Reducing the risk of musculoskeletal disorder for nurses during continuous bladder irrigation procedures

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Abstract: Following a musculoskeletal injury to a nurse caring for a patient undergoing continuous bladder irrigation procedures, a workplace project was instigated. The project aimed to provide a more in-depth assessment of the manual handling task, by using four different tools and a participatory ergonomics approach. Each MSD tool confirmed the MSD risk. An evaluation survey by the eight workers involved indicated that the majority of participants found each of the MSD tools to be helpful in identifying the hazards and suitable control measures. They particularly favoured the use of worker participation, consultation and discussion. The outcomes of the project are the recommendations to implement engineering control measures for the manual handling task and to consider ways to improve the manual handling risk management system, such as through worker participation.

Keywords: musculoskeletal disorder, MSD assessment tools, participatory ergonomics.

1. Introduction

Following a shoulder injury to a nurse on a ward with urology patients, initial investigation identified that the frequent use of an intravenous (IV) pole for patients undergoing continuous bladder irrigation was a hazardous manual task. A 2 litre fluid bag is changed on an IV pole every 15 min for at least a 24 hour period post-surgery; the fluid bags are positioned as high as possible, for gravity-assisted drainage into the patient. This involves awkward postures and actions and frequently raising a load above head height.

There could be several patients per week who have had a specific surgical procedure requiring continuous bladder irrigation (CBI). They are inpatients for at least 48 hours, possibly up to 5-7 days, and the CBI occurs 24 hours per day. The changing of 2 litre fluid bags may eventually slow down to once every few hours prior to discharge. There are approximately 18 nurses on this ward, who would all look after patients for CBI. CBI is a frequent task, with many staff exposed to the manual handling risk factors.

The safety professional identified room for improvement in both the process and the outcome from the local risk assessment. In order to achieve good engineering controls in a tight fiscal environment, and identify how to improve the workplace’s current risk management system, more detailed assessments and a participatory ergonomics approach were indicated.

2. Project organisation

A search for more detailed musculoskeletal disorder (MSD) assessment tools was carried out. A helpful starting point was the “Smart Moves Toolkit Part 3C MSD Prevention Toolbox More on in-depth risk assessment methods”; unfortunately it is no longer available on WorkCover NSW’s website. Many methods were deemed not applicable as they did not take into account relevant risk factors such as a one-handed vertical lift conducted every 30 minutes.

Those that did seem applicable were proposed, particularly Rapid Upper Limb Assessment (RULA) and Quick Exposure Check (QEC). Other tools identified included the Body Discomfort Survey, which helps to identify hazardous manual tasks and Participative Ergonomics for Manual Tasks (PErforM), which provides a risk profile rather than risk analysis.

To facilitate worker participation and consultation, a core group of 7-8 Registered Nurses (RN) on the ward were identified, who were rostered on either morning or afternoon shifts on several weekdays over a period of 3 weeks. The safety professional had access to staff during in-service time, 2:30 PM-3 PM, when there was maximum number of RNs on the ward due to crossover of the morning and afternoon shifts. Usually only two RNs were available at a time, sometimes only one. Most staff were seen three times over the three-week period; some could only be seen twice.
A search for engineering solutions currently on the market was conducted. Two other hospitals which perform the same surgical procedure were also contacted, but reportedly CBI was being done in similar ways at each site.

Economic impact of the preferred control measures was considered, in terms of cost-benefit analysis (using the cost of the workers' compensation claim incurred) and productivity.

An evaluation survey was conducted with the participating RNs.

3. Method

3.1 Body Discomfort Survey

Workers are asked to indicate on a body map if and where they feel pain or discomfort from continuous bladder irrigation tasks. This can help identify hazardous manual tasks. Early reporting of symptoms can lead to interventions being put into place which may then prevent injury from occurring (Safe Work Australia, 2011).

3.2 Participative Ergonomics for Manual Tasks (PErforM)

PErforM is a participatory ergonomics program for reducing MSD risk from hazardous manual tasks. Participants select a manual task; on a body chart, they mark which part(s) of the body are affected by the task. Considering each affected body part separately, participants then rate the level of severity of each risk factor between one (not present) and five (most severe). The five risk factors are forceful exertion, awkward/static postures, vibration, duration and repetition. Using a different colour for each body part, the dots can be joined to form a risk profile of each body part for that task. See figure 1. Ratings of 4 or 5 indicate that action is needed (see the green shaded area of figure 1).

