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Chainsaw Related Injuries

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Summary

The New Zealand Forest Industry has made enormous progress in reducing the number and severity of chainsaw inflicted injuries. Through coordinated industry effort, the number of lost time chainsaw injuries has reduced from 122 in 1985 to only 20 in 2003.

This report details findings from an analysis of the New Zealand Accident Reporting Scheme data for logging injuries for the three-year period January 2001 to December 2003. The injury rate for inexperienced chainsaw users was greater than that for more experienced users which highlights the importance of good judgement and decision making while using a chainsaw. Training in chainsaw use and the potential for the further development of practical and useful personal protective equipment were identified as effective injury reduction measures.

ACKNOWLEDGEMENTS

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1. Introduction and Background

This study was undertaken to identify key risk factors for chainsaw users through the analysis of New Zealand Forest Industry Accident Reporting Scheme (ARS) data. Over the last two decades there has been a significant decrease in the number and severity of chainsaw inflicted injuries in the New Zealand professional logging workforce (Parker *et al.*, 2004). However, recent ACC data indicate that injury resulting from chainsaw use continues to be a major problem for the general population. In the year to July 2004 there were 229 paid entitlement claims for chainsaw inflicted injury resulting in a total cost of $856,000. There were also 112 ongoing claims costing $1.29 million. (ACC, 2004). These claims include all chainsaw users in New Zealand, not just logging professionals. The problem is not isolated to New Zealand - the US Consumer Products Safety Commission reported over 28,500 chainsaw injuries in 1999 in the United States, with the average chainsaw injury requiring 110 stitches and costing US$5,600.

2. Method

Accident Reporting Scheme data on lost time (at least one complete work day lost due to injury) and minor (less than one full day lost) injuries resulting from chainsaw use were selected from the period January 2001 to December 2003. Cases incorrectly coded or with significant missing information were removed from the analyses. The accident descriptions – i.e. the narrative text - were content analysed and coded to produce new variables not existing in the original ARS database. This method has been successfully used in previous analyses drawn from the ARS, (Parker *et al.*, 1999; Bentley and Parker 2001; Ashby and Parker, 2002).

Table 1 – Distribution of lost time and minor chainsaw injuries reported to the logging ARS for the period January 2001 to December 2003

Year	Total reported logging injuries	Chainsaw Injuries			Proportion of all logging injuries (%)
		Number of lost time	Number of minor	Total chainsaw injuries	
2001	402	22	51	73	18
2002	437	15	58	73	17
2003	469	20	57	77	16
Total	**1308**	**57**	**166**	**223**	**17**

3. Results

3.1 Injury Data Analysis – summary of chainsaw injuries

During the period January 2001 to December 2003 there were a total of 1308 injuries to professional loggers in the New Zealand forest industry. Of these, 337 were lost time injuries and 17% (57 lost time injuries) were the direct result of chainsaw use. Similarly there were a total of 971 minor injuries to professional loggers and 17% (166 injuries) were the direct result of chainsaw use.

