Using Safety Alerts as Hazard Surveillance for Mechanized Logging Systems

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INTRODUCTION

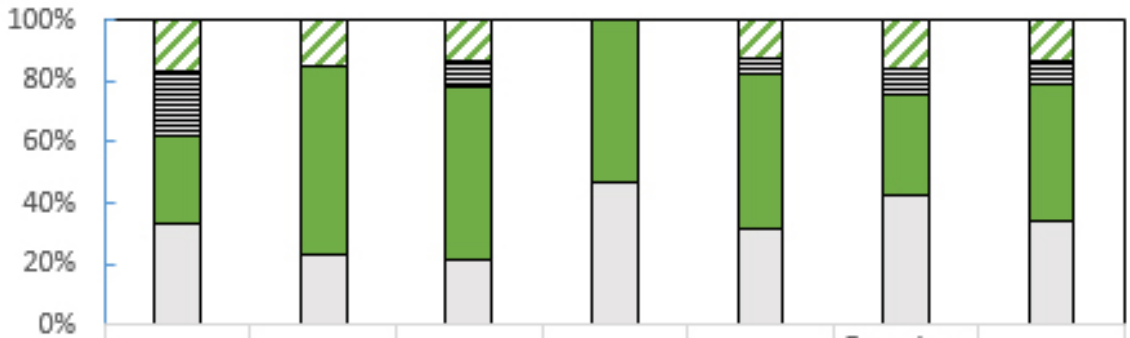
One of the key tasks in a safety program is to perform a job hazard analysis which involves the identification and description of serious hazards for specific jobs and tasks. A number of sources including operator's manuals, safety manuals, and FRA safety alerts are useful in that task. Injury or accident surveillance data can also provide key information in prioritizing hazards according to frequency and seriousness. Bureau of Labor Statistics data are available for both the logging industry (NAICS 1133) and the logging occupation (SOC 45-2000), but so few cases are recorded that only general hazard information is available and there is no available data for activity at the time of injury. Several analyses of workers compensation claims have provided more information relative to activity and the type of operation (mechanized, partially mechanized, and non-mechanized). Those data are difficult to accumulate and updates are infrequent.

FRA Safety Alerts ("Alerts") provide a type of surveillance data organized under the Domino Theory of accident causation developed by Heinrich in 1931. Alerts are developed independently by local authors and submitted to the Forest Resources Association for editing and publication. Incidents from the Alerts may not be proportionally representative of the hazards, but may identify a larger spectrum than would be available from other sources. We classified Alerts from 1996 to 2015 (20 years) using the data definitions from the Occupational Injury and Illness Classification Manual. Since hazard assessments that reflect only mechanized logging tasks are rare, we excluded all incidents which involved cable skidders, chainsaw use or manual felling, bucking, or limbing. We also developed statistics from both Census of Fatal Occupational Injuries (CFOI) and Survey of Occupational Illness and Injury (SOII) data from the similar time periods for comparison.

RESULTS AND DISCUSSION:

We analyzed 376 Alerts and entered data on 234 Alerts which included mechanized logging tasks or support activities. Data recorded included experience, occupation, activity, event, nature, and source. Many of the Alerts did not include the age of the person involved or presented age as a broad category ("in his 50's"), so no age data were entered. Other data, including the time of the incident, were presented in ways that made it difficult to categorize (e.g. afternoon, morning). While the presence of training was mentioned in many Alerts, we had no certainty that no information listed on the training of the individual reflected an absence of or inferior training. While logging occupations were clearly identified in the narratives, the occupations of non-loggers other than truck drivers were difficult to classify. As a result, we classified occupations as either logger (L) or non-logger (NL).

