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Cameron S. Crandall
University of New Mexico, ccrandall@salud.unm.edu

Peter F. Jost
University of New Mexico

Lisa M. Broidy
University of New Mexico, lbroidy@unm.edu

Jerry Daday
Western Kentucky University, jerry.daday@wku.edu

David P. Sklar
University of New Mexico - Main Campus, dpsklar@salud.unm.edu

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Cameron S. Crandall
Department of Emergency Medicine
University of New Mexico

Peter F. Jost
Department of Emergency Medicine
University of New Mexico

Lisa M. Broidy
Department of Sociology
University of New Mexico

Gerhard Daday
Department of Sociology
University of New Mexico

David P. Sklar
Department of Emergency Medicine
University of New Mexico

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Abstract

Objective

To differentiate risk factors for future homicide victimization and offending, we measured emergency department (ED) use among homicide victims, offenders and controls.

Methods

Design

Matched case control.

Setting

Bernalillo County, NM and its university affiliated health sciences center and hospital.

Participants

Cases: All Bernalillo County homicide victim (N=124) and offender (N=138) cases identified between January 1996 and December 2001 who linked to university physician billing records and who had health care use during the 3 years prior to the homicide incident. *Controls:* Randomly selected age- (±1 year)

and sex-matched controls with health care use within 3 years of their matched pair's homicide.

Main Outcome Measures

The number and type of ED visits by cases and controls.

Results

Among the 124 victims and 168 offenders who used health care, most were male (80%) and averaged 27.7 years of age. Victims and offenders had similar health care utilization and were grouped for final analyses. Cases (victims and offenders) were more likely to have had an ED visit within 3 years of the homicide (85%) compared to controls (59%) (odds ratio (OR): 4.3, 95% confidence interval (CI) 3.0, 6.2). Within previous ED visits, assault (OR 4.5, 95% CI 2.9, 7.0), firearm injury (OR 13.6, 95% CI 4.9, 37.7), and substance abuse (OR 3.7, 95% CI 2.2, 6.0) were associated with future homicide. ED visits for cases but not controls increased in the months leading up to the homicide incident ($p<0.001$).

Conclusions

Patients with ED visits for assault, firearm injuries and substance abuse are at increased risk for homicide and often have an escalating number of visits leading up to the homicide event. ED-based identification and referral programs

similar to those used for intimate partner violence or other preventive strategies should be considered for this high risk population.

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Introduction

Background

Homicide is now the number two cause of death for people ages 15–24 years, making it a major public health priority.[1] Several factors are associated with homicide, including: alcohol and drug use,[2,3] ethnicity,[4,5] gang participation,[2,5] firearms, [2,5,6,7,8] poverty,[5] and mental illness.[9] Most attempts to decrease homicide have been conducted through the criminal justice system and have emphasized punishment and other deterrents, including the death penalty, to prevent homicide.[2] Public health agencies nationally and worldwide, however, increasingly view violence as a problem that demands a public health response.[1] Most previous public health research on homicide prevention has focused on victims of abuse. In one study, 44% of intimate partner violence (IPV) homicide victims had previous emergency department visits and 93% of these were injury-related visits.[10] Additionally, a significant proportion of IPV homicide victims have evidence of recent prior injury on autopsy.[10,11] If these patterns hold for other types of homicide, then efforts like those aimed at early recognition and referral of IPV victims by health care workers can serve as a model for reducing all forms of homicide.

Importance

Despite much scientific investigation of homicide victimization and offending, there has been little investigation of emergency department (ED) utilization prior to the homicide event. Such an investigation could demonstrate the usefulness of health care data to identify future homicide victims and offenders by identifying risk factors associated with homicide and examining patterns of ED use in the weeks and months leading up to the homicide event. Additionally, this analysis would allow for a comparison of health-related characteristics of victims and offenders of homicide, a group that has been suggested to be very similar.[12,13] The information obtained could be useful in the development of risk profiles and target individuals, both potential victims and offenders, for intervention prior to the homicide event.

Goals of this investigation

We identified homicide victims and offenders and compared them to controls to characterize ED and other health care system utilization prior to the violent incident. Our goal was to identify patterns and factors that might prospectively identify individuals at increased risk of future violence.

