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ANALYSIS OF FORESTRY WORK ACCIDENTS IN FIVE AUSTRALIAN FOREST COMPANIES FOR A PERIOD OF 2004 TO 2014

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Abstract:

There is little knowledge available regarding Australian forestry work safety and accident rates. Machine operators and forestry workers are a vital part of the forestry sector and their health and well-being can greatly impact on their work quality and efficiency. To increase our knowledge on forest workers' safety this project aimed to analyse the frequency, type and root causes of work accidents which occurred within different forestry activities of five industry partners of AFORA over the period from 2004 to 2014. A questionnaire was designed and distributed to the partners to collect the safety incident reports. Total number of work accidents was 470 for a period of 11 years (a rate of 43 accidents per year). Considering the estimated yearly production rates of the industry partners participated in this project the accident severity rate was 14.40 accidents/million cubic meters of harvested wood. Most of accidents occurred in harvesting operations (37%) and forest management (30.2%). Based on the results 8.1% of the accidents occurred during firefighting and 24.3% of work accidents occurred in other forestry activities. Main root causes of accidents for different types of activities were personal errors such as lack of PPE, operator error, poor body position and poor applied techniques. Work safety training could be delivered to forestry personnel to minimise accidents caused by personal errors. Back and shoulder (as upper body parts) received the most injuries. To avoid/reduce muscular damages (such as strain and sprain) the workers should be provided with proper ergonomic training.

Keywords: Forestry, Operations, Safety, Work accident, Accident rate, Root cause

Introduction

Research projects carried out by Cooperative Research Centre (CRC) for Forestry and Australian Forest Operations Research Alliance (AFORA) have investigated economic and environmental impacts of forest operations. These projects have mostly helped the industry improve machine productivity, reduce costs of harvesting operations, reduce the potential environmental impacts and improve yield and stand productivity (Acuna et al. 2012; Ghaffariyan et al. 2015; Ghaffariyan et al. 2012; Ghaffariyan and Brown, 2013). However, there is little knowledge available regarding Australian forestry work safety and accident rates. Machine operators and forestry workers are a vital part of the forestry sector and their health and well-being can greatly impact on their work quality and efficiency. To increase our knowledge on forest workers' safety this project aimed to analyse the frequency, type and root causes of work accidents which occurred within different forestry activities of five industry partners of AFORA over the period from 2004 to 2014.

Research method

Five industry partners of AFORA (27% of total numbers) participated in this project. A questionnaire was designed and distributed to the partners to collect the safety incident reports from 2004 to 2014 (this period was selected to match most of the provided information of each partner). The information was classified and put in a Excel-based data base including; date of accident, time of accident, type of forestry activity, operation, harvesting system, harvesting machine/forestry tool, age of worker, root cause, category of accident, type of injury, injured parts, side of body, type of first aid provided, number of days off work, cost paid for medical insurance/treatments and employment type. Root causes were classified into personal errors (fatigue, lack of personal protective equipment (PPE), operator error, poor body position, poor applied technique and poor judgment), environment (such as poor maintained equipment and excessive heat) and system (such as lack of safety training, pre-existing injuries). Part of body was classed into upper body (including hands/fingers), lower body and head/neck. Injury types were classified as skin damages (including cut, abrasion, scratch, rash and laceration), contusion (bruise/struck, fracture, dislocation, struck and broken bone), muscular damage (strain, sprain and soft tissue), and others (object in eye, bitten by insect/snake, blood nose, infection and dehydration).

Study results

Total number of work accidents was 470 for a period of 11 years (a rate of 43 accidents per year). Considering the estimated yearly production rates of the industry partners participated in this project the accident severity rate was 14.40 accidents/million cubic meters of harvested wood. Frequency and percentage of the work accidents for each forestry activity is presented in Table 1. Most of accidents occurred in harvesting operations (37%) and forest management (30.2%). Operations included harvesting, transport and roading. Forest management included activities such as silviculture, planting, nursery, planning, assessment, establishment and fertilisation. Based on the results 8.1% of the accidents occurred during firefighting. The distribution of work accidents over the study period (2004-2014) is shown in Figure 1. Many accidents occurred in 2012 (16%) and 2013 (14%) while the lowest percentage was in 2007 and 2008 (about 3%). Figure 2 presents the distribution of accidents for different months. The worst months for accidents were January and February (>10%) while the lowest accident rates occurred in December and September (Figure 2). There is a suggestion that workers aged between 50 to 59 years may have had higher accident rate while workers older than 65 years the lowest share of the accidents. However, 51% of the incidents reports (shown as n/r (not reported) in Figure 3) had no records of worker age which makes it difficult to get accurate estimate of age distribution and proportion of accidents.

