


## RESEARCH ARTICLE

# A comparison of owner/operator and worker perspectives on workplace safety in the West Virginia logging industry

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## Funding information

University of Kentucky's Southeast Center for Agricultural Health and Injury Prevention (SCAHIP) funded by the National Institute for Occupational Safety and Health, Grant/Award Number: 3049025288-14-061

## Abstract

**Background:** The logging industry is known to have one of the highest rates of fatal and nonfatal occupational injuries in the United States. Perspectives on why this study is so hazardous may differ between logging company owners/operators and workers. In this study, we explored and compared the safety perspectives of logging company owners/operators and workers in West Virginia.

**Methods:** Using a mixed-methods approach, we analyzed survey ( $n = 245$ ) and interview ( $n = 14$ ) data collected in 2015 from logging company owners/operators and workers in West Virginia. Survey data were analyzed via logistic regression; interview data were analyzed using thematic analysis. Response patterns were contrasted by occupational status (owners/operators vs. workers) in both analyses.

**Results:** Owners/operators and workers agreed on several aspects of workplace safety including the importance of personal protective equipment and the benefits of mechanization when timber harvesting. Key differences observed between owners/operators and workers included why injuries are underreported and the effects of production pressures on safety.

**Conclusion:** While there was much agreement, owners/operators and workers in the West Virginia logging industry reported differences in key domains of workplace safety. These differences should be taken into account when designing and implementing safety programs in the logging industry.

## KEYWORDS

hazard perception, logging, logging safety, occupational status, safety perspectives

## 1 | INTRODUCTION

Logging has been recognized as one of the most dangerous occupations in the United States. In 2018, workers in the logging industry experienced an estimated 153.2 workplace fatalities per 100,000 workers, 43.7 times higher than the national average for all workers.<sup>1,2</sup> The West Virginia logging industry consistently has a fatal injury rate higher than the national industry average.<sup>2</sup> This is thought to be associated with the state's mountainous terrain which prevents logging crews from accessing timber with mechanized timber harvesting equipment.<sup>3</sup> As a result, the

majority of West Virginia logging operations utilize manual felling techniques, which are associated with higher fatality rates<sup>4</sup> and higher rates of musculoskeletal injuries than mechanized (feller-buncher) timber harvesting techniques.<sup>5</sup> Additionally, the majority of species collected in West Virginia are hardwoods, the harvesting and processing of which are associated with an increased risk of injury due to their high storage of potential kinetic energy when compared to softwoods.<sup>3,6,7</sup>

Despite the well-known dangers of logging, most loggers do not perceive their jobs as exceedingly hazardous. One study found that only 15.6% of Virginia loggers surveyed considered the industry to be

“very/extremely dangerous.”<sup>8</sup> This is distinct from other hazardous occupations, such as timber processing, in which increases in occupational injury risk are associated with more accurate perceptions of jobsite hazards and increased use of personal protective equipment.<sup>9</sup>

The logging industry in West Virginia is primarily composed of small businesses. A typical company has a median of five employees working together in a single crew.<sup>10</sup> Small logging companies in West Virginia tend to hire part-time workers and are less likely to engage in contract work than larger companies, resulting in increased production pressure.<sup>11</sup> Loggers who experience increased pushes for production are more often forced to take risks to get the job done. This can be rushing to fell a tree or reluctance to ask a coworker for help in the felling of hazardous timber which might slow production.<sup>12</sup>

Despite the close working relationship between owners and workers within the small business structure, differences in perspectives on workplace safety by occupational status (i.e., owners/supervisors vs. employees/workers) are common.<sup>13,14</sup> Such discordant owner/worker views have been associated with an increased risk of work-related injuries.<sup>15</sup> In this study, we examined the workplace safety perspectives held by West Virginia logging company owners and workers and identified the degree to which discordant perspectives exist among the two groups. Understanding and addressing these differences may help alleviate the already high injury burden suffered by loggers in these small companies.

## 2 | METHODS

To understand the perspectives of company owners and workers and the differences between these two groups, we employed a mixed-methods approach using a combination of self-administered surveys and semi-structured telephone interviews.

