

## ORIGINAL ARTICLE

## A study of logger fatalities from 1992–2000

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**Objectives:** To determine if certain loggers are at increased risk of death during logging operations.

**Methods:** Statistical analysis of 780 logger fatalities for a nine year period (1992–2000).

**Results:** The major findings are: (1) treefallers suffer nearly 63% of all fatalities, (2) the region where the fatality occurred and the size of the employer were not significant factors that contributed to a high percentage of treefaller fatalities, and (3) the Northeast and Midwest regions showed a higher percentage of fatalities compared with the South and West regions.

**Conclusions:** Overall, the logger fatality rate for 1992–2000, compared with 1980–88 has decreased slightly; however, treefallers continue to be the group of loggers who suffer the highest fatality rate.

The objective of this study was to determine if certain loggers are at increased risk of death during logging operations. The Bureau of Labor Statistics Census of Fatal Occupational Injuries (CFOI) 1992–2000 logger fatality data set contained several new variables to describe logger fatalities which were unavailable in earlier data sets analyzed by previous researchers. These variables included the cause of death, the activity of the logger at the time of death, year of death, month of death, day of death, time of day of death, region where fatality occurred, age of victim, gender of victim, victim's race, the size of the employer victim was employed with, and part of body which was injured and resulted in death were analyzed. The primary question to be answered was, "are certain logging jobs at a greater risk for fatalities?"

## PREVIOUS STUDIES

According to Sygnatur, logging was the most dangerous occupation in the United States during the year 1997, with a logger death rate 27 times higher than the national average for all other occupations combined.<sup>1</sup> Sygnatur also found that from 1992 through 1997 the death rate for loggers averaged 128 per 100 000 workers, compared with only five per 100 000 workers in all other occupations combined. The National Institute for Occupational Safety and Health (NIOSH) issued "Alerts" about the high fatality rates associated with logging in December 1994 and May 1995.<sup>2,3</sup> It found that the logger fatality rate (164 deaths per 100 000 workers) was 23 times that of "all United States workers". From 1992 to 1997, one out of every 780 loggers lost their life due to a logging accident even though only 0.5 % of the workforce was involved in logging operations, yet logger fatalities accounted for 2% of all occupational deaths.<sup>1</sup> Of all occupations from 1992–96, only occupational fishing was more dangerous than logging.<sup>1</sup> The earliest and most comprehensive study on logging fatalities was done in 1974 by Goldberg.<sup>4</sup> He used state data (1966–72) from California, Oregon, and Washington. He recognized that not only the cause of the fatality was important, but the job of the victim was equally important. Goldberg also used cross tabulations to summarize logger fatality causal relationships by identifying 37 causes for fatalities and comparing them to 17 logger occupations.<sup>4</sup> Causes of logging related fatalities from 1992–99 were summarized in a technical release by Jarvis.<sup>5</sup> Based on CFOI data, he concluded that 67% of the logger fatalities were a result of falling objects (tree, limbs, and logs) and 78.1% of those fatalities occurred during treefelling. Jarvis

also reported that the highest number of fatalities occurred from 10:00 am to 11:00 am and the second highest number of fatalities occurred between 1:00 pm and 2:00 pm. Jarvis again reported on logging fatalities investigated by the Office of Safety and Health Administration (OSHA) from 1996–97.<sup>6</sup> His analysis showed that 107 fatalities were reported to OSHA from 1996–97, and 34% were loggers felling a tree, 49% were loggers employed in the southern United States, and 43% of the logger employers employed one to four persons.

Myers and Fosbroke reported on logging fatalities in the United States by region, cause of death, and other demographic characteristics.<sup>7</sup> They used data from NIOSH National Traumatic Occupational Fatality surveillance system. Their data set included 1278 logging fatalities for a nine year period (1980–88). Their findings showed that race was not a risk factor in logging fatalities. They were unable to calculate specific rates for logger jobs, but did show that 65.5% of all logger deaths were to a combined group of jobs including fellers, limbers, buckers, and choke setters. Logger death rates were calculated for each year and ranged from a low of 127.6 deaths per 100 000 loggers (1981) to 192.1 deaths per 100 000 loggers (1986), with a rate of 168.3 logger deaths per 100 000 loggers in 1988. They examined the regions where the fatalities occurred and found no region suffering more fatalities than other regions. Their most significant finding was that the highest ranked cause of death was from falling objects (50% of the deaths).

