2004

The Case for Enhanced Data Collection of Gun Type

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Recommended Citation

Richmond, T. S., Branas, C., Cheney, R., & Schwab, C. W. (2004). The Case for Enhanced Data Collection of Gun Type. *The Journal of Trauma Injury Infection and Critical Care, 57* (6), 1356-1360. http://dx.doi.org/10.1097/01.TA.0000141886.22472.F5

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Abstract
Background: National surveillance systems have differentiated long guns into rifles and shotguns but fail to do so for handgun type. We sought to determine whether specific gun type data could be collected and whether knowledge of specific gun types (rifle, shotgun, pistol, revolver) could be used to distinguish gun homicide victims with respect to important injury parameters such as number of wounds.

Methods: Data on gun fatalities over a 5-year period in three communities were abstracted from medical examiner/coroner, police, and crime laboratory records.

Results: Gun type was obtained for 92% of 490 guns linked to 405 gun homicides. Handguns were associated with more wounds per gun than long guns ($p = 0.001$) and more entry wounds per gun than long guns ($p = 0.002$). Among handguns, pistols were associated with more wounds per gun ($p < 0.001$) and entry wounds per gun ($p = 0.001$) than revolvers. These same associations were not found among specific long gun types (i.e., rifles and shotguns).

Conclusion: Our findings demonstrate that information about gun type can be obtained and that significant differences exist in wounds per gun between long guns and handguns and between pistols and revolvers. Classification of long guns into rifles and shotguns and handguns into pistols and revolvers should be included in local, regional, and national data collection systems.

Keywords
Firearms, Handguns, Wounds, Surveillance, Injury, Mortality

Disciplines
Medicine and Health Sciences | Nursing

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Word Count: 1931

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Funding: The Joyce Foundation, Chicago IL

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Presented at SafeUSA Meeting, Atlanta, GA

Abstract

Background: National surveillance systems have differentiated long-guns into rifles and shotguns but fail to do so for handgun type. We sought to determine whether specific gun type data could be collected and if knowledge of specific gun types (rifle, shotgun, pistol, revolver) could be used to distinguish gun homicide victims with respect to important injury parameters such as number of wounds.

Methods: Data on gun fatalities over a 5 year period in three communities were abstracted from medical examiner/coroner, police, and crime lab records.

Results: Gun type was obtained in 92% of 490 guns linked to 405 gun homicides. Handguns were associated with more wounds-per-gun than long guns ($p=0.001$) and more entry wounds-per-gun than long-guns ($p=0.002$). Among handguns, pistols were associated with more wounds-per-gun ($p<0.001$) and entry wounds-per-gun ($p=0.001$) than revolvers. These same associations were not found among specific long-gun types, rifles and shotguns.

Conclusions: Our findings demonstrate that information about gun type can be obtained and that significant differences exist in wounds-per-gun between long-guns and handguns and between pistols and revolvers. Classification of long-guns into rifles and shotguns and handguns into pistols and revolvers should be included in local, regional, and national data collection systems.

Key Words: Firearms, handguns, wounds, surveillance, injury, mortality

Introduction

National data pertaining to automobile crash deaths have vastly improved over the past several decades and contributed to substantial decreases in crash-related deaths in the U.S.[3,5] Today, these data are readily accessible[4] and contain the many details of all fatal crashes, including information about specific automobile types (i.e. motorcycles, light trucks, sport-utility vehicles etc.). As the second leading cause of injury death in the U.S[4] after crashes, shootings have comparably little detail in the collection of data on specific gun types. Trauma centers treat a disproportionate share of patients sustaining gunshot wounds, have been shown to contribute to recent decreases in firearm fatalities,[9] and serve a central role in the surveillance of these gun injuries.

Trauma center surveillance of local and regional gun injury trends relies on national injury classification systems, such as external cause of injury codes (E-codes)[10,11] These and other similar injury classification systems have been integrated into hospital and State trauma registries and are incorporated in the American College of Surgeons' National Trauma Data Bank,[14] the Centers for Disease Control and Prevention's National Vital Statistics System,[12,13] and the Federal Bureau of Investigation's Uniform Crime Reports.[15] These registries inform prevention efforts by local trauma centers and serve as the data source of a large cadre of studies aimed at better understanding injury care, outcome and prevention, many of which are published in the *Journal of Trauma*. Although all these data systems have historically differentiated long-guns into rifles and shotguns, they have not likewise differentiated handguns into revolvers and pistols.[10,11,16] In addition, the newest E-codes[16] no longer differentiate long-guns into rifle and shotguns. (Table 1)

A lack of detail in terms of specific gun types may render significant differences between gun injury victims indistinguishable. In this paper, we examine whether specific gun type data can be collected and if knowledge of specific gun type can be used to distinguish gun homicide victims with respect to important injury parameters such as number of wounds.

