NC-FASTER
North Carolina Firearm-Related Injury Surveillance Through Emergency Rooms

ANNUAL DATA REPORT

Report Prepared By:

Amy Ising, Nicole L. Snyder, Lucas Neuroth, Shana Geary, Michael Dolan Fliss, Danielle Brathwaite, Krishna Dutt, Marissa Leff, Catherine Wolff, and Anna Waller

Carolina Center for Health Informatics, Department of Emergency Medicine, and Injury Prevention Research Center, University of North Carolina at Chapel Hill

Submitted to NC DHHS/IVPB, June 29, 2023

This report was supported by and is a deliverable for Contract Number 00044255 from the Injury and Violence Prevention Branch of NC Division of Public Health.

Table of Contents

Tables

Figures

The Carolina Center for Health Informatics in the Department of Emergency Medicine at the University of North Carolina at Chapel Hill prepared the NC-FASTER 2023 Annual Report. Key contributors for the 2023 update are listed below. For more information about NC DETECT, please visit our website (https://ncdetect.org/) or email us at ncdetect@listserv.med.unc.edu.

Amy Ising, PhD[1,2]
Nicole L. Snyder, PhD[1]
Lucas Neuroth, MPH[1,2]
Anna Waller, ScD[1,2]

1. Carolina Center for Health Informatics, Department of Emergency Medicine, University of North Carolina at Chapel Hill
2. Injury Prevention Research Center, University of North Carolina at Chapel Hill

Data Disclaimer: NC DETECT is a statewide public health syndromic surveillance system, funded by the NC Division of Public Health (NC DPH) Federal Public Health Emergency Preparedness Grant and managed through collaboration between NC DPH and UNC-CH Department of Emergency Medicine's Carolina Center for Health Informatics. The NC DETECT Data Oversight Committee does not take responsibility for the scientific validity or accuracy of methodology, results, statistical analyses, or conclusions presented.

Suggested Citation: Ising A, Snyder NL, Neuroth L, Geary S, Fliss M, Brathwaite D, Dutt K, Leff M, Wolff C, Waller AE. NC-FASTER Annual Report 2023. Chapel Hill: NC. Carolina Center for Health Informatics, Department of Emergency Medicine, University of North Carolina at Chapel Hill, 2023. Available at: https://ncdetect.org/nc-faster-firearm-quarterly-reports/

This report was supported by and is a deliverable for Contract Number 00044255 from the Injury and Violence Prevention Branch of NC Division of Public Health.

Background

Firearm injuries are the 13th largest cause of death overall in the United States (US); they are the third leading cause of injury death and account for half of all suicides and two thirds of all homicides. Firearms cost the nation more than $45 billion in medical costs and lost productivity each year. Younger generations are disproportionately affected by firearm violence; while those under 45 account for only 10% of overall national mortality, half of all firearm deaths occur in those aged 10-44. Injury is the primary cause of death for younger generations and firearms are now the leading injury-related cause of death for those aged 10-34, overtaking motor vehicle crashes, which led for decades. This sets firearm injury apart from most causes of death in the US, as the impact on economic productivity and years of potential life lost is much greater than for diseases primarily affecting older generations, such as diabetes and stroke. Homicide alone, which is caused primarily by firearms, accounts for 1 out of every 20 years of potential life lost (YPLL) in the US. Furthermore, readmission and recidivism following non-fatal firearm-related injury are significant, adding nearly 10% to total direct medical costs for firearm-related injury and costing hundreds of millions of dollars. In North Carolina (NC), more than 60% of violent deaths are caused by firearms (most from suicide), and for every firearm-related death, there are more than 3 firearm-related injury visits to an emergency department (ED) in the state.

From 1996 to 2020, the CDC's National Center for Injury Prevention and Control, the source for most federal funds for injury-related work, was largely restricted from funding projects related to firearm injuries. This left a gap in the understanding related to all aspects of firearm-related injury and death, including descriptive epidemiology that can be used to inform prevention and response efforts. Timely data about firearm-related injury are essential to support groups engaged in these efforts.

In 2020, NC received the first round of funding for the Firearm Injury Surveillance Through Emergency Rooms (FASTER) surveillance program - the first CDC funding dedicated to firearm injury surveillance in more than two decades. The goals of FASTER are to increase availability of timely data on firearm-related injuries treated in EDs and disseminate findings from these ED surveillance data to key stakeholders working on firearm injury prevention and response efforts. For this program, the NC Injury and Violence Prevention Branch (IVPB) partnered with NC Division of Public Health's Epidemiology Section's Surveillance Systems Unit (SSU), the University of North Carolina (UNC) Injury Prevention Research Center (IPRC), and the Carolina Center for Health Informatics (CCHI) based in the Department of Emergency Medicine in the UNC School of Medicine. These groups have decades of experience working together to improve public health practice and surveillance in the state. Since Fall of 2020, the project team has formed an active Partners Group, developed, and implemented a data dissemination plan, and evaluated both the available data and the syndromic surveillance definitions used to identify firearm-related injuries in those data.

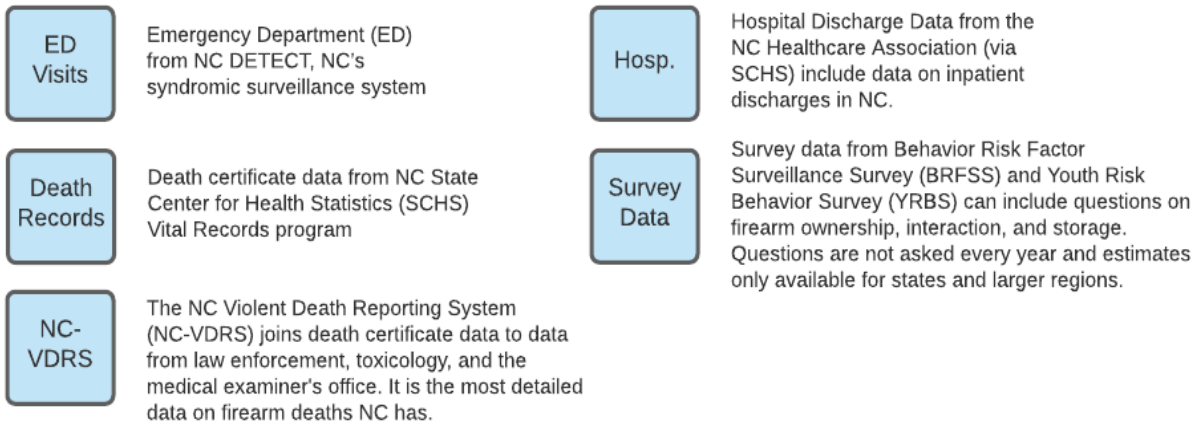
The goal of this NC-FASTER Annual Data Report is to provide relevant background information to Partners and collaborators regarding state data available to support firearm injury prevention efforts. In this Annual Data Report, we have included various sources of firearm injury data from 2016 to the most recent year available to provide a brief overview of recent state trends. We also include overviews of work we are doing to address demographic and spatial patterns, disparities and special populations, and intent coding for ED visits and EMS encounters related to firearm injury.

