Surveillance of Non-Fatal Workplace Assault Injuries, Using Police and Employers' Reports

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Although the majority of work-related homicides are routinely reported in the United States, information on non-fatal events is less complete. Comprehensive surveillance of non-fatal events depends on understanding reporting trends to different agencies. This study characterizes workplace assaults reported to police and through employers in eight southern California cities. Employers' reports filed from October 1, 1994, through January 31, 1995, and police reports filed from June 1, 1994, through March 31, 1995, that involved a non-fatal workplace assault injury were included. Reports from police and employers were linked, and annualized rates combining non-duplicative reports were calculated and event characteristics compared. The combined annualized rate of workplace assault injury for the eight cities was 184.6 per 100,000 workers, which was almost twice the rate found in either reporting source individually. Police reports differed from employers' reports by industry and occupation of victim but not type of event or weapons used. Examination of multiple reporting sources for non-fatal workplace assault injuries is essential to identifying the magnitude of these events. Understanding trends in reporting is important for the effective design of prevention programs.

Surveillance of work-related injuries involves the enumeration and description of the distribution and determinants of injuries in workplace populations and is the scientific basis for prevention.[1] Successful surveillance strategies depend on consistent case definitions and ascertainment strategies as well as standardized and comprehensive reporting mechanisms. Without accurate and comprehensive case ascertainment, surveillance will underestimate the true number of events, which may lead to misidentification of the risk factors and exposures involved.

Although reporting mechanisms for work-related injuries have been evaluated for many years, the emergence of violence as a common and growing cause of work-related injury necessitates careful re-examination of reporting mechanisms not previously used for workplace injuries. Traditional types of workplace injuries rarely involve criminal activity, and injuries from workplace violence differ from other workplace injuries in this sense. The association of violent workplace injuries with criminal activity introduces law enforcement agencies as an important reporting source, especially for injury events that do not result in death and therefore do not generate a death certificate.

Surveillance of work-related fatalities has depended on many different reporting sources, including death certificates, coroner reports, workers' compensation reports, and surveys of workers and employers. Although death certificates are the most

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complete single source for identifying workplace injury deaths, they are not completely accurate in identifying all fatalities that are work-related.[2,3] Examinations of multiple reporting sources have concluded that no one source can accurately identify all workplace deaths.[3,4] One review of sources for identifying fatal occupational injury found that 81% of occupational injury deaths were identified by death certificates, 57% by workers' compensation reports, 32% by Occupational Safety and Health Administration fatality reports, and 68% by medical examiner records.[3] Of all workplace deaths, homicides are among those least accurately identified as work-related.[3,4]

Case ascertainment in the surveillance of non-fatal workplace injuries is much more problematic than that for fatal injuries because no centralized reporting mechanism, such as the death certificate, exists. Occupational assaults identified in the National Crime Victimization Survey indicated that 44% of workplace assault victims reported the event to the police, approximately 40% did not report the event, and 27% reported through other mechanisms.[5] This finding suggests that reports to law enforcement may provide the most comprehensive identification of work-related assaults. However, no published studies have enumerated workplace assault injuries reported to the police or compared police reports with reports to other agencies.

This research examines the number and types of non-fatal workplace assault injuries reported by employers and reports to local law enforcement agencies in eight southern California cities. The objectives were to determine if the reporting of individual events overlaps, to identify characteristics of events reported to the two sources, and to estimate a combined non-duplicative incidence rate for non-fatal workplace assault.

Methods

Surveillance involved the identification of non-fatal workplace assault injury reports to law enforcement and employers' reports filed through the California Department of Industrial Relations in eight southern California cities. The eight cities included were Coronado, National City, El Cajon, Carlsbad, Chula Vista, and Escondido in San Diego County, and Santa Monica and Inglewood in Los Angeles County. The cities are not identified individually in this report. The sampled cities have small to mid-sized populations with autonomous police departments. They were chosen because the number of records to review was reasonable to work with but could provide a solid base for rate estimation and because local law enforcement agencies were interested in participating in the study.

