

Historical Perspective

Trends in Workplace Homicides in the U.S., 1993–2002: A Decade of Decline

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Background Trends in workplace homicide rates are compared to the trends in U.S. homicides from 1993 to 2002, inclusively. The homogeneity of workplace homicide rates by victim demographics, circumstances, and types of events are also addressed.

Methods Using publicly available data from several sources, Poisson models are used to statistically compare the trends of workplace homicide rates versus U.S. homicide rates and to compare trends within categories of workplace homicides.

Results Overall, there was a significant decline in the rates of occupational homicide of approximately 6% per year during the study time period; this decline was found to be statistically greater than the decline of all U.S. homicides (5% per year). Taxi cab drivers and chauffeurs demonstrated the greatest decline of all occupational subgroups. When looking at the circumstances of workplace homicides, only the rate of homicides committed during a robbery or other crime demonstrated a significant decline.

Conclusions While workplace homicides have declined in the U.S., the declines have not occurred uniformly across demographic and occupational categories. *Am. J. Ind. Med.* 50:316–325, 2007. © 2007 Wiley-Liss, Inc.

KEY WORDS: occupational homicide; trends; CFOI; UCR; MCMC modeling

INTRODUCTION

During the 10-year period from 1993 to 2002, inclusively, a total of 8,148 American workers were victims of

homicide while working or on duty [BLS, 2003a]. Although this represents only 4% of all homicides which occurred in the United States during this time period [FBI, 2005], it represents 14% of all work-related injury deaths over the same period. Despite a reduction in workplace homicides from 1993 to 2002, homicide remained one of the three leading causes of occupational injury death exceeded only by motor vehicle incidents from 1993 to 1998, and by motor vehicle incidents and falls from 1999 to 2002 [BLS, 2003b].

Overall homicide rates in the United States peaked in the early 1990s and by 2000 had declined to a level comparable to the late 1960s [BJS, 2003a]. While a great deal has been written about the decline in violent crime, particularly homicides, in the U.S. in recent decades [Blumstein, 2000; Blumstein and Wallman, 2000; Rosenfeld, 2002, 2004], these analyses did not address issues specific to workplace homicide. Similarly, although studies examining overall trends in occupational injury deaths [Stout et al., 1996] and workplace homicides in specific occupations [Kaminski and

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The findings and conclusions in this report are those of the authors and do not necessarily represent the view of the National Institute for Occupational Safety and Health.

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Marvell, 2002] or geographic areas [Hewitt et al., 2002] are available, a detailed analysis of a decade of national data on workplace homicides across all industries and occupations has not been published.

It is important to understand workplace violence and homicide in the context of the general level of violence in American society and how the nature and magnitude of workplace violence has changed over time. For these reasons, the purpose of this article is to compare workplace homicide rates to overall United States homicide rates over time and to examine the trends in occupational homicides from January 1, 1993 to December 31, 2002, along a number of demographic and workplace factors. The specific aims of the study are: (1) to assess whether the decline in workplace homicides over the time period are greater than, equal to, or less than the decline in overall homicides observed in the U.S. population during the same time period; (2) to assess the extent to which the decline in workplace homicides is homogenous across demographic categories of victims, circumstances, and types of events; and (3) to compare the decline in workplace homicides due to robbery to the U.S. decline in homicides due to robbery.

MATERIALS AND METHODS

The number of workplace homicide fatalities for the years 1993–2002, inclusively, was obtained from the Census of Fatal Occupational Injuries (CFOI) [BLS, 2003a]. CFOI is administered by the Bureau of Labor Statistics (BLS) in conjunction with participating state agencies. The program compiles data on fatal work-related injuries occurring in the 50 states and the District of Columbia. Data on work-related fatalities are compiled from various State and Federal administrative sources, such as death certificates, workers' compensation reports, OSHA reports, medical examiner reports, and newspaper reports. At least two independent source documents are typically required to verify that an injury fatality is work-related. The complete and extensive definition employed by CFOI to determine what constitutes a work-related fatality is provided in detail elsewhere [BLS, 2003b] and can be briefly summarized as a fatality occurring to someone non-institutionalized, age 16 or older, who was legally employed (paid or unpaid) and on-duty at the time of the incident. A fatality due to homicide was based on the fatalities in CFOI which had event codes 610–619 (assault and violent acts by persons), inclusively, based on the Occupational Injury and Illness Classification System (OIICS) developed by BLS [1992].