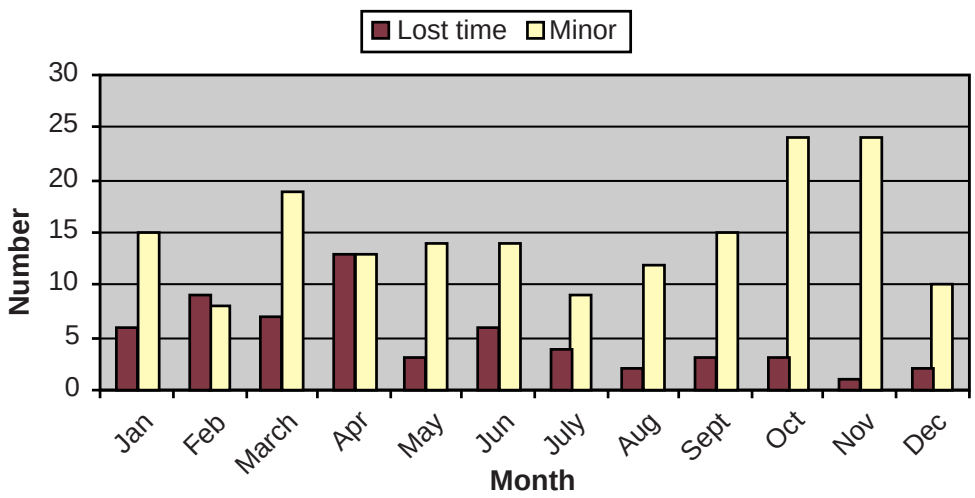


Figure 1 – Distribution of reported chainsaw associated injuries by month

3.2 Temporal analyses

The greatest proportion of lost time injuries occurred in the first four months of the year, with 60% of lost time injuries between January and April compared with 40% during May to December (Figure 1). This distribution may be related to the greater summer temperatures, particularly in the Central North Island where warmer temperatures are found in the January to April period compared with late spring and early summer. Minor injuries exhibited a peak in the late spring and early summer period. A large proportion of these late spring and early summer injuries occured during chainsaw maintenance and require further investigation.

More lost time injuries occurred earlier in the week with 42% occurring on Monday or Tuesday and only 26% occurring on Thursday or Friday (Figure 2). Wednesday had the single greatest number of injuries with 31%.

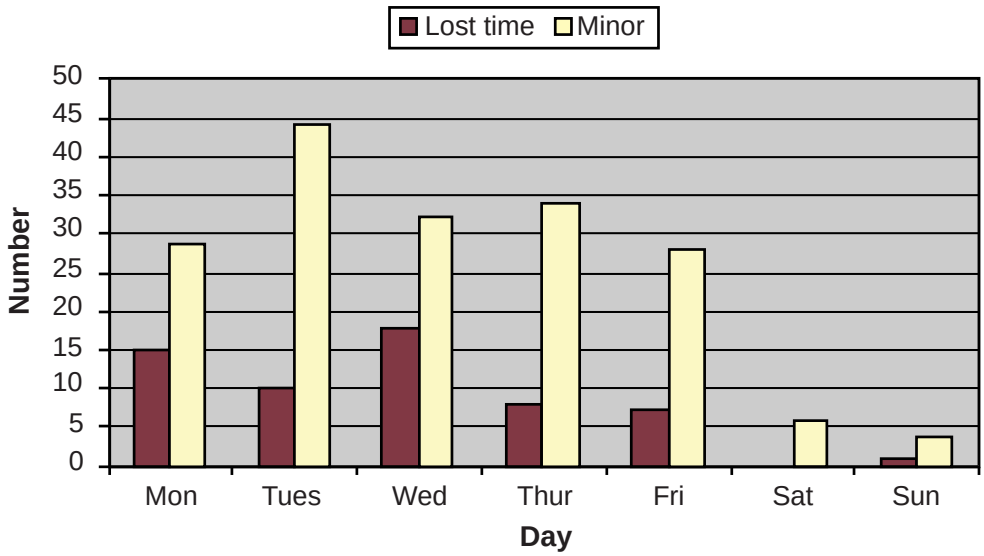
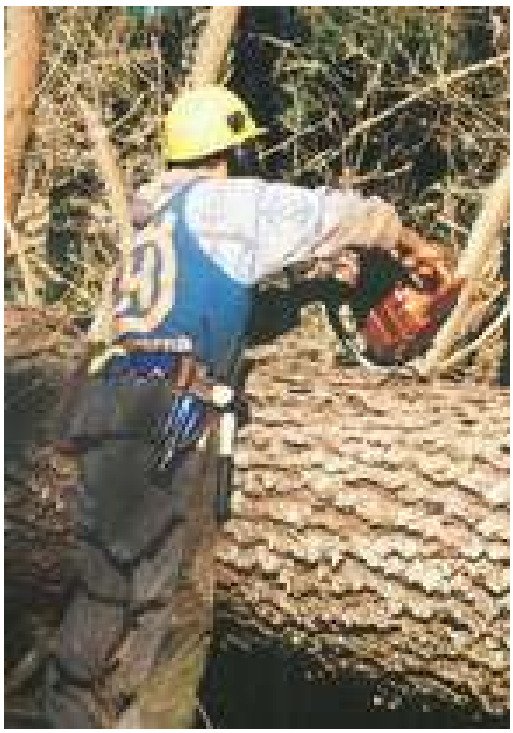


Figure 2 – Distribution of reported chainsaw associated injuries by day of the week



Most chainsaw related injuries occurred in the mid morning (Figure 3). This result is consistent with previous studies of ARS data which have shown a morning peak in injuries (Ashby and Parker, 2002). Fatigue amongst New Zealand forest workers (Kirk and Parker, 1996) and dehydration (Bates *et al.*, 2001) have been associated with the higher number of mid morning injuries. Loggers leave home early and after breakfast may have no substantial food or liquid intake until taking a break between 10 am and 11 am.