Law enforcement surveillance was conducted from June 1, 1994, through March 31, 1995, except in City 6, in which surveillance ended on December 31, 1994. Although computerized logs of police activity were kept by most of the participating police departments, the logs did not contain the detailed information needed to identify and describe assaults in the workplace. Hence, it was necessary to examine all police reports manually to find those that involved workplace violence. There are no legal requirements to report workplace violence events to law enforcement.

In California, all employers are required by law to report any workplace assault injury that requires medical attention or leads to time away from work. However, this requirement is not enforced, and many events go unreported. Employers' reports from October 1, 1994, through January 31, 1995, obtained through the California Occupational Safety and Health Administration, were examined. Events involving an assault were identified, and those occurring within the boundaries of the eight study cities were identified by address.

For both reporting sources, only events leading to physical injuries were included; stress, fear, and complaints of pain without reported physical injury were excluded. Fatal injuries were not included.

Event Linkage

The 4 months of employers' report surveillance fell within the time frame of the 9-month police surveillance, and the linkage scheme sought to find a police report for each of the existing employers' reports. The estimates presented represent linkage from the same 4 months of reporting from both agencies.

Individual identifiers for the victims and perpetrators were not collected from either reporting source. Linkage between sources was based on the address and date of the incident and verified by the Standard Industrial Classification code, victim gender, date of birth, and occupation. When exact links between incident address and date were not made, the incident date window was opened in each direction by 10 days, holding the incident address constant. Potential matches were included if all of the verifying variables were similar.

Analysis

Estimates of the working civilian population for rate calculations were obtained from the Current Population Survey.[6] For concordance between numerator and denominator, all assaults occurring to non-civilian employees were sought for exclusion from the numerator, but none were found. Rates of workplace assault injury are reported for employers' reports, police reports, and both reporting sources combined. The combined rates count each linked case only once.

The estimated annual number of events was determined by inflating the actual number of reported events by a proportional amount to represent 12 months. Police report surveillance occurred for 9 continuous

TABLE 1
Number and Rate of Police and Employer's Reports of Non-Fatal Workplace Assault Injuries

	Police Reports		Employer's Reports			Rates		
City	Number Reported	Annual Estimate of Cases*	Number Reported	Annual Estimate of Cases†	Working Population‡	Estimated Annual Rate (Police)*§	Estimated Annual Rate (Employers')†§	Combined Annual Rate‖
City 1	12	16	2	6	7207	222.0	83.4	305.3
City 2	70	93	11	33	17721	524.8	186.3	677.2
City 3	10	13	3	9	32789	39.6	27.3	57.9
City 4	21	28	15	45	39478	70.9	114.0	177.3
City 5	26	35	15	45	47373	73.9	95.1	162.5
City 6*	19	38	20	60	47672	79.7	126.0	205.3
City 7	29	39	10	30	51563	75.6	58.2	133.8
City 8	50	67	6	18	59482	112.6	30.3	142.9
Total	237	329	82	246	303285	104.2	81.0	184.6
Average	29.6	41.1	10.1	30.8	37910	105.5	90.0	232.8

* Police surveillance is based on 9 months of reporting. Estimated annual number of police cases is determined by dividing the number of police reports by .75; surveillance in City 6 was for 6 months and estimated annual number is the reported number multiplied by 2.

† Employers' report surveillance is based on 4 months of reporting. Estimated annual number of employers' report cases is determined by multiplying the number of employers' reports by 3.

‡ Data provided by Current Population Survey for 1994 California Civilian Workforce.

§ Rate per 100,000 workers.

‖ The combined annual rate excludes the employers' report of the five cases reported to both agencies.

months; annualized rates were estimated by multiplying the number of reported incidents by 1.33. For City 6, in which surveillance was conducted for 6 months, the annualized rates were estimated by multiplying the number of events by two. Employer report surveillance occurred for 4 continuous months, and annualized rates were estimated by multiplying the number of workplace assault injuries by three.