Methods

We evaluated whether data about gun type could be collected and if gun type was associated with differential wounding in firearm homicides. The settings were trauma centers located in three medium-sized cities from different states. Existing surveillance systems had been shown to inadequately capture gun injury at the community level.[17] To remedy this, each trauma center implemented a more detailed firearm injury reporting system,[18,19] by partnering with local medical examiners/coroners, police, and crime laboratories. Site coordinators of a trauma center-community partnership project abstracted five years of firearm homicide data from the records of these organizations.[20] These data were used to investigate gun types and wounds among all firearm homicides occurring from 1994 to 1998. Data on wounds per body region were acquired from medical examiner's/coroner's records and were categorized according to the six Abbreviated Injury Scale regions.[21] Data on decedents, circumstances, environments, and gun was obtained from police departments and crime laboratories. Long-guns were separated into shotguns and rifles and handguns into revolvers and semiautomatic-pistols. For simplicity and because it is a common convention,[22,23] semiautomatic-pistols are referred to as pistols.

Bullet wounds were identified as either entry or exit cavities[24] by medical examiners and coroners. Wounding was operationalized as "wounds-per-gun" (the total number of wounds divided by the total number of guns) and "entry-wounds-per-gun" (the total number of entry wounds divided by the total number of guns). We examined the association of gun type with

wounds-per-gun and number of body regions injured. Data are presented with means, standard deviations, and 95% confidence intervals. Because of the potential for non-normality among our distributions, all statistical comparisons were completed with nonparametric Mann-Whitney U and Spearman rank-order correlation tests.

Results

Of 405 firearm homicides, 85% were shot with a single gun and 15% were shot with multiple guns. There were 490 guns identified, of which 92% were of known type (rifle, shotgun, revolver, pistol). All long-guns were of known type. Three-quarters of handguns were of known type. Of the 490 guns, 367 were handguns and 85 were long-guns. The majority of handguns (58%) were pistols while the majority of long-guns (62%) were shotguns.

A total of 30% of homicide decedents had one wound (viz. only one entry wound with no exit), 69% had multiple wounds and <1% were missing wound data. Handguns were associated with significantly more wounds-per-gun than long guns (4.01 $\pm$ 4.49 vs. 2.72 $\pm$ 3.65, p=0.001) and more entry-wounds-per-gun than long-guns (2.66 $\pm$ 2.57 vs. 1.94 $\pm$ 2.36, p=0.002). Among handguns, pistols were associated with significantly more wounds-per-gun (4.45 $\pm$ 4.84 vs. 2.00 $\pm$ 1.68, p<0.001) and entry wounds-per-gun (2.85 $\pm$ 2.86 vs. 1.54 $\pm$ 1.24, p=0.001) than revolvers. No such association was found between long-gun type and wounds-per-gun (rifles vs. shotguns: 3.00 $\pm$ 3.59 vs. 2.33 $\pm$ 3.51, p=0.56 respectively) and entry wounds-per-gun (rifles vs. shotguns:1.97 $\pm$ 2.17 vs. 1.75 $\pm$ 2.37, p = 0.99 respectively). (Figure 1) Correspondingly, 28.3% of individuals shot with pistols had more than 4 wounds-per-gun as compared to only 5.9% of individuals shot with revolvers. (Figure 2)

The association between wounds-per-gun and the number of body regions injured were similar among specific gun types. Pistols showed the strongest correlation (rho=0.56, p<.001)

followed by revolvers (rho=0.52, p<.001), rifles (rho=0.20, p=0.32) and shotguns (rho=0.14, p=0.38). The ordering of these associations was also the same for entry wounds-per-gun and the number of body regions injured: pistols (rho=0.56, p<0.001), revolvers (rho=0.50, p<.001), rifles (rho=0.26, p=0.19), and shotguns (rho=0.09, p=0.57).