Table 1. Frequency and percentage of accidents for different activities

Activity	Frequency	%
Forest management	142	30.2
Harvesting operations	176	37.4
Firefighting	38	8.1
Other	114	24.3
Total	470	100

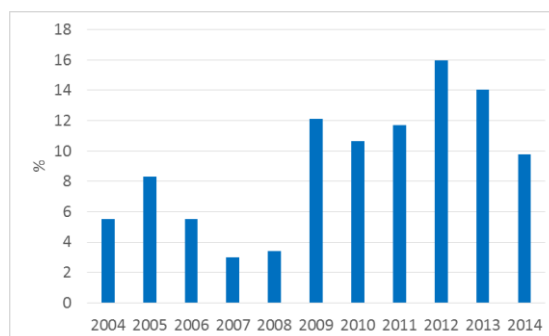


Figure 1. Percentage of accidents from 2004 to 2014

Harvesting operations accidents

There were 101 harvesting accidents which corresponds to an average severity rate of 2.85 accidents/ million m³ of harvested wood in this case study. The rate is lower than accident rate of 6.03 accidents/ million m³ for harvesting using harvester and forwarder and it is also lower than severity rate of 12.00 accidents/ million m³ for harvesting using skidders in Austria (Jänlich, 2009; Kühmaier, 2011). Most of accidents (72.3%) were caused by personal error (such as lack of PPE, error of operators or poor body position) and 5.9% were due to system/management issues (such as lack of safety training) (Figure 4). Categories of accidents included first aid (26.7%), injury (21.8%), lost time (24.8%), medical treatment (25.7%) and n/r (1.0%). Most workers were employees (workers employed by the company) (48.5%) while 39.6% were contractors and 11.9% was not recorded. Major types of injury were skin damage (such as bitten by insect or cut) and muscle damage (such as sprain and strain) (Figure 5). Main injured part was upper body with 39.6% of total injuries (Figure 6). Main injury points included eye (12.9%), leg (12.9%), back (8.9%), ankle (6.9%) and knee (5.9%) while rest of injuries (52.5%) were on other points of body.