There are two worksheets – only PErforM Worksheet 2 was used. Using the pain and discomfort results from the Body Discomfort Survey (3.1 above), seven workers were asked to score the risk factors on PErforM Worksheet 2 for each of the body parts affected, for the task of CBI.

3.3 Quick Exposure Check (QEC)

QEC is a validated tool which takes into account research on musculoskeletal hazards and the need to assess both physical and psychosocial factors (HSE, 2005). It includes factors such as visual demands, work pace and work stress. It uses a checklist - half is completed by the observer and the other half by workers. QEC quantifies the exposure risks of the four main areas of the body (back, shoulder/arm, wrist/hand and neck). It does this by scoring interactions between different pairs of factors on a separate scoresheet, e.g. back posture plus duration could result in a score between two and 12, repeated motion of the wrist plus force could result in a score between two and eight. Exposure scores are then categorised into four exposure categories between 'low' and 'very high'. If the exposure scores are rated as moderate or higher, it is recommended that controls should be implemented and/or changes made to reduce the level of exposure for any interactions with particularly high scores.

3.4 Rapid Upper Limb Assessment (RULA)

RULA (McAtamney et al 1993) is a validated tool, providing an objective measure of musculoskeletal disorder risk for tasks primarily performed by the upper limb. It looks at postures, muscular effort and external loads on the body. A scoresheet is used and a final score is derived which corresponds to a series of "action levels" for the MSD risk, between 1 (acceptable) and 7 (investigate and change immediately).

The assessment was conducted by the safety professional, through observing multiple workers carrying out the task of CBI. This was only done for the dominant arm.

3.5 Cost-benefit analysis

Formula used: Cost of equipment + cost of worker’s compensation claim = payback period (Oxenburgh et al, 2004).
3.6 Worker evaluation
To find out how effective they found the MSD methods used in this project, as well as the experience of active involvement, participants were given a survey consisting of three Likert items with five response levels between ‘1. strongly disagree’ and ‘5. strongly agree’.

4. Findings
Where there were multiple scores or ratings, the median was used as an average. An underlying assumption is that each RN is looking after only one patient for CBI, in an eight-hour shift, during the first 24 hours postsurgery.

4.1 Body Discomfort Survey
Out of seven staff:
- 7 indicated that they feel discomfort from this task.
- 5 indicated that they feel discomfort in their shoulder(s), and 5 in their knees.
- Other body parts affected included the neck, low back and wrists.
- The median number of body parts affected = 2.
- The median rating of level of discomfort/pain on a scale of 1 (just noticeable) to 5 (unbearable) = 3 (moderate).

4.2 Participative Ergonomics for Manual Tasks (PErforM)
The results indicated a score of 4 for awkward postures of the shoulders and knees. There was also a score of 4 for exertion and awkward posture of the wrist. The scores of 4 indicated that action needs to be taken. Refer to figure 1.

4.3 Quick Exposure Check (QEC)
Exposure levels were rated as low for the neck; moderate for the back, shoulder/arm and wrist/hand; moderate for work pace and high for stress. The pace of work and the high level of work stress reported add even further to the risk of MSD, hence a more urgent need for action. Specific interactions that scored the highest and so should be addressed were: shoulder/arm (perceived weight of load plus hands at/above shoulder level, when hanging bags); back (posture plus perceived load, when emptying the catheter bag); wrists (posture plus force, when hanging bags).

4.4 Rapid Upper Limb Assessment (RULA)
As two distinct methods for hanging the bags were observed, RULA scores were calculated for each method:
- Method 1, height of the IV pole is adjusted manually - Final score = 6.
- Method 2, height of the IV pole is not adjusted - Final score = 5.
Both techniques for hanging fluid bags had a final score of 5-6, indicating action is needed soon. Upon closer analysis, the first method appeared to be more demanding on the worker’s body than the other, as there were more arm movements involved and greater forces/loads. This helped to identify that the second technique is the preferable one.