### 2.1 | Participants

This study included loggers ( $n = 245$ ) working in the state of West Virginia who attended a West Virginia Division of Forestry (WVDOF) Best Management Practices (BMP) session in 2015. West Virginia state code mandates that all timber felling operations in the state of West Virginia are supervised by a logger certified through the WVDOF<sup>16</sup>; completing a BMP session through the WVDOF certifies a logger for 2 years. Through a pre-existing relationship with the University's Safety Extension Program, the WVDOF provided researchers with access to BMP sessions statewide throughout the year 2015.

### 2.2 | Data collection

Paper surveys were administered to loggers at 14 WVDOF BMP sessions at 14 different locations throughout West Virginia in 2015. Participation was incentivized with a raffle in which each participant who completed the survey would be included in a random drawing

for a single \$300 gift card to a sporting goods retailer. All attendees were provided surveys; participants turned in completed surveys as they left the room. A few participants may have not turned in surveys or may have submitted blank surveys. The survey response rate, though not precisely known, is believed to be near 100%; we anticipated very little bias due to nonresponse.

Survey item responses were recorded using a 4-point Likert scale with responses ranging from “Strongly Agree” to “Strongly Disagree”; there was no neutral response option. The questionnaire gathered basic demographic data including a question indicating whether participants considered themselves an “owner/operator” or “worker.” Survey questions were organized into the following workplace safety domains: (1) Injury Risk (10 questions), (2) Views/Expectations Regarding Injuries (3 questions), (3) Views on Non-reporting of Injuries (3 questions), (4) Understanding Safety Practices (4 questions), and (5) Understanding Safety Risks (2 questions).

Loggers who participated in the survey were also asked if they would agree to be interviewed by phone at a later date. Interviewees were incentivized with a \$20 gift card to a sporting goods retailer. Interview questions were designed to address loggers' perspectives on workplace safety beyond those addressed via the survey. The content of the interviews was based on the quantitative survey questions but was expressed as topics for open-ended discussion rather than simple direct answers. Interview topics of discussion included: (1) perceptions of what makes the logging industry dangerous, (2) interpretations of worker “carelessness,” (3) personal experiences with unsafe work conditions and occupational injuries, as well their causes, and (4) suggestions for making the logging industry safer.

Two separate but similar interview guides for owners/operators and workers were prepared. Participants were asked at the start of the interview if they considered themselves an owner/operator or a worker and the appropriate guide was utilized. Interviews were conducted in a semi-structured format to allow for areas outside of these domains to be explored as they arose. Questions were phrased in informal, industry- and worker-friendly terms; clarification was provided when participants asked for it. Additionally, questions in each guide were paired with a set of interview “prods” that the interviewer could use to aid in conveying the meaning and context of a question when necessary. For example, the question “How common are injuries at your company?” was followed by the prod, “In a year, how many people do you see injured or hurt where you work?” if the interviewee did not understand the question.

All interviews were conducted separately by one investigator with extensive experience communicating with this workforce. They were recorded, transcribed and, deidentified. This study protocol was approved by the West Virginia University Institutional Review Board which determined that written consent from participants was not required.

### 2.3 | Quantitative data analysis

Survey data were analyzed using RStudio version 1.1.456.<sup>17</sup> Descriptive statistics were reported for age, sex, race, years of experience in the

logging industry, occupational status (owner/operator vs. worker), and the main task performed on the logging site (e.g., Feller/Cutter). Continuous variables were reported as means with standard deviations; categorical variables are reported as percentages. Since no neutral option was provided, and to simplify analyses, Likert scale responses were dichotomized into “Strongly Agree/Agree” and “Strongly Disagree/Disagree” categories. Dichotomizing the responses allowed logistic regression to be used to analyze the data while controlling for potential confounders.

## 2.4 | Qualitative data analysis

Interview transcripts were entered into Microsoft Excel (version 16.35), with each cell corresponding to an individual participant's response; owner/operator and worker responses were grouped into separate sheets.<sup>18-20</sup> We used a codes-to-theory, phenomenological approach<sup>21</sup> to analyze the qualitative data. Individual responses were coded inductively to capture each participant's unique interpretations and experiences. These initial codes were reviewed by two members of the study team (one of which conducted the initial interviews) and were subsequently refined and collapsed where appropriate. Condensed codes were further reviewed and organized into emergent themes using pattern coding, which was ideal for identifying major themes in previously coded data as well as for elaborating social networks, patterns, and constructs.<sup>22</sup>