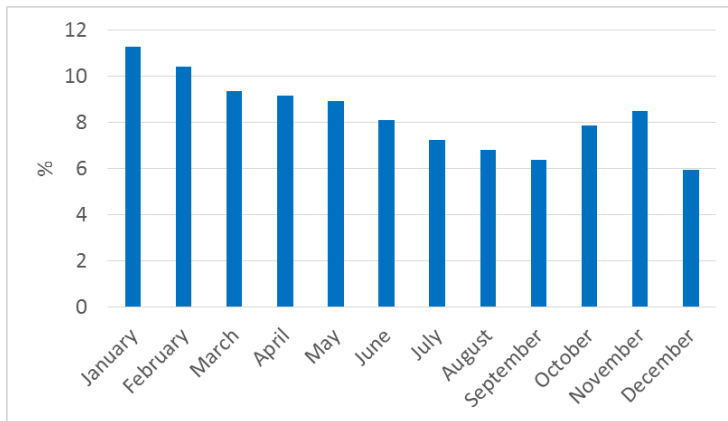


Figure 2. Percentage of accidents for different months

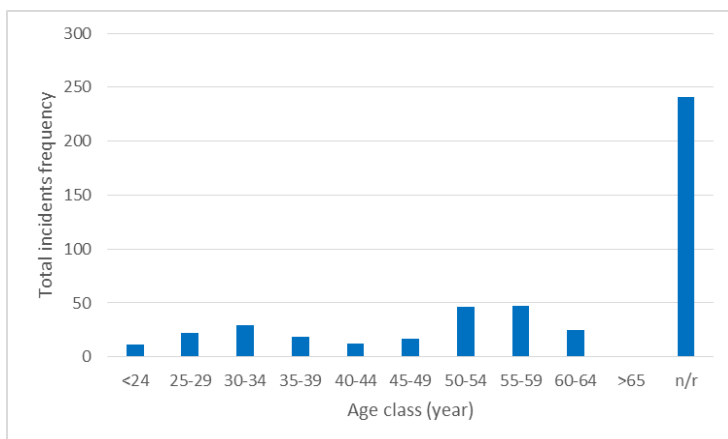


Figure 3. Percentage of accidents for age classes

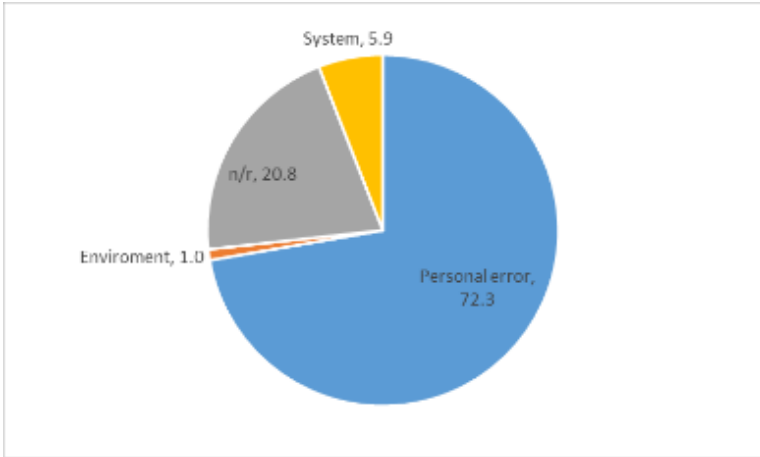


Figure 4. Percentage of root cause for harvesting accidents

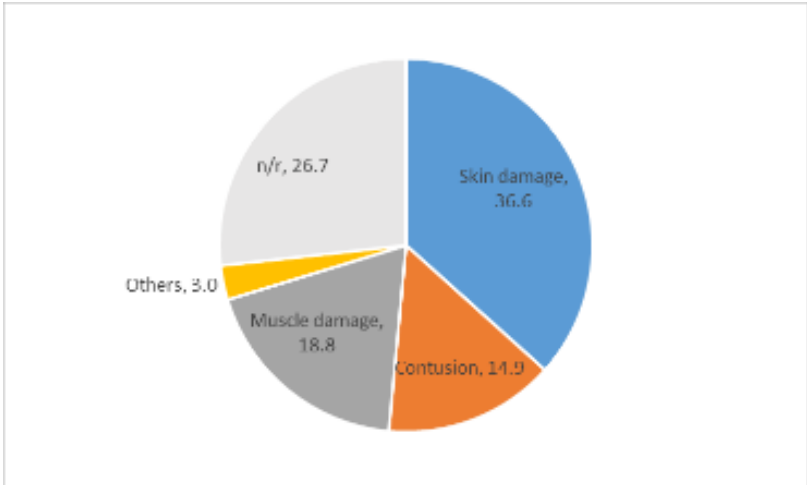


Figure 5. Percentage of injury types for harvesting accidents

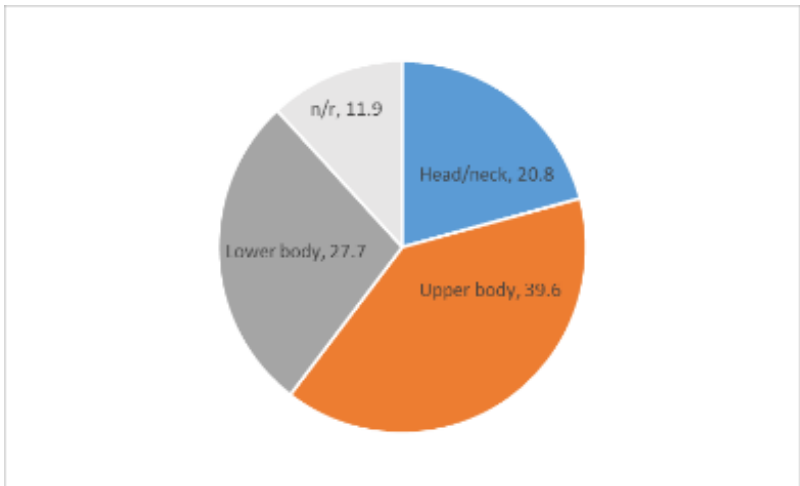


Figure 6. Percentage of injured parts for harvesting accidents

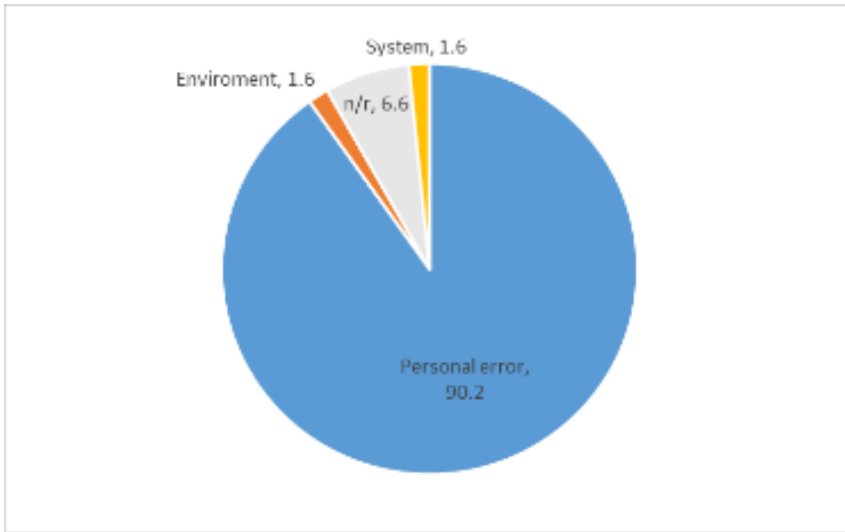


Figure 7. Percentage of root cause for transport accidents

Transportation accidents

There were 61 transportation accidents in the data base. Personal errors (Figure 7) were the main root cause of accidents (such as operator error, poor body position, poor technique applied and lack of PPE). Excessive speed (as personal error) caused 4.9% of the accidents. The accidents were categorised as lost time (45.9%), medical treatment (31.2%), first aid (13.1%) and injury (9.8%). Employment type of operators included contractor (78.7%), employee (4.9%) while 16.4% were not recorded.