In 1976 the NIOSH attempted to reduce the high rate of logging fatalities by recommending a standard for logging activity and evaluated and recorded information from literature searches, meetings with advisory groups, and visits to logging sites to develop best practices for safe logging. NIOSH concluded that, "inadequate training, poor working techniques and safety measures, coupled with the inherent dangers of felling, bucking, yarding and loading logs, are the major reasons why logging is one of the most hazardous occupations in the United States".<sup>8</sup>

OSHA set forth a new regulation (29 CFR 1910.266) for logging companies to comply with by 9 February 1995. Logging operations were to provide additional job and first aid training to loggers, expand the uses and types of personal

**Abbreviations:** CFOI, Census of Fatal Occupational Injuries; CI, confidence interval; FACE, Fatality Assessment and Control Evaluation (program); LMR, logger mortality rate; NIOSH, National Institute for Occupational Safety and Health; OR, odds ratio; OSHA, Office of Safety and Health Administration

protective equipment, make requirements for the use of rollover and falling-object protective structures more stringent, and teach comprehensive manual felling techniques. Although this new regulation was a step toward improving the high fatality rate for loggers, the logger mortality rate since 1995 has actually increased.

Several states are involved in NIOSH's Fatality Assessment and Control Evaluation (FACE) program.<sup>9</sup> These 15 states are Alaska, California, Iowa, Kentucky, Massachusetts, Minnesota, Missouri, Nebraska, New Jersey, Ohio, Oklahoma, Texas, Washington, Wisconsin, and West Virginia. This program is designed to allow states to identify occupational fatalities, perform investigations of specific types of events to identify injury risks, develop recommendations designed to control or eliminate identified risks, and to make injury information available to workers, employers, and safety and health professionals. Reports from FACE are normally descriptive summaries of injuries and fatalities for many occupations, including logging. However, no FACE database has been initiated to compile all state logger fatality information.

Kinard reported on certification of loggers in the states of Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia.<sup>10</sup> His report lists all certification courses loggers can complete for safer logging practices. It remains to be determined if this new certification process will affect the high frequency of logger fatalities in these 13 states.

OSHA keeps yearly records of logger fatalities. Data collected by OSHA for each fatality include the date of the fatality, a narrative describing the fatality, age of victim, gender of victim, and victim's occupation.<sup>11</sup> However, this data set does not contain the number of descriptive variables to be of value in a descriptive study. OSHA also released an Executive Summary titled, "A Review of Logging Fatalities Investigated by the Occupational Safety and Health Administration in FY 1996 and FY 1997, Parts 1 and 2".<sup>12</sup> OSHA's analysis was quite complete for FY96 and FY97 logger fatalities and includes statistics summarizing the region where the fatality occurred, time of day of each fatality, month the fatality occurred, age of victim, and the size of the company where the victim was employed. However, OSHA established no relationships among the variables.

Several authors (Bunger, Hagberg, Lee, and Nilsson and others) found that carbon monoxide inhalation by loggers could be a factor in logger deaths.<sup>13-16</sup> Nilsson and others found that during the felling operation, high levels of carbon monoxide during the short exposure time contributed to "discomfort" among most chain saw operators.<sup>16</sup>

Batchelor *et al* estimated incidence rates for occupational fatalities in Victoria, BC, Canada.<sup>17</sup> He standardized 10 job types (farm hands, plumbers, police officers, mixed crop and livestock farmers, sportspersons, coaches, and related, farmers and farm managers, truck drivers, miscellaneous laborers, air transport professionals, and forestry and logging workers) and estimated that forestry and logging workers had an incidence rate of 104.9 per 100 000, which was the highest of the job types estimated.

## METHODS

The Bureau of Labor Statistics CFOI database is a compilation of death certificates, news media reports, state worker's compensation reports, state coroner/medical reports, OSHA reports, state initiated follow ups, state motor vehicle reports, and federal reports.