NC Firearm Data Source Overview

Core Data Sources

Firearm-related deaths are only the tip of the iceberg; the burden of firearm injuries can be measured by many different metrics and found in many different data sources. North Carolina has five core sources of firearm injury data (Figure 1): emergency department (ED) visits, death certificates, the NC-Violent Death Reporting System (NC-VDRS), in-patient hospitalizations, and survey data from the Behavioral Risk Factor Surveillance System (BRFSS) and the Youth Risk Behavior Survey (YRBS). Each of these data sources provide additional context on the burden of firearm-related injuries in the state, as well as the prevalence of risk behaviors that can contribute to firearm-related injury.

Figure 1: Core NC data sources for firearm data.



Novel and Supplemental Data Sources

In addition to the core data sources previously described, novel and supplemental data sources can tell us more about the events and environment that drive firearm-related injuries. Below is an incomplete list of some of those data sources:

Community and violence survivor groups can share stories and wisdom about how to prevent firearm injuries. Some groups may be taking **local action for prevention** which can be tracked. **Cost data** from tools like CDC's Web-based Injury Statistics Query and Reporting System (WISQARS), hospitalization charges, or cost-effectiveness studies of interventions can be applied to the NC environment. **Timely incident data** may come from law enforcement 911 or incident reports, some of which might be geocoded at the **street level**. **Spatial data** may include firearm retailers and geocoded event data. Other health data sources, including the **NC Trauma Registry** and **Emergency Medical Services (EMS) data**, may provide details other systems miss. **Firearm-related laws** differ between states and often set the bounds on what evidence-based action is possible. Lastly, **social determinants of health and other non-medical drivers**, including demographics and disparities, also drive associations with firearm injuries and exposure to firearm violence.

In 2023 we completed an evaluation of 2021 and 2022 EMS data available in NC DETECT for firearm injuries and include our major findings in this annual report update.

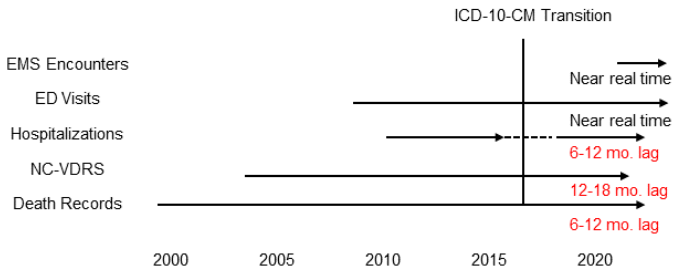
Firearm Data Source Availability, Lag, & Suppression

Data Availability and Lag Time

Each data system has its own review and finalization process to ensure data quality. This impacts the timeliness and availability of annual data for firearm-related injury surveillance, as well as the availability of complete and timely provisional data (Figure 2). Though NC-VDRS provides the most detailed data on firearm deaths, it takes time to collect, abstract, and combine these data from a variety of sources, and therefore this data source has the longest lag between collection and availability for analysis (approximately 18 months).

NC DETECT ED visit and EMS encounter data are the timeliest data available for firearm-related injury surveillance. These data are available to NC DETECT users within the NC DETECT data portal in near real time. Clinical data (including ED and hospitalization) transitioned diagnosis and injury mechanism coding systems in 2015. Therefore, data in this year are often suppressed and not compared across this time frame.

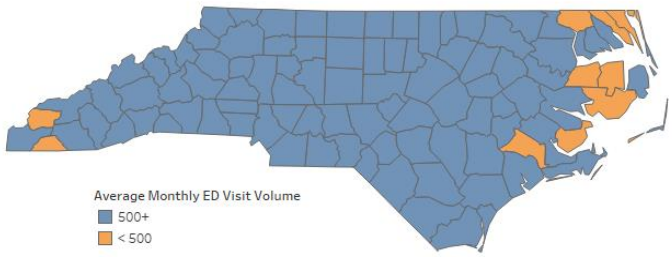
Figure 2: Data lag and availability diagram



Data Suppression

Though NC DETECT ED visit data are available within hours of a visit, ED data have strict data suppression requirements to protect patient privacy. Small counts (1-4) of visit types from time spans under 1 year cannot be reported publicly without at least 500 total ED visits in the denominator. In NC, 12 counties average fewer than 500 total ED visits each month (Camden, Caswell, Clay, Currituck, Gates, Graham, Hyde, Jones, Madison, Pamlico, Tyrrell, and Washington). (Figure 3)

Figure 3: Counties averaging fewer than 500 ED Visits per month



Demographic-specific questions require 500 total ED visits by that demographic group. This means that many more counties will have their data suppressed in public reports when presenting data by age group and/or race category, for example.

Key Data Sources Comparison: NC-VDRS and ED

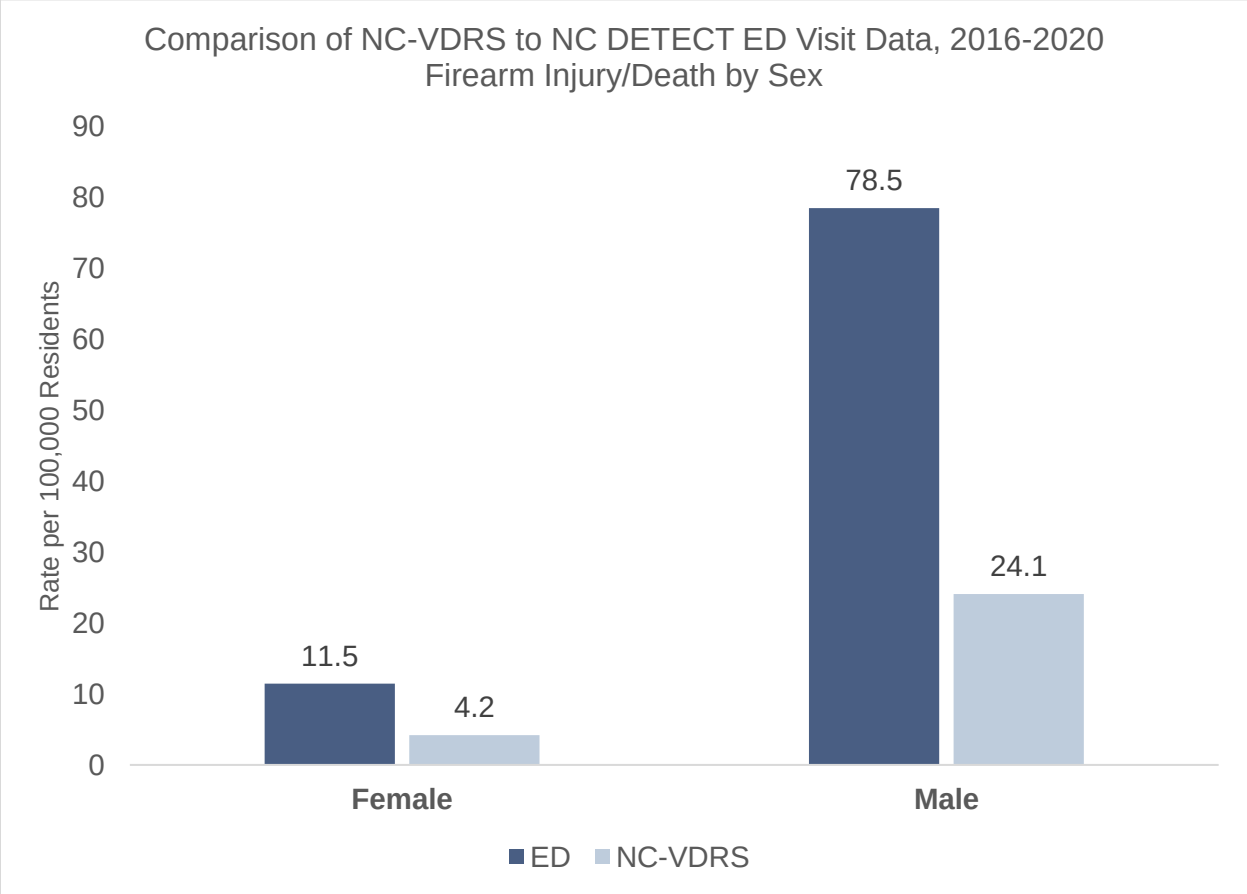
NC-VDRS and NC DETECT ED visit data are the most used data sources for public health surveillance of firearm injuries in NC. Typically, these data are presented publicly via separate mechanisms. NC-VDRS information is available on a dashboard, as well as through reports, fact sheets and data downloads. NC Firearm ED visit data are published quarterly and available on the NC-FASTER reports page on the NC DETECT website. In this 2023 annual report, we highlight demographic comparisons for these two data sources.

