

Job Factors Associated with Occupational Injuries and Deaths in the United States Forestry Industry

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Work in the forestry industry is recognised internationally as high risk for occupational injuries and deaths. Forestry logging operations generally involve felling trees, skidding (moving trees and logs from the stump to the point of delivery), and transporting trees to mills. Loggers need to recognize the hazards associated with identifying dangerous (dead) trees, felling, delimiting, bucking, debarking, chipping, skidding, yarding, loading, unloading, and transporting logs. The purpose of this study was to determine the specific work conditions and job factors that workers identified as greatest risk for injury or death in logging operations in the intermountain region of Montana and Idaho.

The study investigators recruited professional loggers through logging companies and professional logging associations in the states of Idaho and Montana. The professional loggers were asked to participate in focus group meetings regarding their perception of the association between logging tasks and logging injuries / deaths. One focus group session of 16 participants for 90 minutes was conducted and moderated by the investigators. The focus group moderator posed a series of questions designed to promote group discussion regarding logging practices and injuries. Injury data from workers' compensation reports was also shared with the participants and served as a basis for the focus group questions.

Felling trees was often associated with injuries sustained from falling branches. Conventional chainsaw logging and skyline skidding were perceived as high-risk processes. Loggers indicated that being struck by the carriage attached to the skyline was a significant risk. Other risks identified included being hit by the butt of swinging trees when that became snagged or caught on tree stumps as they were being skidded up the slope. Workers identified working on steep slopes as well as working in below freezing temperatures as a major risk for injury. Physical fatigue while performing strenuous work for 8-10 hours was also identified as a risk for injury.

The results of this study identified work conditions (extreme cold temperatures, steep incline of mountain slope), as well as job factors (felling trees, skyline skidding, driving logging trucks) that professional loggers perceived as contributing to increased risk for occupational related injury and death. The conditions and factors identified will be used to target interventions that reduce the risk of logging injuries in the future. Due to the remote nature of the logging work in this region, emergency first-aid training among the crewmembers was thought to be a critical part of logging safety. A culture promoting safety was also stressed for professional loggers.

1. Introduction

Work in the forestry industry is recognized internationally as an industry with high risk for occupational injury and death (Peters, 1991; Foley, 1994; Myers and Fosbroke, 1994; Parker et al. 2002, Bently et al. 2002; Bell et al. 2006). Forest operations involve logging and log transportation. The forest 'value chain' also includes the wood processing industry, the largest sector of which is sawmilling. The logging industry is one of the most dangerous industries in the United States (U.S.). According to U.S. Bureau of Labor Statistics (2015a) data from 2014, the national occupational fatality rate for all industries was 3.3 workers per 100,000 full time equivalents (FTE). During that same period the occupational fatality rate for forestry workers was 92 per

100,000 FTE, 28 times higher than all industries combined (U.S. Bureau of Labor Statistics, 2015b). In terms of all occupational injuries, the Occupational Health and Safety Administration (OSHA) recordable case rate for all U.S. industries was 3.2 per 100 FTE while the injury rate for forestry and logging workers was 5.1 per 100 FTE, (U.S. Department of Labor, 2015).

Logging in the intermountain region of Montana and Idaho in the U.S. is especially dangerous due to steep terrain, extreme weather conditions, and remote work locations. Both traditional chainsaw felling and mechanical harvesting (Figures 1A and 1B) are performed in this region on primarily natural stands as opposed to plantation stands as in other regions of the United States. Traditional chainsaw felling is predominantly performed in steep mountainous terrain where mechanical harvesting equipment is neither safe nor feasible. Approximately 25%-35% of the harvesting in Montana and Idaho involve traditional chainsaw felling. This region is also comprised of mainly small business logging operations with 5 to 10 workers. The wood markets affecting these small businesses is cyclical in nature and access to forests is often complicated by political and drought (fire) conditions. To date, there are very few published studies in the peer-reviewed literature regarding logging safety and none that focus on the specific occupational challenges and risks present in the intermountain region in the U.S.



Figure 1A & 1B: Two types of logging systems in the intermountain region of Montana and Idaho, USA. 1A) Sawyer using traditional chainsaw logging, which is used in steep mountainous conditions. 1B) Mechanical harvesting system with feller buncher common in many areas of the intermountain region.

2. Methods

The study investigators recruited professional loggers through logging companies and professional logging associations in the states of Idaho and Montana. The professional loggers were asked to participate in focus group meetings regarding their perception of the association between logging tasks and logging injuries / deaths.