Methods

Theoretical model of the problem

There is a growing body of criminological theory and research to suggest that violent victimization and offending are intricately linked. This work is framed by lifestyle/routine activities theory.[12,13] According to this theory, a criminal event occurs when a motivated offender, a suitable target/victim, and the absence of capable guardianship all converge. The theory further argues that certain individuals are more likely than others to experience this convergence. The likelihood of violence is determined by variation in lifestyles (particularly vocational and leisure activities), which are largely shaped by demographic and social characteristics. Many lifestyles are associated with risky activities and behavior, such as drinking and driving, alcohol and drug use, and ownership of weapons. Ultimately, it is these high risk lifestyles that increase an individual's chances for both victimization and offending. From this perspective, victims and offenders of violent crime have common characteristics that distinguish them from the general population. Because these distinctions manifest as high risk behaviors, they increase the likelihood of injuries and illnesses,[14,15,16] which often result in emergency department (ED) visits. As such, the ED offers an ideal location for screening individuals at risk for future involvement in violence based upon demographic, social, behavioral and visit characteristics.

Study design

We used a matched case control design to compare homicide victims and offenders with age- and sex-matched controls to measure the association of prior health care visits and subsequent violence.

Setting

Bernalillo County contains New Mexico's largest and most urban city, Albuquerque. The population of Bernalillo County was 556,678 persons in the 2000 census, of whom 80.6% lived in Albuquerque.[17,18] Two principal law enforcement agencies cover Albuquerque and Bernalillo County: 1) the Albuquerque Police Department (APD) and 2) the Bernalillo County Sheriff's Department (BCSD). The jurisdictional area covered by these two agencies serves as the referral area for the homicide cases. The University of New Mexico Health Sciences Center (UNMHSC) contains New Mexico's only medical school and teaching hospital complex. The health complex is the state's only Level I trauma center and is the only public hospital in Albuquerque and Bernalillo County to serve the general public. From July 2001 through June 2002, UNMHSC had more than 750,000 visits from 125,000 different patients.

Selection of participants

Case and control definitions

Cases: Cases were derived from the population of police identified Bernalillo County homicide victims and offenders from incidents that occurred between January 1, 1996 and December 31, 2001. Homicide victims and offenders who linked to physician billing records and who had a health care encounter that generated a physician bill within the three years preceding the homicide incident defined a case. Of the 361 homicide victims and 400 offenders from incidents during the study period, a similar proportion of victims (54%) and offenders (59%) linked to health care records over a period of the prior ten years (proportion difference: -5%; 95% confidence interval (CI): -12% to 2%). Among the homicide victims and offenders who linked to health care records, a slightly greater percentage were Hispanic (linked: 61.3%; unlinked: 56.5%) and were from poorer communities (percentage of residents in the subject's census block group below poverty level) (linked: 25.3%; unlinked 22.9%) than those who did not link. Of those who linked, a similar proportion of victims (64%) and offenders (59%) used health care at UNMHSC in the three years leading up to the homicide incident (proportion difference: 5%; 95% CI: -2% to 12%).

Controls: Age- and sex-matched controls that had used health care in the UNMHSC system were selected from the physician billing records. A sampling frame of all potential age- and sex-matched controls was selected from the billing

database. Age was matched to within ±one year to their control. Age was measured for both cases and controls at the time of the homicide incident. Just as the list of cases was restricted to those who had had a health care encounter in the three years before the homicide incident, we imposed this same criterion to the controls. The list of controls was limited to only those individuals who had at least one billing record in the three years prior to their matched pair's homicide incident date. This allowed us to examine the distribution of the control's visits relative to a fixed date, while simultaneously adjusting for the seasonality of health care visits and trauma. For the small number of cases without gender information (n=24), controls were matched only to age. Controls were randomly sampled without replacement from the sampling frame. Because of the rarity of some of the exposures, especially among the controls (*e.g.*, firearm-related visit), five controls per case were drawn to increase statistical power. In a few instances, the control selection routine only identified four controls (n=17) or three controls (n=2), yielding 21 controls less than the 1,310 predicted.

Methods of measurements

Health care utilization was measured from physician billing records for visits to the UNMHSC hospitals and affiliated clinics. The UNMHSC uses a single university affiliated billing agency. Demographic data from the homicide

victim and offender criminal justice data were linked to health care records using last name, first name, gender, date of birth and social security number.

The billing records are itemized by invoice and represent each separate billable item. Each billing invoice can have up to four International Classification of Disease 9th Version Clinical Modification (ICD–9CM) diagnostic and current procedural terminology (CPT) codes. The initial analysis dichotomized case and control exposures into ever/never categories for particular health care encounter (*e.g.*, an ED visit for substance abuse or a firearm injury-related visit). Each health care visit type was coded as '1' for having the particular visit type characteristic (*e.g.,* ED visit) and '0' for not having the visit type characteristic (*e.g.,* no ED visit). Table 1 lists the diagnostic and visit type classifications by ICD–9CM codes. Unless otherwise specified, all subsequent decimal ICD–9CM codes were included within the range (*e.g.*, 290.1 and 290.2 were included with code 290; 305.31 was included with 305.3). Health care encounters resulting from the homicide incident itself were not included.