The Bureau of Labor Statistics CFOI database from 1992 through 2000 was analyzed and a data set of 780 logger

**Table 1** Fatalities by cause-activity

Cause-activity	No (%)
Treefall/cutting	285 (36.5)
Treefall/limbing	16 (2.1)
Treefall/unknown	189 (24.2)
Limbfall/cutting	46 (5.9)
Limbfall/unknown	37 (4.7)
Struck by log/limbing	13 (1.7)
Struck by log/choker	11 (1.4)
Struck by log/loading	27 (3.5)
Struck by log/unknown	25 (3.2)
Struck by other/unknown	9 (1.2)
Runover/skidding	11 (1.4)
Runover/unknown	29 (3.7)
Rollover/skidding	56 (7.2)
Other/unknown	26 (3.3)
Total	780 (100.0)

fatalities was chosen. Fatalities in this paper are defined as deaths occurring while the victim was cutting (felling) trees, limbing and bucking trees, skidding trees, or loading trees.

The cause of death (treefall, limbfall, fall from a tree, struck by log, struck by object other than log, run over by logging vehicle, skidder or tractor rollover, chainsaw, lightning strike, other and unknown) and the activity at the time of death (cutting trees, limbing or bucking, skidding, setting chokers, loading logs, other and unknown) were combined into 14 cause-activity variables (table 1).

The cause-activity variable was used to determine the cause and activity with the highest percentage of fatalities. The risk of death for various combinations of variables was done using  $2 \times 2$  tables, resulting in odds ratios and confidence intervals.

## RESULTS

Table 2 and fig 1 show the logger mortality rate (LMR) for 1992–2000. The LMR is the number of loggers employed each year divided by the number of logger fatalities per year times 1000. The LMR showed a similar trend from 1992–95 (slight decrease). However, the LMR increased in the years 1996–2000 to rates above or equal to previous years.

Table 3 is a summary of all characteristics (variables) described by this study.

The results of combining the variables cause and activity (cause-activity) showed that treefall/cutting, treefall/limbing, and treefall/unknown combined as a group accounted for 62.8% of the logger fatalities. Therefore, further analysis of the Bureau of Labor Statistics CFOI 1992–2000 logger data set focused on the risk of death to treefallers compared to the risk of death to non-treefallers.

Because treefallers suffered a higher percentage of fatalities, several variables were considered as risk factors,

**Table 2** Logger mortality rate (LMR; per 1000)

Year	No of loggers	Logger fatalities	LMR	95% Confidence interval
1992	79000	97	1.2	1.0 to 1.5
1993	94000	93	1.0	0.8 to 1.2
1994	86000	89	1.0	0.8 to 1.3
1995	97000	85	0.9	0.7 to 1.1
1996	75000	95	1.3	1.0 to 1.5
1997	79000	96	1.2	1.0 to 1.5
1998	60000	69	1.2	0.9 to 1.5
1999	66000	80	1.2	1.0 to 1.5
2000	66000	76	1.2	0.9 to 1.4

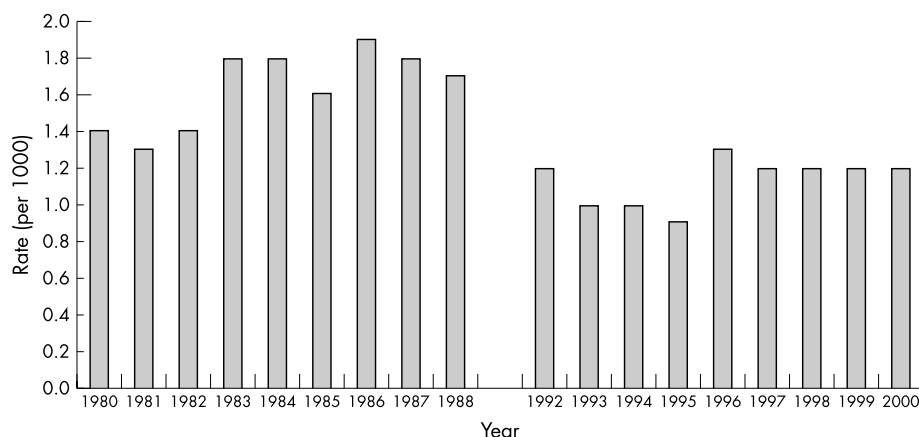
Numerator: Bureau of Labor Statistics CFOI 1992–2000 data set; denominator: Bureau of Labor Statistics Current Population Survey.<sup>18</sup>



Nearly 80% of all fatalities were suffered by white males. Therefore, black and white treefallers and black and white

