Most physiotherapists (91%) experience work related musculoskeletal disorders (WMSDs) at some time, and one in six makes a career change as a consequence. Many of these disorders are attributed to manual handling of patients. This paper proposes guidelines to reduce the risk of WMSDs based on Australian legislative requirements, the results of a survey of Australian physiotherapists and the literature surrounding injury prevention. These guidelines address the areas of environmental and job design, and the personal physical capabilities of physiotherapists, within the context of law. The paper concludes by calling for further research to explore and develop this area of injury prevention in the physiotherapy profession. [Cromie JE, Robertson VJ and Best MO (2001): Occupational health and safety in physiotherapy: Guidelines for practice. Australian Journal of Physiotherapy 47: 43-51]

Key words: Musculoskeletal System; Occupational Health; Risk Management; Workers’ Compensation

Introduction

Physiotherapists experience work related musculoskeletal disorders (WMSDs) (Bork et al 1996, Cromie et al 2000, Holder et al 1999, Mierzejewski and Kumar 1997, Molumphy et al 1985, Scholey and Hair 1989) of sufficient severity that one in six make career changes as a consequence (Cromie et al 2000). Musculoskeletal injury is frequently associated with manual handling (Burdorf and Sorock 1997), defined as “any activity requiring the use of force exerted by a person to lift, push, pull, carry or otherwise move, hold or restrain … an animate or inanimate object” (Manual Handling Regulations 1999). Although physiotherapists frequently need to use manual handling and awkward postures in the course of their work (Ellis 1993, Fenety 1992, Hignett 1995), there are no profession-specific guidelines to assist them. As the coming decade is designated the decade for the prevention and treatment of musculoskeletal disorders (Garfin et al 1999), it is timely for physiotherapists to consider preventive measures they might implement to reduce their own WMSDs.

The first part of this paper outlines the legislative framework in which occupational health and safety issues in Australian physiotherapy practice are to be considered. The risk management approach to controlling workplace hazards is outlined. The paper then proposes guidelines to reduce the risk of WMSDs within the framework of the legislative requirements. The proposed guidelines are presented in Italics, and each is followed by a justification using findings from a 1997 survey of Victorian physiotherapists (Cromie et al 2000) and other published literature documenting injury prevention in both the physiotherapy profession and other industries.

Legislation

Occupational health and safety legislation provides a framework to ensure that all parties in the employment agreement (employer, employee) meet minimum standards for injury prevention. The law may then be interpreted into a practical document providing industry guidelines, such as codes of practice. Individual industries or occupational groups may then explicate the law and code of practice to provide guidelines specific to the work context of that industry or occupation. These are all external controls aimed at reducing injury by influencing job design and workers’ behaviour at a macro level.

In Australia, occupational health and safety legislation and resulting codes and standards state that the employer has a duty of care to their employees to provide a safe workplace (NOHSC 1999). Laws about
occupational health and safety are the responsibility of each state or territory government, and may differ between jurisdictions. However, all Australian legislation is based on a risk management model in which a hierarchy of control prescribes hazard identification, risk assessment, risk control and review.

**Hazard identification** Hazard identification involves identifying situations or events which could harm people in the workplace. The hazard may be environmental or relate to particular tasks, activities or systems of work. Checklists, workplace inspections, injury records and consultation with workers are all sources of information to assist with hazard identification.

**Risk assessment** Once a hazard is identified, risk assessment is required to determine the likelihood of the injury and the consequences of its occurrence. Risk assessment for manual handling should incorporate a consideration of the postures, movements, forces exerted, environmental conditions and the duration and frequency of the task (Manual Handling Regulations 1999).

**Risk control** The aim of risk control is to eliminate the hazard or, if that is not possible, to minimise the likelihood of harm. The preferred option is to change the environment, rather than the people working in it. Control of manual handling risks is implemented by:

- introducing design changes to eliminate the risk;
- reducing the risk where design changes are not possible (including introducing breaks, pacing and scheduling);
- changing the objects used in the manual handling task;
- using mechanical aids where removing the risk is not possible when none of the previous strategies are practicable; and
- providing training in performance of work to minimise the risk of injury.