To prepare for focus group meetings with professional loggers, the investigators obtained a summary of injury claim data from two State (Montana and Idaho) workers' compensation providers. All injury and fatality claims occurring during a 5-year period between 2010 and 2015 were obtained from companies in the logging industry. Injury claim data from each company contained information on demographics, the time, type and source of injury, as well as the cost associated with each injury claim. The providers removed all personal identifiers from the claims. A total of 800 workers' compensation claims were analysed. This data provided the background from which our focus group questions were developed.

As per the work of Krueger (1994), focus groups are conducted to identify trends and perceptions of the target audience of interest. An analysis of the focus group discussions and conclusions can reveal how the topic under study is perceived among group members. A focus group differs from a structured interview in that group members often have an influence on each other (Krueger, 1994). Unlike the structured interview, the focus group is a discussion where group members are able to respond to the ideas and perceptions of other focus group participants. There are several advantages to using focus groups as a method of gathering qualitative data (Krueger, 1994). The first advantage of using a focus group is the inherent openness and free

discussion that is created in this type of forum. A focus group is often composed of individuals with similar experience or views. The commonalities between participants drives natural and dynamic discussion (Krueger, 1994). Unlike with structured interviews, focus groups moderators are able to guide the discussion in order to achieve a deeper understanding of the underlying topic. Finally, focus groups can be used to gather results with high face validity at a low cost in terms of resources and time (Krueger, 1994). The results of the focus group are almost immediately available and can be used to drive intervention or direct future research.

One focus group session of 16 participants for 90 minutes was conducted and moderated by the investigators. The focus group moderator posed a series of questions designed to promote group discussion regarding logging practices and injuries. Injury data from workers' compensation reports was also shared with the participants and served as a basis for the focus group questions. The questions consisted of the following:

- What is your primary job?
- What do you think are the most dangerous (highest risk) tasks leading to injuries in logging?
- How can logging risks be prevented?
- What are the most effective solutions to preventing logging injuries?
- What can be done to reduce the number and rate of injuries among loggers?
- What are the barriers to safe logging practice?
- How can safe logging practices be promoted / facilitated?
- How can the logging community improve and protect workers more effectively?

The moderators introduced all questions initially and then elicited feedback for each individual question sequentially. Responses were recorded by the investigators based upon a consensus group approach. All focus group participants provided consent for participation in the research. Participant names or other unique identifiers were not recorded. All participants were anonymous.

3. Results

The participants consisted of 16 professional loggers with a mean age of 48.4 years (SD, 6.7). Mean time working in logging was 19.6 years (SD, 12.2). The youngest participants were hookers, while the eldest were truck drivers. Participants' primary job titles were sawyer (n=5), hooker (n=3), equipment operator (n=4), and truck driver (n=4). Ten of the participants were from Montana, six from Idaho. The results of the focus group session were summarized and analyzed for common themes.

Focus group discussions were concentrated around identifying the most dangerous aspects of the different work tasks. Current or former sawyers (also known as fellers) indicated that felling trees was often associated with injuries sustained from falling branches and trees, chain saw operation and the inherent risks caused by nearby skyline skidding. Hookers, which attach cable lines around logs (Figure 2), which are pulled up the mountain by cables, indicated that being struck by the carriage attached to the skyline was a significant risk. Other risks for hookers included being hit by the butt of swinging trees when that became snagged or caught on tree stumps as they were being skidded up the slope.



Figure 2: Professional logger (hooker) releasing cables around logs from skyline skidding in the mountainous region in Montana, U.S. Note the proximity of the carriage overhead with the worker on the log pile.

Working on steep slopes as well as working in temperatures below freezing was identified as a major risk for injury by both sawyers and hookers. Physical fatigue while performing strenuous work for 8-10 hours was also identified as a risk for injury.

Equipment operators of skidders, feller bunchers, yarders, processors, loaders (Figure 3) associated prolonged sitting with potential injury. Jumping out of equipment as well as falls from equipment were identified as risks that were associated with injuries among equipment operators. Among truck drivers injury risks were associated with awkward postures while securing logs on the truck, slippery conditions due to snow and ice, prolonged sitting and at times heavy lifting. Driving log trucks for many hours during the day and night was also associated with fatigue and greater risk of accidents (Figure 4).



Figure 3: An equipment operator sitting in a yarder which uses a system of cables (skyline) to pull logs from the stump up to the landing situated 300 meters in elevation above.