In addition to the total number of workplace homicides by year provided by CFOI, the number of homicides was obtained for the sex of the victim, age of the victim, race of the victim, occupation of the victim, industry of the victim, type of weapon used, circumstance of the incident, worker activity at time of the incident, location of the incident, and

time of the incident. These variables were coded by BLS and summaries by year were provided for the analysis [BLS, 2003a]. Circumstance of fatality was coded using the following topology suggested by previous research [Howard, 1996; IPRC, 2001]: criminal intent incidents in which the perpetrator has no legitimate relationship to the business and is usually committing a crime in conjunction with the violence, generally but not always robbery (Type I); customer/client incidents in which the perpetrator has a legitimate relationship with the business and becomes violent while being served by the business (Type II); worker on worker incidents in which the perpetrator is an employee or past employee of the business and attacks or threatens another employee (Type III); and personal relationship incidents in which the perpetrator does not have a relationship with the workplace, but has a personal relationship with the intended victim (Type IV). Workplace homicides related to the Oklahoma City bombing in 1995 ($n=123$) were omitted from the data for the purpose of these analyses. The CFOI data do not include any fatalities directly related to the September 11, 2001 terrorist attack [BLS, 2002].

Annual rates were calculated by dividing the number of workplace homicides in a specific category by the number of workers in the respective category for sex, age, race, occupation, and industry. For event and circumstance of the incident, annual rates were calculated by dividing the number of workplace homicides attributable to the category by the total number of U.S. workers for the specific year. Rates were not calculated for worker activity at time of the incident, worker location at time of the incident, and for time of the incident due to a lack of appropriate denominator data for these variables. Subgroups in each category were considered for analysis if there were a sufficient number of homicides which met BLS's publishing criteria for each year of data under consideration.

Employment data used for the calculation of workplace homicide rates were taken from the Current Population Survey (CPS) for the years 1993–2002 [BLS, 1993, 2002]. The CPS is conducted by the Bureau of the Census for the U.S. Department of Labor, BLS and is a rotating monthly survey of a scientifically selected sample of households (approximately 50,000 household interviews are completed each month) of the civilian non-institutional population age 16 years and older. These data provided employment data by sex, age, race, occupation, and industry. Employment data were not available by worker activity, location, or time of day.

Data on all homicides and robbery-related homicides in the United States were obtained from Uniform Crime Reports (UCR) tabulated by the Federal Bureau of Investigation (FBI) [FBI, 2005]. The UCR data are produced by the FBI from data provided by nearly 17,000 law enforcement agencies across the United States. For the purpose of these analyses, robbery-related homicides were defined as all homicides in the U.S. which the data

categorized as related either to a robbery, burglary, or larceny. Population estimates of the United States which were used to calculate homicide rates by year were also obtained from the UCR data—these estimates are the provisional estimates from the Bureau of the Census for each year as of July 1 except for 2000, which reflects a decennial census count [FBI, 2005]. For comparability to the workplace homicide rates, the homicides due to the Oklahoma City bombing in 1995 ($n = 123$) were omitted from the UCR data for the purpose of this analysis. Data pertaining to events related to the September 11, 2001 terrorist attacks are not included in the UCR data used in these analyses [FBI, 2002].

Statistical Methods

Analysis of trends was conducted using Poisson regression, assuming a linear trend throughout the time period. When applicable, the number of workers was included in the regression as a weight term so that trends in rates were analyzed. A lag term of the number of workplace homicides from the previous year was included for all regressions to account for the auto-correlation present in time trends since these data are serially correlated [Sayrs, 1989]. An average annual decline (in terms of a percentage decrease from the preceding year) in rates (or numbers) of workplace fatalities with 95% confidence intervals was produced by exponentiating the parameters from the regressions. The difference in the percentage average annual decline in a specific category and the percentage average annual decline of all workplace homicides along with corresponding 95% confidence intervals was also estimated based on the results of these regressions. It should be noted that all of the statistics presented in this article are in terms of decline so that a negative decline corresponds to an increase through time.

All regressions were estimated employing Markov–Chain Monte Carlo (MCMC) modeling with the software BUGS and were based on 90,000 simulations after a burn-in of 10,000 simulations [Gilks et al., 1996]. Non-informative normal prior distributions for the parameters which were estimated in the regressions were assumed. All the Poisson regressions where denominators were available (including the overall U.S. homicide regression) were estimated simultaneously in one MCMC model. Another separate MCMC model was estimated for all the Poisson regressions where denominators were not available.