Final thematic frameworks for owners/operators and workers were created using a superordinate and subordinate arrangement and were compared and contrasted to create a holistic view of each groups' perspectives on workplace safety within the logging industry and elaborate intergroup dynamics. Final themes/frameworks and relevant participant quotations, the format present in this report, were reviewed and agreed upon by four members of study team.<sup>23</sup>

## 3 | RESULTS

### 3.1 | Sample characteristics

A total of 245 loggers completed a paper survey. All were male and nearly all were white (99.2%,  $n = 243$ ). More than half (60.8%) considered themselves to be an “owner/operator” and 39.2% ( $n = 96$ ) considered themselves “workers” (Table 1). The mean age of our sample was 41.6 years and participants had an average of 17.1 years of experience in the logging industry. Relative to workers, owners/operators were older (45.8 vs. 35.0 years,  $p < 0.001$ , data not shown) and reported more years of experience (20.8 vs. 11.1 years,  $p < 0.001$ , data not shown). The most common tasks participants considered to be their “main job” were feller/cutter ( $n = 86$ ; 37.3%), skidder operator ( $n = 43$ ; 18.6%), and loader operator ( $n = 43$ ; 18.6%). Less common tasks included dozer operator ( $n = 27$ ; 11.6%) and feller-buncher operator ( $n = 10$ ; 4.3%); 22 respondents labeled their

**TABLE 1** Sample characteristics

Categorical variables ( $n = 245$ )	$n$ (%)
<b>Employment status</b>	
Owner/operator	149 (60.8)
Worker	96 (39.2)
<b>Main job</b>	
Feller/cutter	86 (35.1)
Skidder operator	43 (17.6)
Feller-buncher operator	10 (4.1)
Dozer operator	27 (11.0)
Loader operator	43 (17.6)
Other	22 (8.9)
Did not respond	14 (5.7)
<b>Race</b>	
White	243 (99.2)
Native American	2 (0.8)

main task on the jobsite as “other.” There was no statistically significant difference in reported main tasks between owners/operators and workers.

### 3.2 | Differences in workplace safety perspectives

#### 3.2.1 | Quantitative results

After adjusting for age and main task, regression results showed that responses to many survey items were statistically indistinguishable between owners/operators and workers (Table 2). Controlling for years of experience in addition to age and main task did not change these results (data not shown). Key areas where owner/operator and worker responses agreed concerned the ubiquity of workplace hazards and risks on a logging jobsite, the idea that hazards and injuries are “just part of the job,” nonreporting of injuries for fear of retribution, and recognition of the negative effects bad weather and working too quickly have on workplace safety. Furthermore, owners/operators and workers nearly unanimously agreed that both proper training and maintenance of equipment have important implications for workplace safety.

However, differences between owner/operator and worker responses were present in several areas. Owners/operators were less likely than workers to agree that close calls (hazardous events that almost resulted injury) are commonplace (odds ratio [OR] = 0.5, 95% confidence interval [CI] = 0.2–0.9). They were also less likely than workers to agree they feel adequately compensated given their dangerous working conditions (OR = 0.4, 95% CI = 0.2–0.9). Additionally, owners/operators were less likely to agree that injuries go unreported because injuries are “just part of their job” (OR = 0.5, 95% CI = 0.3–0.9) or that they would be embarrassed to report an injury (OR = 0.5, 95% CI = 0.3–0.9).