Detailed demographic data (including gender, race-ethnicity, and age groups) are important for designing interventions and understanding the disparate burden of firearm injuries. To stabilize these demographic rates for statewide comparison, the graphs below display 2016-2020 combined rates. (At the time of writing this report, the NC-VDRS dashboard's most recent 5-year rate was 2016-2020).

Sex

Males have significantly higher rates of both firearm injury and death in the ED visit and NC-VDRS data. (Figure 4)

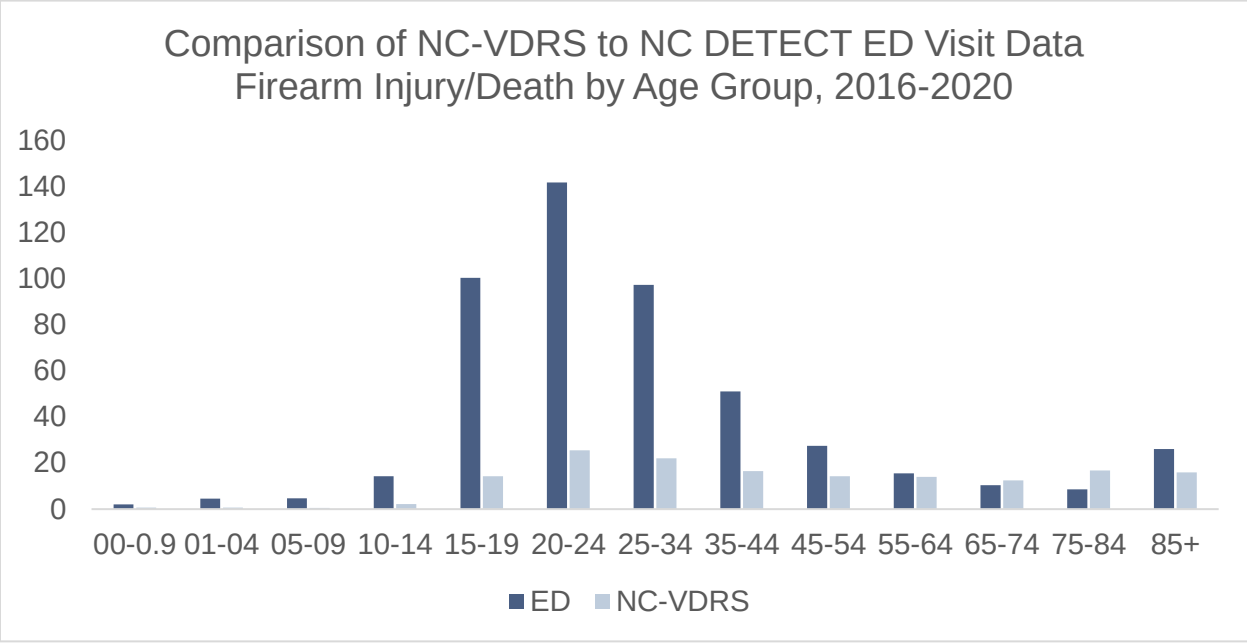
Figure 4: NC-VDRS & ED Firearm Injury Comparison by Sex



Age Group

ED visit rates for firearm injuries are higher than NC-VDRS for all age groups except those in the 65-74 age group (12.4 per 100,000 residents in NC-VDRS compared to 10.3 per 100,000 residents in ED) and 75-84 age group (12.4 per 100,000 residents in NC-VDRS compared to 8.6 per 100,000 residents in ED). (Figure 5)

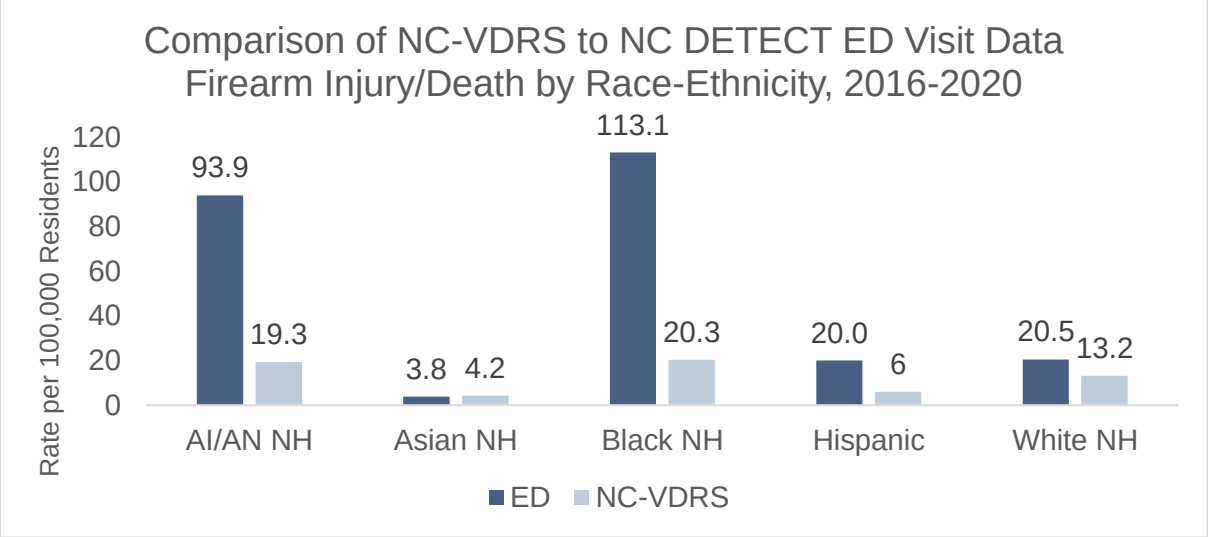
Figure 5: NC-VDRS & ED Firearm Injury Comparison by Age Group



Race-Ethnicity

American Indian / Alaska Native Non-Hispanic/Latino (NH) and Black Non-Hispanic/Latino (NH) populations have the highest rates for firearm injury in both NC-VDRS and ED visit data (Figure 6).