Legislation and codes of practice require employers to undertake risk assessment and implement risk control measures. They are explicitly framed to ensure that training and education are implemented only after the work environment and work systems have been modified, the objects changed and mechanical aids introduced (Manual Handling Regulations 1999, Regulation 15.2).

**Review** The final step in the systematic approach to risk management is to review the effectiveness of the implemented control measures, and ensure that no new risks have been introduced as a consequence. Injury statistics need to be monitored following the introduction of risk control measures, to determine whether the controls have indeed reduced the injury rates. The process of risk management is continuous. Hazard identification and risk assessment must be carried out whenever circumstances change and suitable control measures should then be implemented (Manual Handling Regulations 1999).

**Industry standards and physiotherapy** The Victorian WorkCover Authority (VWA) has published a document advising on the design of workplaces where patients are handled (Victorian WorkCover Authority 1999), with a particular emphasis on spatial requirements. Australian Standards provide for the selection and use of mechanical aids for patient lifting and moving (AS2569.2), however no standards are available regarding optimal workplace design for therapists engaged in manual therapy, nor are there suggested workloads for physiotherapists.

**Proposed guidelines**

The remainder of this paper proposes guidelines for physiotherapy practice and provides justification by referring to the legislation and relevant literature.

1. **All physiotherapists must familiarise themselves with requirements of the legislation governing occupational health and safety (and in particular manual handling) in their jurisdiction. As a minimum, they should know the principles of risk management, and be able to apply hazard identification, risk assessment, control and review in their workplace.**

Occupational health and safety legislation provides a framework to ensure that all parties in the employment agreement (employer, employee, designers) meet minimum standards for injury prevention. The primary justification for Guideline 1 is the law itself. The National Occupational Health and Safety Commission emphasises the obligation of
employers and employees to comply with relevant state or territory law, and the duty of care for employers to provide a safe place of work for employees (National Occupational Health and Safety Commission 1999). The assumption underlying the legislative requirements is that it is the job, rather than inadequacies on the part of the worker, that contributes to injury. If this assumption is true, modification of the job and the physical demands of the job will act to reduce the risk of injury. The occupational health laws vary between states, but all advise changes in job design ahead of training (Manual Handling Regulations 1999, National Occupational Health and Safety Commission 1990).

The second justification for Guideline 1, in the absence of objective scientific proof of the effectiveness of injury prevention strategies, is to offer a defensible rationale for preventive measures.

Cromie et al (2000) reported a discrepancy between the risk factors therapists identified as contributing to their WMSDs and the self-protective strategies they most commonly reported using. More than 50% of the therapists who used manual orthopaedic techniques identified their use as making a major contribution to their WMSDs and more than 50% (to whom it was relevant) specified performing the same task repeatedly as contributing significantly to WMSDs. In spite of this, the majority of self-protective strategies these therapists reported using related to postural factors, such as adjusting the height of the work surface and modifying patient or therapist position. This discrepancy suggests that therapists need to consider a risk management approach to identify hazards and address risk factors specific to their work.

2. The majority of physiotherapists experience WMSDs. The low back, neck, upper back and upper limbs are most vulnerable to injury, and therapists must identify factors in the workplace, and away from work, that increase risk of injury to these areas.

In order to implement the risk management model of hazard identification, risk assessment, risk control and review, it is helpful to understand the common injuries experienced by therapists, and the risks to which they are exposed. Indeed, these data are frequently used in the preliminary step of hazard identification.

In the study of Victorian therapists reported by Cromie et al (2000) most physiotherapists (91%) experienced WMSDs at some time, and one in six therapists was forced to make career changes as a consequence. Therapists in this study identified performing manual techniques and lifting or transferring patients as contributing to WMSDs, suggesting formal risk assessment and management of these activities is appropriate (Manual Handling Regulations 1999).