The ability to process information is particularly susceptible to impairment with dehydration and may be associated with the increased injury rate. (Bates *et al.*, 2001).

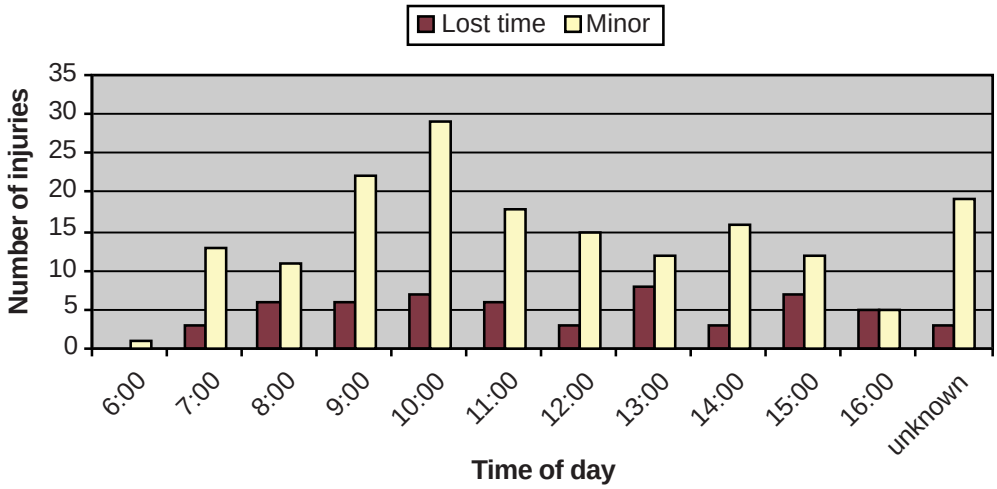


Figure 3 – Distribution of reported chainsaw associated injuries by hour of the day

3.3 Activity at time of injury

The activity occurring immediately before injury was determined by analysis of the text describing the injury events. This information was combined with associated injury severity and days-lost distributions (Table 2).

Table 2 - Distribution of chainsaw related injuries and days lost by activity immediately preceding the injury event

Activity	Lost time injury		Minor injury		Number of days lost	Average days lost
	Number	%	Number	%		
Trimming	19	33	31	19	207	11
Log cutting	15	26	28	17	186	12
Walking	8	14	55	33	90	11
Clearing tree	7	12	5	3	39	6
Maintenance	4	7	37	22	48	12
Wedging tree	2	4	0	0	17	9
Felling	1	2	4	2	1	1
Unknown	1	2	0	0	12	12
Other tasks	0	0	6	4	0	0
Total	**57**	**100**	**166**	**100**	**600**	**10.5**

Trimming (or delimbing) was the activity which resulted in the greatest proportion of lost time injuries (33%) and the greatest number of days lost. Twenty–six percent of lost time injuries occurred during log cutting, resulting in an average of 12 days off work.

Simply walking and stumbling onto ones own chainsaw was the single greatest activity leading to minor injury, resulting in over a third of all minor injuries. Chainsaw maintenance related injuries were rarely severe (7% of lost time injuries) but comprised 22% of minor injuries.

3.4 Injury initiating event

The distribution of chainsaw related injuries and lost days by injury initiating event is summarised in Table 3. The greatest proportion of lost time injuries (74%) resulted from the chainsaw user being struck by 'some object' (or in a small number of cases striking against an object). Similarly, the greatest proportion minor injuries (65%) resulted from the user being struck by 'an object'. In most cases the object striking the user was the chainsaw but chainsaw users were also struck by tree stems or logs. A similar proportion of lost time (21%) and minor (23%) injuries resulted from the chainsaw user slipping, tripping or falling on the level, as opposed to falling from a height.