Figure 6: NC-VDRS & ED Firearm Injury Comparison by Race-Ethnicity



County-level Trends & Disparities

Both NC-VDRS and NC DETECT ED visit data can be used to identify county-level disparities. However, stratified (demographic-specific) analyses trigger more strict ED data suppression rules. When analyzing firearm injury data by place (e.g., county) and time (e.g., month), small counts of incidents are very common, creating problems in interpreting trends, proportions, and rates. For example, 25 counties average fewer than 500 ED visits by month and patient sex. Nearly all (98/100) counties average fewer than 500 ED visits by month and detailed age groups, and some age group/county combinations do not reach 500 ED visits combined in a decade. Note that NC residents living near the state border may also travel to neighboring states for care, which further reduces resident ED visit counts.

The tables below compare county-level trends for NC-VDRS (provisional data), and NC DETECT ED visit data for 2021.The first two sets of tables list the counts and rates for counties with the highest firearm ED visit rates (Table 1) and the highest firearm death rates (Table 2). Counties that are listed in both tables are marked with an asterisk (*).

Table 1: Highest Population Rates of Firearm-related ED Visits by County of Residence, North Carolina 2021

County	Number of ED Visits	Population Estimate[a]	Visit Rate[b]
Northampton	40	17917	223.25
Robeson*	261	118836	219.63
Vance	82	42650	192.26
Chowan	23	13796	166.72
Edgecombe*	77	49609	155.21
Halifax*	68	49291	137.96
Columbus*	71	51474	137.93
Richmond	55	43301	127.02
Scotland*	43	34345	125.20
Lenoir	61	55344	110.22

[a] County-level population estimates from five-year American Community Survey (2017-2021).
[b] Rate per 100,000 population.
* Indicates county is also in top 10 for firearm-related death rates.

Table 2: Highest Population Rates of Firearm-related Deaths by County of Residence, North Carolina 2021

County	Number of Deaths	Population Estimate[a]	Death Rate[b]
Washington	8	11183	71.54
Scotland*	16	34345	46.59
Macon	16	36532	43.80
Edgecombe*	19	49609	38.30
Robeson*	45	118836	37.87
Yadkin	13	37198	34.95
Ashe	9	26598	33.84
Anson	7	22388	31.27
Halifax*	15	49291	30.43
Columbus*	15	51474	29.14

[a] County-level population estimates from five-year American Community Survey (2017-2021).
[b] Rate per 100,000 population.
* Indicates county is also in top 10 for firearm-related ED visit rates.

Counties with the lowest firearm ED visit and death rates are listed in the Tables 3 and 4. There is no overlap in these counties when comparing lowest rates in ED visit data and lowest rates in NC-VDRS

Table 3: Lowest Population Rates of Firearm-related ED Visits by County of Residence, North Carolina 2021

County	Number of ED Visits	Population Estimate[a]	Visit Rate[b]
Yancey	2	18357	10.90
Camden	1	10353	9.66
Alleghany	1	10910	9.17
Avery	1	17747	5.63
Currituck	1	27575	3.63
Cherokee	1	28515	3.51
Dare	1	36718	2.72
Clay	0	10997	0.00
Hyde	0	4697	0.00
Gates	0	10584	0.00

[a] County-level population estimates from five-year American Community Survey (2017-2021).
[b] Rate per 100,000 residents.

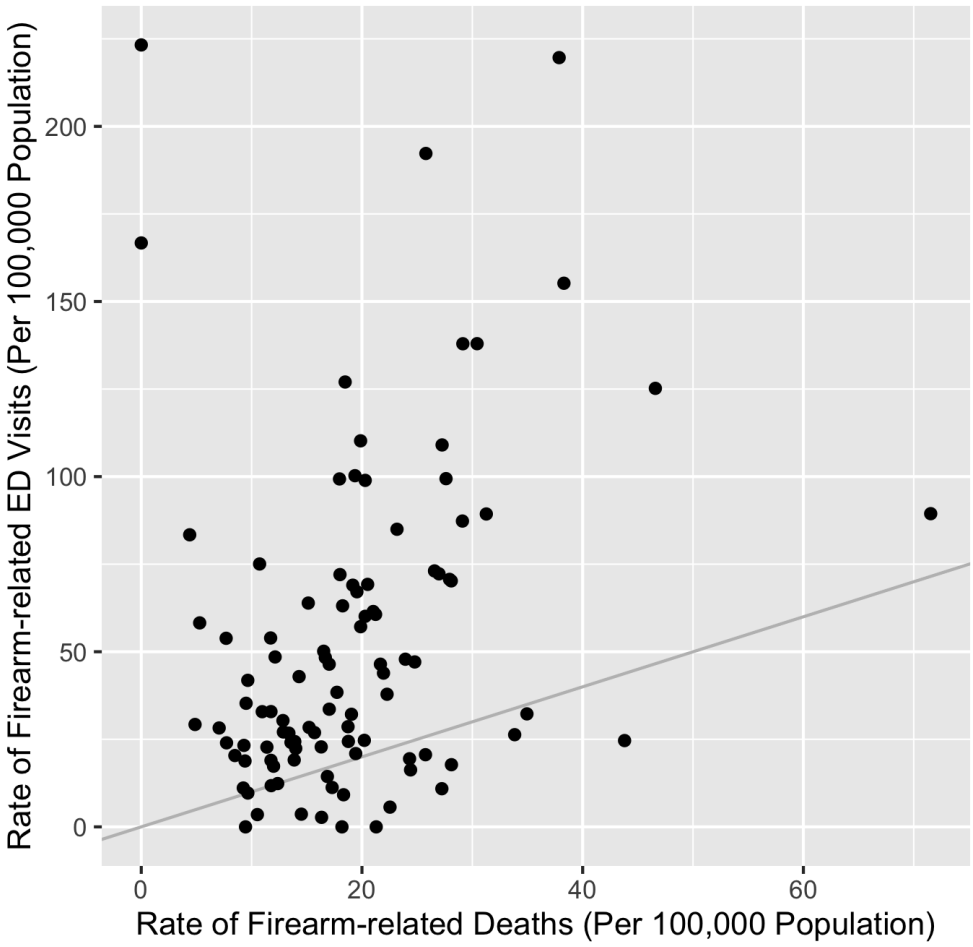
Table 4: Lowest Population Rates of Firearm-related Deaths by County of Residence, North Carolina 2021

County	Number of Deaths	Population Estimate[a]	Death Rate[b]
Watauga	5	54077	9.25
Union	20	235699	8.49
Wake	86	1112883	7.73
Perquimans	1	13002	7.69
Swain	1	14166	7.06
Warren	1	18889	5.29
Greene	1	20524	4.87
Caswell	1	22785	4.39
Northampton	0	17917	0.00
Chowan	0	13796	0.00

[a] County-level population estimates from five-year American Community Survey (2017-2021).
[b] Rate per 100,000 residents.