We defined a health care encounter as a unique day for which health care was obtained. When more than one visit occurred on any particular day, it was difficult to determine reliably which invoices were associated with which specific visit; therefore, we could not distinguish between multiple encounters on any given day. For this reason, visits on the same day were combined and subjects could only have one visit per day.

The time (in days) between the health care encounter and the homicide incident for both cases and controls was measured by subtracting the date of the health care encounter from the date of the homicide incident for the case, or that of their matched pair for the controls (Figure 1).

Outcome measures

We calculated the odds of key health care encounter visit types for cases and compared them to the odds observed for controls. Consistent with the theoretical model, health care encounter types were selected to represent various behaviors associated with risky lifestyles. Specific ED health encounters that were hypothesized *a priori* as associated with case control status included visits for injury, assault, firearm injury, alcohol, drugs, and mental illness.

Primary data analysis

The number and type of health care visits, in particular ED visits, were compared between cases and controls in the three years before the homicide. Figure 1 provides a schema of the comparisons between cases and controls. We analyzed victims and offenders separately and then combined them for later analyses as their results were similar. Matched pair odds ratios were used as the measure of association between case and control status and the dichotomous exposure factors of interest.

We also compared the absolute and relative differences in the number of visits between cases and controls. The number of separate encounters for indicator visits was counted and compared between the case-control matched pair using a paired analysis that adjusted for the correlation within case-control groups. For the absolute differences, the number of ED visits for a particular case was subtracted from the number of ED visits for their matched controls. These differences were then averaged for each visit types. For relative differences, the number of visits for cases and controls were compared as a ratio of counts. Confidence intervals were calculated using general linear modeling and generalized estimating equations (GEE) with an exchangeable correlation matrix.[19] This method calculates standard error estimates that adjust for the correlation within each case-control stratum. For absolute differences, we used the normal distribution and an identity link. For relative differences, we used the Poisson distribution and a log link.

The time distribution of health care encounters in days leading up to homicide incident was compared between the cases and controls using the uniform distribution, with an expected value of -545 days (midway point in the three years) as the expected median value under the null hypothesis.

SAS software (version 8.2, Cary, NC) was used throughout. PROC PHREG was used for the conditional logistic regression modeling; PROC

GENMOD was used for general linear modeling. Confidence intervals for medians were calculated in SAS using PROC LIFETEST.

We used a two-tailed Type I error rate of 5% to determine statistical significance.

The University of New Mexico Health Sciences Center and the University of New Mexico institutional review boards gave this study full review and approved the study design with a waiver of informed consent.

Results

The demographic characteristics of the homicide victims and offenders, separately and together (cases), and their matched controls are presented in Table 2. Offenders were more likely male (victims (V): 73.4%, offenders (O): 86.2%, difference: 12.8%, 95% CI: 3.1, 22.5) and were slightly younger (2.7 years, 95% CI: 0.03, 5.5) compared to victims. Due to matching, age and sex characteristics of cases and controls were similar. The year of the homicide, weapon use, and incident location are also shown in Table 2.

Victims and offenders had nearly equivalent patterns of health care visits (Table 3). The ED was the most common site of health care access for both victims and offenders (V: 84.7%; O: 84.8%), followed closely by other outpatient sites (V: 83.1%; O: 80.4%). Over one-quarter had been admitted to the hospital for at least one day (V: 29.8%; O: 24.6%). Slightly more than one-quarter of the

homicide victims and offenders (V: 30.6%, O: 25.4%) ever had an identified primary care physician. Only drug abuse visits (V: 3.2%; O: 10.1%; difference: 6.9%; 95% CI: 0.1, 13.4) and firearm-related visits (V: 2.4%; O: 8.7%; difference: 6.3%; 95% CI: 0.1, 12.4) stood out as different between victims and offenders.

Because of the similarities of victims and offenders, we analyzed them together as cases and compared them to controls (Table 4). Cases were substantially more likely to have ever been seen in the ED compared to controls (OR: 4.27; 95% CI: 2.95, 6.19); cases also were more likely to have been admitted to the hospital (OR: 1.45; 95% CI: 1.07, 1.98). Compared to controls, homicide cases were more likely to have had a mental health visit, particularly for substance abuse (OR: 3.57, 95% CI: 2.36, 5.42). Within visits to the ED, cases were more likely to have had an injury visit (especially assaults (OR: 4.47) and firearm injury (OR: 13.6)) or a substance abuse visit, particularly for alcohol (OR: 4.48).

