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Improving Data Infrastructure to Reduce Firearms Violence

Chapter 1. Comprehensive Data on Gun Violence: Current Deficits, Needed Investments

Philip Cook, PhD | Duke University

Editors:

John K. Roman, PhD
NORC at the University of Chicago

Philip Cook, PhD
Duke University

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Introduction

The surge in gun violence starting in 2020 underscores the urgent need for a reliable system for documenting firearms violence. Prevention efforts require reliable and timely information. There are myriad questions that can be answered only with more and better data. How many people are shot, under what circumstances, and with what outcome—and are these rates trending up or down? How are shootings distributed across jurisdictions and among different demographic groups? What determines whether victims of gun assault and robbery are killed, wounded, or "merely" threatened? What do we know about the shooters in assault and robbery cases? Which programs and policies have been effective in reducing gun violence? Current data systems, and especially the NVDRS, provide detailed documentation for fatal shooting cases, including both suicides and homicides. But with respect to nonfatal shooting cases, including 80 percent of those shot in assaults and robberies, we remain largely in the dark.

This briefing identifies current deficits and promising avenues to develop a comprehensive firearms injury database. We focus on improving the quality and scope of existing data systems that use administrative records. There are two primary sources: hospital medical records and police crime records. These are documented and discussed in detail in the associated reports by Cathy Barber (see Chapter 2) and Susan Parker (see Chapter 3).

Any comprehensive data system for tracking and analyzing nonfatal firearms injuries will require data from both hospital medical records and police records. The current systems to compile hospital medical records are being refined and are on track to provide reliable national estimates within the next three years. Since hospital medical records are also compiled at the state-level, they could be used as a basis for state-level surveillance of firearms injuries. Police records have greater potential in some respects, but the existing UCR system is seriously deficient and the FBI has yet to specify a clear path forward.

Potential Uses for Data on Firearms Injuries

A comprehensive data system on gun violence is needed for surveillance and for policy analysis.

- **Surveillance** provides reliable descriptive information on trends and patterns, to answer the "where," "when," "who," "how," and "why" questions. The ideal system would provide reliable statistics on a timely basis, aggregated to the local, state, and national level. In addition to informing the public, surveillance would be useful for planning and for needs assessment. A system limited to fatal shootings (i.e., suicide and homicide) does not tell the whole story, since nonfatal shootings exhibit much different patterns; for example, most fatal shootings are suicides (60 percent), but only five percent of nonfatal shootings are self-inflicted. In addition, most nonfatal shootings occur in the context of criminal assaults. The difference reflects the fact that almost all firearms suicide attempts result in death, while only about 20 percent of gunshot assaults result in death and leave many more survivors overall.

- **Policy analysis and planning offers** the data needed to understand the causes of gun violence—for policy design—and to evaluate the impacts of public and private actions intended to prevent or mitigate gun violence. For these purposes, it is important to have data on the shooters and the incidents that led to the shootings. A comprehensive data infrastructure should include measures of the underlying crimes of gun assault and robbery. The rationale follows from our understanding of gun violence prevention. In most gun assaults and robberies, the victim is threatened but not shot; however, a shooting is always a possible outcome. An intervention that reduces the overall volume of gun robbery and assault would likely reduce firearms injuries.

Data Sources

The two primary sources of data on gun violence are hospital medical records and police crime records. In principle, hospital records are comprehensive, since about 90 percent of all firearms injuries are treated in a hospital emergency department (ED). The information in hospital records is routinely coded and compiled for billing purposes. The primary focus is on coding diagnoses and procedures, although injury cases coding is now required to include the external cause (e-code). Most gunshot wounds are identified as such in e-coding. However, accuracy in coding the *intent* of the shooting (assault, accident, suicide attempt) has proven a greater challenge.

Police records are comprehensive on shootings that would normally be investigated—cases in which the victim was shot by another person—and ordinarily provide more detail about circumstances and intent than medical records. Most nonfatal gunshot wounds occur in the context of criminal encounters. The remaining cases—accidental and self-inflicted shootings—are likely to be missing from police records.