Since our main objective was to compare the trends between workplace homicides and non-workplace homicides and trends within subgroups of workplace homicides, estimating the regressions simultaneously through a single MCMC model provided two distinct advantages. The first advantage was that the confidence intervals for comparing the differences in trends are easily attainable through this procedure. Of note, these confidence intervals take into account the correlation which exists between the parameters

for the trends; these correlations would not be attainable by estimating each model separately [Gilks et al., 1996]. The second advantage in this modeling approach was that a single common global auto-correlation parameter could be estimated for all separate regressions by essentially pooling together all information available in each subgroup. Estimating a single common global auto-correlation parameter avoids potential confounding effects in the trend comparisons which would otherwise bias these comparisons if a separate auto-correlation parameter is used for each regression model [Sayrs, 1989].

RESULTS

During the period from 1993 to 2002, inclusively, there were 187,486 total homicides in the U.S. used for these analyses, of which 16,264 (8.7%) were robbery-related. For the same period, there were 8,148 workplace homicides used in these analyses of which 6,682 (82%) were Type I homicides. There were 53,016 workplace fatalities during this period which were non-homicide related (Table I).

The value for the auto-correlation parameter from the MCMC estimation for all Poisson models which had denominators available was 0.31 (95%CI; 0.25–0.38). The value for the auto-correlation parameter from the MCMC estimation for all Poisson models where a denominator was not available was 0.06 (95%CI; –0.03–0.13). These results indicate that serial correlation exists in the data, especially regarding rates, and should be accounted for when making statistical comparisons between groups.

TABLE I. Number of Workplace Fatalities (by Non-Homicide, Homicide, and Type I Homicide) and All U.S. Homicides (by Total and Robbery-Related) by Year, 1993–2002

Year	Workplace fatalities			U.S. homicides	
	Non-homicide	Homicide	Type I homicide	All	Robbery-related*
1993	5,257	1,074	942	24,526	2,515
1994	5,552	1,080	938	23,326	2,263
1995 ^a	5,239	913	751	21,460	2,020
1996	5,275	927	741	19,645	1,765
1997	5,378	860	734	18,206	1,626
1998	5,341	714	571	16,974	1,353
1999	5,403	651	501	15,522	1,152
2000	5,243	677	522	15,586	1,169
2001 ^b	5,272	643	504	16,037	1,177
2002	5,056	609	478	16,204	1,224
Total	53,016	8,148	6,682	187,486	16,264

*Includes all homicides related to robberies, burglaries, and larcenies.

^aExcludes victims of Oklahoma City bombing.

^bExcludes victims of September 11, 2001 terrorist events.

The rate of all homicides in the United States declined by an average of 4.7% per year (95%CI; 4.4–5.0%) from 1993 to 2002 (Fig. 1). During this same period, the rate of workplace homicides declined by an average of 6.2% per year (95%CI; 5.5–7.0) (Fig. 1). The difference in these declines of 1.5% (95%CI; 0.8–2.3%) demonstrated that the rates of workplace homicides had a statistically significant greater decline than the rates for all U.S. homicides. Non-homicide related workplace fatality rates declined by 2.2% per year (95%CI; 1.7–2.3%) during this same period. The difference in the declines between homicide related workplace fatality rates and non-homicide workplace fatality rates of 4.2% (95%CI; 3.4–5.0%) demonstrated that workplace fatalities due to homicide had a significantly greater decline from 1993 to 2002 than workplace fatalities not due to homicide.

Demographics

Both males and females demonstrated a significant average annual decline in the rate of workplace homicides (Table II). All age groups considered also showed a significant average annual decline in rates of workplace homicides. The decline in average annual rates was greatest for the age groups of 16–19 (9.4%), 20–24 (8.7%), and 65+ (9.2%); however, these declines were not found to be significantly greater than the overall decline in workplace homicide rates (Table II). The average annual decline in workplace homicide rates for whites, blacks, and Hispanics was also significant (Table II).

Occupation and Industry

All the occupations included in this analysis showed a significant average annual decline in the rates of workplace

homicides (Table III). The average annual decline in rates for the occupations of “sales workers-retail and professional services” (8.4%) and “taxicab drivers and chauffeur” (11.7%) were significantly greater than the average annual decline in the rate of all workplace homicides.

Although the industries of “health services” and “public administration” showed a decline in the average annual rate of workplace homicides (2.2% and 3.4%, respectively), this decline was not found to be statistically significant (Table III). All other industries considered demonstrated a statistically significant decline in the average annual rate of workplace homicides. The average annual decline in homicide rates for the industries of “transportation and public utilities” (8.6%) and “taxicab” (10.3%) had an average annual decline in workplace homicide rates significantly greater than the average annual decline in rates for all workplace homicides (Table III).

Event and Circumstance

The rates of fatal workplace shootings and stabbings both demonstrated a statistically significant average annual decline during the years 1993–2002; however, the rate of decline in rates for other types of fatal workplace assaults was not statistically significant during the same period (Table IV). For the circumstance of the workplace homicide, only Type I workplace homicides demonstrated a statistically significant average annual decline in rates.