**TABLE 2** Owner/operator versus worker perspectives on workplace safety (n = 245)

Survey domain and question	Number of respondents	% (n) Agree/Strongly Agree		Odds ratio (95% CI) <sup>a</sup>
		Owners/operators	Workers	
<b>Injury risk</b>				
"Logging is more dangerous than other 'hands-on' jobs"	244	81.8 (120)	89.6 (86)	0.6 (0.2–1.6)
"During a normal workweek, it is common to experience a number of 'close calls' that under different circumstances might have resulted in injury"	242	59.9 (88)	70.5 (67)	<b>0.5 (0.2–0.9)*</b>
"Not much can be done to make logging work safer"	244	29.5 (44)	37.9 (36)	0.8 (0.4–1.4)
"As long as I pay attention to what I am doing, I will not get hurt on the job"	244	26.9 (39)	23.2 (22)	1.0 (0.5–2.0)
"Loggers must be very careful about avoiding hazardous situations while working"	240	99.3 (145)	96.8 (91)	8.4 (0.7–214.2)
"I am confident that I know the hazards of logging and how to protect myself on the jobsite"	244	95.6 (143)	90.6 (87)	2.8 (0.7–11.6)
"I am confident that my coworkers know the hazards of the job and how to be safe on the jobsite"	244	87.9 (131)	81.3 (78)	1.4 (0.6–3.1)
"To get the job done, sometimes a logger must take risks that endanger their safety"	242	42.9 (63)	54.7 (52)	0.7 (0.4–1.3)
"To make money, sometimes a logger must take risks that endanger their safety"	243	42 (28.4)	32 (33.7)	0.9 (0.5–1.7)
"I get a sense of pride in doing work I know is dangerous"	245	49.7 (74)	66.7 (64)	0.7 (0.4–1.4)
"I feel the money I make is worth the risk of being injured on the job"	241	14.9 (22)	31.9 (30)	<b>0.4 (0.2–0.9)*</b>
<b>Understanding safety risks</b>				
"Working in bad weather (rain, snow, high wind, and heat) is common in logging and this puts us at risk of injury"	244	81.2 (121)	83.2 (79)	0.7 (0.3–1.5)
"Working too fast is common in logging and this puts us at risk of injury"	244	82.5 (123)	80.0 (76)	1.1 (0.5–2.3)
<b>Views/expectations regarding injuries</b>				
"Injuries are just part of the job of logging that must be accepted if you are going to be in the business"	243	55.4 (82)	61.1 (58)	0.9 (0.5–1.6)
"Working with new workers is dangerous for me and puts me at risk of being injured"	244	82.6 (123)	71.6 (68)	1.6 (0.8–3.2)
"When a worker gets injured on the job, most coworkers think it was the workers' own fault"	243	69.8 (104)	69.2 (65)	0.9 (0.5–1.8)
<b>Views on nonreporting of injuries</b>				
"Workers sometimes do not report injuries because they fear they will be blamed"	244	53.0 (79)	54.7 (52)	0.8 (0.5–1.5)
"Workers sometimes do not report injuries because they feel embarrassed or ashamed"	243	46.3 (69)	55.3 (52)	<b>0.5 (0.3–0.9)*</b>
"Workers sometimes do not report injuries because they feel that being injured is just part of the job"	244	44.3 (66)	63.2 (60)	<b>0.5 (0.3–0.9)*</b>
<b>Understanding safety practices</b>				
"Having good training is important for being safe on the job"	245	96.6 (144)	100 (96)	<sup>b</sup>
"Using equipment/tools that are in good working order is important for being safe on the job"	245	97.9 (146)	100 (96)	<sup>b</sup>

TABLE 2 (Continued)

Survey domain and question	% (n) Agree/Strongly Agree		Odds ratio (95% CI) <sup>a</sup>
	Owners/operators	Workers	
"Using proper safety devices and personal protective equipment are important for being safe on the job"	97.3 (145)	97.9 (94)	0.1 (0.0–2.6)
"Owners and/or foremen have different views from workers on what they consider safe work practices"	57.1 (84)	62.1 (59)	0.9 (0.5–1.8)

Abbreviation: CI, confidence interval.

<sup>a</sup>Odds ratios owner/operator perspective compared to worker perspective, adjusted for age and main task on the jobsite.

<sup>b</sup>Zero in cell prevented an odds ratio from being produced; no significant association was detected.

\* $p < 0.05$ .

### 3.2.2 | Qualitative results

Interviews with study participants revealed several similarities in the perspectives of owners/operators and workers, as well as different views on the determinants of workplace hazards and injuries. While our analysis revealed several themes, the most prevalent were as follows: (a) owners/operators and workers both viewed logging as unpredictable, (b) owners/operators and workers both understood the safety benefits of mechanized timber harvesting, (c) owners/operators' believed workers' overconfidence and inexperience were barriers to safe work, and (d) workers viewed production pressures as contributing to unsafe working conditions.

(a) *Owners/operators (O) and workers (W) both believed that unpredictability is a barrier to safety.*

Both groups believed that there is inherent unpredictability in the world which contributes to the dangers of logging. This took several forms, including the concept of unforeseeable events within the natural world, as well as the idea that some occupational injuries were the result of "dumb luck."