A third potential source of information on assaults in which the victim is shot is the National Crime Victimization Survey (NCVS), conducted by the Bureau of Justice Statistics (BJS) since 1973. In practice the NCVS national estimates of gunshot assault are a fraction of the true total, due to intrinsic limitations of the sampling process. We do not know of any feasible revision to the NCVS that would solve this problem and do not view a household survey as a promising source.

Hospital Data

Three existing systems have great potential to provide useful national surveillance systems for nonfatal gunshot injuries. Each has its own strengths and limitations.

1. HCUP NEDS

Most states with statewide hospital databases disseminate their own data locally and forward their data to the HCUP at the federal Agency for Healthcare Research and Quality. HCUP uses these data to construct the National Inpatient Sample (NIS) and the NEDS. NEDS is a stratified, single-stage cluster sample constructed by categorizing hospitals according to five strata: geographic region, urban/rural location, teaching status, ownership, and trauma-level designation. In 2019, the sample comprised 990 hospitals in 37 states that submitted data on nearly 36 million ED visits of all types, from which HCUP projected total visits of over 143 million for the nation. HCUP makes individual-level NEDS data available to researchers for a fee (as well as access to NIS and state-specific databases). In addition, HCUP disseminates aggregate state and national data via an online data-query interface (HCUP-Net).

Strength. NEDS is in place and can be used to generate national and regional estimates of the incidence of firearm injuries, together with patient demographics, seasonality, intent, nature of the wounds, procedures, payors, charges, length of stay, and outcome.

Limitations. For gunshot cases to be identified as such, medical records coders must include the appropriate coding for the mechanism of injury (for example, gunshot) rather than only the nature of the wound. This so-called e-coding has become common in recent decades and appears to be near universal in most states. Beyond identifying a gunshot as the mechanism of injury, e-codes indicate the intent and whether the gunshot was a suicide attempt, accident, or assault. In practice, the e-coding of intent is not accurate. A large proportion of firearm injuries (mostly assaults) are misclassified as accidents. This is a serious problem caused in part by limitations of the hospital coding software. If the coder does not specify that the injury is intentional (assault, self-inflicted, and so forth), the software in common use defaults to "accidental." While NEDS is thought to provide a reasonably accurate estimate of the overall volume of nonfatal firearms injuries, it is not a reliable source concerning the breakdown of injuries by intent: NEDS-based estimates greatly underestimate injuries from gun assault and overestimate accidental injuries.

Other limitations include the multiyear lag in releasing data and associated estimates and the fact that NEDS cannot be used to generate estimates at the state and local level.

Recommendations:

- NEDS is widely believed to provide reasonably accurate estimates of the national and regional volume of firearms injuries (albeit with long delay) and can be utilized as such. More research is needed on the sensitivity of e-coding to identify firearms injuries.

- NEDS estimates are not reliable in estimating the rates of firearms injury by specific intent. A study funded by Arnold Ventures will propose a change in coding guidance to the joint CDC National Center for Health Statistics (NCHS)/ Centers for Medicare & Medicaid Services (CMS) International Classification of Disease (ICD)-10 Coordination and Maintenance Committee in March 2022. Federal resources are needed to implement reforms and educate researchers on pitfalls of the existing data.

- NEDS is not structured to provide state-level estimates of firearms injuries, but hospital medical data are compiled in the HCUP State Emergency Department Databases (SEDD). Coupled with the HCUP State Inpatient Databases (SID), these data may be used for firearms injury surveillance and analysis in the 42 states that currently report these data. Public use is hampered by the fact that data are only available for public use at a substantial charge and are of variable quality. CDC could provide a useful service by purchasing these data, abstracting injury cases, and providing convenient public access to the resulting state-level files. The data limitations discussed above would remain.

2. NEISS Firearm Injury Surveillance System (FISS)

CDC collaborates with the U.S. Consumer Product Safety Commission to collect data on consumer product injuries through the NEISS. Two related systems collect data on firearm injuries through the NEISS-FISS, using a sample of 96 EDs intended to be nationally representative, and data on all injuries through the NEISS-All Injury Program (AIP), based on a two-thirds sub-sample.

