

Addressing Musculoskeletal Disorders in the New Zealand Log Sawmilling Industry

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The paper presents findings from a government funded, industry-based study of timber handling tasks in New Zealand log sawmills, and discusses some of the issues encountered in conducting a long term study of this type. Twelve months' of accident register records from a sample of log sawmills were first analysed to determine the tasks most commonly linked with musculoskeletal disorders (MSD). Work system assessments were then conducted on two high risk tasks in a total of four log sawmills. Possible interventions were identified and priorities for implementation were developed following discussion with each mill. Informal implementation assistance was provided to two mills over the next 18 months, after which re-assessment of the two work systems was conducted in two sawmills with the main findings outlined in this paper.

Introduction

New Zealand produces approximately 20 million m³ of plantation timber per year, of which 20% is processed by log sawmills into sawn lumber (NZ Forest Industry, 2003). Log sawmills employ around 50% of the workforce involved in this first stage timber processing (MAF, 2001).

The log sawmilling industry has been aware of the prevalence of MSD through their own injury statistics, however little has been done to assess the extent of the problem or identify causes and possible solutions. Anecdotally, efforts from within the industry have focused on increased mechanisation, not only as a way to improve system productivity but as a means of reducing worker exposure to perceived high-risk manual handling tasks.

In NZ, the Accident Compensation Corporation (ACC) scheme provides 24-hour no-fault personal accident insurance cover for both work and non-work injuries. ACC injury data from the four year period 1994/1995 to 1998/1999 (Lauris, 2000) placed log sawmilling as the wood processing sector with the highest level of new claims (42%). Of these claims, most were soft tissue injuries: strain/sprain (51%), along with back injuries (17%), and laceration (14%). More recent data from 1999/01 (ACC, personal communication) showed log sawmilling new claims to be 52% of the total for the wood processing sector, with similar proportions for injury types found as for previous years claims. Similar data from the British

Columbia Workers' Compensation Board (1999) lists overexertion claims in sawmills as causing 27% of all time-loss injuries and repetitive motion at 5%. Mill labourers and labourer material handlers comprised 51% of the workforce affected.

Recent initiatives from the Occupational Safety and Health Service of the Department of Labour (OSH) and ACC Injury Prevention to reduce industry injuries in high-risk sectors has focused on log sawmilling as one of their target industries. Regional inspection audits and the establishment of industry-based health and safety groups has led to an increasing awareness of injury prevention strategies among log sawmillers. This has provided a valuable forum for discussing, developing and implementing outputs from the study itself.

This government funded study commenced in 2001, with the aims of: determining the prevalence of musculoskeletal problems among log sawmilling workers; identifying high risk log sawmilling tasks; and designing and evaluating measures to prevent or alleviate musculoskeletal problems in these tasks.

Accident Register Survey

In New Zealand it is a requirement of the law for every workplace to hold an accident register. This is a potential source of industry information at a level beyond which ACC data can usually provide, such as identifying injury incidence for specific tasks or work areas involved in the injury. Twelve months' of accident register records from 37 log sawmills (representing approximately 26% of the NZ log sawmill workforce and 45% of the annual production volume), were collected and analysed to identify: (a) which tasks were linked to reported injuries; (b) the nature of these injuries; (c) the opinions of the health and safety staff in the mills involved.

Millhands (30%), Tablehands (26%) and Sawyers (23%) had the highest percentage of reported MSD injuries, with timber handling specifically mentioned in the task descriptions of 60% of all injuries. Back (37%) and upper limb (35%) were the body areas most commonly involved in all injuries. The opinions of the health and safety staff surveyed largely supported the accident data, with timber handling on the sorting tables being seen as creating the most significant injury risk (involving tablehands and many millhands). Filleting timber was also seen as a high-risk task.

Despite obvious weaknesses with this data, such as not being able to determine frequency or severity rates, there were tangible benefits derived from this phase of the study independent of the data. These included establishing an ongoing contact with a large number of log sawmills and other industry groups, and increasing understanding of the industry processes, technology and politics through this contact. Tappin, et al (2003) provides more information on this survey.

