

Effectiveness of Source Documents for Identifying Fatal Occupational Injuries: A Synthesis of Studies

ABSTRACT

Background: The complete and accurate identification of fatal occupational injuries among the US work force is an important first step in developing work injury prevention efforts. Numerous sources of information, such as death certificates, Workers' Compensation files, Occupational Safety and Health Administration (OSHA) files, medical examiner records, state health and labor department reports, and various combinations of these, have been used to identify cases of work-related fatal injuries. Recent studies have questioned the effectiveness of these sources for identifying such cases.

Methods: At least 10 studies have used multiple sources to define the universe of fatal work injuries within a state and to determine the capture rates, or proportion of the universe identified, by each source. Results of these studies, which are not all available in published literature, are summarized here in a format that allows researchers to readily compare the ascertainment capabilities of the sources.

Results: The overall average capture rates of sources were as follows: death certificates, 81%; medical examiner records, 61%; Workers' Compensation reports, 57%; and OSHA reports 32%. Variations by state and value added through the use of multiple sources are presented and discussed.

Conclusions: This meta-analysis of 10 state-based studies summarizes the effectiveness of various source documents for capturing cases of fatal occupational injuries to help researchers make informed decisions when designing occupational injury surveillance systems. (*Am J Public Health*. 1991;81:725-728)

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Introduction

Identifying all of the fatal occupational injuries in the United States work force is a difficult task that has not been accomplished with precision.^{1,2} Recent literature has questioned the accuracy and completeness of ascertainment of such cases by various sources of information.^{1,3-6} Death certificates, Workers' Compensation files, Occupational Safety and Health Administration fatality reports, medical examiner records, reports collected by state health or state labor departments, and various combinations of these have been used to identify cases of fatal work injuries. Each of these sources was developed for different purposes, using different definitions and methods. Because there is no universally accepted gold standard against which to compare, particularly at the national level, it is difficult to measure precisely the proportion of all fatal injuries identified by a specific source.

In a smaller geographic area, such as a state, the pool of fatal work injuries can be defined as the combination of unique cases identified through several sources. Capture rates can then be estimated as the proportion of the total pool identified by each source. This method of assessing the completeness of case ascertainment by various sources of fatal work injury data has been employed in at least 10 states. Results of these studies are summarized here to provide an indication of both the overall average capture rates of the sources, and the variation in capture rates by state.

Sources of Data

The source documents used to identify fatal occupational injuries differ in

their primary purposes, methods, and target populations. The advantages and limitations of various sources have been discussed elsewhere.^{1,3,7} Issues of validity, completeness, accuracy, timeliness, and the usefulness of data elements in these sources are important considerations in fatality surveillance, but are outside the scope of this paper. The sources examined here are briefly described in terms of their characteristics salient to comparing capture rates.

Death certificates and medical examiner records are the only two available sources that have the potential to identify all cases of fatal work injuries in a given geographic area. Death certificates are filed for each death that occurs in the US and follow a standard format that includes an item indicating whether the death was due to an injury sustained at work. The accuracy and consistency of this item is questionable, however, as no explicit national guidelines exist that define "injury at work."^{8,9} Motor vehicle crashes and homicides at work appear to be particularly underreported as work injuries on death certificates.^{7,8,10,11}

In most states, medical examiner (ME) or coroner investigations are required for deaths that are due to accidents, homicides, suicides, or deaths that occur unexpectedly.⁹ In jurisdictions where ME or coroner records are computerized, or at least centralized, they are a valuable source of information.^{12,13} In most states,

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TABLE 1—Percent of Fatal Work Injuries Identified by Various Sources: Summary of State-Specific Studies

States	Time Period	N	Source Documents				
			% Death Certificate	% Workers' Compensation	% OSHA Fatality Reports	% Medical Examiner Records	% State Dept Health or Labor
Wisconsin ¹¹	1976	161	76	57	33		
Maryland ^{4,a}	1978	148	67	58	42	90	
Michigan ^{20,b}	1980	195	88				51
Alaska ²¹	1980–1985	422	83	47			
Colorado ⁷	1982–1984	425	86	66	32		
California ¹⁹	1983	673	90	40	21		
New Jersey ^c	1984–1985	204	84		34	32	
Texas ^d	1986	872	67	70	27		9
Oklahoma ¹⁰	1985–1986	329	78	53	29	82 ^e	
Massachusetts ¹⁸	10/86–11/87	86	88	62	41		22
Range (%)			67–90	40–70	21–42	32–90	9–51
Average (%)			81	57	32	68	27

^aSusan Baker, Johns Hopkins Injury Prevention Center, personal communication, January 1991.