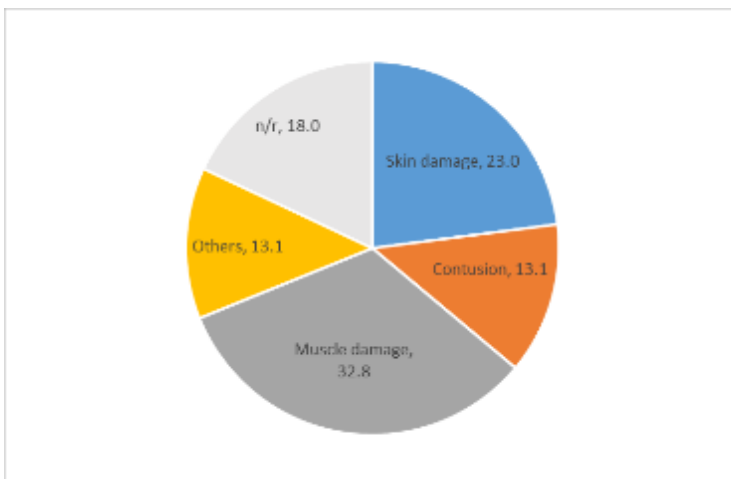


Figure 8. Percentage of injury types for transport accidents

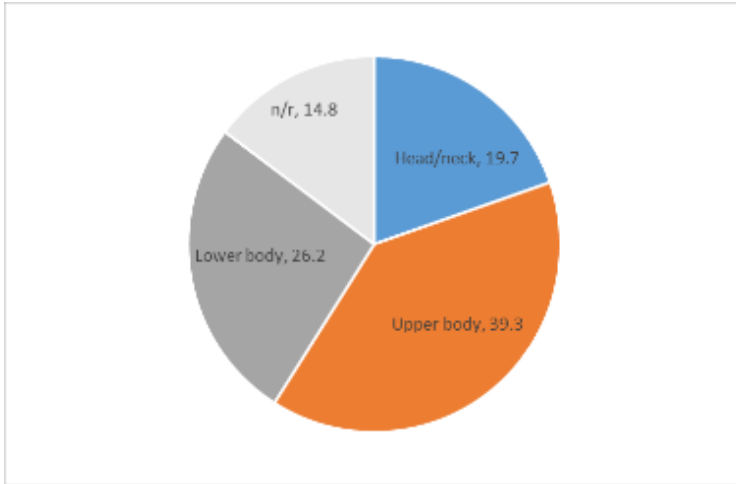


Figure 9. Percentage of injured parts for transport accidents

Major injury types were muscle damage (32.8% of accidents) (such as strain and sprain) and skin damage (such as cuts which formed 11.5% of records) (Figure 8). Upper body and lower body were the main area of injury which consisted of 39.3% and 26.2% of total accidents respectively. Head/neck accounted for 19.7% of injuries. Drilling down to specific body parts, ankle injuries were the most prevalent for transportation (11.5% of injuries) while injuries to other parts of body such as back (9.8%), shoulder (9.8%), knee (6.6%) and fingers (6.6%) were also highly injured compared to the other parts of body.

Silviculture accidents

Of the 83 accidents occurring in silvicultural practices, the root cause of most injuries was not recorded on the incident forms (54.2%). However, personal errors (such as poor judgment, operator error, poor technique applied and lack of PPE) were the major cause of accidents (Figure 10). The main category of accidents was injury accounting for 38.6%, while the share of first aid, medical treatment and n/r accounted for 31.3%, 20.5% and 9.6% respectively. Most workers were employees (80.7%) while 19.3% were contractors.