Analysis Phase

Method

Timber handling tasks at four sorting tables (two green timber tables, two dry timber tables) were assessed. These mills had all shown interest in the study during the accident register survey, and were therefore thought more likely to put in place interventions arising from the study. Yard filleting tasks were also assessed at two of these mills at a later date.

Data was collected over two main site visits totaling several hours at each mill, enabling

different shifts, personnel, production volumes and outputs to be assessed. Assessment methods included: company archival data collection, semi-structured interviews with management and workers involved in the tasks, task verification/participation, physical workload analysis (REBA, RPE, Standardised Nordic Questionnaire, NZ Manual Handling Code assessment tools), and the collection of physical measurements (static anthropometric data, workplace dimensions, force measurements for handling timber).

Findings

In the initial work systems assessment, all physical workload analysis tools indicated a high number of MSD injury risk factors present in both the table and filleting work systems. Many aspects of the work design contributed to this, including piece rate payment, work compression, minimal task rotation, and limited task training. Analysis of anthropometric data with workplace dimensions indicated a number of significant mismatches in the workspace geometry of both tasks. Edwin, Tappin, & Bentley (2002) reports on preliminary work conducted with sorting table tasks.

Perhaps the most significant finding was that in all four mills, while there was a willingness to identify and address any risks present, there was also quite a low level of understanding about what the potential MSD risks were. On subsequent interaction with the industry, this would appear to remain a valid observation. Unsurprisingly therefore, prioritised interventions and further involvement were well received by all four mills, despite being critical of many of the systems in place at the mills.

Intervention Phase

Method

From assessment findings, interventions were developed and presented to each mill. These were prioritised according to their likely contribution to the occurrence of MSD and could be grouped into organisational design, physical design, and training design categories. Emphasis was placed on the increased likelihood of success through implementing a range of interventions from across these categories rather than focusing on just a few, or those that seemed easiest to implement (Karsh, 2001). Each mill then worked their selection of interventions into their own management plan, amending them to fit in with logistic, engineering, and business priorities. In some cases the implementation of interventions involving capital outlay or downtime occurred a considerable time after they were first presented, to fit in with planned plant overhaul or maintenance schedules. The number of mills involved in the ongoing study was reduced from four to two. After the initial presentation of interventions, 2-3 monthly contact was maintained through site visits, telephone contact and industry group meetings.

To enable as many interventions to be evaluated as possible, reassessment of the filleting and table work systems occurred at the two mills 9 and 18 months respectively after the initial findings were presented to the mills. The methodology was repeated as closely as possible to the original format.

Findings

Interventions, while specific to each mill, were largely based around workspace geometry improvements, reduction in forces required, workflow and workload management, and task technique training.

At the time that the mills were embarking on implementing their interventions, a health and safety group for log sawmillers and other timber processors was being established in the central North Island (the largest timber harvesting and processing area in New Zealand) by ACC and OSH. This group provided impetus to the study in two main ways – by encouraging changes within mills to reduce MSD and other health and safety risks, and by becoming a forum for the refinement of industry resources developed out of the work conducted. A similar group has consequently been initiated in the South Island.

Interventions that exhibited some tangible measure of success when evaluated included:

- (i) Reduction in the force required to begin moving boards off tables through better surface maintenance and reduced area in contact with the boards. In one mill this force reduced on average by almost 50% for three common board dimensions.
- (ii) Improvement in workspace geometry in one mill so that the need for reaching forward and double handling were eliminated, and transfer distances between source and destination were brought within a more comfortable range for a larger number of workers.
- (iii) Workflow improvements in both mills through raised awareness, better communication between mill departments, and availability of trained additional staff if required. In one mill, planned mechanisation had been implemented but with consideration also given to reducing MSD risks. As a result, exposure to repetitive, rapid heavy handling had been eliminated, task rotation steps had increased, and work space increased in manual handling work areas.
- (iv) Preventive maintenance programmes helped ensure ongoing risk reduction, particularly for high use areas such as table and chain maintenance.
- (v) Staff perceptions in both mills were very positive about changes made, mainly due to feelings of ownership from involvement in the change process.