The characteristics of reports to each agency were examined by gender, type of event, type of industry, and occupation. The typology of event classification expands on general guidelines developed by the California Occupational Safety and Health Administration.[7] Type I events involved criminal activity, such as robbery. Type II events involved an assault by a customer, client, patient, or inmate. Type III events involved an assault on an employee by another employee. Type IV events involved a personal, non-business acquaintance of the employee. Kendall-τ rank correlations were calculated to determine the non-parametric agreement in the rankings of compared categories.[8]

Results

Linkage

Among the 82 employers' reports filed during the 4-month study period, only five (6.10%) had matching police reports ("linked" events). Of the five linked cases, all were Type I events (occurred during a robbery/crime). Four of the linked event victims worked in retail establishments, and one was a maintenance worker for a government agency. The five linked cases were found in three different cities.

Incidence of Non-Fatal Workplace Assault Injury

In the eight cities, the total annualized number of police reports was 329 and of employers' reports was 246, with a total civilian workforce of 303,285. The corresponding rates were 104.2 and 81.0 per 100,000 workers for police and employers' reports, respectively (Table 1). When duplicate reports of the linked cases were removed, the combined annual non-fatal workplace assault injury rate for the eight cities was 184.6 per 100,000 workers. The combined rate, which included all distinct workplace assault injuries, was almost double the rate using either reporting source individually. The combined rates by city varied widely, from 57.9 to 677.2 per 100,000 workers.

The average number of annualized non-fatal workplace assault injuries reported to police per city was 41.1, with a corresponding average rate of 105.5 per 100,000 employed individuals. Overall, employers submitted fewer reports than the number reported to police, with an average number of events per city of 31.0 and corresponding rate of 90.0 per 100,000 employed. Rates based on police reports ranged from 39.6 to 524.8 events per 100,000 employed; rates based on employers' reports ranged from 27.3 to 186.3 per 100,000 employed.

In the sampled cities, there was no clear trend in the workplace assault injury rate, based on the size of the working population in the city. Cities 1 and 2, with the smallest working populations, reported the highest and second-highest rates, and City 6, with the third largest working population, reported the third-highest rate. Because the number of reported events and the working populations

TABLE 2
Number, Percentage, and Rank of Non-Fatal Workplace Assault Injuries by Industry, Using Police and Employer Reports*

Industry	Police Reports†			Employer's Reports†		
	Number	Percentage	Rank	Number	Percentage	Rank
Retail‡	108	32.8	1	18	7.3	5
Grocery/gas station/ convenience Store	90	27.4	2	18	7.3	5
Drinking and eating establishments	75	22.8	3	21	8.5	4
Police/security	13	4.0	4	60	24.4	1
Transportation§	9	2.7	5	9	3.7	7
Health care‖	3	0.9	6	39	15.9	2
School	1	0.3	7	39	15.9	2
Other/unknown	30	9.1		42	17.1	
Total	329	100		246	100	

* Kendall-τ correlation = −0.75 (P = 0.012).
† Annualized numbers.
‡ Includes department stores, novelty shops, and liquor stores.
§ Includes public and private transportation workers and truck drivers.
‖ Includes hospitals, physicians' offices, home health care providers, and long-term caregiving facilities.

in Cities 1 and 2 were small, compared with those of the other cities, these estimates may not be stable enough to represent other cities. Rates for Cities 5–8, each with a working population of over 45,000, ranged from 133.8 to 205.3 per 100,000 workers.

Characteristics of Violent Injury Events

Industry. Industries showed wide variation in reports to police and through employers (Table 2). The majority of police-reported events were from retail stores (32.8%), grocery/gas/convenience stores (27.4%), and eating/drinking establishments (22.8%). By contrast, only 7.3% of the employers' reports were from the retail industry, 7.3% from gas/grocery/convenience stores, and 8.5% from eating and drinking establishments. The three most prevalent industries reporting through employers were hospitals (15.9%), police/security (24.4%), and schools (15.9%). These three industries combined made up only 5% of police reports.

Frequency ranking of events by industry showed a strong difference between reporting sources. The Kendall-τ rank correlation coefficient showed a negative correlation of −0.75 (P = 0.012), which indicates that the ranking of industries in the police reports was strongly negatively correlated with employers' reports.