For the entire U.S. population, rates for robbery-related homicides, after subtracting out the number of robbery-related workplace homicides, declined by an average of 7.7% per year (95%CI; 6.9–8.6%). The difference in the decline of Type I workplace homicides and all U.S. robbery-related homicides (subtracting out the number of Type I homicides) of 0.6% (95%CI; –0.4–1.6%) was not statistically significant.

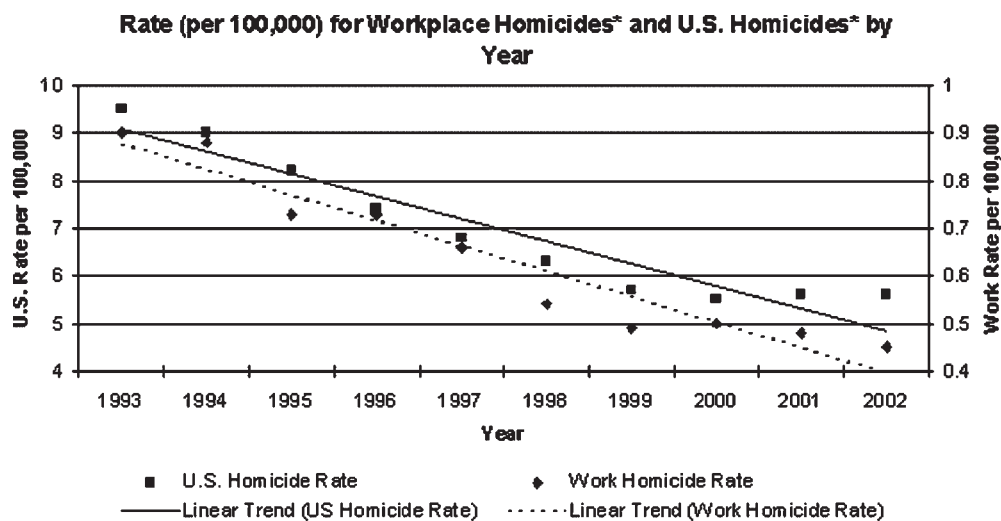


FIGURE 1. *Excludes victims of the 1995 Oklahoma City bombing and the September 11, 2001 terrorist event.

TABLE II. Average Annual Decline in Workplace Homicide Rates and Difference in Percent Decline by Sex, Age, and Race, U.S., 1993–2002

	Total homicides ^a	Average annual homicide rate per 100,000 employees	Average annual percent decline in rates	Percent difference from all workplace homicide rates ^b
All workplace homicides	8,148	0.64	6.2 (5.5, 7.0) ^c	—
Sex				
Male	6,588	0.96	6.5 (5.6, 7.3)	0.2 (–0.9, 1.3) ^c
Female	1,560	0.26	4.8 (3.1, 6.5)	–1.4 (–3.3, 0.4)
Age				
16–19	256	0.40	9.4 (5.2, 13.4)	3.1 (–1.1, 7.2)
20–24	603	0.48	8.7 (6.0, 11.3)	2.5 (–0.3, 5.2)
25–34	1,997	0.63	5.4 (3.8, 6.9)	–0.9 (–2.5, 0.8)
35–44	2,139	0.61	5.7 (4.2, 7.1)	–0.6 (–2.2, 1.0)
45–54	1,689	0.64	6.1 (4.5, 7.7)	–0.1 (–1.9, 1.6)
55–64	976	0.78	6.5 (4.4, 8.5)	0.3 (–2.0, 2.4)
65+	481	1.27	9.2 (6.3, 12.1)	3.0 (–0.0, 6.0)
Race				
White	4,385	0.40	6.4 (5.4, 7.5)	0.2 (–1.0, 1.4)
Black	1,469	1.07	7.6 (5.8, 9.3)	1.3 (–0.5, 3.2)
Hispanic	1,199	0.99	8.7 (6.8, 10.5)	2.4 (0.5, 4.4)^d

^aSubgroups may not sum to the total due to missing information.

^bThe difference presented in this column may not match the actual difference in the table due to rounding.

^cParentheses denote a 95% confidence interval.

^dBold denotes a statistical significant difference from the all workplace homicide trend.

Activity, Location, and Time of Day

A statistically significant average annual decline in the number of workplace homicides was found for vehicular and transportation activities (10.6%), protective service activities (3.6%), and tending a retail establishment (7.8%) at the time of the workplace homicide (Table V). An average annual increase in the number of workplace homicides was found for health care or social services (3.8%); however, this increase was not found to be statistically significant. The average annual decline in the number of workplace homicides for the activities of protective services, office work, and health care or social services was significantly less than the overall average annual decline in the number of all workplace homicides (Table V).