Cromie et al’s (2000) study found that the body area with the highest annual prevalence of WMSDs was the low back (63%), followed by neck (48%), and upper back (41%). Thumb (34%), shoulder (23%) and wrist and hand (22%) WMSDs were also prevalent. The researchers found that therapists who performed manual therapy, performed the same task repeatedly, saw many patients in one day and who did not have enough rest breaks were at increased risk of neck and upper limb injuries (including thumb). Thumb symptoms in particular were related to performing manipulation and mobilisation techniques, with the prevalence of symptoms increasing as the number of hours performing these techniques increased. Postural risk factors and moving or transferring patients were associated with an increased risk of spinal (neck, upper and lower back) symptoms (Cromie et al 2000). These areas of the body and their associated risk factors provide a basis for risk assessment in the context of physiotherapy work.

Postural factors (particularly in conjunction with heavy loading) are recognised as potentially harmful to physiotherapists (Ellis 1993, Fenety 1992, Hignett 1995, Robertson et al 1993). Therapists’ posture can be constrained by anthropometric dimensions or the need to use a technique requiring them to assume harmful postures (Hignett 1995). Other studies have identified repeated muscle contractions and static loading as risk factors in the development of WMSDs (Kilbom 1994b, Roquelaure et al 1997).

These risk factors, and the common WMSDs experienced by physiotherapists, suggest risk assessment should consider not only the postural and patient handling demands, but also risk factors associated with manual therapy, such as repetitiveness of the work, caseload and work organisation.

**Risk control** Legislation requires an employer to eliminate risk and, if that is not practicable, to reduce
it as far as is practicable (Manual Handling Regulations 1999, Regulation 15.1).

Where risk cannot be eliminated, physiotherapists must minimise risk by altering the workplace.

3. **Established ergonomic guidelines for space, equipment, furniture and environmental conditions should be mandatory in the design of physiotherapy workplaces.**

Design of the physical environment is an important consideration in the prevention of WMSDs. Elimination of extreme postures and force, or prolonged static postures, should be considered when designing the physical environment, as should space and lighting. Prolonged or repeated bending is recognised as increasing the risk of back problems (Burdorf and Sorock 1997), and provides a rationale for using a height and angle-adjustable work surface. While most therapists would be aware of the usefulness and benefit of an adjustable treatment plinth in the physiotherapy workplace, it is not a requirement, even when multiple therapists (with different anthropometric dimensions) are using the same facilities. Patient handling with assistance is less risky than handling by only one person (Robertson et al 1993), but presumes an adequate availability of staff. This factor needs to be considered by physiotherapy managers and others representing the interests of therapists.

Changing the physical equipment used by workers can reduce the amount of time spent in awkward postures (Keyserling et al 1993), a known risk factor in the development of WMSDs of the upper limb (Silverstein et al 1986). This suggests that the principle of environmental design may be effective in reducing upper limb injury as well as low back injury.

Many of the known ergonomic risks associated with posture and exertion are taught to student physiotherapists as part of a musculoskeletal physiotherapy program. However, students may see these principles as applying only to patients, rather than themselves. Possibly a more explicit consideration of the relevance of this information to the practice of physiotherapy at a student level would ensure that therapists consider these issues in the context of their own work. Development of design guidelines specific to physiotherapy practice should incorporate principles of injury prevention.

4. **The physiotherapist’s job must be designed to ensure variety in the physical demands of work. This may be done by:**

   - scheduling different activities throughout the working day and week, and by including a variety of techniques and treatment options into therapy sessions;
   - scheduling adequate and regular rest breaks involving a change in posture as well as activity level;
   - seeing a range of clients with various conditions;
   - participating in policy development in health care to ensure reasonable workloads and adequate work environments; and
   - increasing the range of treatment techniques at the therapist’s disposal, aiming for variety in physical demands.

