequencies of manual handling and other injuries were not significant.

Rates of severity
Cleaners experienced no significant change after implementation of the recommendations in the rates of costs of claims or the duration. By contrast, orderlies experienced a significant increase in the rate of costs of claims. For brevity, these results are not tabulated.

Discussion
This was a longitudinal before-after intervention study with one intervention and three comparison groups. A significant reduction in the number of injuries (table 2) and frequencies (table 5) was noted for the group that had implemented the recommendations of the team but no other group. The large reductions were contributed to by a fall in risks of both manual handling and other injuries. This may partly reflect that, despite the focus on manual handling, many other hazards were considered concurrently by the team. Also, a Hawthorne effect may well have influenced behaviour. This does not really matter if, as in this study, the effect is beneficial and sustained. A fall in the total cost and duration of claims after implementation of the recommendations was also experienced by the study hospital cleaners (table 1). However, this was due to the reduction in numbers of injuries and not their severity.

Although the knowledge base on assessment of risks of manual handling is still in its infancy, there is emerging evidence that employee participation is an important component of an effective strategy to reduce the risk of injury. This study indicates that consultative teams to assess workplace risk, with appropriate training and support, can be effective in producing a significant and sustained reduction in rates of manual handling and overall injuries. The team process can be generalised, and could be adapted (with a different checklist) to focus on another hazard.

Limitations of this quasi-experimental study are that data were gathered retrospectively, and membership of all groups was dynamic. Also, the calculation of frequencies within the state and peer hospital groups was not possible because data on hours worked were unavailable. Ideally, the same subjects would have been followed up throughout the study period, and variables such as age and sex that can influence the risk of injury from manual handling would be accounted for. To partly overcome these limitations, data are currently being captured to facilitate modelling of risk of injury after adjusting for potential confounding, for the subgroups of study hospital cleaners and orderlies who worked both before and after implementation of the recommendations.

We thank the staff from the study hospital, and the Editor and referees for their helpful comments. This work was supported in part by the Research Grants Council of Hong Kong.

Table 3 Number of staff in each lost time injury (LTI) category, cross classified by intervention (implementation of the recommendations) periods

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleaners</td>
<td>267</td>
<td>194</td>
</tr>
<tr>
<td>Orderlies</td>
<td>138</td>
<td>120</td>
</tr>
</tbody>
</table>

Table 4 Frequencies of types of lost time injuries/million hours worked before and after intervention (implementation of the recommendations)

<table>
<thead>
<tr>
<th>Types of lost time injuries</th>
<th>Before intervention</th>
<th>After intervention</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual handling: Cleaners</td>
<td>76</td>
<td>97</td>
<td>22</td>
</tr>
<tr>
<td>Other</td>
<td>57</td>
<td>45</td>
<td>14</td>
</tr>
<tr>
<td>Total: Cleaners</td>
<td>133</td>
<td>142</td>
<td>37</td>
</tr>
</tbody>
</table>

Table 5 Adjusted effect of intervention (implementation of the recommendations) based on frequency of type of lost time injury/million hours worked

<table>
<thead>
<tr>
<th>Types of lost time injury</th>
<th>Effect of intervention (95% CI)</th>
<th>Orders</th>
<th>Cleaners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual handling: Cleaners</td>
<td>~51.7 (~82.8 to −20.6)</td>
<td>19.0</td>
<td>−8.0 to 46.0</td>
</tr>
<tr>
<td>Other</td>
<td>~38.7 (~56.5 to −20.8)</td>
<td>13.2</td>
<td>−1.1 to 27.6</td>
</tr>
<tr>
<td>Total</td>
<td>~93.3 (~123.2 to −63.4)</td>
<td>35.0</td>
<td>7.0 to 62.9</td>
</tr>
</tbody>
</table>

*p<0.05.
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