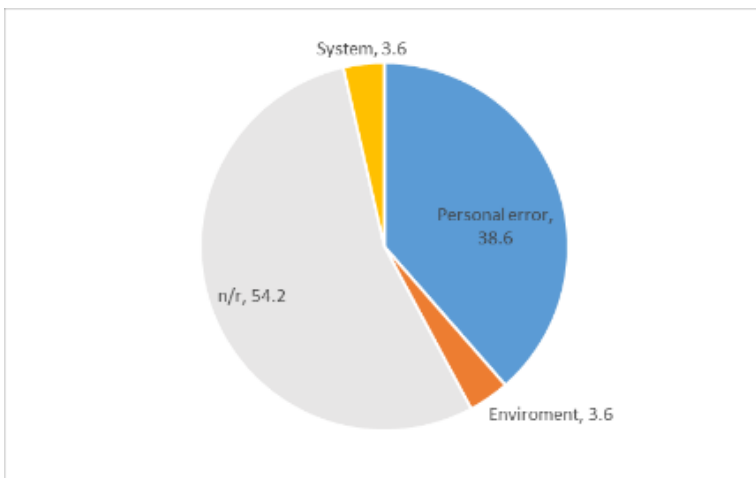


Figure 10. Percentage of root cause for silviculture accidents

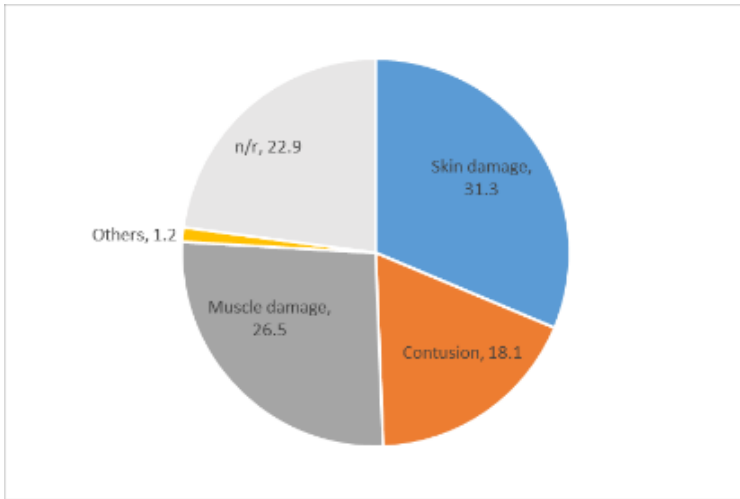


Figure 11. Percentage of injury type for silviculture accidents

Major types of injury occurred were skin damage (31.3%, such as cuts) and muscle damage (26.5%, such as sprain and strain). Contusion resulted from 18.1% of accidents, in which hit (9.6%) was most frequent. Based on the results 22.9% of the accidents had no injury type reported (Figure 11). The upper body was injured more than other parts (Figure 12). Back injuries resulted from 14.5% of all silvicultural accidents while foot (12%), knee (9.6%), eye (7.2%), shoulder (6%) and ankle (6%) were also frequently injured in silviculture operations.