As shown in the following scatter plot (Figure 7) and maps (Figure 8), there is no significant relationship between firearm ED visit rates using the CDC V1 Firearm all intents definition and the and the firearm death rates by county from NC-VDRS (footnote a). The Pearson correlation coefficient is 0.27.

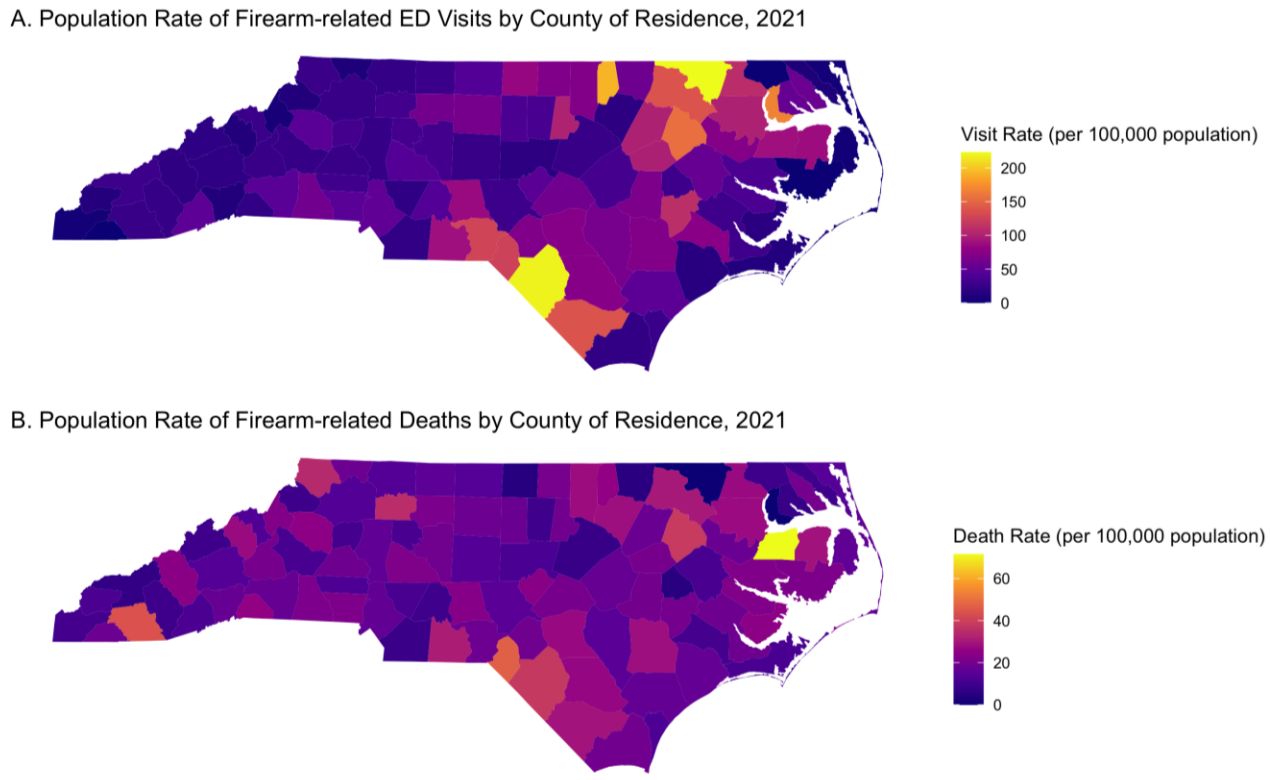
Figure 7: Scatter Plot of County-level Rates, North Carolina 2021



Note: Grey trendline added to show 1:1 relationship between the two rates as the scales of the plot differ.

[a] Firearm-related deaths were identified via NC-VDRS weapon indicators (n=1834). Out of state decedents excluded.

Figure 8: Firearm-related Population Rates by County of Residence, North Carolina 2021

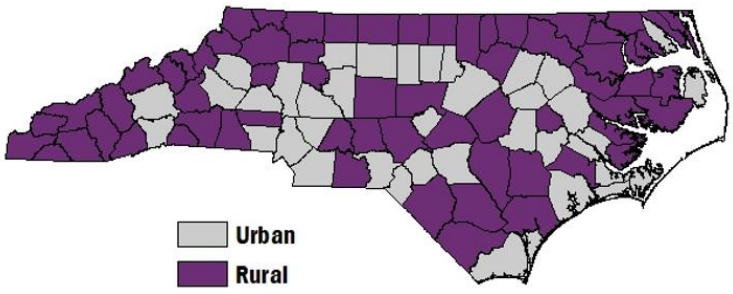


[a] Firearm-related deaths were identified via NC-VDRS weapon indicators (n=1834). Out of state decedents excluded.

Aggregating County-level Data into Rural / Urban Categories

NC has the second largest rural population in the country and geographic differences in non-fatal firearm injury ED visits exist when comparing NC rural and urban counties. We used the US Census urban/rural definition (Figure 9) to classify firearm injury ED visits by county of residence. This definition is based on residential population density, while also considering land use characteristics of densely developed territory. If 50% or more of a county's population is considered rural, then the county is classified as rural. There are rural communities located within counties that are classified as urban, as well as urban communities within counties classified as rural.