Cases as a whole had 1.2 more ED visits compared to controls (95% CI: 0.9, 1.4). ED visits for any reason, inpatient visits, and ED visits for substance abuse accounted for the greatest absolute difference in visit numbers between cases and controls. Cases were more likely than controls to have had multiple ED visits in a three year period, with at least one being injury-related. Firearm-related injury visits, ED assault visits, and ED alcohol-related visits accounted for the greatest relative difference in visits between cases and controls.

The association of prior ED visits and future homicide varied by sex. Women had a stronger association of prior ED visits for injury (OR females: 6.2; 95% CI: 3.1, 12.2; OR males: 2.1; 95% CI: 1.5, 2.8), mental illness (excluding substance abuse) (OR females: 7.9; 95% CI: 2.3, 27.3; OR males: 1.0; 95% CI: 0.4, 2.3), and alcohol abuse (OR females: 24.1; 95% CI: 2.8, 206.8; OR males: 3.7; 95% CI: 2.0, 6.7) compared to men. Among men, we observed a strong association of prior firearm injury and homicide involvement. We could not estimate the odds ratio for women as there were no prior firearm injuries among women (OR males: 13.6; 95% CI: 4.9, 37.7; OR females: undefined).

A small number (N=7) of victims and offenders were less than 15 years of age. Elimination of these cases from the analysis did not appreciably change the results.

Among the cases, the number of ED visits rose significantly as the day of the homicide incident approached and differed significantly from the pattern observed in the controls. The median value (in days) for the distribution of ED visits for cases (median: -402 days; 95% CI: -434, -364) was closer to the homicide incident than was the median value for control ED visits (median: -487 days; 95% CI: -498, -474) (Figure 2). A similar pattern of increasing visits was observed for both the homicide victims and offenders. We could not identify any particular visit types that accounted for this increasing pattern.

Limitations

Our data are limited by the use of billing records to characterize visit diagnoses and not actual chart abstraction. It is possible that some subjects had diagnoses which were apparent in reading the chart, but were not entered as diagnoses in the billing codes. We are currently performing chart abstractions on the cases to determine if more specific and discriminative information about their visits can be obtained.

We only examined the health care utilization at one of Bernalillo County's hospitals, suggesting a potential source of selection bias. UNMHSC is the area's only Level 1 trauma center, therefore it sees a disproportionate amount of trauma. One may infer, however, that because UNMHSC is the only trauma center, that this study likely captured a more complete assessment of serious trauma among the cohort than for medical illness, which may be seen at any number of local emergency departments. We have no data on the stability of this population regarding movement in or out of the hospital catchment area or on changes in economic status for either cases or controls. It is possible that prior violence, injury, or medical conditions have differentially affected patterns of health care utilization. A statewide or regional database of health care visits would help address these limitations.

Only a subset of the total number of homicide victims and offenders are represented in our analysis. Homicide victims and offenders who used our health

complex were more likely Hispanic and came from disadvantaged communities compared to those who did not use our health care system. Thus, we caution that our findings may not be generalizable to those who did not use our health care system. Whether the lack of health care utilization at our health system denotes generally better health or selection of other health care facilities (because of geography or financial capacity) is uncertain. Therefore, we limit our findings to those patients who do use our services. Of note, however, this subset of homicide victims and offenders differs substantially from our health care system's average health care user.

In a few instances, our control selection routine failed to produce five controls for each case. We believe that this was due to a faulty programming routine that failed to return to the start of the control selection list when the sampling routine began near the end of the list. We do not believe that this error introduced any significant biases.

A priori, we limited our investigation to a specific list of potential "at risk" identifiers. We did not investigate whether certain chronic medical conditions (*e.g.*, asthma, chronic pain) were associated with future violence. As a very broad list of ICD–9 billing codes are required to capture these conditions, a chart abstraction of past medical history may prove a more useful method to identify this type of marker.

We did not have any direct measures of ethnicity or markers of socioeconomic status (*e.g.* education, income, occupation). These factors likely would prove useful in differentiating future violence risks.

Finally, our findings are subject to standard admonitions regarding case control study designs, including misinterpretation of odds ratios as relative risks, selection bias, and limitations of retrospective data. Our data are not, however, subject to recall bias, as we used data collected for other reasons (billing records) to capture health care utilization.