With the exception of hotels, each of the locations at the time of a workplace homicide considered demonstrated a statistically significant average annual decline in the number of workplace homicides (Table V). Workplace homicides which occurred in an industrial place or premise and hotels had a significantly less annual average decline than the average annual decline in all workplace homicides. Workplace homicides which occurred in convenience stores had a significantly greater annual average decline than the average annual decline in all workplace homicides (Table V).

All of the time of day categories demonstrated a significant average annual decline in the number of workplace homicides (Table V). The average annual decline for workplace homicides which occurred between 8 a.m. and 12 noon was significantly less than the average annual decline in the total number of workplace homicides.

DISCUSSION

Both the number and rate of workplace homicides in the United States declined over the 10-year period from 1993 to 2002, inclusively; the decline in workplace homicides was slightly greater than the decline in the rate of all U.S. homicides. Detailed analyses of the circumstances of workplace homicides indicate that the overall decline was primarily driven by substantial reductions in Type I workplace homicides (which are primarily homicides which occurred during the course of a robbery or other crime) and that this reduction in Type I workplace homicides mirrored the decline in robbery-related homicides in the general U.S. population. Detailed analysis of the trends in workplace homicides by occupation, industry, worker activity, and location also support the notion that the overall decline in workplace homicides during this period was primarily driven by substantial reductions in robbery-related homicides.

TABLE III. Average Annual Decline in Workplace Homicide Rates and Difference in Percent Decline by Occupation and Industry, U.S., 1993–2002

	Total homicides	Average annual homicide rate per 100,000 employees	Average annual percent decline in rates	Percent difference from all workplace homicide rates ^a
All workplace homicides occupation	8,148	0.64	6.2 (5.5, 7.0) ^b	—
Managerial and professional	1,410	0.38	6.0 (4.2, 7.7)	−0.3 (−2.1, 1.6) ^b
Technical, sales, and administrative support	2,888	0.76	6.9 (5.6, 8.1)	0.6 (−0.8, 2.0)
Sales occupations	2,556	1.66	7.6 (6.3, 9.0)	1.4 (−0.1, 2.9)
Sales workers, retail, and professional services	1,145	1.73	8.4 (6.4, 10.4)	2.1 (0.1, 4.2)^d
Service occupations	1,792	1.02	4.9 (3.4, 6.5)	−1.3 (−3.0, 0.4)
Protective service occupations	1,077	4.64	5.3 (3.3, 7.3)	−1.0 (−3.1, 1.1)
Operators, fabricators, and laborers	1,411	0.79	6.0 (4.2, 7.7)	−0.3 (−2.2, 1.6)
Transportation and material moving	944	1.77	7.1 (5.0, 9.2)	0.9 (−1.4, 3.1)
Truck drivers	202	0.67	5.6 (0.9, 10.2)	−0.6 (−5.4, 4.0)
Taxicab drivers and chauffeurs	581	23.7	11.7 (9.1, 14.3)	5.5 (2.8, 8.1)
Industry				
Transportation and public utilities	833	0.92	8.6 (6.3, 10.8)	2.3 (+0.0, 4.7)
Taxicab	576	46.1	10.3 (7.6, 12.9)	4.0 (1.3, 6.7)
Retail trade	3,713	1.72	7.1 (6.0, 8.2)	0.9 (−0.4, 2.2)
Grocery stores	1,264	4.16	6.7 (4.8, 8.6)	0.4 (−1.6, 2.4)
Gasoline and service stations	276	7.16	8.5 (4.3, 12.5)	2.2 (−1.9, 6.2)
Liquor stores	159	12.0	6.8 (1.5, 11.9)	0.5 (−4.8, 5.7)
Eating or drinking places	1,079	1.64	5.8 (3.8, 7.7)	−0.5 (−2.6, 1.6)
Service industries	1,438	0.31	5.6 (3.8, 7.3)	−0.7 (−2.6, 1.2)
Health services	122	0.11	2.2 (−3.9, 8.1)^c	−4.0 (−10.2, 1.9)
Public administration	568	0.20	3.4 (−2.9, 9.5)	−2.8 (−9.2, 3.3)

^aThe difference presented in this column may not match the actual difference in the table due to rounding.

^bParentheses denote a 95% confidence interval.

^cBold denotes not a statistically significant trend in this column.

^dBold denotes a statistical significant difference from the all workplace homicide trend in this column.