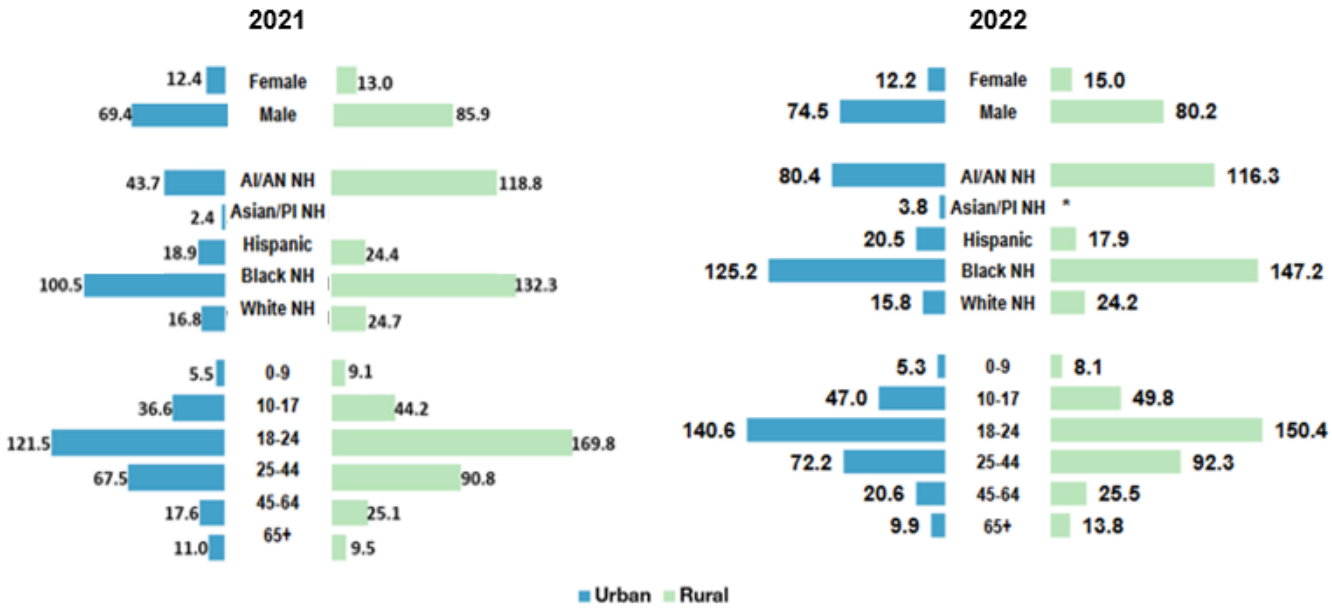
Figure 9: US Census Urban/Rural Classification of NC Counties



Statewide rates of non-fatal firearm ED visits by demographic group (age group, race/ethnicity, and sex) and urban/rural classification were included in last year's annual data report for 2021 data and in the Quarter 4 (October – December 2022) report for 2022 data (Figure 10). In 2021, rural rates of ED visits for non-fatal firearm injury were higher across all demographic groups other

than those ages 65 and older and in the Asian / Pacific Islander NH population. The greatest difference was between urban and rural NH American Indian residents, with rural NH American Indians experiencing a rate of firearm ED visits that is 2.7 times higher than urban NH American Indians. In 2022, all rural demographic groups have higher rates compared to urban, except for Hispanic/Latino and NH Asian populations. The significant rate difference seen in NH American Indian rural and urban residents in 2021 does not continue in the 2022 data.

Figure 10: Firearm Injury Rural/Urban Comparison by Demographics, 2021 & 2022



Sub-County Spatial Analysis

Firearm data are available at different spatial scales. Some **event data,** such as gun injury incidents and deaths, can be geocoded at the point-level, and spatially jittered to provide some privacy protections. **Aggregate population data** - at levels including census tract / neighborhood, ZIP code, city, county, and state region - are often used for population-level action and surveillance efforts. Not all small spatial scales are available in all data sources: the most granular ED data are available at the 5-digit ZIP code level and survey data are often not available any smaller than regions and large counties. A separate project is leveraging EMS firearm injury data to quantify and analyze firearm incident locations. Initial findings from this project will be available in Fall 2023.

Social Determinants of Health

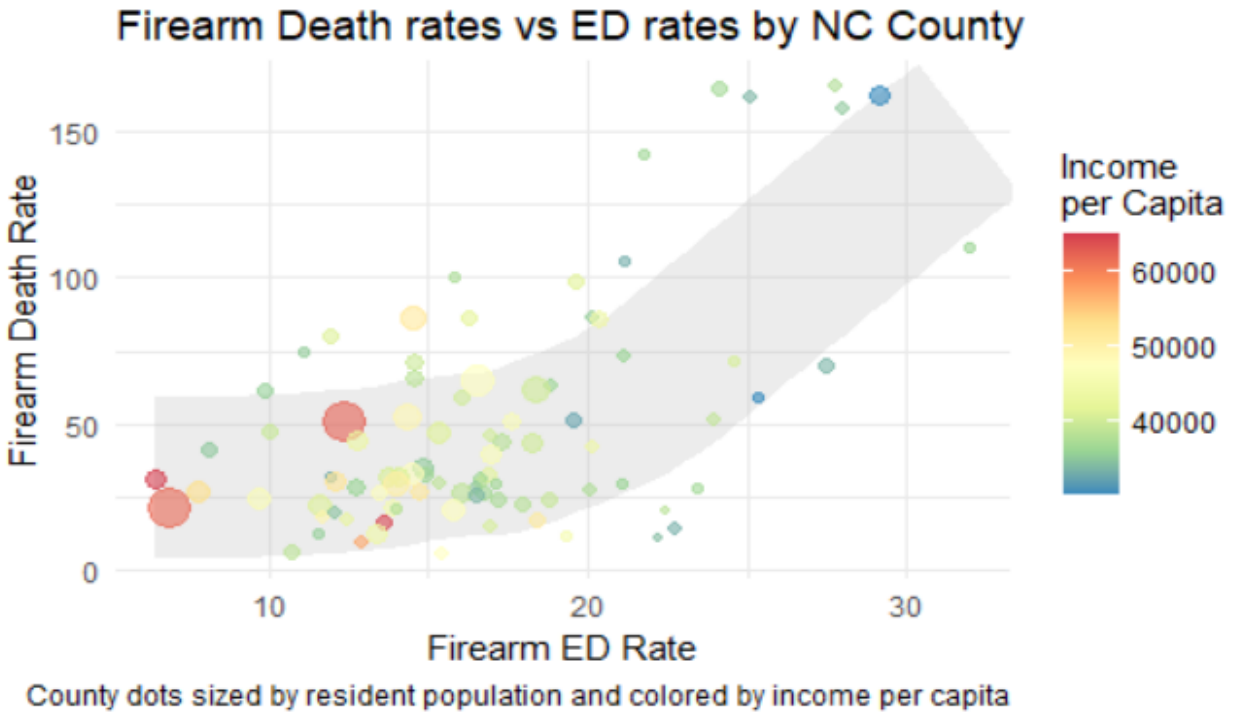
In 2022, we completed an exploratory analysis of the association of firearm ED visits and firearm deaths, examining the social determinants connected to that association. Those determinants of health include: (1) hospital bed density, (2) income per capita, (3) mental health professional shortage areas (HPSAs), (4) population size, and (5) rurality.

At the NC county level from 2017 through 2020, firearm injury death rates increase almost proportionally with firearm injury ED Visit rates. This relationship is further explained by a county's area-designation, hospital bed density, and income per capita. For example, firearm death rates modestly decrease as a county's hospital bed density increases.

Firearm injury death and ED visit rates increase significantly for NC counties designated as rural. Rural counties in NC (smaller dots / populations in Figure 11, typically lower income per capita) have higher death and ED rates per capita for firearm injury.

This analysis was not updated in 2023.