Discussion

Mortality statistics indicate that prevention efforts should be concentrated on motor vehicles and firearms as the two leading causes of injury death.[4] Deaths due to motor vehicle crashes have decreased despite an increase in the miles driven; an accomplishment regarded as one of the top ten public health successes of the 20th Century.[5] This reduction was brought about through the application of systematic epidemiologic surveillance and analyses of motor vehicle crash data that included the effects of specific vehicle types and designs.[5] A comparable success may be possible for firearm injury, but more specific data are needed. There are 87 external cause of injury codes in the ICD 10 for land-based vehicles, accompanied by hundreds of specific sub-codes. In comparison, there are only 13 codes for firearm injury.[16]

The National Vital Statistics System no longer differentiates long-guns into rifles and shotguns and neither it nor the Federal Bureau of Investigation's Uniform Crime Reports differentiate handguns into revolvers and pistols.[10,11,12,15,16] While these systems provide information about the relative contribution of all guns to injury death, more specificity is needed. The value of specificity is highlighted in a recently released analysis of the effectiveness firearm laws in preventing violence.[25] This report identified aggregated data as a hindrance to effective research. Although the relatively new National Violent Death Reporting System[32,33] is a potential solution to this data oversight, it is currently being tested in a minority of states.

Our findings indicate that working directly with local medical examiners and police is a successful strategy to obtain specific data about gun type and better understand firearm death. Previous analyses using national vital statistics data found that gun type was unspecified in 75% of fatal shootings.[13] In the most recent of these analyses, the gun was unspecified in 84% of firearm homicides.[7] By comparison, we demonstrated that gun type could be obtained in all but 8% of the firearm homicides. These differences are most likely accounted for by the local nature of our data collection and our use of source documents beyond death certificates. Although in our study all long-guns were identified by type, one-fourth of handguns were of unknown type, a limitation of this study. The 25% missing data calls attention to the fact that local data can also have shortcomings. Possibly because they are more concealable than long-guns, handguns linked to homicides may not be retrieved or sufficient information may not be available to identify handgun type. However, if E-codes were to differentiate gun type at the state or national levels, it is probable that handgun data would improve over time.

Handguns and long-guns were associated with significantly different wounds-per-gun. Pistols were associated with more than twice as many wounds-per-gun than revolvers and largely accounted for the differences found between handguns and long-guns. Pistols also had the strongest association between wounds-per-gun and number of body regions injured. Additionally, more than one-quarter of individuals shot with a pistol had greater than 4 wounds-per-gun. These findings suggest that the extent of wounding from pistols is significantly different from that of other gun types. Pistol wounds may thus present distinct clinical challenges requiring the application of different clinical algorithms and sometimes competing treatment priorities.

One reason pistols produce more wounds-per-gun than revolvers may be due to the fact that the magazine capacity of pistols typically exceeds the number of chambers in most revolvers, [22,23] often allowing more shots to be fired. This increase in the number of shots fired is supported by a recent analysis of gun assaults where assailants with pistols were shown to fire more shots per incident than then assailants with revolvers.[26] In this way, the wounding profile of pistols compared to revolvers, combined with the manufacture of pistols in greater numbers,[22,27] the shorter time for pistols to go from first retail sale to crime,[28] and the trend of pistols being increasingly implicated in firearm homicide[18,29,30,31] further reinforce the need to collect data on specific handgun types.

Firearm violence is a complex disease that cannot be cured in isolation from the broader community, requiring the interaction between health care, criminal justice, and public policy. Our study has demonstrated that trauma centers can take the lead among these groups and pool resources to acquire data about firearm fatalities. Collecting gun type is an important step in fulfilling the goals of good epidemiologic surveillance - to identify epidemics, recognize clusters, and detect emerging conditions - as they apply to the prevention and amelioration of injuries.[1,2]

Our findings demonstrate that data on specific gun types can be collected and then used to distinguish firearm homicide victims with respect to important injury parameters such as number of founds. Much the same way that data collected on specific automobile types has been used to direct very successful interventions to reduce automobile crash deaths, data collected on specific gun types can be used to direct similar efforts in the reduction of shooting deaths. A lack of detail in terms of specific gun types will make important differences between firearm injury victims undetectable, negatively affecting the efficiency of future prevention activities as well as the clinical management of these injury victims.[34,35]