Existing guidelines for the prevention of WMSDs advocate optimum workplace design in accordance with established ergonomic principles, time limits for exposure to risk factors and reduction of extreme exposure. Winkel and Westgaard (1992) proposed guidelines for the prevention of neck and shoulder injuries, suggesting the introduction of new work tasks with differing physical demands as a way of reducing exposure to risk. Kilbom (1994a), in her recommendations for the performance of repetitive work, proposed interventions against the following risk factors: extreme postures and static work; lack of control; other risk factors such as lack of skill; high output demands; and monotony. She suggested interventions should be prioritised in the same order and could include work station and tool re-design, work re-organisation and training.

Guidelines for work and rest times are based on the assumption that fatigue is a precursor to injury, and that allowing the body to recover from fatigue reduces the risk of injury (Koniz 1998a and 1998b). However, this has not been established by research findings (Viikari-Juntura 1997).

In terms of job design, there are no standards available stipulating workloads for physiotherapy treatment. While there is evidence that therapists modify their position relative to the patient where
possible (Cromie et al 2000), other aspects of their work, such as scheduling, number of patients, rest breaks and variety in work have not been addressed. Although Fenety and Kumar’s (1992) study did not use symptoms of WMSD as an outcome measure, their intervention dealing with workloads improved productivity and made workloads more manageable.

Repeated muscle contractions and static loading are known to be risk factors in the development of cumulative trauma disorders (Kilbom 1994b, Roquelaure et al 1997). Variety in work and breaks in repetitive or prolonged static activities are recommended to prevent these injuries (Kroemer 1989). Job rotation, rest breaks and variety in work can be integrated into the physiotherapist’s job to avoid overloading any particular anatomical area either by sustained posture or repetitive actions. The implication for physiotherapists is that they should ensure variety in their techniques, in order to vary the stresses placed on a range of anatomical areas. Cromie et al (2000) suggested a need for therapists to have at their disposal a variety of treatment tools, to enable them to vary the physical demands on their bodies.

Scheduling variety into tasks, and organising the work to maximise efficiency, may provide a way of reducing risks associated with poor work flow. While manual orthopaedic techniques cannot always be eliminated (or engineered out) from the job, they may be reduced or modified while still achieving treatment goals. Mechanical aids may provide an appropriate solution in some instances.

Cromie et al (2000) found that Victorian physiotherapists used self-protective strategies to reduce the strain on their bodies while working. Most modified their patient’s or their own position or adjusted the treatment plinth height. By contrast, a minority interrupted their work to alter their posture, or stopped a treatment that was causing symptoms. Almost half (42%) of the respondents who used manual techniques reported using a different part of the body to administer a manual technique.

Although workload issues were significantly represented as being associated with WMSDs in the neck and upper limbs, Cromie et al (2000) found only one self-protective strategy addressed this area. This strategy was to select techniques that would not aggrivate symptoms, and was used by 40% of respondents concerned.

5. Mechanical aids and equipment should be used whenever appropriate. Therapists must be trained in their use.

Cromie et al (2000) reported that more than 90% of therapists used some type of assistive device to reduce the strain on their bodies. These included adjustable work surfaces, “wheelie” stools, slide boards, lifting belts, splints and unspecified “other”.

Although commercial literature and catalogues provide evidence that physiotherapists probably use a variety of aids and equipment, their ubiquity is unknown. Aids and equipment alone, without training in their proper use, are unlikely to be effective in reducing the risk of injury. Training in risk minimisation, and the use of aids and equipment, should be ongoing and incorporated into both pre-clinical and continuing professional education.

6. Training must not be the sole or primary means of controlling risk. Training in injury prevention must contain the risk management model of controlling risk, and include ‘in principle’ preventive measures rather than training in specific methods or techniques.

The term “training” is used in the literature to mean a program designed to address perceived deficiencies in knowledge, physical ability, or both. Education as a means of reducing injury assumes that the cause of injury is that workers are unaware of the correct way of doing things, and are therefore injured because of ignorance.