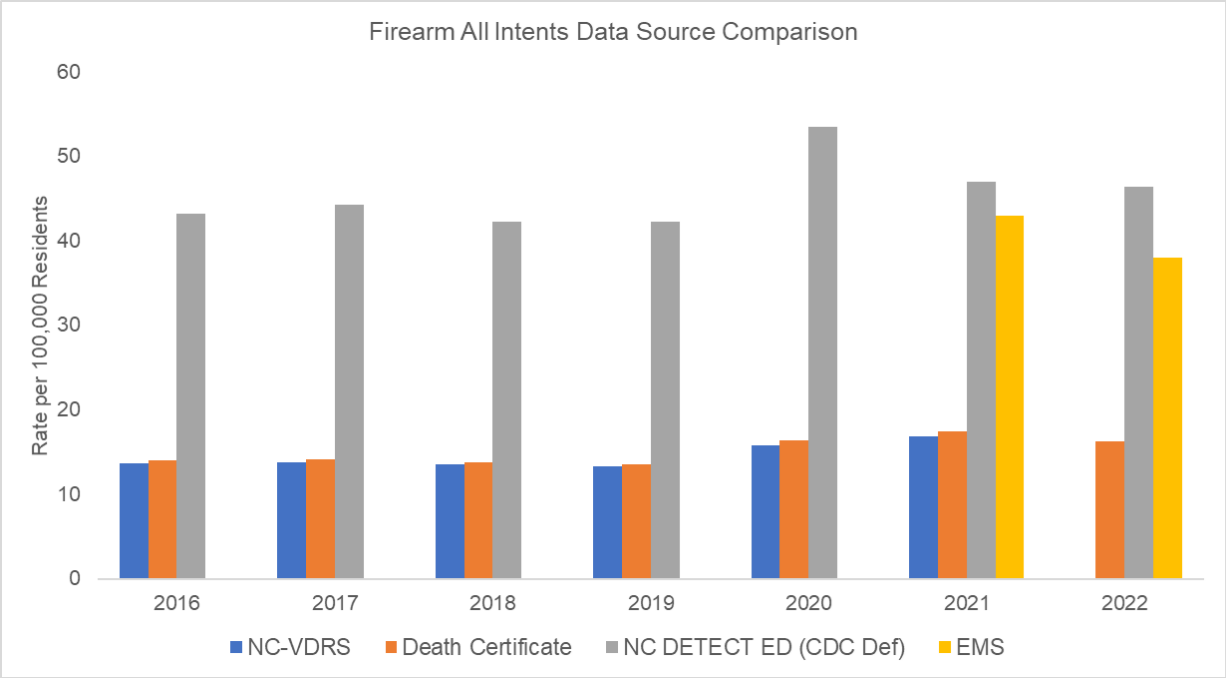
Figure 11: Firearm ED and Death Rate Comparison by County, Population and Income per Capita



Statewide Trends Across All Available Data Sources

We continue to compare firearm injury and fatality trends in ED visit data and EMS encounter data from NC DETECT, death certificate data, and data from NC-VDRS. Figure 12 includes data from 2016 through 2022, with some exceptions; EMS data in NC DETECT are available only from 2021 to the present, and NC-VDRS data are provisional for 2021 and not yet available for 2022.

Figure 12: Firearm Injury Data Source Comparison, All Intents

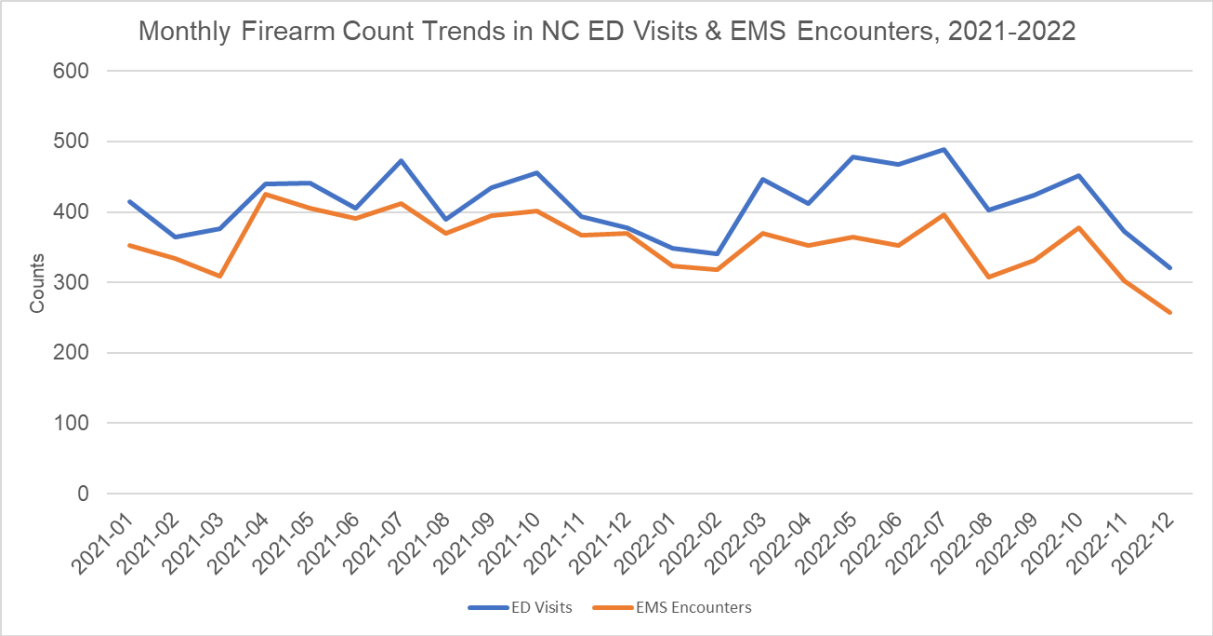


NC-VDRS and death certificates have very similar rates, counts, and trends, suggesting NC-VDRS is likely best used for more detailed questions, while death certificate data are usually timelier. The highest rate of ED visits for firearm injury from 2016 to 2022 occurred in 2020, even with a significant decline in overall ED visits during the initial months of the COVID-19 pandemic. The rate of firearm deaths increased from 2019 to 2021 but declined slightly (based on provisional death certificate data) in 2022.

Monthly Trends in ED & EMS Data

As our two most timely data sources for firearm injury data, we can use ED and EMS data to look at sub-year trends. We continue to explore approaches for conducting near real time firearm injury surveillance and detecting patterns that can inform intervention efforts. Figure 13 shows monthly count trends for ED visits and EMS encounters for 2021 and 2022.