Discussion

Our study identifies health care usage patterns by victims and offenders that differ significantly from a similar age and sex group. A careful examination and combination of these factors may lead to the prospective identification of individuals during an ED visit who are at increased risk of future violence.

Victims and offenders tended to use the ED more than any other health care resource, suggesting that the ED is a good place to identify and refer cases. The accelerating pattern of ED visits as the homicide incident approached also suggests a potential red flag to identify patients at risk for serious future violence. The pattern of increasing ED visits is consistent with theoretical and empirical work in criminology, which suggests that those at increased risk for violent offending and victimization often have a lifestyle that exposes them to violence,

drugs and alcohol use, all of which could increase the need for health care.[12,13,20] Recent work by Hensen *et al*.[21] has also noted a pattern of increasing calls for service among emergency medical services (EMS) in the immediate geographic area of the homicide incident in the days and weeks prior to the homicide. This observation in the prehospital arena is analogous to our observation of clustered visits proximate to a violent event. In addition, an increase in EMS calls for service will likely result in increased numbers of ED visits.

The homicide rate in the United States exceeds that of any other high-income country[22] underscoring homicide and violence as a national public health problem.[1] Emergency departments are charged with the task of treating injuries resulting from violence, but are also well situated to take a proactive role in preventing violence.

Professional organizations, including the American College of Emergency Physicians,[23] have taken the position that health care providers should screen patients for intimate partner violence and make appropriate referrals. These types of activities may serve as an intervention model for other forms of interpersonal violence. While the efficacy of intimate partner violence screening programs is not well established,[24] such activities have construct validity. Referral of patients with a history substance abuse may be an important target population, as substance abuse treatment has been shown to decrease violence experienced among couples with a history of intimate partner violence.[25] Intervention

programs among adolescent youth have also been shown to reduce self-reported high risk behaviors among disadvantaged youth.[26] If we are able to identify and intervene with at-risk patients by mobilizing the broad array of existing resources in medicine, mental health, social services and substance abuse services toward the prevention of injuries and deaths from violence, we may have success with this public health crisis.[1] Further study is needed to assess the effectiveness of violence intervention programs in the emergency department setting.[27]

The association of homicide and mental illness, especially substance abuse, alcohol- and drug-related visits is consistent with prior retrospective and cross-sectional studies that have demonstrated a positive correlation between alcohol and drug use and homicide victimization and offending.[3] Our study documents this association with nonconcurrent prospective data (*i.e.,* the substance abuse diagnoses were established prior to the homicide incident in data collected for routine purposes). Victims and offenders also had more ED injury visits, including assault and firearm visits, with firearm visits showing the strongest association. These factors may identify future homicide victims and offenders.

While prior ED firearm injury visits are uniquely predictive of homicide involvement among men, we observed stronger associations of prior ED visits for non-firearm-related injury, mental illness and substance abuse for women compared to men. These observations are consistent with prior studies in the

criminology literature, which have shown higher rates of mental illness and substance abuse among female as compared to male offenders.[28] After stratifying by sex, we no longer noticed an association of prior mental illness diagnosis among male cases compared to male controls. This may in part be due to greater acceptability and use of mental health services among women as compared to men, leading to a relatively greater likelihood of recognizing and diagnosing mental illness in women compared to men. These differential observations between men and women suggest that sex-specific criteria may be needed to identify future violent victims and offenders.

The similar health care utilization patterns of victims and offenders demonstrate that victims and offenders represent a very similar at-risk population. While health care has traditionally viewed victims and offenders as distinct and separate populations, previous sociological studies support the theory that offender and victim groups overlap significantly and represent the same violence-exposed population.[29,30,31]

Our study provides initial evidence that health care providers may be able to identify patients at higher risk of either committing or becoming a victim of future interpersonal violence. Several factors suggest that this may be possible. First, it is important to note the striking similarities between homicide victims and offenders and their differences from controls. Second, that there are specific types of health care and ED visits, including visits for mental health, drug and alcohol

use, and injuries (especially assault or firearm injury), that put these patients at higher risk for future homicide involvement. Finally, homicide victims and offenders exhibited a pattern of increasing emergency department and health care utilization over time that suggests an increased risk of future violence. Whether a combination of these factors with additional characteristics, such as socioeconomic factors and prior criminal or victimization histories will have sufficient sensitivity and specificity to identify future violent incidents deserves further study. These factors appear to allow identification of patients at higher risk of future homicide involvement, which will hopefully allow intervention and prevention of future violence and homicide.

Table 1. Diagnostic and visit type classifications by ICD–9CM codes within the billing database.