TABLE IV. Average Annual Decline in Workplace Homicide Rates and Difference in Percent Decline by Event and Circumstance, U.S., 1993–2002

	Total homicides ^a	Average annual percent decline in rates	Percent difference from all workplace homicide rates ^b
All workplace homicides	8,148	6.2 (5.5, 7.0) ^c	—
Event			
Shooting	6,643	7.0 (6.1, 7.9)	0.7 (−0.3, 1.8) ^c
Stabbing	680	3.7 (1.2, 6.2)	−2.5 (−5.2, 0.1)
Other assault	328	2.2 (−0.2, 4.6)^d	−4.0 (−6.6, −1.5)^e
Circumstance			
Type I: robberies/other crimes	6,682	7.1 (6.3, 8.0)	0.9 (−0.2, 2.0)
Type II: customer/client	313	3.2 (−0.5, 6.7)	−3.0 (−6.8, 0.6)
Type III: co-worker/ex co-worker	669	2.0 (−0.7, 4.6)	−4.3 (−7.0, −1.6)
Type IV: relatives/other personal acquaintances	447	2.1 (−1.2, 5.2)	−4.2 (−7.5, −1.0)

^aSubgroups may not sum to the total due to missing information.

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^cParentheses denote a 95% confidence interval.

^dBold denotes not a statistically significant trend in this column.

^eBold denotes a statistical significant difference from the all workplace homicide trend in this column.

TABLE V. Average Annual Decline in Workplace Homicide Rates and Difference in Percent Decline by Worker Activity, Location, and Time of Day, U.S., 1993–2002

	Total homicides ^a	Average annual percent decline in homicides	Percent difference from all workplace homicide trends ^b
All workplace homicides	8,148	6.6 (5.8, 7.4) ^c	—
Worker activity			
Vehicular and transportation	787	10.6 (8.1, 13.0)	4.0 (1.6, 6.3)^{c,d}
Protective services	1,052	3.6 (1.6, 5.7)	-3.0 (-5.1, -0.8)
Tending a retail establishment	3,445	7.8 (6.5, 9.1)	1.2 (-0.1, 2.5)
Office work	523	0.0 (-3.0, 3.0)^e	-6.6 (-9.8, -3.4)
Health care or social services	116	-3.8 (-10.6, 2.6)	-10.4 (-17.3, -3.9)
Location			
Street or highway	1,079	8.5 (6.4, 10.6)	1.9 (-0.2, 3.9)
Industrial place or premise	544	3.2 (0.4, 6.1)	-3.3 (-6.3, -0.4)
Public building	4,673	7.6 (6.4, 8.8)	1.0 (-0.1, 2.2)
Hotel	161	-0.5 (-6.0, 4.9)	-7.1 (-12.8, -1.5)
Convenience store	1,284	12.2 (10.1, 14.3)	5.6 (3.6, 7.5)
Office building	363	8.0 (4.6, 11.5)	1.4 (-2.0, 4.8)
Restaurant, caf ³	773	7.0 (4.5, 9.4)	0.4 (-2.1, 2.8)
Shop, commercial, store (except grocery)	1,397	5.4 (3.6, 7.2)	-1.2 (-3.1, 0.7)
Time of day			
12 midnight–4 a.m.	1,174	8.1 (6.1, 10.1)	1.5 (-0.5, 3.5)
4 a.m.–8 a.m.	788	6.1 (3.7, 8.4)	-0.5 (-3.0, 1.9)
8 a.m.–12 noon	1,249	3.0 (1.1, 4.9)	-3.6 (-5.6, -1.5)
12 noon–4 p.m.	1,365	6.0 (4.1, 7.8)	-0.6 (-2.5, 1.3)
4 p.m.–8 p.m.	1,231	6.8 (4.8, 8.7)	0.2 (-1.8, 2.1)
8 p.m.–12 midnight	1,694	8.3 (6.6, 10.1)	1.8 (+0.0, 3.5)

^aSubgroups may not sum to the total due to missing information.

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^dBold denotes not a statistically significant trend in this column.

^eBold denotes a statistical significant difference from the all workplace homicide trend in this column.

The strength of this study is that it provides analysis of well-established national level surveillance data on both overall homicides and workplace homicides in the U.S. for a 10-year period. These data have not been previously analyzed in conjunction with one another to assess the trends in workplace homicides as compared to national level homicide trends. Limitations of this study include a lack of information on perpetrators of workplace homicide events and on the detailed circumstances of each event. In addition, while 10 years is sufficient to begin to assess trends, another decade may be needed to more fully understand the natural fluctuations in workplace homicides and to describe the trends in workplace homicides in the context of overall U.S. homicide data.