Strengths. Working with a small sample of EDs enables CDC to employ and train expert coders. In particular, the classification of intent for firearm injuries is handled by a small number of coders at the CDC National Center for Injury Prevention and Control (NCIPC) and appears largely accurate. Data from AIP, which began in 2000, have been made available on Center for Disease Control and Prevention's (CDC's) user-friendly Web-based Injury Statistics Query and Reporting System (WISQARS)-Nonfatal Injury Data querying interface. Individual-level data from FISS are available to researchers from the Inter-University Consortium for Political and Social Research website.

In comparison with NEDS, NEISS estimates are more timely; annual estimates are available within 24 months.

Limitations. The sample of hospitals used by NEISS-AIP is too small to support stable national estimates, leading to suppressed cells on WISQARS-Nonfatal in recent years. Also, because firearm injuries are highly concentrated at a relatively small number of hospitals, even national estimates based on the full NEISS-FISS sample can shift abruptly from year to year as individual hospitals drop out of the sample and are replaced by hospitals with very different firearm caseloads.

> **Recommendation.** The CDC is committed to reforming the NEISS-FISS program. Current CDC initiatives appear adequate to produce reliable national estimates of the volume of firearms injuries overall and by specific intent by 2023. These reforms should receive continuing support. The sample will be increased. When hospitals exit the sample, care will be taken to ensure that the replacement hospital from the same sampling tier has a roughly equivalent firearm injury caseload. The estimated coefficient of variation will be large (16.7 percent) but acceptable and far better than the current coefficient of variation of over 30 percent. More importantly, estimates will no longer be subject to large jumps and false trends due to the vagaries of hospital turnover in the sample.

3. NSSP

The purpose of NSSP is to "send early warning signals from EDs to public health" professionals in near real-time on threats such as infectious disease outbreaks, terrorism-related attacks, overdose spikes, etc. It is operated by the CDC's Division of Health Informatics and Surveillance. Approximately 70 percent of hospital EDs now transfer data on all visits to a CDC-designed platform. Data elements include presenting complaints, triage notes, patient age and sex, and diagnosis codes and external cause-of-injury codes when available. NSSP defines specific syndromes (e.g., COVID-19, overdose) and uses natural language processing and artificial intelligence to identify ED visits. Currently the CDC NCIPC's Firearm Injury Surveillance Through Emergency Rooms (FASTER) pilot in ten states will determine whether firearm injuries can be reliably detected and if so, whether they can be reliably classified as to intent.

Strengths. NSSP counts are available within 48 hours of a hospital visit and could be used to detect surges in gun violence, to help develop a timely response. Further, the system is in place, with 70 percent of EDs transferring data on a regular basis. The data are a census, rather than a sample, so that they could be used for state-level and small-area level surveillance.

Limitations: The FASTER pilot is only in its first year. It appears the system will be successful in identifying firearm injuries; however, accuracy at classifying by intent will likely be poor, at least in the short term. This is not necessarily a fatal flaw, since most ED-treated gunshot wounds are assaults, and spikes and dips in the number of gunshot wounds are driven by assaults. A second limitation is that the CDC supplies the platform for NSSP but does not have access below the national or regional aggregate level. Only hospitals and state/local health

departments can access the state and local aggregate and individual-level data except where they have given CDC explicit, active permission or where CDC has paid for the data.

Recommendations: Support the CMS current proposal to expand NSSP-participating EDs from 70 percent to nearly 100 percent. If the FASTER pilot proves successful, provide funding for the CDC NCIPC to access state and local data and to provide the public with convenient access to these data.

Police Records of Criminal Incidents

Police records provide detailed information on violent crimes. Of the crime categories used by the FBI UCRs, gun robbery and gun aggravated assault include almost all cases in which one person is shot by another and survives. These crime categories also include the more frequent instances in which an individual is threatened with a gun but not shot.