^bFigures presented here exclude the "natural deaths" from the original study.

^cMartha Stanbury, New Jersey Department of Health, personal communication, June 1990. New Jersey data exclude intentional injuries.

^dTexas Department of Health, Occupational Safety and Health Division. Traumatic Occupational Fatalities, 1986. Unpublished report, 1989.

^eFor ME records with unclear work-relatedness, death certificates were reviewed to verify injury at work or reject false positives.

however, both ME and coroner reports exist as fragmented paper files held in various locations throughout a state, they are inconsistent among jurisdictions, and frequently do not indicate the work-relatedness of a fatal injury.³

Employers under Occupational Safety and Health Administration (OSHA) jurisdiction are required to report to OSHA all work-related fatalities of employees. Many of these incidents are then investigated and OSHA investigation reports are filed. Not all workers are under OSHA jurisdiction and not all incidents are investigated. Public sector employees, and self-employed workers, for example, are exempt from reporting requirements. Events such as airplane crashes, motor vehicle crashes, and homicides are investigated by other agencies, and are not routinely identified or investigated by OSHA. Recent studies also suggest substantial underreporting of fatalities that do fall under OSHA jurisdiction.^{5,7,14–18}

Workers' Compensation claims can provide valuable detail about the nature of fatal injuries and accurate specification of employment. Like OSHA coverage, however, many workers are not covered by Workers' Compensation laws. Moreover, state compensation laws differ substantially so that covered worker populations are not comparable by state, and the national population of covered workers is difficult to define.

In some states, occupational fatalities are reported to the state department of labor or the state department of health.

The specific types of employment and fatal events that are reported vary from state to state. For example, in Massachusetts all construction industry employers must report every accident resulting in death. The Massachusetts Department of Labor and Industries maintains records of these and other work-related fatalities reported voluntarily by employers, workers, unions, police, etc.¹⁸

The State Health Department source of data for the Texas study cited here refers to fatalities reported by employers participating in the Bureau of Labor Statistics (BLS) Annual Survey of Occupational Injuries and Illnesses by Industry. The survey is limited to establishments under OSHA jurisdiction, employing 11 or more workers and, as a sample survey, is not designed to capture all work fatalities.

Differences in capture rates among these sources of fatal work injury data are due in part to variation in types of employments covered by each source. Although several studies have examined capture rates of sources relative to the population covered by law to measure underreporting,^{5,7,15,17} the data presented here do not address underreporting of fatal events but rather the potential of various sources to identify the universe of fatal occupational injuries.

Summary of Study Results

In each of 10 studies presented here, multiple data sources were linked, eliminating duplicate cases, to identify a total

"pool" of unique fatal occupational injury cases in a state, and the proportion of that pool identified by each separate source. Table 1 summarizes the results of these studies and presents the capture rates for each source, and the range and average capture rates of the combined study results.

All 10 studies used death certificates as one source of case ascertainment and in all but two studies a greater proportion of the total pool of fatal work injuries was identified by death certificates than by any other source. The average capture rate for death certificates over all the studies was 81 percent.

Workers' Compensation files, used as a source of case ascertainment in eight states, had an average capture rate of 57 percent. The wide range (40 to 70 percent) is likely due to the different worker groups covered by the various state compensation laws.

OSHA fatality reports identified an average of 32 percent of cases. The variation in capture rates by state (21 to 42 percent) may be partially due to differences in the OSHA forms examined. In most states, first reports of fatal injuries were used to identify cases. The California¹⁸ and New Jersey^a studies, however, used OSHA fatality investigation reports. Since not all reported fatalities are inves-

^aMartha Stanbury, New Jersey Department of Health, Personal Communication, June 1990.

TABLE 2—Percent of Fatal Work Injuries Identified by Only One Source, by Source: Summary of State-Specific Studies

States	Time Period	Sole Source Documents				
		% Death Certificate	% Workers' Compensation	% OSHA Fatality Reports	% Medical Examiner Records	% State Dept. Health or Labor
Wisconsin ¹¹	1976	43	24	0		
Maryland ⁴	1978	(N/A)	(N/A)	(N/A)	(N/A)	
Michigan ^{20,a}	1980	49				14
Alaska ²¹	1980–85	53	17			
Colorado ⁷	1982–84	34	14	0		
California ¹⁹	1983	56	7	1		
New Jersey ^b	1984–85	31		3	12	
Texas ^c	1986	26	27	1		<1
Oklahoma ¹⁰	1985–86	2 ^d	12	<1	11 ^d	
Massachusetts ¹⁸	10/86–11/87	28	17	0		2
Range (%)		2–56	7–27	0–3	11–12	<1–14
Average (%)		36	17	<1	12	5

^aFigures presented here exclude the "natural deaths" from the original study.