The prevalence of work related musculoskeletal disorders among physiotherapists is evidence that their education about injury, its causes and mechanisms does not prevent injury (Bork et al 1996, Cromie et al 2000, Holder et al 1999, Mierzejewski and Kumar 1997, Molumphy et al 1985, Scholey and Hair 1989). Stubbs et al (1983) commented, “If the work is intrinsically unsafe, then no amount of training can correct the situation” (p. 777), and concluded by recommending the development of safe systems of work (work design).

Education in manual handling as a means of reducing the risk of low back injury has been used extensively by industries ranging from health care to manufacturing. Back schools have advocated
education as a means of injury prevention for many years. In most cases they have aimed to prevent recurrence once injury has occurred (secondary prevention). Studies of the effectiveness of these schools typically demonstrated increased knowledge of back injury among participants, but little or no reduction in injury rates. Linton and Kamwendo (1987) reviewed 16 studies on the effectiveness of back schools. At that time, they concluded that little empirical evidence existed that low back school improved either behaviour or symptoms. More than a decade later, the evidence does not appear to have changed their conclusion (Daltroy et al 1997, Straker 1999b). There is some evidence that workers do not always implement the methods they have been taught (St-Vincent et al 1987), which may partially explain why the demonstrated increase in knowledge does not necessarily mean improvement in behaviour and symptoms. Both physiotherapy and industry assume that improved knowledge will result in a commensurate reduction in the rate or severity of injury. In the light of the available studies, this assumption is probably not justifiable, and certainly does not vindicate education as the only injury prevention strategy.

The assumption that correct patient handling effectively prevents WMSDs is exemplified by the use of the adjective “proper” to describe lifting or patient handling techniques (Mierzejewski and Kumar 1997, Molumphy et al 1985). This supposition operates widely in the area of manual handling, where physiotherapists are frequently called on to provide training in “proper” or “safe” techniques. (The unstated assumption is that proper performance of the lifting task will prevent injury.) However, there are several schools of thought as to what this “proper” technique might be. Garg (1993) observed that there was no concrete evidence supporting one method as safer than the others. Squat, stoop, freestyle and semi-squat lifting techniques all have their advocates (Straker 1999a). Straker suggested that rather than teaching a particular technique, principles to reduce the risk of injury should be taught. This approach is appropriate to physiotherapy, where there is much variability in the capabilities and needs of patients and in the tasks undertaken by therapists (Manual Handling Regulations 1999).

7. Risk assessment and control must be ongoing. Once implemented, these guidelines must be examined for their effectiveness, and modified where necessary. Risk management and review

must be carried out at both an individual and institutional level.

Work related musculoskeletal disorders should be documented prior to, and following, implementation of these guidelines. A minority of therapists claim workers’ compensation (Cromie et al 2000), so alternative measures such as lost time, or symptom surveys, should be utilised to monitor the effectiveness of any changes that are implemented.

The requirement for risk assessment and control to be reviewed and updated is written into law (Manual Handling Regulations 1999, Regulation 14.3). Hazard identification must be applied whenever a task is undertaken for the first time and again before any alteration is made to objects used in the workplace, or an object used for another purpose. Hazard identification is also required if new information about manual handling is made available to the employer or if a musculoskeletal disorder is reported by or on behalf of an employee (Regulation 13.3; a-e).

8. Prospective physiotherapists must recognise the physical demands and constraints of the job. Students and qualified physiotherapists need to choose career paths congruent with their physical abilities. Physiotherapists should maintain an appropriate level of personal fitness for their work.

As opposed to training to address perceived deficiencies in knowledge, physical training assumes the cause of injury to be a mismatch between the physical capacity of the worker and the requirements of the job. The training program targets deficiencies in the individual to reduce the discrepancy. This guideline addresses the issue of a mismatch between the physical capability of the physiotherapist and the physical demands of the job.

Selection to prevent injury assumes that some workers are more at risk than others due to prior history, fitness or physical ability. It is based on knowledge of the demands of the job, and excludes workers deemed to be at high risk of injury, to ensure that only individuals with a low risk are selected for the job.