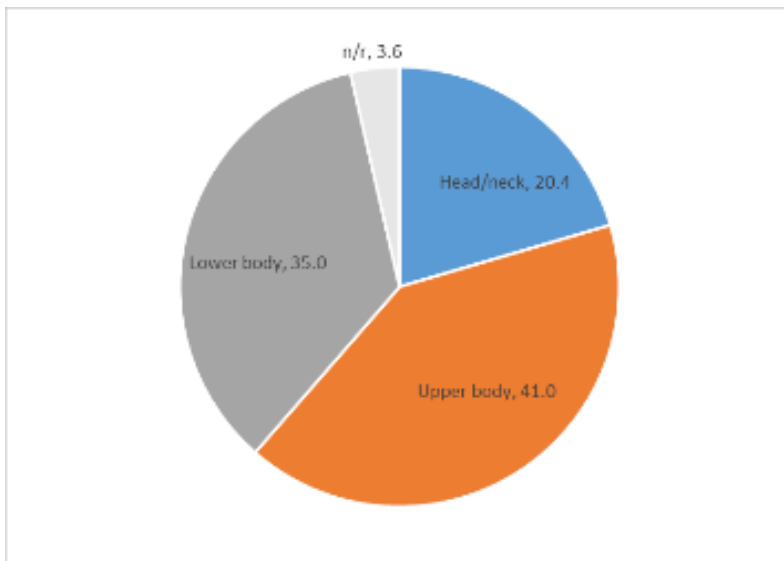


Figure 12. Percentage of injured parts for silviculture accidents

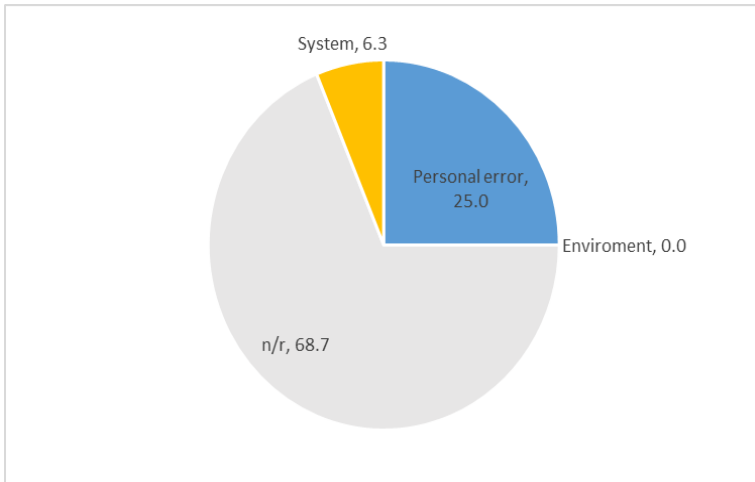


Figure 13. Percentage of root cause for planting accidents

Planting accidents

There were 48 cases of planting accidents (85.4% of these workers were employees and 14.6% were contractors). While most root causes were not recorded in the incident reports (68.8%), the most frequent accidents were due to personal errors (including operator error, poor body position and lack of PPE) (Figure 13). Planting accidents were categorised as injury (64.6%), lost time (16.7%), first aid (10.4%) and medical treatment (8.3%). Figure 14 illustrates most of planting injuries included muscle damage (e.g. strain) and skin damage (e.g. cut) while a largest share of accident reported (37.5%) had no record of injury type. Upper body injuries accounted for 62.4% of planting accidents (Figure 15). Shoulder (20.8%), finger (10.4%), knee (10.4%) and back (8.3%) were also prevalent injuries planting operations.

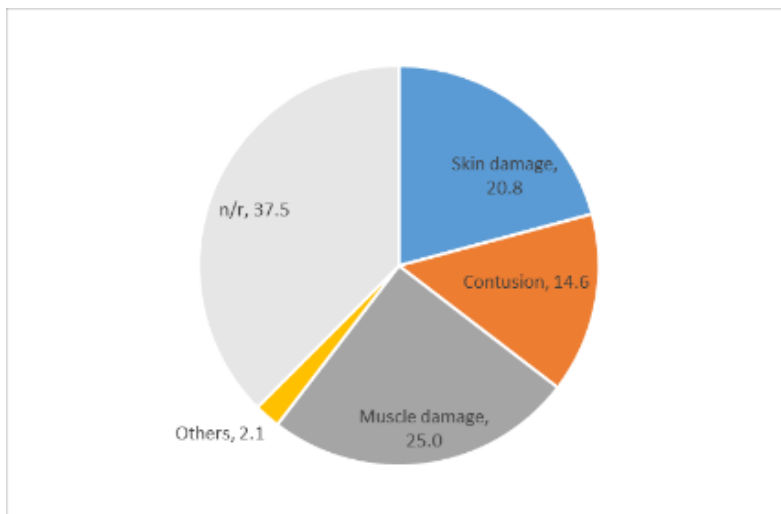


Figure 14. Percentage of injury type for planting accidents

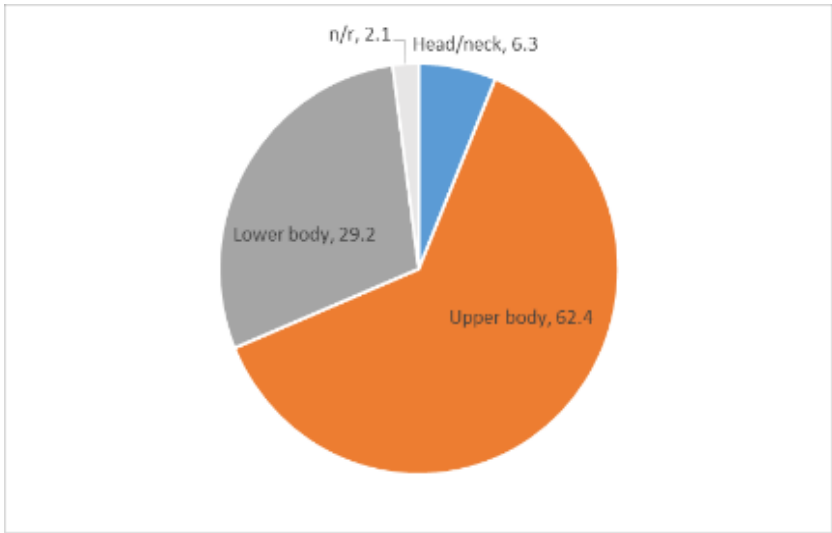


Figure 15. Percentage of injured parts of body for planting accidents

Firefighting accidents

There were 38 accidents for firefighting in the data base (92.1% of workers were employee while 7.9% were contractors). More than 76.4% of the accident reports had no record of root causes however personal errors (such as operator error, poor technique applied) and environment (such as heat and excessive smoke) during firefighting were the most frequent recorded root causes of accidents (Figure 16). The accident categories included injury (52.6%), medical treatment (26.3%), first aid (15.8%) and lost time (5.3%). Skin damage (42.1%) and muscle damage (15.8%) were most frequent types of injuries (Figure 17). Most frequently injured were upper body (such as back (15.8%), hand (13.2%)) and lower body (such as knee (13.2%) and foot (10.5%)) (Figure 18).