Most of the Alerts presented experience data either as the number of years on the job or "experienced" as a general qualifier, and for approximately 10% no job experience information was available (Unknown). Only about 3% of the Alerts indicated that new workers (<1 year) were involved (Figure 1). No fatalities were recorded for workers with 4 to 10 years of experience, but all of the other categories had a similar proportion of fatalities (18% to 24%). The proportion of fatalities in the Unknown category was about twice the proportion for all the Alerts (Total) (38% vs. 21%). CFOI and SOII data (for NAICS 1133) report a different metric (time with the employer). For SOII and CFOI between 30% and 40% of all injury cases were to workers with less than a year with the employer. Since Alerts data did not include time with employer, we cannot say if there is a difference. Across different injury surveillance data analyses, less than one year with an employer is a principal risk factor. For workers with more experience, it has been difficult to relate experience with injury risk because so many factors are involved (population of employees, type of assigned jobs/tasks, confounding of age and experience, etc.).

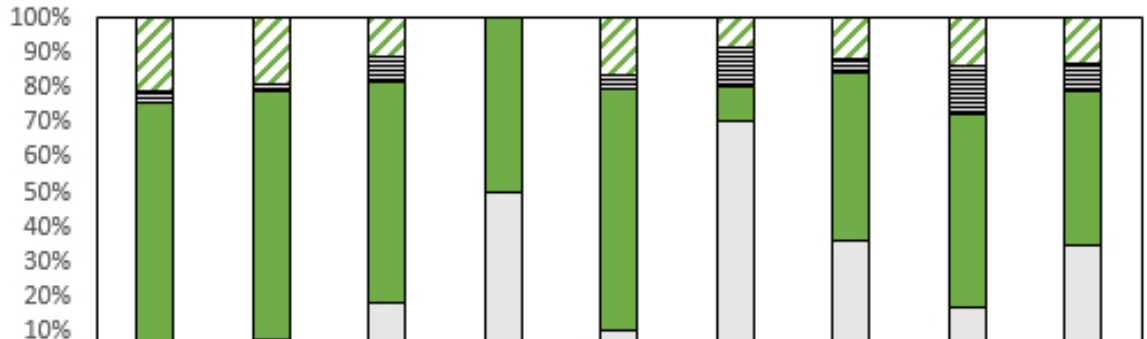


	unknown	<1 year	1-3 years	4-10 years	> 10	Experienced	Total
Fatal - L	4	2	3	0	11	11	31
Fatal - NL	5	0	2	0	5	6	18
Nonfatal - L	7	8	13	8	45	23	104
Nonfatal -NL	8	3	5	7	28	30	81

Figure 1. Fatal and Non-fatal injuries by experience level for Loggers (L) and Non-loggers (NL).

In the Alerts, 44% of non-fatal and 37% of fatal incidents were to non-loggers (truck drivers, mechanics, foresters, etc.). CFOI and SOII data indicated non-loggers were about the same proportion of injury cases (37% of injuries) but a smaller proportion of fatalities (16% of fatalities). In CFOI classification, fatalities similar to those in the alerts occurring at mill sites, roadways, or retired logging sites, could have been attributed to other NAICS codes (e.g. timber tracts (1131), forestry services (1153), transportation (484), etc.).

All activities had a similar proportion of fatal injuries ranging from 16% to 27% of all incidents, except chipping which had none **(Figure 2)**. Incidents during transportation involved mostly non-loggers, and maintenance activities were roughly evenly split between loggers (60%) and non-loggers (40%). There were incidents with some non-loggers in all of the in-woods activities, but most of the in-woods fatalities were suffered by loggers. Skidder/forwarder activities had the most injuries among the in-woods activities.



	FBH	SF	LDP	Chipper	All In-woods	All Transport	All Maint.	Support	Total
Fatal - L	6	10	3	0	19	8	6	4	31
Fatal - NL	1	1	2	0	4	10	2	4	18
Nonfatal - L	22	37	17	3	79	9	24	16	104
Nonfatal -NL	0	4	5	3	12	64	18	5	81

Figure 2. Fatal and Non-fatal injury by activity and occupation (Logger (L) and Non-logger (NL). In-woods activities include Fellerbuncher Harvester (FBH), Skidder/Forwarder (SF), Loader/Delimber/Processor (LDP), and Chipper operation.