^bMartha Stanbury, New Jersey Department of Health, personal communication, June 1990. New Jersey data exclude intentional injuries.

^cTexas Department of Health, Occupational Safety and Health Division. Traumatic Occupational Fatalities, 1986. Unpublished report, 1989.

^dFor ME records with unclear work-relatedness, death certificates were reviewed to verify injury at work or reject false positives.

tigated, first reports are likely to identify a greater proportion of deaths than investigation reports.

Two of the three studies that included ME records identified more cases from ME records than any other source.^{4,10} One study used death certificates to verify injury at work for an unknown proportion of ME records on which work relatedness was not indicated; the capture rate would have been lower if ME records had been reviewed independently.¹⁰ In the third study, ME records identified the smallest proportion of cases.^a This range in capture rates, from 32 percent to 90 percent illustrates the magnitude of variation by state in the potential for ME records to ascertain cases of fatal work injuries.

Occupational fatalities reported to state health departments and state departments of labor under various legislation are grouped together in Table 1 for simplicity. The average capture rate, (27 percent) is presented as a rough indication of the usefulness of such reports for identifying fatal injury cases. This average, however, is based on only three studies, and substantial differences in reporting requirements limit the comparability of these data by state.

Table 2 presents the proportion of the pool of fatal injury cases identified by only one source of information in each study. The range and average sole source capture rates provide an estimate of the proportion

of the universe that might be identified by only one specific source and not the others. Obversely, the average for each source presented in this table may be interpreted as the additional proportion of the total pool of cases that might be identified by using this as an additional source of case ascertainment.

These capture rates are a function of the total pool of fatalities identified in each state, and the number and types of source documents used to define that pool. The sole source averages are presented in Table 2 as crude estimates for the purpose of comparison, rather than as precise means.

Over all the studies, death certificates uniquely identified the greatest proportion of fatal work injuries (36 percent), followed by Workers' Compensation records (17 percent), and ME records (12 percent). State labor department records (5 percent) and OSHA fatality reports (less than 1 percent) contributed relatively few additional cases to the total pool.

Discussion

Generally, if surveillance is limited to one source of information, death certificates will likely ascertain a greater proportion of the universe of fatal work injuries than will the other sources examined here. For national level surveillance, death certificates are unique among these sources in their combined potential to

identify all fatal work injuries, and their comparability between states. However, the accuracy and consistency with which the injury at work items on death certificates are completed varies by state. Current efforts by the Agency for Vital Records and Health Statistics (AVRHS), National Institute for Occupational Safety and Health (NIOSH), and the National Center for Health Statistics (NCHS) to increase the validity and reliability of this item could vastly improve our ability to identify the universe of fatal occupational injuries at both state and national levels.

Under some jurisdictions, ME records may provide more complete case ascertainment than other sources. However, they also show the greatest variation by state in their ability to identify cases. Efforts to computerize ME records in a consistent format are currently underway in several states. Uniform automation of ME records could substantially improve fatal work injury surveillance within states and enable interstate comparisons.

The combined results of these studies suggest that Workers' Compensation records are not a useful sole source for case ascertainment of work fatalities. As a supplemental source, however, Workers' Compensation records could be expected to add the greatest proportion of cases to a vital records-based system. OSHA fatality reports have limited utility in fatal injury surveillance. Alone, they might be expected to identify about one-third of all cases and, as an additional source, they might capture an additional 1 percent of cases.

Because the definition of state health department and state labor department fatality reports varies so widely by state, generalized conclusions about this source cannot be drawn. In developing surveillance systems, the state-specific characteristics of this potential data source should be considered.

The combined results of these studies highlight several salient points regarding fatal work injury surveillance. The most prominent of these is that using multiple sources of data will always result in more complete case ascertainment than using one source alone.

The value added by including a subsequent source for case ascertainment depends on which source is added and its characteristics within that geographic area. For example, using state labor department records in addition to death certificates in Michigan improved case ascertainment by 14 percent.²⁰ In the Massachusetts study, however, where

three other sources were also used and where Department of Labor reports had limited coverage, only 2 percent more cases were identified by these records.¹⁸

In addition to the sources discussed here, other sources should be considered to fill gaps in surveillance systems. For example, all of these sources tend to underreport occupational motor vehicle fatalities and likely undercount homicides. Police report forms and Highway Traffic Administration reports could be valuable in identifying such cases, if efforts were made to include an indication of work-relatedness on these reports.