Conclusions

There are a number of limitations in the approach followed. Significantly, only four mills were involved, reducing to two later in the study. These mills were also approached on the basis of their willingness to be involved, with industry representativeness being a secondary consideration. This has been partly offset by the more recent involvement of a larger number of mills through the industry health and safety group. Between-mill and before-after comparisons were also limited by differences in work systems and individual sawmill priorities for implementation. Further limitations are listed in Edwin et al, 2002.

Conducting this study in industry has helped to raise the otherwise low profile of MSD among log sawmills as well as providing a willing test bed in which to trial and refine potential interventions, and a forum for refining and disseminating information of use to industry. Conducting industry-based studies does however mean that the study process is difficult to control and monitor. Issues such as business priorities, the pace and nature of implementation, and industry pressures can all have a significant impact.

Difficulties in conducting industry-based studies include:

- Even the most useful suggested interventions will need to be weighed against other business considerations. In this study these included; mill capacity; production targets; staffing availability, quality control standards; engineering resources and available capital.
- The timing of implementation is beyond the researchers control, despite the advised priority of the intervention. Two mills had to wait several months for a maintenance

- shutdown before making some physical changes. Such delays can create further problems.
- Depending on the degree of participation and involvement, the potential exists to get things wrong. Although improvements were made in one mill to workspace geometry, a significant component was excluded – with a likely reduction in overall effectiveness.
 - Changes in company structure, personnel, and processes are likely to impact on the study in some way. For example, reducing rapport or credibility within the organisation, or making significant physical changes to the mill plant.
 - Factors external to the industry may also have an effect. In NZ unfavourable exchange rates have made it harder to sell sawn lumber. There is less money to spend and priorities inevitably shift away from health and safety.
 - A ‘Hawthorne Effect’ is very likely to remain in place as contact with mills continues over time.

The benefits of conducting industry-based studies include a growing level of rapport with the companies which may result in a greater level of possible participation – further involvement in implementation, and gathering more useful information from a wider number of staff, for example. Industry credibility may increase over time as they see the study as being ‘real life’ and offering practical, usable advice. In this study, the development of industry reports has been well received and has helped smooth the way for further initiatives in the industry developed from the original study. This will include the establishment of a log sawmill injury surveillance scheme.

Overall, the benefits of conducting this type of study within an industry setting outweigh the difficulties, as ergonomics principles are only relevant if ultimately applied to the end user. Demonstrating effectiveness of interventions might be better achieved through discrete on-off studies, but applicability to ‘real life’ situations relies on having the flexibility to use less tangible but realistic means and measures such as those employed at times throughout this study.

References

- Edwin, M., Tappin, D., Bentley, T. 2002, Musculoskeletal disorders in the New Zealand Log Sawmilling Industry, *Proceedings of the 11th Conference of the New Zealand Ergonomics Society*, (NZES, Palmerston North), 112-117.
- Karsh, B.T, Moro, F.B.P., Smith, M.J. 2001, The efficacy of workplace ergonomics interventions to control musculoskeletal disorders: a critical analysis of the peer reviewed literature, *Theoretical Issues in Ergonomics Science* 2(1), 23-96.
- Lauris, M. 2000, *Analysis of ACC claims data for the period 1994/95 to 1998/99 for: Forestry and Logging, & Log Sawmilling and Wood Product Manufacturing*, ACC Report, Rotorua, New Zealand.
- MAF, 2001, *New Zealand Forestry Statistics 2000*, Ministry of Agriculture and Forestry, Wellington, NZ.
- New Zealand Forest Industry, 2003, *Facts and Figures 2003/04*, NZ Forest Owners Association, Wellington.
- Tappin, D., Edwin, M., Moore, D., 2003, Sawmill Accident Register Records – Main Findings of a Survey from 37 Mills, *COHFE Report 4(5)*, 2003.
- Workers Compensation Board of British Columbia (1999). *Forest Products Manufacturing: focus report on preventing injuries to workers*. WCB, British Columbia, Canada.