Diagnostic/Visit type	ICD–9CM Codes
Injury visit	800–959
Mental health visit	290–319
Mental health visit (excluding substance abuse)	290, 293. 294–302, 306–319
Alcohol-related visit	291, 303, 305.0,
Drug use-related visit	292, 304, 305.2, 305.3–305.9
Substance use-related visit	Either alcohol or drug use codes
Suicide/Self-inflicted injury visit	E950–E959
Assault visit	E960–E969
Firearm visit	E922, E955, E965.0–4, E958.0–4, E970

Table 2. Demographic characteristics of homicide victims, offenders and matched controls and homicide incident characteristics. Bernalillo County, New Mexico, 1996–2001.

	Cases						Controls	
	Victims		Offenders		Total		Total	
	N	%	N	%	N	%	N	%
Total	124	47.3%	138	52.7%	262	—	1,289	—
Demographics								
Male	91	73.4%	119	86.2%	210	80.2%	1,021	79.2%
Female	33	26.6%	19	13.8%	52	19.8%	268	20.8%
Age (in years)*								
Mean	29.1		26.4		27.7		27.8	
SD	13.1		9.0		11.2		11.3	
25% quantile	20.0		19.5		19.6		19.8	
50% quantile (median)	26.8		23.0		24.2		24.2	
75% quantile	37.8		53.9		34.5		34.6	
Homicide incident characteristics								
Year of homcide incident								
1996–97					97	37.0%		
1998–99					89	34.0%		
2000–01					76	29.0%		
Weapon								
Firearm					155	59.2%		
Knife/Cutting instrument					41	15.6%		
Personal weapons (hands/feet)					35	13.4%		
Blunt object					13	5.0%		
Asphyxiation					8	3.1%		
Other/Type unknown**					10	3.8%		
Location								
Residence/Home					109	41.6%		
Highway/Road/Alley					74	28.2%		
Parking lot/Garage					32	12.2%		
Jail/Prison					10	3.8%		
Field/Mesa/Lake					9	3.4%		
Motel/Hotel					8	3.1%		
Commercial business					7	2.7%		
Other					13	5.0%		

*Age of the homicide case at the time of the homicide incident. Age of controls is their age at the time of the homicide incident of their matched pair.
**Other weapons used included: unspecified/unknown (4), motor vehicle (3), and fire/incendiary device, drugs/narcotics and none used (1 each).

Table 3. Visit characteristics of homicide victims and offenders, by victim and offender status, Bernalillo County, New Mexico 1996–2001.

Visit characteristics	Victims		Offenders	
	N	%	N	%
Total	124	—	138	—
Visit Types				
ED visit	105	84.7%	117	84.8%
Other outpatient visit	103	83.1%	111	80.4%
Inpatient stay	37	29.8%	34	24.6%
PCP identified in record	38	30.6%	35	25.4%
Mental Health Visits				
Psychiatric diagnosis	33	26.6%	38	27.5%
Psychiatric diagnosis, excluding substance abuse	17	13.7%	21	15.2%
Substance abuse diagnosis	19	15.3%	24	17.4%
Alcohol diagnosis	16	12.9%	14	10.1%
Drug diagnosis	4	3.2%	14	10.1%
Suicide attempt	2	1.6%	1	0.7%
ED Visit Types				
ED injury-related visit	68	54.8%	71	51.4%
ED assault-related visit	20	16.1%	19	13.8%
ED firearm-related visit	3	2.4%	12	8.7%
ED psychiatric diagnosis	18	14.5%	19	13.8%
ED psychiatric diagnosis, excluding substance abuse	5	4.0%	8	5.8%
ED substance abuse diagnosis	14	11.3%	14	10.1%
ED alcohol diagnosis	13	10.5%	11	8.0%
ED drug diagnosis	1	0.8%	4	2.9%

Abbreviations: ED, emergency department; PCP, primary care physician

Table 4. Visit characteristics of homicide victims and offenders and controls, Bernalillo County, New Mexico, 1996–2001.