It is worth noting that the workplace homicide numbers used in this article exclude the 2,886 work-related homicides which occurred on September 11, 2001 and the 123 work-related homicides which occurred in Oklahoma City on April 19, 1995. Although workplace homicides are rare events in

and of themselves, mass killings on the order of these events are extraordinarily rare. For the purposes of analyzing trends and making comparisons over time, such events should be excluded from analysis to eliminate outlier bias. The FBI specifically addressed the exclusion of the murders on September 11, 2001 from their annual compilation of crime statistics by stating that such events are distinctly different from “day-to-day crimes” captured in their Uniform Crime Reporting system and that the numbers were so high as to skew all possible measurements [FBI, 2002]. The BLS generated a separate analysis of the work-related homicides which occurred during the terrorist attacks on September 11, 2001, and did not include these cases in their summary of work-related deaths for 2001 [BLS, 2002]. Although the event related to April 19, 1995 is included in BLS’s summary of work-related deaths for 1995, these 123 murders from a single event provide 13% inflation in the total number of work-related homicides for the year 1995. Further, the distribution of the demographics of the victims from

the 1995 event is not at all similar to the distribution of the demographics of victims in general for work-related homicides.

The literature contains a number of theories regarding the causes of the general decline in homicides in the U.S. These include the role of changing demographics, changing levels of crime and violence among youth, changes in economic opportunities over time, declines in domestic homicides among adults, tougher policing strategies, and increasing incarceration rates [Blumstein, 2000; Blumstein and Wallman, 2000; Rosenfeld, 2002, 2004]. Taking each of these in turn, some are more consistent with and relevant to the trends in workplace homicides reported here than others. For example, the importance of changing demographics for the overall homicide rates reflects the movement of cohorts of the population out of the age groups at higher risk for violence (i.e., 18–24 years) [Fox, 2000]. This argument is based on the age of both victims and offenders given that a substantial portion (42%) of all homicides occurs between persons within 5 years of age of one another [Fox, 2000]. It is not clear if this pattern is true of workplace homicides. No national data exist on the offenders in workplace homicides—all of the occupational injury fatality data systems include information only on victims of workplace homicides. In the current analysis, the largest declines in average annual workplace homicide rates occurred for the two youngest age groups—that is, victims age 16–19 years and 20–24 years—and the oldest age group—victims over age 65 years. It is possible that workplace crimes, particularly robberies, may reflect the extent to which there are large cohorts in the age groups more likely to be victims of violent crimes.

Analyses of crime among youth have focused largely on the sharp increase in youthful homicides (both as victims and offenders) in the late 1980s and early 1990s which was followed by a decline in the mid and latter portion of the 1990s. Blumstein [2000] and Rosenfeld [2002] have made a clear connection between the peak in homicides among youth and the violence surrounding crack cocaine markets, particularly in large cities. It is not clear what role the decline in youth violence and crack markets may have played in workplace homicides. The present analysis begins in 1993—at the time of the beginning of the sharp decline in youth homicide rates. Additional studies are needed to determine and address what relationships exist, if any, between violence related to crack cocaine and workplace homicide rates.

The crux of the issue with regard to changes in economic opportunity and crime rates is the availability of legitimate employment opportunities. While Rosenfeld [2002] points out that there is debate among social scientists as to the precise nature of the relationship, he posits that “it is the combination of rising legitimate and falling illegitimate opportunities that has made criminal activity a less attractive

alternative to legal work for many low-income youth.” Janicek [2003] examined the relationship between unemployment rates and workplace homicide rates using regional level average monthly occupational homicide data and monthly employment and unemployment data from 1997 to 2000. He reports statistically significant differences in workplace homicide rates by region of the country as well as a statistically significant correlation between regional unemployment rates and workplace homicide rates. While these data do not permit generalizations with regard to causality, it does confirm the potential influence of economic opportunity on workplace homicide rates. Certainly, a bulk of the period of time analyzed here (1993–2002) reflects a period of economic prosperity in the U.S. and this may, in a large part, help to explain the dramatic declines in Type I, criminal intent, workplace homicides.

In reviewing the criminology literature with regard to the declines in homicide rates among adults, a clear pattern emerges with regard to significant declines in homicides among current or former intimate partners in the general U.S. population. These declines are attributed both to declining marriage rates and to the expansion of domestic violence advocacy and prevention programs [Rosenfeld, 2002]. It is interesting to note that in the present analysis, Type IV workplace homicides—that is, those involving a personal relationship between the worker and the offender—have actually declined significantly less than overall workplace homicides and declined the least of the four types. Future research should explore the extent to which workplace homicides of intimates are a function of the victim being protected in other settings, but still being vulnerable on the job. Clearly, the economic independence which is crucial to leaving an abusive relationship requires victims to maintain employment and this may pose particular risks for intimate partner homicides to occur in or around the workplace.