When designing and developing fatal occupational injury surveillance efforts, cost-benefit analysis and value-added formulas are often considered to determine which sources of data will provide the most effective results given study objective and resource limitations. It is hoped that this synopsis of studies will help researchers make informed decision when designing surveillance systems, recognize limitations of various sources, and support improvements to existing sources so that we might all better understand the magnitude and nature of fatal occupational injuries in the United States. □

References

- Pollack ES, Keimig DG (eds): *Counting Injuries and Illnesses in the Workplace: Proposals for a Better System*. Washington, DC: National Academy Press, 1987.
- Stout-Wiegand N: *Fatal occupational injuries in US industries, 1984: Comparison of two national surveillance systems*. *Am J Public Health* 1988; 78:1215-1217.
- Graitcer PL: *The development of state and local injury surveillance systems*. *J Safety Res* 1987; 18:191-198.
- Baker SP, Samkoff JS, Fisher RS, Van Buren CB: *Fatal occupational injuries*. *JAMA* 1982; 248:692-697.
- Suruda A, Emmett EA: *Counting recognized occupational deaths in the United States*. *JOM* 1988; 30:868-872.
- Murphy DJ, Seltzer BL, Yesalis, CE: *Comparison of two methodologies to measure agricultural occupational fatalities*. *Am J Public Health* 1990; 80:198-200.
- Colorado Department of Health: *Colorado population-based occupational injury and fatality surveillance system report, 1982-1984*. Denver: Health Statistics Section, Colorado Department of Health, 1988.
- Bell CA, Stout NA, Bender TR, Conroy CS, Crouse WE, Myers JR: *Fatal occupational injuries in the United States, 1980 through 1985*. *JAMA* 1990; 236:3047-3050.
- US Department of Health and Human Services: *Medical Examiners' and Coroners' Handbook on Death Registration and Fatal Death Reporting*. Hyattsville, MD: National Center for Health Statistics, 1987.
- Russell JC: *Comparison of Four Sources of Occupational Mortality Data*. Doctoral Dissertation. Oklahoma City: University of Oklahoma, 1989.
- Karlson TA, Baker SP: *Fatal occupational injuries associated with motor vehicles*. *Proceedings of the 22nd Conference of the American Association for Automotive Medicine*, Arlington Heights, Illinois, American Association for Automotive Medicine, 1978; 1:229-241.
- Sneizek JE, Horiagon TM: *Medical-examiner-reported fatal occupational injuries, North Carolina, 1978-1984*. *Am J Ind Med* 1989; 15:669-678.
- Centers for Disease Control: *Death investigation-United States, 1987*. *MMWR* 1989; 38:1-4.
- Seligman PJ, Sieber WK, Pedersen DH, Sudin DS, Frazier TM: *Compliance with OSHA record-keeping requirements*. *Am J Public Health* 1988; 78:1218-1219.
- Parkinson DK, Gauss WF, Perper JA, Elliott SA: *Traumatic workplace deaths in Allegheny County, Pennsylvania, 1983 and 1984*. *JOM* 1986; 28:100-102.
- Stanbury M, Goldoft M, O'Leary K: *Traumatic occupational fatalities in New Jersey*. In: Pollack ES, Keimig DC (eds): *Counting Injuries and Illnesses in the Workplace: Proposals for a Better System*. Washington, DC: National Academy Press, 1987.
- Stanbury M, Goldoft M: *Use of OSHA inspection data for fatal occupational injury surveillance in New Jersey*. *Am J Public Health* 1990; 80:200-202.
- Massachusetts Department of Health: *Traumatic occupational fatalities in Massachusetts, November 1986-October 1987*. Boston, MA: Department of Public Health, Technical Report, March 1989.
- Cone JE, Daponte A, Becker C, Reiter R, Balmes J: *Fatal Occupational Injuries in California*. Final Report MOU 86-003. Berkeley, CA: Epidemiologic Studies and Surveillance Section, California Department of Health Services, 1988.
- Roberts C, Eyster J: *A Comparison of 1980 Fatality Reports and Death Certificates in Michigan*. Lansing, MI: Office of Vital and Health Statistics, Michigan Department of Public Health, 1983.
- Schnitzer PG: *The Epidemiology of Work-related Injury Fatalities in Alaska, 1980-1985*. Masters Thesis. Anchorage: University of Alaska, 1987.