Police data provide an alternative to hospital data for surveilling gunshot injuries or at least that subset of gunshot injuries resulting from one person shooting another, which are the bulk of all nonfatal shootings. Police agencies know of most such shootings. Reports from citizens (calling 911) are supplemented by reports from medical providers, who in almost all states are obligated to report to the police all gunshot cases that they treat. For their own purposes, some police departments have record systems that identify which violent crimes involved a gunshot injury, but no state or federal system currently distinguishes gunshot victims from other victims of gun crimes.

As of 2021, the FBI UCR—the primary source of national crime statistics—implemented a fundamental change. Since the early 1930s, the UCR has compiled and published summary reports from law enforcement agencies, with the reports comprising counts of certain types of crime. The list of crime types includes the following: murder, aggravated assault, and robbery, classified by type of weapon. The summary reports are widely used by the public and policymakers to track trends and patterns in crime. Summary reporting has been discontinued by the FBI, replaced by a requirement that agency reports use the NIBRS. NIBRS has been an option available since the 1980s but has not caught on. The expansion of NIBRS to all reporting entities would allow the UCR to continue reporting national counts of aggravated assaults and robberies known to the police. The FBI is considering a minor adjustment in coding instructions, to provide a comprehensive database on cases in which one person shot another. For such cases, NIBRS has greater detail than hospital records and provides information on the crimes committed in conjunction with the shooting and on any suspects.

Despite the change in direction by the FBI, and some effort by federal and state criminal justice agencies, a large share of police departments, including many of the largest departments, do not participate in NIBRS. (It should be noted that UCR use by law enforcement agencies has always been voluntary but was near universal when summary counts were all that was needed.)

It is unclear what is required to increase participation in NIBRS from the current level—55 percent of law enforcement —back to the level of participation enjoyed by the SRS of over 90 percent.

This interruption in comprehensive crime reporting is an urgent concern that transcends the problem of measuring gun violence. The UCRs have been essential to measuring levels, trends, and patterns of crime in the United States. The FBI's decision to discontinue the SRS in place for the last nine decades, and to replace it with an unenforced requirement for agencies to submit crime data in NIBRS, means that the nation has lost the leading measure of crime trends and patterns. The scope of this problem is far broader than the need to develop the infrastructure for gun violence prevention.

Until more agencies begin reporting in NIBRS, one alternative to generate valid national estimates of crime counts from law enforcement agencies is to create an estimation procedure based on a representative sample of agencies. BJS has pursued this possibility with the National Crime Statistics Exchange (NCS-X). A sample of 400 agencies, including the 72 largest agencies, is designed to produce reliable national estimates if all 400 agencies participate. Unfortunately, the grants program and offer of technical assistance have proven inadequate, and about half of the NCS-X sample is still not submitting NIBRS data.

An inexpensive tweak in NIBRS would make the data useful to surveilling and analyzing nonfatal shootings in those jurisdictions that do report. From the current NIBRS format, it is possible to identify assaults and robberies in which the perpetrator used a gun and to determine whether the victim was injured. What should be added is an item specifying whether the injury was a gunshot wound. Such a modification in NIBRS reporting was recommended by an FBI advisory board and will likely be adopted. With the modification in place, NIBRS data for participating jurisdictions could be used for analytic purposes.

Strengths. Police records of shooting cases should provide information that is not ordinarily included in hospital records—in particular, data on the shooter (when available) and the incident that led to the shooting. Such information is vital to understand the great majority of nonfatal shootings, those in which one person shoots another in criminal circumstances.

For local jurisdictions and entire states that are well represented by agencies that report crime through NIBRS, the resulting UCR data on gun crime can be used for surveillance purposes and to provide detailed data for policy analysis. These data will become much more useful for our purposes when and if NIBRS reporting is modified to identify gunshot wounds.

Police data also provide unique information on a larger set of gun crimes that have no counterpart in the hospital data—assaults and robberies in which the victim is not shot—that provide context for the shooting cases. These data are essential to investigating the epidemiology of gun violence.

Traditionally, the UCR data for each calendar year have been reported to the public within 10 or 11 months, yielding more timely results than NEDS or NEISS.