Table 1 is the distribution of incidents (fatal and non-fatal) by event and activity. All event classifications with more than ten incidents and all major event classifications are presented. Struck by flying object (022) events occurred mostly in-woods, while struck by swinging and shifting objects (023) occurred in transportation and support. Falls (11x) were about equally split between in-woods and transport, but landing (LPDC) and transport activities accounted for most of the Falls (68%). Contact with electric current (3xx) was about three times more frequent for in-woods tasks compared to transportation and support tasks. As expected most of the Vehicle/Equipment incidents (4xx) occurred during transportation tasks, but nonhighway - noncollision incidents (423) were just as likely with in-woods tasks as transportation tasks. Vehicle/Equipment accidents (4xx) and Struck By/Against events (01x) combined for over 50% of incidents. Together with Caught in (03x) and Falls (11x), the four event classifications account for over 80% of the incidents.

	In-woods						
Event	SF	FBH	LPDC	Transport	Support	Total	Total (%)
01x: Struck by/against (all)	11	8	11	19	12	61	26
021: Struck by falling obj.	3	3	4	7	2	20	9
022: Struck by flying obj.	2	4	2	0	1	10	4
023: Struck by swinging or shifting obj.	3	0	2	11	8	24	10
03x Caught in (all)	13	6	7	13	3	42	18
032: Compressed/pinched by rolling/shifting obj.	8	6	4	8	0	22	9
11x Falls (all)	7	0	6	13	2	28	12
118: Fall from nonmoving vehicle	1	0	3	7	0	11	5
2xx: Overexertion (all)	1	0	0	0	2	3	1
3xx Contact with electric current	5	4	6	6	1	22	9
313: Contact with overhead power lines	2	4	2	5	0	13	6
4xx: Vehicle/Equipment	14	9	1	37	5	66	28
423 Nonhighway, non-collision accidents	12	7	0	13	2	34	15
5xx Fires/explosions	1	2	2	2	4	11	5
999 Unclassified	0	0	0	1	0	1	0
Total	52	29	33	91	29	234	

Table 1. Events related to activity. All events with more than ten incidents and all major event classifications are presented. Major event classifications are underlined and the sub-classifications are indented. Total (%) is the percent of the total incidents in each row. The underlined events sum to 99% due to rounding. Abbreviations are Skidder/Forwarder (SF), Feller Buncher/Harvester (FBH), and Loader, Processor, Delimber, and Chipper (LPDC).

The distribution of event types among available surveillance data of non-fatal incidents is displayed in Figure 3. Data include the Alert data (non-fatal, loggers), workers' compensation (WC) claims from Roberts et al. (2005) and SOII data for the logging industry (NAICS 1133) and logging machine operators (SOC 45-2022). There was only a small difference in the event distributions between the two SOII data sets. The SOII data and the workers' compensation claim data were also similar despite the decade between the SOII and the WC claims data. Nearly all the categories are shifted for the Alert data. More recently struck-by claims for Montana and Idaho loggers were 22% of the total claims for equipment operator, 51% for Sawyer/Hooker, and 35% for all workers (Lagerstrom et al., 2017. Am J. Ind. Hyg. 60(12):1077-87). While some of the differences could be due to the exclusion of manual tasks (reduction in Struck-by proportion), the types of events reported in the Alerts may also be skewed to more unusual events (e.g. Caught-in, and Contact/Exposure).