The basis for screening in this way is work done by Keyserling et al (1980) who found that when the demands of the job exceeded the capacity of the
workers, they experienced significantly higher injury rates. There is some conflict in the findings of prospective studies using selection as a preventive strategy (Bigos et al 1992, Reimer et al 1994, Smedley et al 1997), with one (Bigos et al) suggesting that pre-employment screening is ineffective in predicting back injury, and the other two suggesting that screening may be useful in prevention.

The literature gives no indication that physiotherapists are selected for a particular job using any physical capacity criteria. Physiotherapists in Australia must meet certain competencies (implying some degree of physical ability) and be registered with a state based registration board in order to practise (Physiotherapists Registration Act 1998). However, there are many areas in which therapists may practise, making it feasible for therapists with differing physical abilities to choose to work within their capability.

Refusing employment to a worker on the basis of their physical capabilities (or any other attribute) is unlawful, unless the attribute is a necessary requirement of the job (Disability Discrimination Act 1992, Equal Opportunity Act 1995). As determination of physical job requirements can be complex, this strategy may prove hard to implement. However, it might be appropriate to document the physical demands of different areas of physiotherapy, so enabling therapists to make an informed choice based on their physical abilities.

Exercise Another way of addressing a mismatch between capacity and job demands is to improve work tolerance and manual handling capacity (Genaidy and Karwowski 1992) using exercise. Improving strength has been shown to decrease the duration of low back symptoms or days lost from work due to back pain (Gundewall et al 1993, Kellett et al 1991), but methodological issues reduce the possibility of drawing conclusions from these studies. For example, Gundewall et al (1993) allowed their intervention group access to physiotherapy advice, making it difficult to determine the cause of the improvement, and Kellett et al (1991) only investigated factory workers with back pain, making the preventive benefits for those without back pain uncertain.

In their study of Californian physical therapists, Molumphy et al (1985) reported that 21% of therapists with subsequent LBP performed back flexibility exercises prior to being injured, and significantly more (61%) did so after being injured. This suggests that at least some of the therapists who were subsequently injured were aware of a predisposition to injury, prompting an exercise program, but there was no indication of how widespread exercise was as a preventive strategy among all therapists.

Exercise may offer a way for physiotherapists to reduce the rate and severity of WMSDs in practice. However, this may not be formally recognised by educators or professional associations. An emphasis on fitness at an undergraduate level, and an ongoing commitment to fitness, may be important strategies to reduce injury in the long term. Pause gymnastics, warming up, resting and changes in posture also are other forms of exercise. Further research is needed to determine the effectiveness of exercise as a preventive strategy.

Limitations Physiotherapy, as a job, can be broadly defined. Therefore these guidelines are qualitative in nature, and to be interpreted by individuals for specific situations. Their qualitative nature means they are responsive and flexible in a variety of situations (Kuorinka 1998). Kuorinka suggests that such guidelines should be procedural, and address multiple criteria. They should be feasible to execute, and once implemented, their effects on work related musculoskeletal disorders (WMSDs) should be assessed (Viikari-Juntura 1997). Development of guidelines should be based on existing knowledge, or be evidence-based (Kuorinka 1998, Viikari-Juntura 1997). Although the existing literature is not extensive, it forms the basis for the guidelines proposed here.

Further research Research is needed to document the physical requirements of physiotherapy, to establish safe work practices with respect to patient workload, scheduling and work/rest ratios.

These guidelines for physiotherapy practice are proposals. As such, they are untested, and will require refinement and modification as the available body of knowledge increases.
Conclusion

These proposed guidelines address the areas of postural and environmental risk factors, within the framework of occupational health and safety legislation. They acknowledge the need for compliance with established ergonomic guidelines in the design of the working environment, and the job and systems of work. The guidelines affirm the need for involvement in policy decisions, as they influence the occupational health and safety of physiotherapists. Finally, the proposed guidelines recognise the developing state of knowledge and the need for ongoing research and development.

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