Visit Characteristic	Cases		Controls					Number of visits (mean)		Differences in the number of visits						
	N	%	N	%	Odds ratio*	95% CI**		Cases	Controls	Absolute Difference	95% CI		Relative Difference†	95% CI		p†
Total	262	—	1,289	—												
Visit Types																
ED visit	222	84.7%	759	58.9%	4.27	2.95	6.19	2.40	1.24	1.16	0.88	1.44	1.93	1.63	2.29	<0.001
Other outpatient visit	214	81.7%	1,021	79.2%	1.18	0.84	1.66	5.63	4.95	0.69	-0.69	2.13	1.14	0.88	1.48	0.325
Inpatient stay	71	27.1%	265	20.6%	1.45	1.07	1.98	3.33	2.14	1.19	-0.38	2.76	1.56	0.94	2.58	0.086
PCP identified in record	73	27.9%	353	27.4%	1.03	0.76	1.38	0.95	0.78	0.17	-0.20	0.54	1.22	0.82	1.81	0.334
Mental Health Visits																
Psychiatric diagnosis	71	27.1%	191	14.8%	2.20	1.59	3.03	1.37	0.91	0.46	-0.58	1.51	1.51	0.66	1.13	0.326
Psychiatric diagnosis, excluding substance abuse	38	14.5%	138	10.7%	1.44	0.97	2.13	0.87	0.75	0.12	-0.94	1.17	1.15	0.33	3.98	0.823
Substance abuse diagnosis	43	16.4%	67	5.2%	3.57	2.36	5.42	0.53	0.17	0.36	0.11	0.61	3.15	1.55	6.38	0.001
Alcohol diagnosis	30	11.5%	45	3.5%	3.72	2.26	6.13	0.36	0.09	0.28	0.07	0.49	4.21	1.98	8.95	0.000
Drug diagnosis	18	6.9%	26	2.0%	3.58	1.91	6.72	0.18	0.08	0.10	-0.03	0.22	2.14	0.87	5.24	0.096
Suicide attempt	3	1.1%	12	0.9%	1.23	0.35	4.36	0.02	0.01	0.01	-0.02	0.04	1.73	0.38	7.92	0.477
ED Visit Types																
ED injury-related visit	139	53.1%	408	31.7%	2.56	1.94	3.39	1.26	0.60	0.66	0.40	0.92	2.10	1.67	2.64	<0.001
ED assault-related visit	39	14.9%	48	3.7%	4.47	2.85	7.00	0.25	0.06	0.19	0.11	0.28	4.50	2.78	7.28	<0.001
ED firearm-related injury	15	5.7%	7	0.5%	13.62	4.92	37.66	0.10	0.01	0.09	0.04	0.14	15.33	5.74	41.09	<0.001
ED psychiatric diagnosis	37	14.1%	70	5.4%	2.82	1.85	4.29	0.25	0.08	0.18	0.06	0.29	3.28	1.89	5.68	<0.001
ED psychiatric diagnosis, excluding substance abuse	13	5.0%	37	2.9%	1.82	0.94	3.50	0.05	0.04	0.02	-0.02	0.05	1.41	0.74	2.68	0.302
ED substance abuse diagnosis	28	10.7%	39	3.0%	3.66	2.23	6.01	0.21	0.05	0.16	0.05	0.27	4.43	2.22	8.81	<0.001
ED alcohol diagnosis	24	9.2%	27	2.1%	4.48	2.57	7.80	0.19	0.03	0.16	0.05	0.27	5.99	2.86	12.57	<0.001
ED drug diagnosis	5	1.9%	12	0.9%	2.03	0.71	5.76	1.18	0.01	1.16	-0.01	0.02	1.29	0.44	3.77	0.636

Abbreviations: ED, emergency department; PCP, primary care physician

*Matched pair odds ratios are presented throughout.

**95% Confidence Intervals (CI) about the matched pair odds ratio estimates.

†Differences presented are the mean values of the differences in visits counts for the specified visit type within the matched pairs. Conditional poisson regression was used to calculate the relative difference in visit number and for inference.