**W7:** "Mother Nature is unpredictable. I mean even if you do everything right, you're still gonna have that one... accident."

**O3:** "I wouldn't say that [injury] was anything other than dumb luck."

Participants in both groups also cited the unpredictable nature of the work itself. For example, both owners/operators and workers noted that the erratic behavior of a tree during the manual felling process was a common occupational hazard. Participants noted that this incalculable behavior of trees and tree limbs resulted in hazards that can lead to workplace injuries.

**W8:** "Mainly there's just things that you can't see. Especially cutting timber."

**O5:** "Sometimes you can't always predict where the limbs gonna come flying off, and I've been hit by limbs, and gotten hurt by them. But you can't always tell which direction they're gonna fly."

Generally, workers maintained that this uncertainty was impossible to overcome irrespective of worker experience:

**W1:** "You can be the best logger there is, but you can't tell what a tree is going to do."

Unpredictability was referenced as an issue ubiquitous to the industry and a constant barrier to safety. One owner/operator perceived unpredictability as so great a barrier that it might inhibit successful safety interventions, stating:

**O3:** "I don't think there's any kinds of rules, regulations or, or safety actions that you can predict because everything's unpredictable with this kind of work."

(b) *Owners/operators and workers both believed that mechanization makes logging safer.*

It was evident throughout the interview process that participants, regardless of their occupational status, perceive mechanization as a meaningful way to make logging safer and reduce injuries on the jobsite. The most frequently mentioned example of



mechanized logging was the feller-buncher, which replaces the need for manual tree felling:

**O4:** "We went... mechanized. That helps with safety."

**W1:** "I believe the feller-buncher makes it a lot safer... A lot of the timber I cut, if it was cut by hand, I'm sure there would be a lot of felling injuries from the tops breaking out."

Workers indicated that certain forms of mechanical equipment could make their jobs safer and result in fewer jobsite injuries. However, participants reported that utilizing mechanized machinery, such as a feller-buncher, was, in many cases, not possible in West Virginia due to the state's terrain. In fact, several participants noted that they have never witnessed the use of a feller-buncher in the state. In such cases, logging crews were left to perform more labor-intensive manual tasks which they believed were less safe.

**W7:** "They [have] tree cutters but I never seen one in this state. And my theory is, the more people you got on a piece of equipment, the less likely they are to get hurt. If they're in a cab, it's hard to get hurt. But there's trees out there in ... West Virginia, you gotta cut by hand. You just can't cut them no other way."

**W8:** "There's always better technology out there. You take your feller-bunchers and stuff like that, but there's so much ground in West Virginia it's not possible to cut with stuff like that. But they do make the job site safer for cutting timber."

- (c) Owners/operators (O) viewed worker inexperience and overconfidence as barriers to safe work.

Owners/operators viewed their employees' lack of experience as barriers to safe work. Complacency was also a barrier to safety noted by the owners/operators. Both of these, according to owners/operators, result in overconfidence among workers and an overestimation of their abilities as loggers.

**O5:** "I think it's dangerous cause you get too many people who are unexperienced. They come out into the woods saying that they know more than they really do... of course you get more injuries that way."

**O3:** "...you get in situations that you get very comfortable, you get very complacent, and then with this particular job... those are your biggest struggles. You get too 'I can do this; I can do that' and you bypass real typical things."

- (d) Workers (W) viewed production pressure as a barrier to safe work.

Production pressures were not a pervasive theme in owner/operator's perceptions of barriers to safe logging, with only one owner/operator stating, "[Workers get in] too much of a hurry [and] try to get production." Nevertheless, this owner/operator still connected production pressures to the unsafe rushing of work on the jobsite.

In comparison to owner/operator responses, production-related pressure as a barrier to safety was commonly cited in interviews with nonowner/operator logging workers. Additionally, workers were more specific in describing the production circumstances they perceived as barriers to unsafe working conditions:

**W7:** "A lot of people in the logging industry get hurt cause they're in a hurry. [Our crew has] gotta get 2 acres a day out or... You know we

can't make it, you know what I mean? And for 2 guys, 2 acres a day is pushing it."

**W8:** "Productivity is running. The faster you can get it done, the faster you can get it out, the more money you make."