Type of event. Type I events, which result from criminal activity, comprised 66.9% of police reports and 46.3% of employers' reports (Table 3). Type II events were far more frequent among employers' reports (47.6%) than police reports (18.2%). Hospitals, schools, and correctional facilities represented most of the Type II events from employers' reports. Type III events, which involve an employee-on-employee assault, comprised less than 10% of reports from either source. No Type IV events were reported through employers' reports, and these events comprised only 1.5% of police reports. Nonclassifiable (unknown) events involved an unknown perpetrator or a perpetrator in which the relationship to the business could not be established and comprised 3.7% of employers' reports and 8.5% of police reports. The Kendall-τ rank correlation coefficient for Type of Event was −0.10, which failed to meet significance because of agreement in rankings of Types III and IV.

In Type II events, females were most frequently injured (83.9%). In Type I and Type II events, males were injured an equal number of times (43.6% and 46.9%, respectively). Females involved in Type II events were predominantly school teachers and health care workers; males were policemen or correctional facility workers. Females involved in Type I events were most frequently employed in the retail industry.

Occupation. Among reports to police, clerks and cashiers were the most frequently identified as victims of assault (27.7%), followed by owners/managers (17.3%) and loss prevention specialists (14.9%) (Table 4). The occupations most frequently identified in employer-reported events were public/private security (including police) (26.8%), teachers (14.6%), health care providers (13.4%), and clerk/cashiers (13.4%). The Kendall-τ rank correlation coefficient for Occupation was −0.50, which was significantly different (P = 0.03).

Weapon. Hitting or kicking was the most common method of assault from both reporting sources (Table 5). Hands/feet were the weapon in

TABLE 3
Number, Percentage, and Rank of Non-Fatal Workplace Assault Injuries by Type of Event, Using Police and Employers' Reports*

Type of Event	Police Reports†			Employer's Reports†		
	Number	Percentage	Rank	Number	Percentage	Rank
Type I: In the course of criminal activity (eg, robbery)	220	66.9	1	114	46.3	2
Type II: Assault by customer, client, or patient	60	18.2	2	117	47.6	1
Type III: Employee-on-employee assault	17	5.2	3	6	2.4	3
Type IV: Assault by personal, non-work acquaintance of employee	4	1.2	4	0	0.0	4
Perpetrator unknown, or relationship to business unknown	28	8.5		9	3.7	
Total	329	100		246	100	

* Kendall-τ correlation = −0.10 (P = 0.45).
† Annualized numbers.

TABLE 4
Number, Percentage, and Rank of Non-Fatal Workplace Assault Injuries by Occupation, Using Police and Employers' Reports*

Occupation	Police Reports†			Employers' Reports†		
	Number	Percentage	Rank	Number	Percentage	Rank
Clerk/cashier	91	27.7	1	33	13.4	3
Owner/manager	57	17.3	2	15	6.1	5
Loss prevention	49	14.9	3	3	1.2	8
Security: private and public	32	9.7	4	66	26.8	1
Delivery service	9	2.7	5	15	6.1	5
Food workers	10	3.0	6	9	3.7	7
Teachers	1	0.3	7	36	14.6	2
Health care providers‡	0	0.0	8	33	13.4	3
Other/unknown	80	24.3		36	14.6	
Total	329	100		246	100	

* Kendall-τ correlation = −.50 (P = 0.03).
† Annualized numbers.
‡ Includes hospital aides and technicians, nurses, physical therapists, and physicians.

70.5% of police reports and 65.9% of employers' reports. Guns were the second most prevalent weapon for both reporting sources but were more frequent in police reports (17.9%) than employers' reports (4.9%). Non-fatal injuries from guns, which are more commonly associated with fatal workplace assaults, were more frequently a result of the employee's being hit with the gun rather than shot. Knives, bottles, glass, and clubs combined represented less than 3% of the weapons used. Other/unknown weapons comprised 9.7% of police and 26.8% of employers' reports. Approximately one fourth of the "other/unknown" category for employers' reports were bite wounds, which were not identified separately in the police reports. The Kendall-τ rank correlation coefficient for weapon rankings was −1.00, which was not significantly different.