Table 3 – Distribution of chainsaw related injuries and days lost by injury initiating event

Injury initiating event	Lost time injury		Minor injury		Number of days lost	Average days lost
	Number	%	Number	%		
Struck by/struck against	42	74	113	65	376	9
Slip, trip or fall on the level	12	21	40	23	174	15
Fall from a height	3	5	14	8	50	17
Other medical	0	0	4	2	0	0
Manual handling	0	0	2	1	0	0
Total	**57**	**100**	**173**	**100**	**600**	**10.5**

The proportion of injuries initiated by 'struck by' of 'slip, trip or fall' events is similar to previous studies of New Zealand logger injuries in felling (Bentley *et al.*, 2005) and skid work (Bentley *et al.*, 2001). Seventy-two percent of injuries sustained while felling trees and 69% of skid site injuries were 'struck by' events. 'Slip, trip and fall' events accounted for 13% and 20% respectively of felling and skid work injuries.

3.5 Experience of injured logger

The distribution of chainsaw related injuries and days-lost by injured worker's logging experience are summarised in Table 4. Previous analyses of New Zealand ARS data (Bentley and Parker,2001; Ashby and Parker, 2002; Parker *et al.*, 2003) also report inexperienced loggers exhibit the greatest proportion of injuries.

Table 4 – Distribution of chainsaw related injuries and days lost by the injured worker's logging experience

Experience	Lost time injury		Minor injury		Number of days lost	Average days lost
	Number	%	Number	%		
0 - 6 months	14	25	27	16	135	10
7 - 12 months	5	9	5	3	94	19
13 - 24 months	6	11	12	7	114	19
25 - 48 months	3	5	8	5	34	11
49 - 72 months	1	2	3	2	1	1
Over 6 years	8	14	8	5	26	3
Unknown	20	35	103	62	196	10
Total	**57**	**100**	**166**	**100**	**600**	**10.5**

No reliable data currently exists to accurately determine the proportion of chainsaw users working in the various experience categories in professional logging to determine exposure. However, these figures suggest that less experienced loggers suffer disproportionately more chainsaw related injuries.

3.6 Part of body injured

The feet were the most frequently seriously injured part of the body, resulting in over one third of all lost time injuries and 36% of the number of days lost (Table 5). The continued high proportion of foot injuries indicates the difficulty of using training alone to completely eliminate this injury.

Most loggers wear leather boots which have no chainsaw cut resistance (Ashby and Parker, 2002). The hands were the most frequently injured body part (31%) for minor injuries. Loggers tend not to wear protective gloves when using the chainsaw although they do wear a protective mitt, attached to the chainsaw, over the left hand.

Table 5 – Distribution of chainsaw associated injuries and days lost by major body part injured

Part of body	Lost time injury		Minor injury		Number of days lost	Average days lost
	Number	%	Number	%		
Head	3	5	14	8	14	5
Eye	1	2	4	2	1	1
Shoulder	1	2	4	2	1	1
Neck	0	0	1	1	0	0
Hand	8	14	51	31	46	6
Arm	10	18	23	14	122	12
Upper torso	2	4	4	2	10	5
Lower torso	1	2	11	7	20	20
Upper leg	4	7	13	8	18	5
Knee	3	5	8	5	24	8
Lower leg	5	9	15	9	85	17
Ankle	1	2	1	1	40	40
Foot	18	32	16	10	219	12
Unknown	0	0	1	1	0	0
Total	**57**	**100**	**166**	**100**	**600**	**10.5**

3.7 Type of injury

The most frequent type of injury from chainsaw use was laceration resulting in a total of 157 injuries and 413 days lost (Table 6). Chainsaw lacerations are often severe, resulting in considerable tissue damage. There were five serious fracture injuries, which resulted in a total of 112 days lost time. All five fracture injuries were the result of being hit by a log or tree stem while trying to removed a jammed chainsaw.