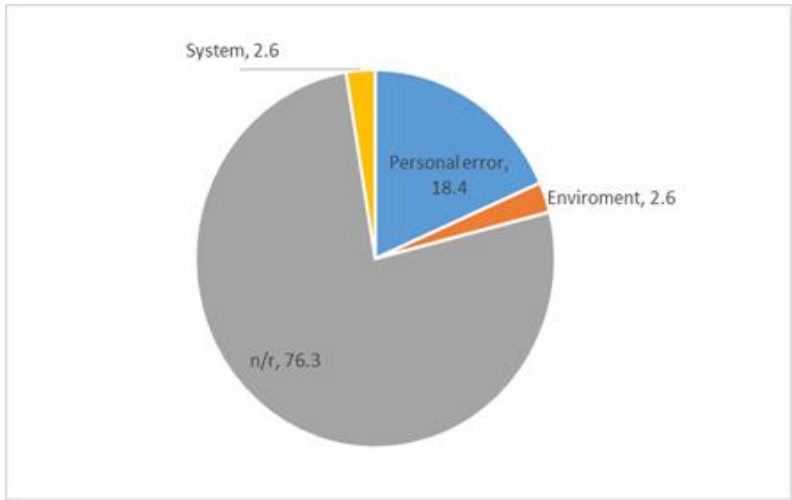


Figure 16. Percentage of root cause for firefighting accidents

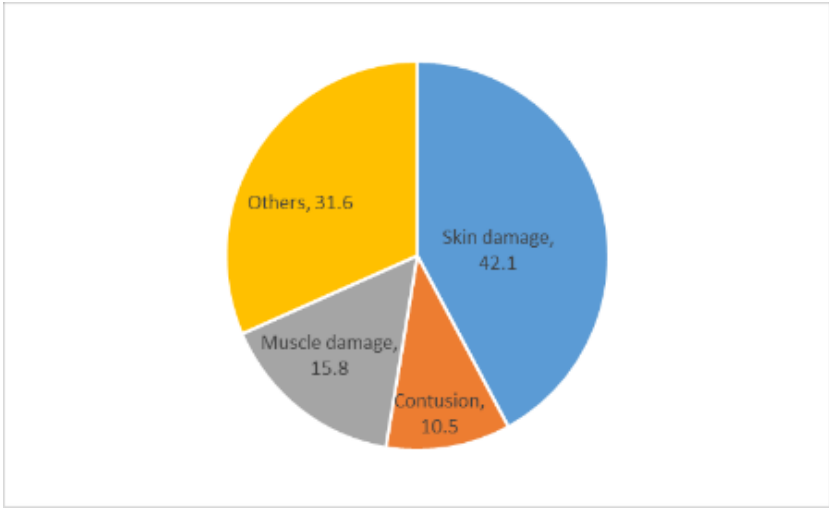


Figure 17. Percentage of injury types for firefighting accidents

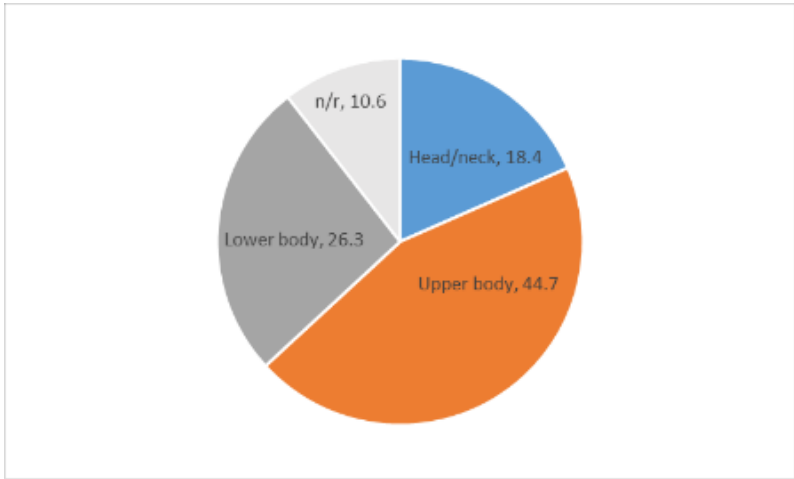


Figure 18. Percentage of injured parts for firefighting accidents

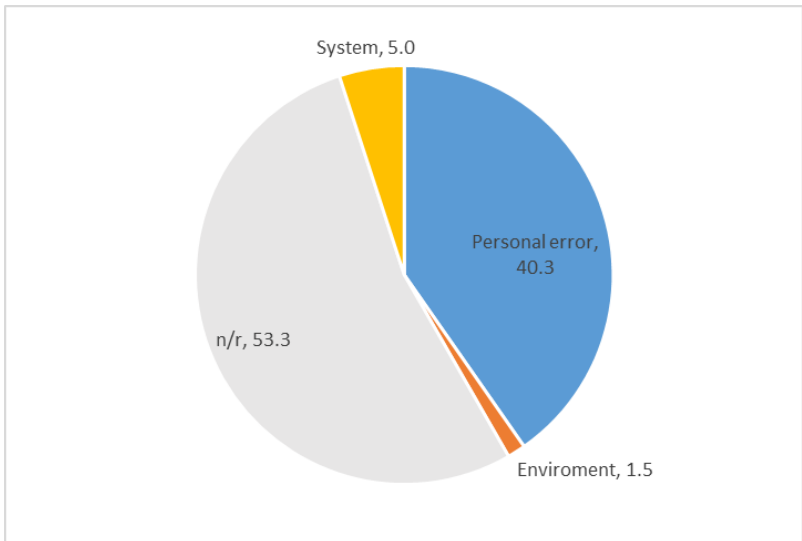


Figure 19. Percentage of root cause for other forestry accidents

Accidents of other forestry activities

Within other forestry activities including assessment, establishment ect. 114 work accidents occurred within the period of 2004 to 2014. Employment statistics indicated that 76.3% of workers were employees while 23.0% were contractors and 0.7% was not recorded. The root cause of a large proportion (53.2%) of accidents was not documented. However, according to Figure 19, personal errors (such as operator error, lack of PPE and poor judgment) were most frequent root causes. The accidents were categorised as injury (43.9%), medical treatment (23.0%), first aid (22.3%), lost time (9.4%) and n/r (1.4%). Skin and muscular damages were most frequent injury types (Figure 20). 65.5% of injuries occurred on the upper body part (Figure 21). Mostly injured were fingers (11.5%), back (9.4%), leg (9.4%), hand (8.6%), shoulder (7.9%) and knee (7.2%).

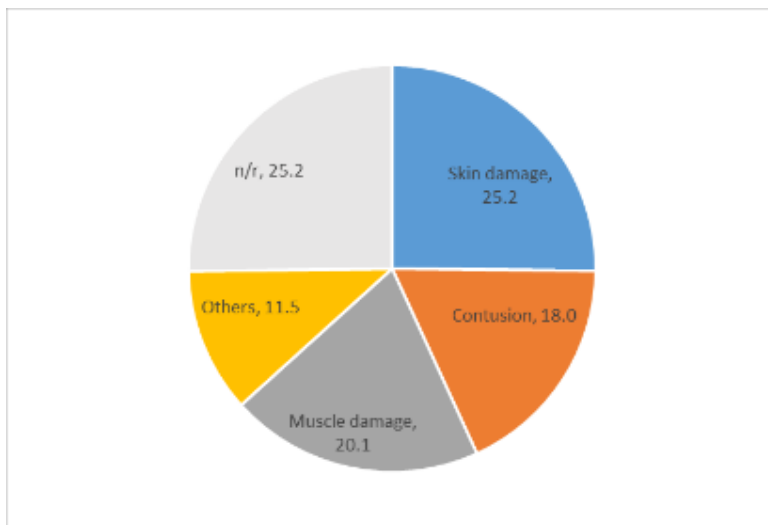


Figure 20. Percentage of injury types for other forestry accidents