Policing strategies such as tougher arrest and sentencing policies as well as community policing and targeted intervention strategies have been credited particularly in specific urban centers for reducing violent crime rates, including homicides [Rosenfeld, 2002, 2004]. It is less clear what role these strategies may have in accounting for changes in national level crime statistics. Given that businesses can play a role in community policing, it seems that these efforts may have the potential to impact workplace homicide rates, particularly those related to robberies and other crimes.

In the 20 years from 1980 to 2000, the U.S. prison population increased fourfold [Rosenfeld, 2002, 2004]. The precise impact, however, of this dramatic increase in incarceration on overall U.S. crime rates is not entirely clear [Rosenfeld, 2002; Rosenfeld, 2004] and sorting out its impact on workplace homicides specifically is virtually impossible. It could be argued that workplace homicide rates may be reduced if a larger portion of “career” criminals are now incarcerated, but it is unlikely that such an explanation

could account for a substantial portion of the significant declines reported in this article. And, as Rosenfeld (2002) points out, the long-term economic and community effects of large-scale incarceration are not yet understood.

It is worth noting that one striking difference between overall homicide statistics and workplace homicide figures is that only 17% of all U.S. murders occur in conjunction with a robbery, burglary, or larceny [BJS, 2003b], while in the workplace, 82% occurred during the course of a robbery or another crime (Type I). While some of this difference is due to definitional differences in the two reporting systems, a previous study found that approximately 67% of workplace homicides were due to robbery during 1998 [Sygnatur and Toscano, 2000]. This difference may be a reflection that a larger portion of workplace homicides are instrumental crimes—that is, they are committed in order to obtain a specific goal such as money—versus expressive crimes which are committed more out of anger, fear, frustration, or retaliation. Due to the lack of data on the perpetrators, it is not possible to test this theory explicitly. Additionally, if robbery-related homicides declined substantially during the period of time under consideration here, the overall decline in workplace homicides would be affected more strongly than the overall decline in all U.S. homicides as found in this analysis.

In addition to overall changes in the U.S. which may affect workplace homicide rates, a number of research and prevention activities have taken place in the occupational safety and health community over the last 15 years which could, at least in part, account for the reduction in the number and rate of workplace homicides. For example, the National Institute for Occupational Safety and Health (NIOSH) published several documents raising awareness of the risk factors and potential strategies to address workplace violence [NIOSH, 1992, 1993, 1996, 2006]. Additionally, NIOSH researchers published a series of articles examining the state of knowledge regarding risk factors for employee injuries and robberies specific to convenience stores and disseminated this information broadly [Amandus et al., 1995, 1996, 1997; Hendricks et al., 1999]. The Occupational Safety and Health Administration (OSHA) issued non-mandatory guidelines or recommendations for preventing violence and homicides in healthcare settings [OSHA, 1996], in late-night retail settings [OSHA, 1998], and for taxicab and livery drivers [OSHA, 2000]. The range of research and prevention efforts undertaken by academic researchers, business and labor groups, and government agencies were summarized in a series of articles published in the *American Journal of Preventive Medicine* in 2001 [Barish, 2001; Merchant and Lundell, 2001; Peek-Asa et al., 2001; Rosen, 2001; Runyan, 2001; Wilkinson, 2001]. Professional and trade associations have also conducted relevant research and made recommendations for the prevention of workplace violence [ASSE, 2001; Sullivan, 2004; ASIS, 2005]. Due to the increase in

awareness and research, many businesses have implemented numerous workplace violence prevention efforts throughout the time period of this study.

CONCLUSIONS

While workplace homicides are declining in the U.S., the declines are not occurring uniformly across demographic and occupational categories. The largest decreases occurred in Type I workplace homicides (generally robbery-related) and the industries, occupations, and locations generally associated with these types of workplace homicides. Although Type I workplace homicides demonstrated the greatest decrease in homicides from the period 1993 to 2002, these type of workplace homicides still account for the vast majority of all workplace homicides; Type I workplace homicides accounted for 78% of all workplace homicides in 2002.

This analysis points to a myriad of societal and workplace issues which are important in understanding workplace homicide rates. Future research and prevention efforts should focus on investigating the effectiveness of workplace interventions after adjusting for other societal changes. Future research should also focus on replicating successes in reducing Type I workplace homicides and addressing those areas where little or no change has occurred—that is, Types II, III, and IV workplace homicides. Such efforts will need to include partnerships between labor, industry, academics, safety and health professionals, security experts, and others who have the ability to change the way work is conducted so that the risks of workplace homicide are further reduced for working Americans.

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