4.5 Staff consultation and discussions
The first three methods listed above required participation by workers. During those sessions, workers were asked for extra input regarding the manual handling issues, which helped clarify details which the manual handling assessment tools/methods didn’t pick up clearly, as well as ideas regarding solutions and feedback on ideas presented. Very few ideas for control measures were generated by the workers. One or two ideas that were presented by the safety professional were rejected unanimously by the workers, based on their expert knowledge of the task and patients.
Although some initially presented as reluctant to participate, all eight workers became actively engaged. They all expressed staff safety concerns about the continuous bladder irrigation task and were keen for solutions to be implemented. Most were sceptical of control measures being implemented if they involved significant cost.

Based on the results of the manual handling assessments and worker consultation, the safety professional recommended that the best control measure was an engineering one, through purchase and use of IV poles with a ‘lift assist’ mechanism. This would mechanically raise and lower the IV pole, which would decrease the extreme postures of the shoulder in particular, especially when the hands are loaded. Workers were in favour of this.

### 4.6 Worker evaluation

Eight workers completed an evaluation form on how effective they found the assessment methods used in this project.

- In terms of helping to clarify the hazard(s), the majority of responses rated each tool/method favourably (i.e. “agree” or “strongly agree”), with the largest proportion of “strongly agree” responses for the Body Discomfort Survey.
- In terms of helping to identify control measures, the majority of responses rated each tool/method favourably.
- In terms of which tool/method they may like to use in future during manual task risk assessments, each tool/method rated favourably, however more staff preferred the Body Discomfort Survey, PErforM and worker participation/discussion.

The only method where 100% of responses were favourable for each question was worker participation/discussions. See figure 2.

### 4.7 Return on investment

**Assumption:** purchase of three battery-operated IV poles from an Australian supplier.

**Result:** = 10.9 months payback period.

At the time of writing, quotes for other suitable products were not available.

### 4.8 Productivity

If use of ‘lift assist’ IV poles is implemented, it may take longer to raise and lower the IV poles - possibly up to 44 seconds at a time (22 seconds each way) which could equate to 23.5 minutes in an eight-hour shift of lost productivity. This could be partially offset as the new IV poles would have more than two hooks, which would mean that a new 2 L fluid bag would not have to be hung so frequently. Ways to use the time productively when mechanically raising and lowering the IV pole needs further investigation.

During the QEC assessment, several workers thought that the cumulative amount of time they spend on CBI was at least four hours out of their eight hour shift, whereas the total was calculated as being under 1.5 hours. Several workers said they found CBI to be “exhausting” or to feel "exhausted" at the end of their shift because of CBI. There is a link between WHS and work performance (Cole, 2005). If implementation of ergonomics interventions reduced this apparent fatigue factor, as well as MSD symptoms, perhaps there would be even more positive impact on productivity, however it would be difficult to prove.

In general terms, there is some evidence that participatory ergonomics interventions have a positive impact on MSD symptoms, decreasing injuries and workers’ compensation claims and days lost due to sick leave (Cole, 2005). Gahan et al (2014) says that in broad terms, "prior research supports the proposition that investments in better WHS will provide a positive return on that investment through reduced costs associated with poor WHS outcomes and improved productivity, or other outcomes that add value to the business.”

### 5. Results

- The MSD methods used confirmed that continuous bladder irrigation is a hazardous manual task. Each method provided quantitative information. All four identified the shoulder/arm as being at risk of MSD. All three participatory tools (Body Discomfort Survey, PErforM and QEC) also identified MSD risk for the wrist/hand, two for the knees, two for the back and one for the neck. The RULA method also supported
Those findings, from the safety professional's observations of multiple staff carrying out the CBI task. The participatory ones also provided valuable qualitative information from staff consultation, with respect to the MSD hazards, MSD assessments and identifying suitable control measures.

- The MSD risk would increase for RNs on a 10 hour night shift or if they are looking after more than one patient for CBI during their shift, due to increased exposure.
- The best control measure to reduce the risk of musculoskeletal injury, especially to the shoulder, is an engineering one involving IV poles with a 'lift assist' mechanism. This would also help reduce musculoskeletal loading on the neck, low back and wrists.