Finally, the region of the United States where the fatality occurred was examined. About 54% of all fatalities occurred in the South (Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia), followed by about 22% in the West (Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming), about 12% in the Northeast (Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont), and 11% in the Midwest (Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin). Because the South had a high percentage of fatalities, the Midwest, West, and Northeast were grouped

Table 3. Selected characteristics of all fatalities between 1992 and 2000 (%)					
Month		Time		Part of body	
January	6.6	8 am	5.8	Abdominal	3.2
February	8.4	9 am	10.7	Back	1.7
March	8.2	10 am	12.9	Chest	21.1
April	6.9	11 am	13.3	Head	42.5
May	7.3	Noon	10.6	Leg	0.5
June	8.2	1 pm	12.2	Multiple injuries	28.7
July	7.1	2 pm	11.6	Neck	2.4
August	10.4	3 pm	7.9	Unclassified	0.3
September	11.0	4 pm	7.2		100.4
October	8.7		92.2	Employer size	
November	9.1	Age		1-10	60.8
December	8.3	<15	0.1	11-19	5.8
	100.0	16-19	2.7	20-49	2.7
Day		20-24	6.9	50-99	1.0
Monday	18.1	25-34	20.2	≥100	1.7
Tuesday	20.0	35-44	27.2	Not reported	27.7
Wednesday	20.4	45-54	20.5		99.7
Thursday	19.3	55-64	16.4	Region	
Friday	15.5	65 & >	5.8	Northeast	12.5
Saturday	5.1		99.8	Midwest	11.3
Sunday	2.2	Race		South	54.5
	100.6	American-Indian	1.9	West	22.1
Gender		Black	14.9		100.4
Male	99.7	White	80.4		
Female	0.2	Other	1.4		
	99.9	Unknown	1.5		
			100.1		



**Figure 2** Comparison of Myers and Fosbroke rates and current study rates.

together and compared to the South ( $n = 780$ ). The risk of a treefaller dying while cutting trees in the South is 1.2 times more likely than a non-treefaller cutting trees in the rest of the United States (OR 1.2, 95% CI 0.90 to 1.59).

## DISCUSSION

Ninety one percent of all fatalities occurred in 14 cause-activity groups. Of these groups, treefall/cutting, treefall/unknown, and treefall/limbing accounted for nearly 63% of all fatalities. Two risk comparisons (treefaller-employer size and treefaller-region) actually had slightly higher risks. The risk of death for a treefaller working for an employer employing from one to 10 workers was 1.7 times more likely than for a non-treefaller. However, according to the United States Census Bureau, nearly 83% of all logging employers employed from one to 10 workers.<sup>18</sup> Therefore, the risk of death for a treefaller working for an employer employing from one to 10 workers is not significant when compared with the fact that 83% of the employers employ only one to 10 workers. The second comparison compared treefallers to the region of the United States where the fatality occurred. Again, according to the United States Census Bureau, 52.3% of the loggers were employed in the South, 31.4% were employed in the West, 8.9% were employed in the Northeast, and 7.4% were employed in the Midwest. Comparing the percentage of fatalities in the regions, the South accounted for 54%, the West accounted for 22%, the Northeast accounted for 12%, and the Midwest accounted for 11%. Therefore, there is no disparity in the number of fatalities in the South, even though the percentage of fatalities is higher. There seems to be a disparity in the percentage of fatalities in the West, Northeast, and Midwest. There are a higher percentage of fatalities in the Northeast and the Midwest compared with the percentage of loggers employed in each region, while the West appears to have a smaller percentage of fatalities compared with the percentage of loggers employed.

A comparison was made with results from this study and the Myers and Fosbroke study (1994).<sup>7</sup> Two different data sets were used. The Myers and Fosbroke study used the NTOF data set and involved 1278 logger fatalities over a nine year period (1980–88) while this study used the Bureau of Labor Statistics CFOI data set and involved 780 fatalities over a nine year period (1992–2000).<sup>7</sup> The Myers and Fosbroke study found no significant difference in fatality relative risk by race (white and black), which was similar to results from this study.<sup>7</sup> They found that the majority of logging fatalities (65.5%) were to a group of treefallers, limbers, buckers, and chokers.<sup>7</sup> This study showed about 63% of all fatalities were to treefallers (cutting, limbing, and unknown), which is also