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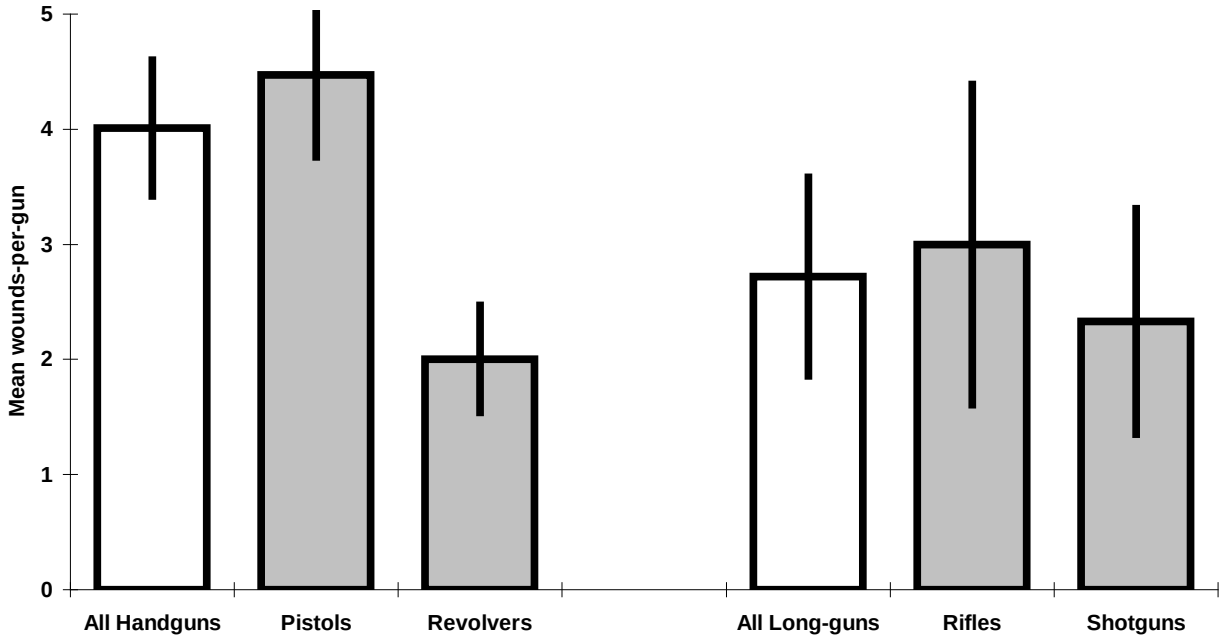
National Vital Statistics Systems, E-Codes ICD-9[10]	**National Vital Statistics Systems E-Codes, ICD-10[16]**	**Uniform Crime Reports Supplemental Homicide Reports[15]**
E965: Homicide & injury purposefully inflicted by another person E965.0 = handgun E965.1 = shotgun E965.2 = hunting rifle E965.3 = military firearm E965.4 = other & unspecified	X93: Assault by handgun discharge X94: Assault by rifle, shotgun & larger firearm discharge X95: Assault by other & unspecified firearm & gun discharge	V27 Offender: Weapon 11 = firearm, type not stated 12 = handgun–pistol, revolver etc. 13 = rifle 14 = shotgun 15 = other gun