At the time of writing, options for obtaining this equipment were still being investigated - only one suitable product has been found in Australia, which is very expensive; an Australian company which manufactures equipment for the healthcare industry is interested in designing a battery-operated IV pole; several products are available in the USA but the companies contacted so far do not export to Australia.

- Potential measures to reduce the risks for workers' knees are still being investigated.
- The author observed that there are opportunities for improvement with procedures in the workplace's manual handling risk management system, and will recommend to management that ways to improve the system be identified, agreed upon and addressed in the workplace. Use of a participatory ergonomics approach will be suggested.

6. Lessons learned

- Typically, manual handling risk management in a hospital environment has focused on tasks involving large, heavy and awkward objects, such as patients, beds and trolleys. This project, involving loads of only approximately 2 kg, was unexpectedly complex and was a very worthwhile investment of the safety professional's time and effort.
- The safety professional could have conducted a risk assessment based on just the incident investigation information and with minimal observation of the task being carried out and staff consultation, which may not have been enough to effect change. The additional MSD methods used provided extra assessment details, which could be presented visually (PErforM), quantitatively and through giving the workers a "voice". There is now much stronger support for the recommended control measures.
- Management liked receiving measurable and quantifiable assessment results.
- From the author's perspective, one of the best outcomes from using the more in-depth MSD tools and the participatory approach was that they clearly identified that softer, administrative control options would not effectively reduce the risk of MSD for this task.
- Productivity measures should be considered in selection of the most suitable IV pole product.
- All of the MSD tools clearly identified risk of MSD, especially of the shoulder. Each method added its own specific value, e.g. the Body Discomfort Survey identified the knees as being at risk too for multiple staff; QEC identified that each participant found the job "moderately stressful", mainly because some patients and visitors display difficult and demanding behaviour; RULA identified one technique for hanging the fluid bags as less demanding on the body than another technique. Staff consultation identified other manual handling issues, such as another staff incident had occurred more recently from the same task; several IV poles were difficult to push along the floor as the castors don't work smoothly. Several staff also expressed surprise when they learnt that they weren't all using the same task techniques for CBI. Observations by the safety professional picked up extra details such as some staff using small amounts of neck extension/hyperextension when hanging the bags up high or raising the IV pole, which QEC and RULA weren't sensitive enough for.
- Observation of at least six different workers doing the CBI task resulted in identifying two significantly different methods of hanging the bags, 4 minor variations in another part of the task (spiking the bag) and three minor variations in yet another aspect (emptying the catheter bag). These details will help with identifying and documenting the safest work practice.
- The challenges of getting participation and consultation with RNs on a ward became clearer, namely because of shift work on a rotating 24/7 roster, a very limited window of availability and only on some days and the demands of a clinical workload always taking top priority. Achieving worker involvement took a persistent and concerted effort on the safety professional's part - it would have been much easier...
to give up or settle for less. The participatory approach requires planning, management support and allocated resources (time and someone to organise and facilitate it.)

- Nursing staff will actively participate, given the opportunity. Although there was only a small sample of eight, the results of the staff evaluation survey indicated 100% support for using staff participation/discussions during this project and in future risk assessments.
- The author's recommendation is that use of an additional and participatory tool in the workplace, such as PErforM, to complement the existing process would assist wards and departments with being able to conduct more effective manual task risk assessments.
- Internet searches for engineering solutions were frustrating, requiring more time and a wider variety of search terms than anticipated. A battery operated IV pole available in Australia was found accidentally (and only a few days before the project results were presented to the ward), while searching for chemotherapy IV poles for a different project.
- If use of ‘lift assist’ IV poles is implemented, a participatory approach will also be recommended to manage the change in work practice, for example, so that the increase in the amount of time to raise and lower the IV pole does not become a barrier to use.
- Evaluation post intervention is recommended. The impact of implemented control measures on quality and productivity would also be useful to evaluate, along with MSD symptoms and any changes to the workplace's manual handling risk management system.

**Figure 1.** PErforM risk profile for task of continuous bladder irrigation.
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