Limitations. UCR counts no longer serve as the basis for tracking national trends in violent crime. To date, the effort to generate a national estimate from a representative sample of agencies has failed due to low participation.

Recommendations

The current version of NIBRS does not specify whether a violent crime victim was shot. We recommend revision of the NIBRS form so that firearms injuries can be identified and analyzed.

In the absence of a mandate, agencies must be persuaded to participate voluntarily in any crime reporting system. The low NIBRS participation rate may reflect a widespread judgment by law enforcement agencies that NIBRS lacks sufficient value to them or their communities to warrant making the switch from summary reporting. We recommend a national survey of agencies, both those now using NIBRS and those that are not, to ascertain what is needed to increase participation.

NIBRS is a notoriously complex and demanding system. A streamlined version of NIBRS may preserve the main advantages of incident-based reporting while offering a more attractive value proposition for law enforcement agencies. A NIBRS redesign should be on the table in planning next steps.

Our principal recommendation is that lead responsibility for generating national crime estimates be shifted from the FBI. Participation rates have dropped dramatically under the NIBRS requirement; for this reason, for the foreseeable future, the FBI's UCR counts will no longer serve as a valid indicator of national crime rates. Data currently available from state crime agencies and UCR (NIBRS) reports could be compiled and used to estimate state-level and national crime rates. However, the estimation process requires statistical sophistication. Requisite expertise may be available in a statistical agency such as BJS. BJS manages the NCS-X sample of 400 law enforcement agencies that was created to provide national estimates based on NIBRS data during the transition to full participation in NIBRS. (BJS is also responsible for the NCVS, which since 1973 has provided national estimates of some crime types based on a household survey.) The role of BJS could be expanded further to include issuing national compilations of crime data collected by state UCR agencies, many of which have continued summary reporting.

To accelerate compliance with the requirement to use NIBRS for UCR crime reporting, a combination of inducements is warranted. In addition to technical assistance and a grants program with a minimum of red tape, Congress may eventually require NIBRS reporting as a precondition for federal grants. One component of the grants program could be channeled

through the state agencies that current manage UCR. Many states are in close touch with individual agencies and may be able to use the funds to effect change.

In sum, we recommend the following:

1. Modify NIBRS so that the type of injury in violent crimes is identified and whether the victim was shot
2. Increase participation in NIBRS by law enforcement agencies
   - ► Solicit information from police agencies to identify barriers to NIBRS participation
   - ► Fund state UCR agencies to manage programs of grants and technical assistance for agencies willing to convert to NIBRS
   - ► Require NIBRS participation as a condition of eligibility for other federal grants programs
3. Generate national estimates of crime rates by statistical inference from the subset of agencies that do report to NIBRS
   - ► Transfer lead responsibility for crime reporting from the FBI to BJS or another statistical agency
   - ► Continue NCS-X sample of cities, with additional resources to encourage participation
   - ► Develop a statistical model for making inferences from the sample of agencies that report to NIBRS

Summing Up: Comparing the Two Data Sources

Both hospital medical data and police crime data have certain advantages as the basis for tracking trends and patterns (surveillance) and for policy analysis.

Hospital medical data include all types of firearms injuries, not just assault. Perhaps most importantly, the federal data systems for compiling hospital medical records are in place. NEDS and NEISS are being revised and should be able to generate high-quality national estimates by 2023 with accurate coding of intent. The NSSP, if it proves successful in the pilot phase, could produce comprehensive counts of firearms injuries at national, state, and local levels with only a brief lag.

Police crime records include all types of crime committed with firearms, not just crimes in which the victim is shot. The records on assaults and robberies in which the victim is shot include more detail concerning the incident and the shooter than is available in medical records. Crime rates and incident-level data on individual jurisdictions are available to the public, for agencies that choose to participate in the FBI's UCRs; such reports are available with a lag of less than a year, far shorter than for NEISS and NEDS. However, participation rate in the UCR is currently only 55 percent, and there is no system currently in place for generating national or state-level estimates based on the sample of agencies that choose to report. A public investment in crime data is urgent.