Table 1: National Data Coding Systems for Firearm Homicide



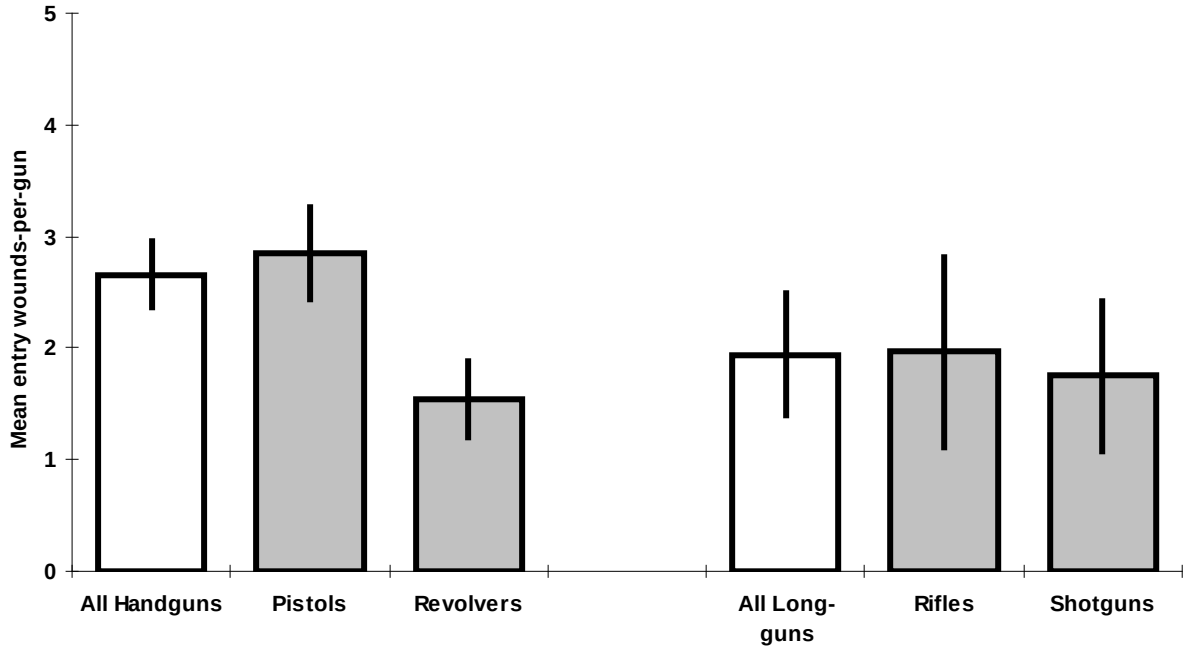


Figure 1: Wounding Profiles of gun types used in homicides. Bars include 95% confidence intervals for means.

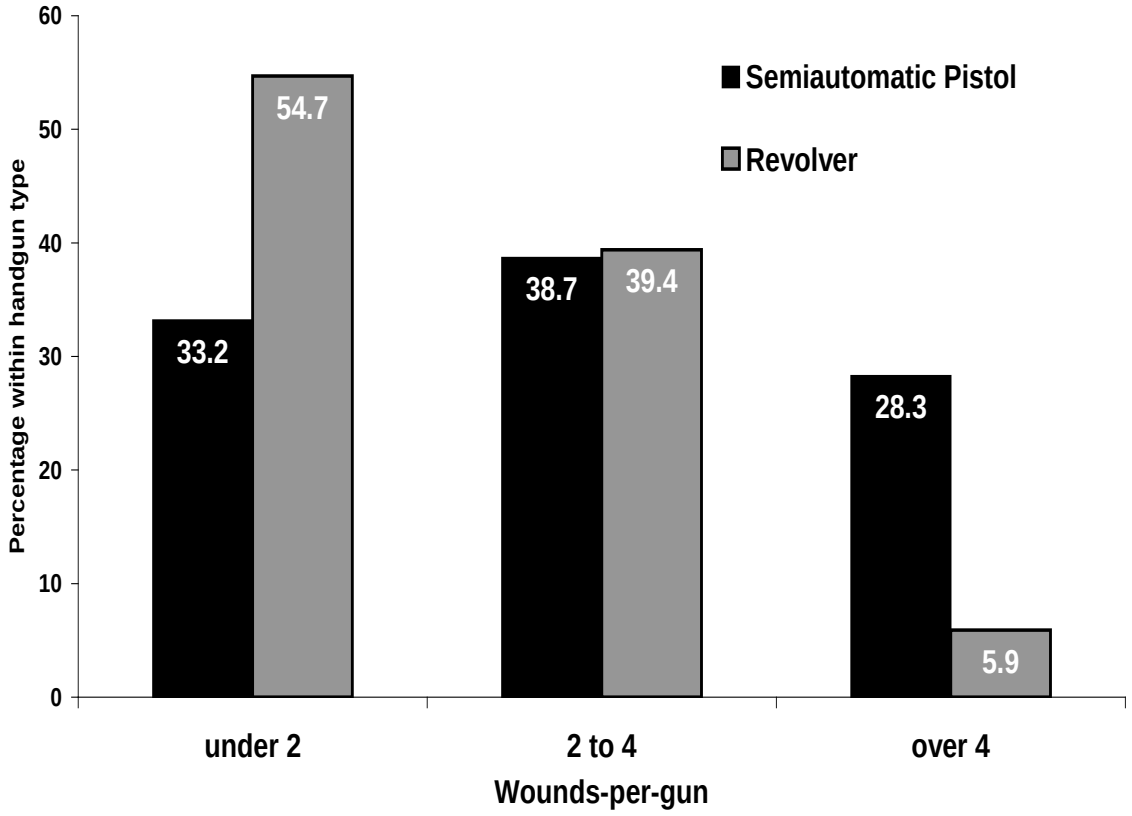


Figure 2. Comparison of relative percentages of wounds-per-gun within handgun type categories.