**W2:** "[T]here's too much of a push to get production for a logging company to stay in business, and that gets people hurt more than anything. I think the price of logging ought to go up and that would slow people down."

Similarly, some workers suggested they would address safety issues brought on by production pressures, such as workers getting tired on the jobsite and being injured, by telling everyone to take a break. This idea was not suggested by any of the owners/operators.

**W6:** "[If I were the owner and] somebody's getting hurt, [I'd] tell him to knock it off and take a break."

**W7:** "If you get tired, and you're dragging... sit down and take a break. [Take a] drink of water... Don't get carried away... cause if you're straining yourself, then you're less likely to be doing whatever you need to be doing."

## 4 | DISCUSSION

In this study, we aimed to investigate the workplace safety perspectives of logging company owners/operators and workers operating within West Virginia using a mixed-methods approach. Additionally, we explored differences in perspectives between the two groups. Our findings showed many areas of overlap in the perspectives of these two groups. For example, regardless of their occupational status, participants in both the surveys and interviews perceived hazards to be ubiquitous in the logging industry. In surveys, owners/operators and workers also agreed that "Logging is more dangerous than other 'hands-on' jobs" and "Loggers must be very careful about avoiding hazardous situations while working," while in interviews, owners/operators and workers both expressed the shared view that timber harvesting was "unpredictable." Additionally, owners/operators and workers both indicated that mechanized timber harvest and safety training are important for jobsite safety. However, notable discrepancies in owner/operator and worker responses were observed, such as those pertaining to production pressures. Interviews with workers revealed they associate pushes for production and working quickly with decreased jobsite safety. Additionally, workers cited a break from work as a way to make their workplace safer. When prompted with similar questions, owners/operators cited production pressure less frequently and often cited worker inexperience and overconfidence as casual to unsafe work.

Broadly, these findings are congruent with previous literature examining safety and health perspectives within small enterprises: business owners and their employees often have differing perspectives.<sup>24,25</sup> Specifically, several qualitative studies have noted similar findings in what owners/operators and workers in our sample viewed as the causes of unsafe conditions. For example, a study from Eakin<sup>26</sup> found that small business owners within various industries often perceived inexperienced workers as more likely to need safety guidance and

mentoring. Elsewhere, Eakin noted that workers expressed the view that pushes for production have negative implications for their workers' health and that their bosses fail to recognize this.<sup>13</sup> These views were expressed by owners/operators and workers in our sample, respectively.

Our findings present a unique opportunity to compare the workplace safety perspectives of West Virginia loggers to those of loggers in other regions; literature concerning safety and health perspectives among West Virginia loggers are scant and this precludes comparisons of our findings to other samples of West Virginia loggers. Owner/operator and worker's agreement on the importance of adequate safety training has been previously observed in studies of logging workers in the northeastern United States.<sup>14</sup> Additionally, both our study and previous literature on the logging industry in the southern United States have observed workers to be more cognizant of the negative effects production pressures have on workplace safety than their supervisors, suggesting these views may be commonplace in the logging industry.<sup>27</sup>

Studies of hazard perceptions within the logging industry of the southern United States have also noted mechanized (i.e., feller-buncher) timber harvesting to be a common job task, with loggers recognizing the safety benefit of such methods regardless of occupational status.<sup>27,28</sup> Both owners/operators and workers we interviewed perceived this association, however, participants also noted that the mountainous terrain of West Virginia often precludes its use, leading most loggers to fell timber by hand.

The unpredictable nature of manual timber harvesting, a theme frequently mentioned in interviews with our sample regardless of occupational status, was absent from other studies on hazard perceptions within the southern United States logging industry.<sup>27,28</sup> While potentially a product of differences in timber harvesting techniques (mechanized vs. manual) or the mountainous terrain of the state, this gap may be related to variations in tree species in West Virginia compared to other regions. While the vast majority of West Virginia's tree species are hardwood, those in the southern United States are predominately softwood.<sup>29</sup> Hardwood tree species store a higher amount of potential kinetic energy than softwoods and may therefore be more likely to exhibit erratic behavior, which was described throughout our interviews.<sup>7</sup> As we have pointed out, the harvesting of hardwoods (compared to harvesting softwoods) and working on mountainous terrain are both associated with increased occupational injury risk in the logging industry.<sup>3</sup>