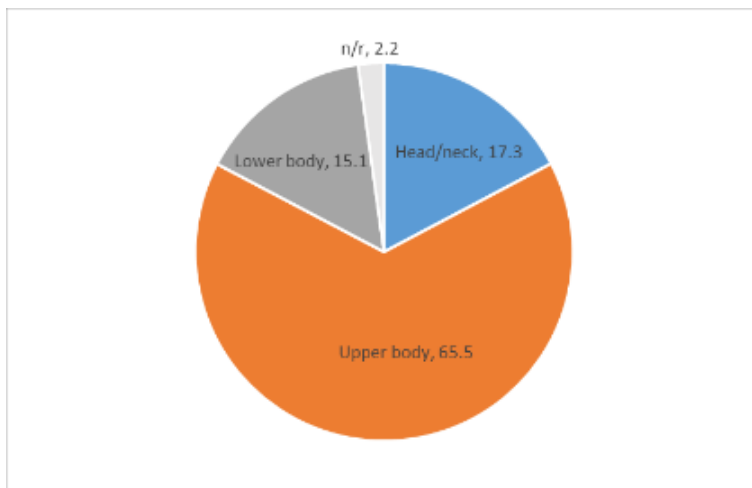


Figure 21. Percentage of injured parts for other forestry accidents

Conclusions

Important information omitted from incident reporting prevented more in-depth analysis on time of occurring accidents, working machines, side of body injured, number of days off work, medical cost associated with accidents and near miss incidents. The incident reporting system should be improved to capture details of working accidents for better work safety

management purposes. Near miss safety cases should be also Main root causes of accidents for different types of activities were personal errors such as lack of PPE, operator error, poor body position and poor applied techniques. Work safety training could be delivered to forestry personnel to minimise accidents caused by personal errors. Back and shoulder (as upper body parts) received the most injuries. To avoid/reduce muscular damages (such as strain and sprain) the workers should be provided with proper ergonomic training. Some of the skin injuries (such as cuts and abrasions ...) to legs/foot/ankle/knee could be reduced by using protective clothing and correct safety boots. Eye injuries could be reduced by using safety helmets equipped with eye protection guard (also with hearing protection to reduce exposure to noises e.g. in the case of chain saw operations).

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