Feasibility of the Capture-Recapture Method to Estimate Incidence

Several studies have used the capture-recapture method to estimate a total number of events by using multiple reporting sources.[9–11] These methods use the number of events reported exclusively to each source and the number that overlap between sources to estimate an overall incidence of events.

One capture-recapture method using two data sources is illustrated in Table 6.[12] Using the 4 months of corresponding reports from police and employers, there were 82 employers' reports, 85 police reports, and 5 that overlapped. Capture-recapture calculations show 1309 events not reported to either source and a total of 1471 estimated events (Table 7). This would correspond to an annual number of 4413 events, for a rate of 1455.1 workplace assaults per 100,000 workers. It is also difficult to imagine that the number of workplace assaults not reported to

TABLE 5
Number, Percentage, and Rank of Non-Fatal Workplace Assault Injuries by Weapon Used, Using Police and Employers' Reports*

	Police Reports†			Employers' Reports†		
Weapon	Number	Percentage	Rank	Number	Percentage	Rank
Hands/feet	232	70.5	1	162	65.9	1
Gun	59	17.9	2	12	4.9	2
Knife	5	1.5	3	6	2.4	3
Bottle/glass/stick	1	0.3	4	0	0.0	4
Other/unknown	32	9.7		66	26.8	
Total	329	100		246	100	

* Kendall-τ correlation = 1.00 (P = 0.99).
† Annualized numbers.

TABLE 6
Model for Capture-Recapture Method from Two Reporting Sources

	Reporting Source 1		
Reporting Source 2	Reported	Not Reported	Estimated Total
Reported	C	N1	
Not reported	N2	X*	
All cases			C+N1+N2+X

* X = (N1×N2)/C.

TABLE 7
Capture-Recapture Method for Two Workplace Assault Reporting Sources (4-Month Reporting Period)

	Police Reports		
Employers' Reports	Reported	Not Reported	Estimated Total
Reported	5	77	
Not reported	80	X=1309*	
All cases			1471

* X = (77×80)/5.

either source exceeds the number of those reported by a factor of more than 15.

The capture-recapture approach is not feasible for this surveillance study because the overlap between reporting sources is small. One assumption in the capture-recapture approach is that events are equally likely to be reported through all sources, and this assumption is violated. Another assumption is that reporting to each source is independent. It is possible in this example that reporting through one source precludes reporting through another, ie, that reporting to police precludes the employer's filing a separate report to the state. Further examination of the mechanisms of workplace assault reporting as well as surveillance using larger geographic areas or longer reporting periods may be necessary to clarify this matter.

Discussion

Surveillance of non-fatal workplace assault injuries using only one reporting source could severely underestimate incidence and fail to identify important epidemiologic characteristics of these events. Police reports are an important resource of information for the surveillance of workplace assault events, and reports to police have a very different profile than those reported through employers.

Although the magnitude of the combined non-fatal workplace assault rates are similar to other published rates, studies are difficult to compare because of differing case definitions. This research included only those assaults that led to physical injury and did not include threats or non-injury events. The most comprehensive surveillance system for non-fatal workplace injuries is the United States Bureau of Labor Statistics annual survey of occupational deaths and injuries, in which over 250,000 private businesses report injuries or illnesses leading to at least 1 day away from work. This survey includes events that may not lead to injuries, such as threats and battery, and counts only those events in which the worker missed at least 1 day of work. The Bureau estimated a non-fatal workplace assault/battery/threat rate of approximately 180 per 100,000 US workers in 1992 and 230 per 100,000 in 1993.[13,14]

Other published reports have been based primarily on either workers' compensation claims or employee interviews and rarely use more than one reporting source.[4,5,15–17] A study of minority health care workers in Los Angeles county found 14.7 claims per 1,000,000 employment days.[17] A study in Ohio reported 430 threats, batteries, or assaults per 100,000 employees, with the highest rates among workers in law enforce-

ment, gas stations, real estate, and hotels/motels.[4] The 1989–1992 National Crime Victimization Survey found that 240 per 100,000 workers reported being assaulted at work.[5]

Using police reports for workplace violence surveillance is a crucial step in identifying businesses and employees at risk and the types of events they experience. Many individually owned smaller establishments may not be included in the commonly used data collection sources, such as workers' compensation programs. Liquor stores and small restaurants and retail establishments, which often have fewer than five employees, had very high rates among police reports and could fall into this category.