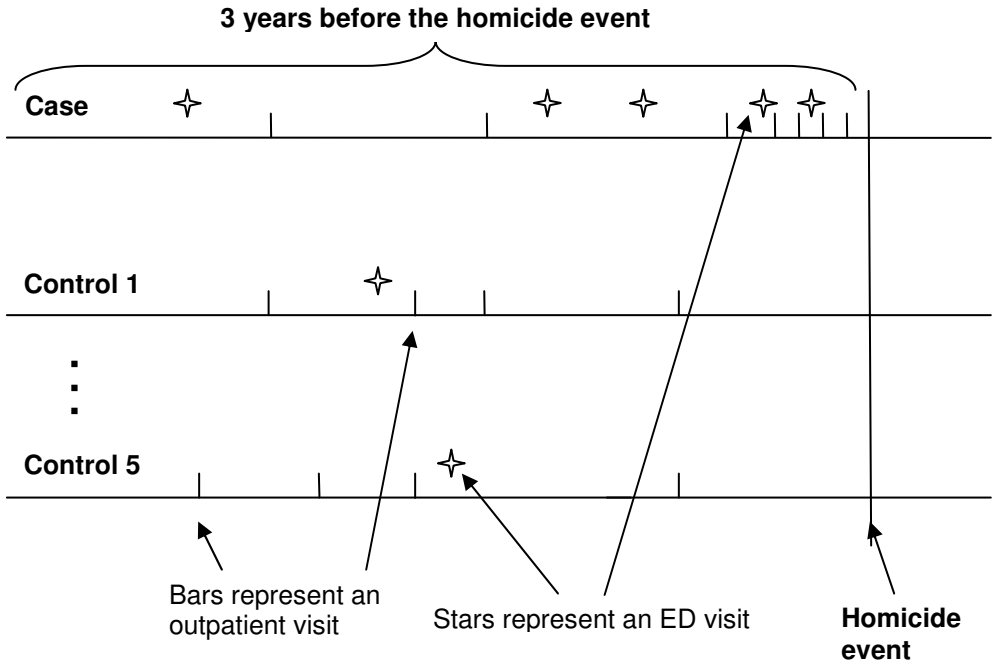

Figure 1. Schematic representation of the comparison of case and control health care utilization prior to the homicide event. Only two controls shown.

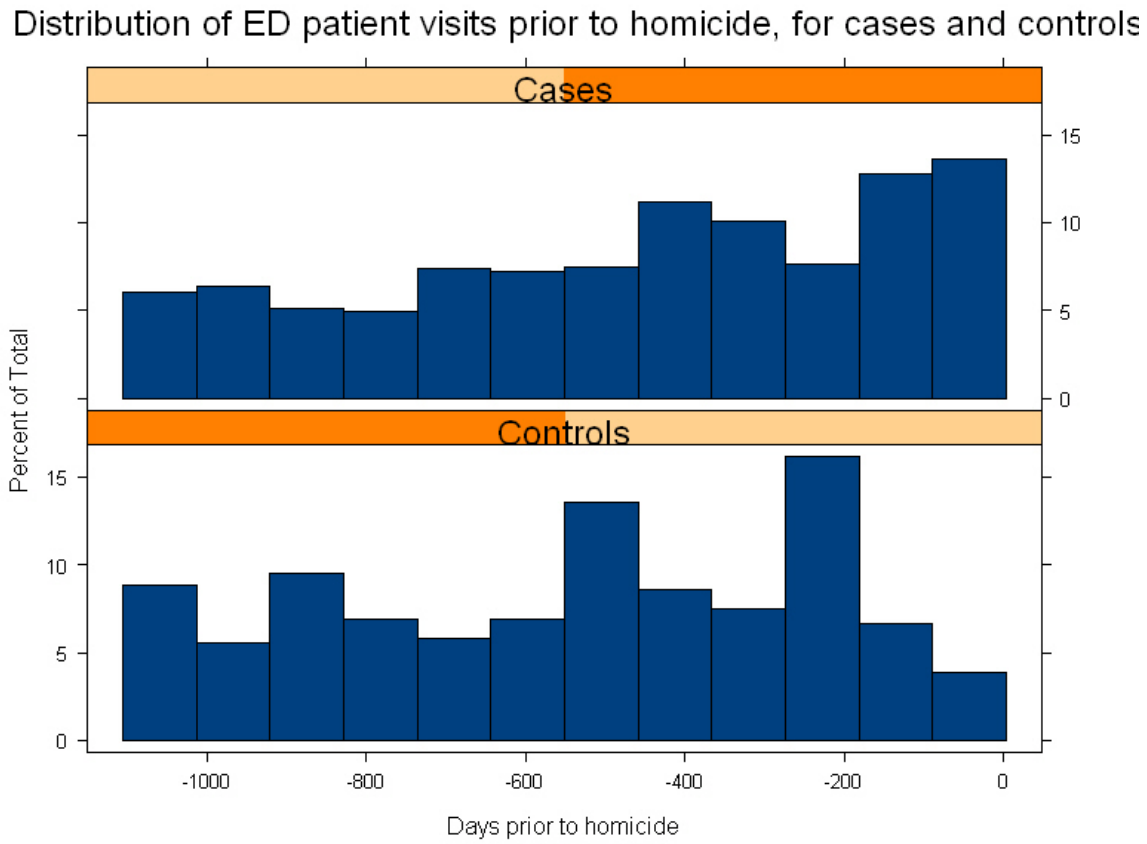

Figure 2. Time distribution of emergency department health care encounters in the three years leading up to the homicide incident. Bernalillo County, New Mexico, 1993–2001.

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