Figure 4: Truck drivers indicated that securing loads of timber required overhead reaching and high muscle force in the shoulders and that long hours of driving increased the risk of motor vehicle accidents.

Discussion was then directed to the question of how risks can be prevented. Common themes involved communication, enhancing safety culture and safety leadership, improving situation awareness, and ensuring proper and consistent use of personal protective equipment. Specifically, within communication, ensuring that frequent safety meetings occur, whether formal or informal, as well as ensuring that safety issues are corrected and addressed as soon as they observed were topics discussed within the focus groups.

Similar ideas were presented when the question was posed what could the logging community do to protect its workers more effectively. Additional ideas included consistency in safety practices and requirements among landowners, enforcement of existing safety laws, use and availability of GPS technology for the location of injury and evacuation sites, and ensuring that all workers knew evacuation procedures and the area's available emergency resources. To respond appropriately to a logging related accident in the remote mountains of Montana and Idaho, nearly all loggers stressed the importance of more training in emergency first-aid. The goal of the emergency first-aid training was to be better responders during occupational (crushed by tree) or non-occupational (heart attack) emergencies among their co-workers. In terms of ideas generated on improving safe work practices, there was a consensus among the participants that the safety culture within intermountain logging industry should be at the highest level.

4. Discussion

Logging in intermountain region of Montana and Idaho is characterized by steep terrain, extreme environmental conditions (subzero temperatures in the winter) and usually performed in remote locations with limited access to emergency services. For some workers (fellers and hookers) the work is physically demanding throughout the work shift, while for others (machine operators, truck drivers) it can involve several hours of sustained sitting with intermittent periods of high forceful lifting and securing of equipment and loads. Due to the handling of large loads (timber) in relative close proximity to other crewmembers, the limited visual perspective within the forest and unpredictable winds, the risk for being struck by logs and falling tree debris is significant. Nearly all focus group participants had worked with a crewmember that had been injured while logging and many had knowledge of a logging fatality. All participants indicated that their work was dangerous and most believed that logging in the intermountain region of Montana and Idaho was more dangerous than in other parts of the country characterized by predominantly plantation forests with a very high use of mechanical harvesting. The results of this study are consistent with other logging studies and data indicating that the logging industry has high risks for occupational injuries and deaths.

Nearly 25 years ago Meyers and Fosbroke (1994) reported on the possible factors that influence the risk of fatal occupational injuries in the logging industry. The authors reported the following factors as associated with potentially higher fatality risk: traditional chainsaw harvesting, steep terrain, small business operations, cyclical wood markets, natural stands (as compared to plantation stands), unmanaged forest stands and saw timber harvesting (as compared to pulpwood harvesting). Many of the above mentioned risk factors are present in the intermountain region of Montana and Idaho.

More recently, Conway et al. (2016) conducted focus groups with 27 logging supervisors and frontline crewmembers in Arkansas, Louisiana and Texas where plantation harvesting is most prominent. They also reported that logging timber was a dangerous profession but that the increased use of mechanical harvesting reduced the risk in the southern forests with relatively level terrain. As in the present study, their participants identified the transportation of logs in trucks as a primary risk for injury and death. The participants in the present study indicated that sawyers and hookers, who were working outside all day, were at risk of injury from being struck by various objects (e.g. trees, logs, branches, cables, carriage). Conway et al. (2016) reported a similar finding that being out of the machinery and on the work site were additional risks for worker injury.

A major limitation of this study is the limited sample size. Thus, caution should be used when interpreting the results. These results and conclusions of this pilot work may not best represent the population of professional loggers in Montana and Idaho. Recognizing the sample size limitation, the authors are planning on expanding this work to include additional loggers in the intermountain region. Caution should also be used when generalizing the findings in the present study to other logging communities. Due to the differences in climate, terrain, accessibility of emergency services, type of logging processes and equipment, size of logging companies and distances to processing mills, our findings may be very different than other logging locations.

5. Conclusions

The results of this study identified work conditions (extreme cold temperatures, steep incline of mountain slope), as well as job factors (felling trees, skyline skidding, driving logging trucks) that professional loggers perceived as contributing to increased risk for occupational related injury and death. The conditions and factors identified can be used to target interventions that reduce the risk of logging injuries in the future. Due to the remote nature of the logging work in the intermountain region of Montana and Idaho, emergency first-aid training among the crewmembers was thought to be a critical part of logging safety. Enhancing a culture that promotes safety and safety leadership were key points emphasized by participants to reducing injuries among professional loggers.

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