The small number of linked cases may underestimate the true number of cases reported through both sources. The sampling frame included only 4 months of employers' reports, and differential delays in reporting may have decreased the number of matched reports. Further investigation, including longer time frames and incorporating more reporting sources, would be beneficial in understanding workplace assault reporting and incidence.

The incidence of non-fatal workplace assault injury warrants serious attention when designing prevention strategies. Considering that multiple reporting sources have not been combined on a large scale and that some events go unreported, the occurrence of non-fatal workplace assault could be much larger than that currently recognized. The toll of these injuries on victims, victims' families, and businesses has yet to be determined. Future studies to further enumerate and characterize non-fatal workplace violence are critical to developing effective and efficient prevention strategies.

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References

1. Hanrahan LP, Moll MB. Injury surveillance. *Am J Public Health.* 1989; 79(suppl):38–45.
2. Kraus JF, Peek C, Silberman T, Anderson C. The accuracy of the death certificate to identify work-related fatal injuries. *Am J Epidemiol.* 1995;141:973–979.
3. Stout N, Bell C. Effectiveness of source documents for identifying fatal occupational injuries: a synthesis of studies. *Am J Public Health.* 1991;81:725–728.
4. Hales T, Seligman PJ, Newman SC, Timbrook CL. Occupational injuries due to violence. *J Occup Med.* 1988;30:483–487.
5. Bachman R. Violence and theft in the workplace. In: *U.S. Department of Justice Crime Data Brief.* [NCJ-148199.] Washington, DC: US Government Printing Office; 1994.
6. United States Census. *1994 Estimates of Population and Housing Summary Tape File 3.* Washington, DC: US Bureau of the Census; 1995.
7. Howard J. State and local regulatory approaches to preventing workplace violence. *Occup Med.* 1996;11:293–302.
8. Kendall MG. *Rank Correlation Methods,* 2nd ed. London: Charles Griffin and Company Ltd.; 1955.
9. Chiu WT, Dearwater MS, McCarty MS, Songer TJ, LaPorte RE. Establishment of accurate incidence rates for head and spinal cord injuries in developing and developed countries: a capture-recapture approach. *J Trauma.* 1993;35:206–211.
10. Ikeda RM, Birkhead GS, Flynn MD, Thompson SF, Morse DL. Use of multiple reporting sources for perinatal hepatitis B surveillance and follow-up. *Am J Epidemiol.* 1995:142:765–770.
11. LaPorte RE, Dearwater MS, Change YF, et al. Efficiency and accuracy of disease monitoring systems: application of capture-recapture methods of injury monitoring. *Am J Epidemiol.* 1995;142:1069–1077.
12. Chandra Sekar C. Deming WE. On a method of estimating birth and death rates and the extent of registration. *J Am Stat Assoc.* 1949:44:101–115.
13. US Department of Labor, Bureau of Labor Statistics. *Violence in the Workplace Comes Under Closer Scrutiny.* [Summary 94–10.] Washington, DC: US Department of Labor; 1994.
14. US Department of Labor, Bureau of Labor Statistics. *Work Injuries by Selected Characteristics, 1993.* [USDL 95–142.] Washington, DC: US Department of Labor; 1995.
15. Alexander BH, Franklin GM, Wolf ME. The sexual assault of women at work in Washington State, 1980 to 1989. *Am J Public Health.* 1994;84:640–642.
16. Lavoie FW, Carter GL, Danzi DF, Berg RL. Emergency department violence in United States teaching hospitals. *Ann Emerg Med.* 1988;17:1227–1233.
17. Sullivan C, Yuan C. Workplace assaults on minority health and mental health care workers in Los Angeles. *Am J Public Health.* 1995;85:1011–1014.