similar. These percentages also compared well to the treefaller fatalities reported by Jarvis (78.1%).<sup>5</sup> Myers and Fosbroke found a significant difference between the rank scores of fatality by region; however, when the rank was normalized, the significance was minimal.<sup>7</sup> This study showed a higher risk to treefallers in the South, but as shown by the United States Census Bureau, more than half of the loggers work in the South. The Myers and Fosbroke study also showed significance in the cause of death (hit from a falling object), compared with this study, which showed that more than half of the fatalities were treefallers cutting trees. Finally, fig 2 shows a comparison between logger fatality rates in 1980–88 and the logger fatality rates in the current study (1992–2000). It is clear that although the rates from 1996–2000 have remained fairly constant, the rates from 1992–2000 are all below the earlier nine year period reported by Myers and Fosbroke.<sup>7</sup>

There are several improvements in this study over earlier studies. First, cause of death (cause) and activity at the time of death (activity) were combined to give a more accurate description of fatalities. Treefallers cutting trees were identified as the group most likely to suffer fatalities. Second, using United States Census Bureau data to supplement the Bureau of Labor Statistics CFOI data, it was found that region of fatality and the size of the employer were not factors contributing to the high percentage of treefaller fatalities. Third, it was identified that there are a higher percentage of fatalities in the Northeast and the Midwest

## Key points

- 63% of all logger fatalities (1992–2000) were from the cause-activity groupings of treefall/cutting, treefall/unknown, and treefall/limbing.
- The risk of death for a treefaller working for an employer employing from one to 10 workers was 1.7 times more likely than for a non-treefaller; however, 83% of all logging companies employ from one to 10 workers.
- There is a disparity in the percentage of logger fatalities in the West, Northeast, and Midwest.
- Compared with an early study by Myers and Fosbroke (1994), the logger fatality rates from 1992–2000 are below those reported in 1980–88.
- Treefallers continue to be the group of loggers who suffer the highest fatality rate.



compared with the percentage of loggers employed in each region, while the West appears to have a smaller percentage of fatalities compared with the percentage of loggers employed. Finally, the rate of logger deaths has actually increased since 1995 and has not decreased from 1996 to 2000 (rate of 1.2/1000 logger fatalities). However, the logger fatality rates for the nine year period of this study compared with the logger fatality rates from the Myers and Fosbroke nine year period are all lower, which show an improvement.

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## LACUNAE

### Couple survives nine story fall after "lover's spat"

A couple survived a nine storey fall from the top floor of a Bangkok apartment block onto the roof of a car after a lover's spat. Witnesses said the pair's plunge was broken by trees before they struck the roof of a Honda sedan which crumpled beneath them. Neighbours said the couple had been arguing heatedly before the fall yesterday but there were no details on exactly how they tumbled from their top floor apartment. The husband was treated in a Bangkok hospital for multiple bone fractures, his wife, who landed on top of him, had been put in a torso cast with minor injuries (from *Sydney Morning Herald*, May 2004; submitted by Ian Scott).

### Quiet crusade against deadly dams

It has been nearly four years since Frederick J House and his 14 year old son, Paul, drowned on a May afternoon while canoeing on the Perkiomen Creek. Rescuers said the pair apparently paddled too close to an unmarked "low-head" dam, a relatively harmless looking structure of a type that spans rivers and creeks all over Pennsylvania. But these dams, built to serve mills, factories, and canals in the 19th and 20th centuries, are not harmless. They have claimed the lives of so many swimmers, boaters, fishermen, and children that water safety experts call them "drowning machines". For the last decade, the Pennsylvania Fish and Boat Commission, the state Department of Environmental Protection, and American Rivers, an organization that promotes free flowing waterways, have been working to remove abandoned and unstable dams. More than 100 in Pennsylvania have been demolished. Two thirds of the removals have been financed with state and federal funds and private grants. The average demolition cost is surprisingly low: \$50 000. Often, the work can be done with a backhoe. Scott Carney, a biologist with the Fish and Boat Commission who coordinates dam removals, said about 50 more dams in Pennsylvania are slated for removal, 15 of them in the Philadelphia area. "It's the best thing for the environment, and it's the best thing for public safety to get rid of these things", Carney said (from *River Revival Bulletin*; submitted by Peter Jacobsen).