Table 6 – Distribution of chainsaw associated injuries and days lost by type of injury

Injury type	Lost time injury		Minor injury		Number of days lost	Average days lost
	Number	%	Number	%		
Bruise	1	2	25	15	14	14
Burn	0	0	4	2	0	0
Laceration	48	83	109	65	413	9
Fracture	5	9	0	0	112	22
Foreign body	1	2	3	2	1	1
Strain / sprain	0	0	6	4	0	0
Crush	1	2	2	1	40	40
Other	2	3	8	5	20	10
Unknown	0	0	10	6	0	0
Total	**58**	**100**	**167**	**100**	**600**	**10.3**

4. Discussion

Most New Zealand injuries were to non-professional chainsaw users. This discussion will concentrate on the professional chainsaw user workforce because of the detailed data available on cause of injury. Consideration of factors contributing to injury and of elements making up the task of chainsaw use provides a basis for addressing these injuries that may also be applicable for non-professional users.

Previous task analyses have indicated that professional chainsaw users undertake a range of tasks where hazards are present, and this range is reflected in the injury data.

Fatigue and inexperience have been identified as leading factors contributing to injury when using a chainsaw, so focusing health and safety resources in these areas is essential. However the mechanisms directly linking fatigue or inexperience with chainsaw related injury have not yet been clearly determined. Some resources have previously focussed on nutrition (Paterson and Kirk,1997) and hydration (Bates *et al.*, 2001) in a New Zealand context, with a view to addressing fatigue issues. These are unlikely (and have not yet been shown) to be totally effective on their own, as fatigue will also be associated with other (perhaps more tangible) factors such as chainsaw performance and sharpness, work organisation, and work technique. (Lilley *et al.*, 2002) reported near-miss injury events were significantly more common among those loggers reporting a high level of fatigue at work.

Less experienced chainsaw users suffered a disproportionate number of injuries. This is perhaps linked to more training in correct use, but again other issues are significant, some of which may be easier to address. For example, identified hazards could be managed according to experience – such as reducing production pressure during trimming and log cutting for inexperienced workers – and while conducting high risk tasks like trimming, inexperienced workers could be 'buddied-up' or mentored by experienced workers.

It seems intuitive that training and education of chainsaw users should help reduce injury rates, although an American study found no statistical evidence of additional specialised training having any effect on injury rates of professional chainsaw users (Bell,2004). Nevertheless, this finding needs to be tested in the New Zealand context against New Zealand data and the effectiveness of training programmes measured: it may be that work practices and management practices are quite different between the United States and New Zealand.

Proven technological chainsaw injury prevention initiatives which have been successful include: mechanisation where chainsaw tasks are eliminated; engineering safety features on

the chainsaw such as the chain-brake, low-kickback chain and personal protective equipment such as chainsaw cut resistant legwear and footwear and face visors.

Most 'lost-time' chainsaw related injuries to professional loggers were during trimming or delimbing, the feet being the most frequently injured part of the body in these serious lost time injuries. Delimbing with a chainsaw, where the users feet are in close proximity to the saw, is being replaced by new technology such as mechanised delimbers and static delimbers: it would appear this is an appropriate intervention to encourage. Bell (2002) reported substantial reductions in logger injury rates with the introduction of feller-buncher machines.

Less serious 'minor' injuries occurred most frequently while walking and subsequently stumbling while carrying the chainsaw and being cut by the saw. While less severe, they still accounted for over a third of the minor injuries and 15% of lost days. More focus is needed on addressing slips, trips and falls by chainsaw users, such as use of appropriate footwear, avoiding rushing and correct handling of saw while walking (Bentley *et al.*, 2001).

Most minor injuries were to the hands. The technological advances already discussed should help address these injuries (such as use of the mechanised delimber) but little advancement has been made in terms of personal protective equipment, an area which may benefit from further work.

5. Conclusion

Consideration of the available data and of hazards associated with using a chainsaw provides opportunity to address chainsaw injuries from a variety of approaches. Tremendous progress has been achieved by the forest industry, and these gains need to be translated to the non-professional chainsaw user. Resources can be focused on further development of technology – already shown to be very effective – and on providing other interventions (such as training, appropriate worker management and provision of information) that are specific to both the task and the experience of the chainsaw user.

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