The patterns we noted in workplace safety perspectives by occupational status are similar to those seen in industries other than logging. For example, a study of small auto-collision repair shops observed that business owners and their workers agreed that occupational safety was the responsibility of each individual worker.<sup>30</sup> This is consistent with owner/operator and workers agreement regarding views/expectations and nonreporting of injuries in our sample. This attitude, referred to as "leaving it up to the workers," is common within the small business structure.<sup>26</sup> As it has been suggested that occupational safety within a given industry is most effective when business owners take a leading role in its implementation, this hands off approach can be detrimental to workers health.<sup>31,32</sup> Similarly, an

analysis of logging companies throughout the United States with good safety records indicated that owners of these businesses displayed a personal commitment to safety.<sup>33</sup> Such a commitment was absent from our interviews with owners/operators.

Our study is not without limitations. Our sample consisted only of loggers who attended a WVDOF BMP session, presumably to become a certified logger; only one worker on a given logging site in the state of West Virginia must be a certified logger. This presents an opportunity for selection bias as our sample excludes loggers who did not attend a BMP session in 2015 and likely have less experience than those in our sample. In addition, those workers in attendance, who were presumably selected by the owners/operators as best choices to become certified via WVDOF BMP training, may hold attitudes more like the owners/operators than other workers not selected for the training sessions. This may have diminished attitudinal differences between owners/operators and workers in our sample. Furthermore, our interview sample consisted of a relatively small subset of survey participants ( $n = 14$ ). Since interview participants were self-selected, there is possible volunteer bias.

To our knowledge, no study has explored the workplace safety perspectives of West Virginia loggers and compared differences in these views between owners/operators and workers. We noted overlap between owners/operators and workers in their perceptions regarding the ubiquity of hazards within the logging industry, as well as differences in areas related to production pressure, injury reporting, and safety practices. While these findings contain similarities with previous literature regarding hazard perceptions within the logging industry outside of West Virginia, differences regarding the natural environment and timber felling techniques were noted. We believe these findings may be utilized by jobsite safety interventions seeking to improve intraorganizational communication about safety within the logging industry; previous studies have noted improvements in jobsite safety within small businesses after improving owner/employee dialogues.<sup>34</sup> Additionally, the results of this study guided the development of a logging safety management program currently being implemented and studied by the investigators throughout the state of West Virginia. As discordant safety perspectives by occupational status can have negative effects on worker health,<sup>15</sup> future studies should explore how the differences observed in the present study affect the implementation and effectiveness of safety and health management programs within the logging industry of West Virginia and beyond.

## ACKNOWLEDGMENTS

The authors would like to thank Drs. Karen Innes and Gordon Smith (West Virginia University) for their comments and suggestions throughout the drafting of this manuscript. Additionally, the authors would like to acknowledge Randy Dye and West Virginia Division of Forestry for access to their Best Management Practices sessions and support throughout the administration of survey instruments used in this study. This study was sponsored by a pilot grant (#3049025288-14-061) from the University of Kentucky's Southeast Center for Agricultural Health and Injury Prevention (SCAHIP) funded by the National Institute for Occupational Safety and Health.

## CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest.

## DISCLOSURE BY AJIM EDITOR OF RECORD

Paul A. Landsbergis declares that he has no conflict of interest in the review and publication decision regarding this article.

## AUTHOR CONTRIBUTIONS

Douglas J. Myers, Wayne J. Lundstrom, Kimberly J. Rauscher, and Mark Fullen contributed to the conceptualization and design of this study and the data collection instruments used. Douglas J. Myers and Wayne J. Lundstrom participated in the acquisition and collection of all data. Eric W. Lundstrom and Kimberly J. Rauscher performed the data analysis. Eric W. Lundstrom and Douglas J. Myers drafted and revised the present manuscript and all authors reviewed, edited, and approved the final version to be published.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author on reasonable request.

## ETHICS APPROVAL AND INFORMED CONSENT

Study design and procedures were approved by the West Virginia University Institutional Review Boards before implementation. Written consent was obtained from participants before data collection.

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**How to cite this article:** Lundstrom EW, Myers DJ, Lundstrom WJ, Rauscher KJ, Fullen M. A comparison of owner/operator and worker perspectives on workplace safety in the West Virginia logging industry. *Am J Ind Med.* 2021;1-9. <https://doi.org/10.1002/ajim.23228>