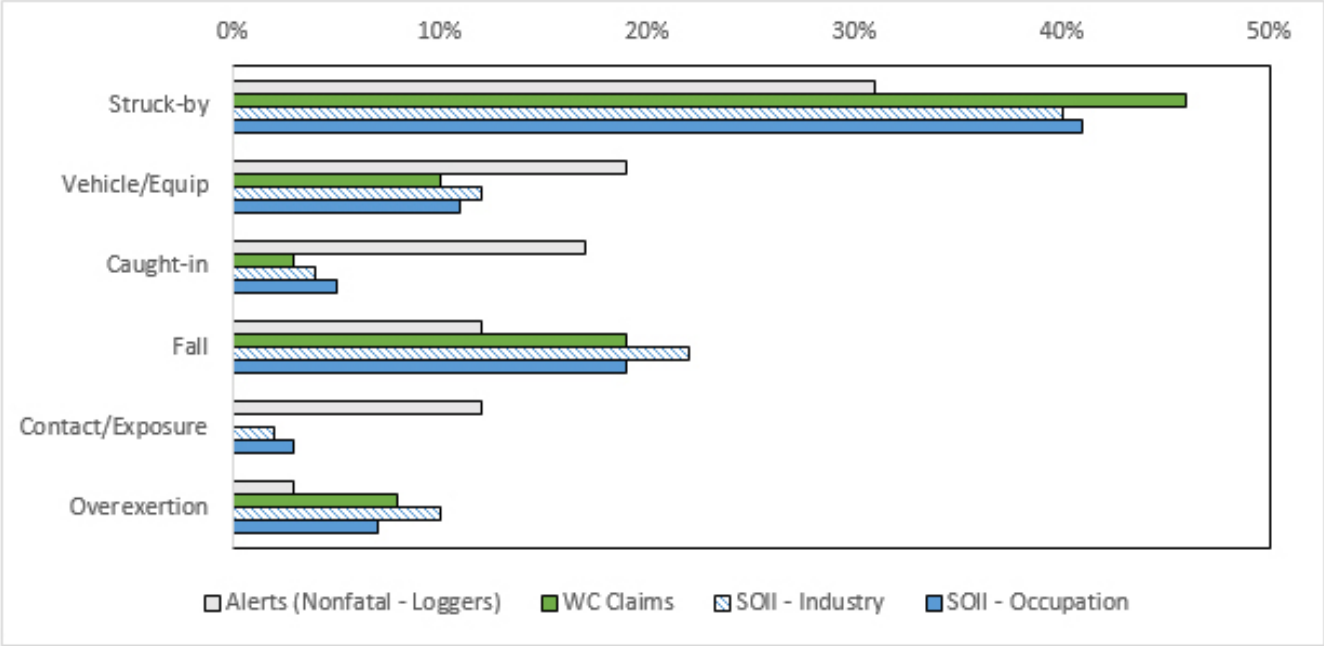


Figure 3. Incidents by event from Alerts (Non-fatal, Loggers), WC claims (from Roberts et al. 2005) and SOII data (NAICS 1133 and SOC 45-4022 from 2005-2015). Roberts, T., R.M. Shaffer, and R.J. Bush. 2005. Injuries on Mechanized Logging Operations in the Southeastern United States in 2001. Forest Products Journal 55(3):86-89.

SUMMARY

The composition of Alert incidents by event deviates from other contemporaneous national surveillance data. Since transportation and support hazards include some workers who are not logging firm employees, greater inclusion of non-loggers reflects incidents typically excluded from other surveillance data. The reduced contribution of struck-by events is likely related to the exclusion of manual logging tasks. The Alert data appears to be skewed toward more experienced workers than other surveillance data and the incident frequency and the proportion of fatal incidents both increase with experience. Those who submit Alerts may want to reflect on how incidents can occur even when prevention measures were taken, including the involvement of experienced people. The other possibility is that firms which were more comfortable with their safety record (better training, more experience) were more likely to contribute to the narratives. The Alert sample could be from a more experienced population.

The objective of this exercise was to characterize the hazards on mechanized crews. While there is a general understanding that the injury frequency may decline in the absence of manual tasks, the distribution of hazards is unknown. The analysis of the Alerts indicate that the four major types of events (struck by, caught in, falls, and vehicle/equipment) should receive about equal attention in safety programs. For these hazards, there was little difference in hazard exposure between logging and non-logging workers. Finally, using the Alert data to exclude typical manual logging tasks did not dramatically change the distribution in hazard exposures from that revealed by other available surveillance data.

ACKNOWLEDGMENTS

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