Figure 13: Monthly Firearm Count Trends in NC ED Visits & EMS Encounters, 2021-2022



Understanding Intent

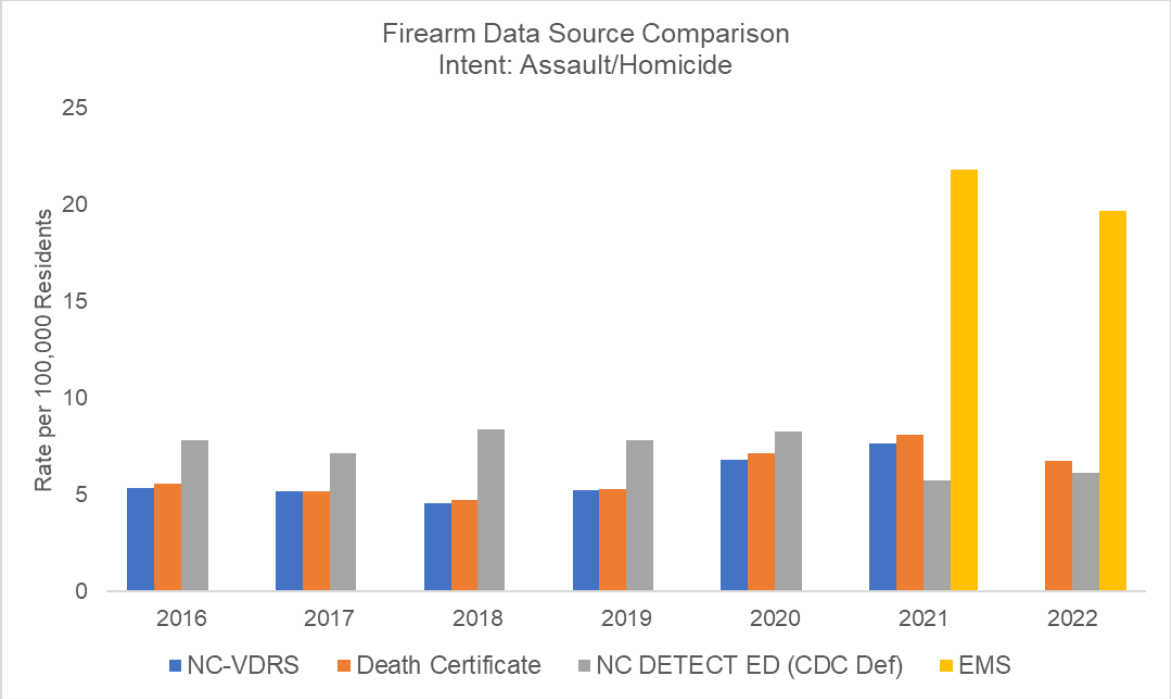
Both ICD-10 (mortality data) and ICD-10-CM (morbidity data) include codes to designate the intent of firearm injury, including intentional self-harm/suicide, unintentional, assault/homicide, and undetermined. In the CDC-developed firearm-injury definitions for use with ED visit data, intent can be identified based on chief complaint terms or ICD-10-CM codes. Intent is not always clearly stated in the chief complaint, however, and ICD-10-CM coding guidance states that intent should be coded as unintentional if the intent of the injury is unknown or unspecified. As a result, intentional self-harm, assault, and undetermined firearm injuries likely coded as unintentional in the ED visit data if intent documentation is inadequate or missing.

The following graphs compare rates by intent for each available data source. EMS data in NC DETECT are available only for 2021 and 2022; we manually categorized the EMS data into intent categories based on review of the complaint, narrative, and injury cause fields in EMS encounters identified in our EMS firearm v1 definition. This definition looks for complaints related to gunshot wounds, *or* ICD-10-CM injury cause codes for firearm injuries, *or* a dispatch complaint of *Stab/Gunshot Wound/Penetrating Trauma* AND narrative keywords for gunshot wounds. NC-VDRS data are not yet available for 2022.

Assault/Homicide

NC-VDRS and death certificate data have similar trends for homicides by firearm, but EMS have much higher rates for assault by firearm (based on manual review) compared to ED visit data (Figure 14). This further reflects the challenges of ICD-10-CM intent coding in the ED visit setting. We continue to discuss approaches, both within NC and nationally, to improve surveillance for nonfatal firearm assaults. EMS encounters include firearm assaults resulting in death at the scene as well as those transported to the ED. ED visits include those who later died from their injury in the ED or hospital.

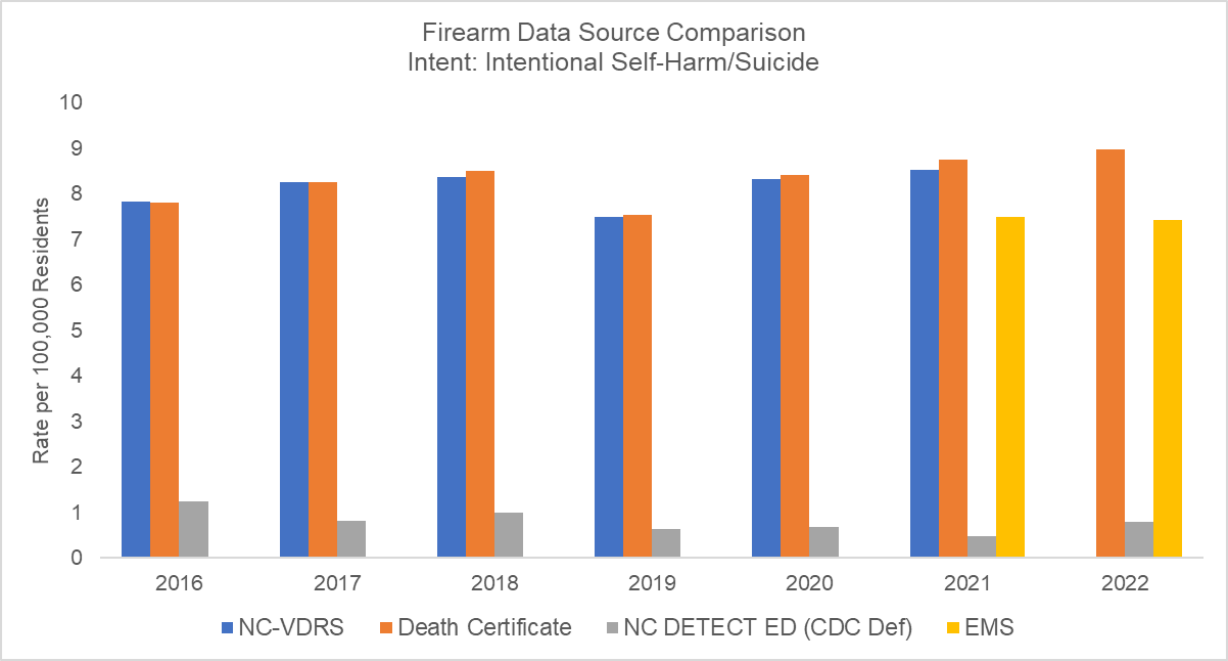
Figure 14: Firearm Injury Data Source Comparison: Assault/Homicide



Intentional Self-Harm/Suicide

Intentional self-directed firearm injury typically results in death. This, combined with the challenges of accurate intent coding previously described results in low rates of intentional self-harm firearm injury identified in the ED visit data (Figure 15). EMS encounters include Intentional self-directed firearm injury resulting in death at the scene as well as those transported to the ED. ED visits include those who later died from their injury in the ED or hospital.

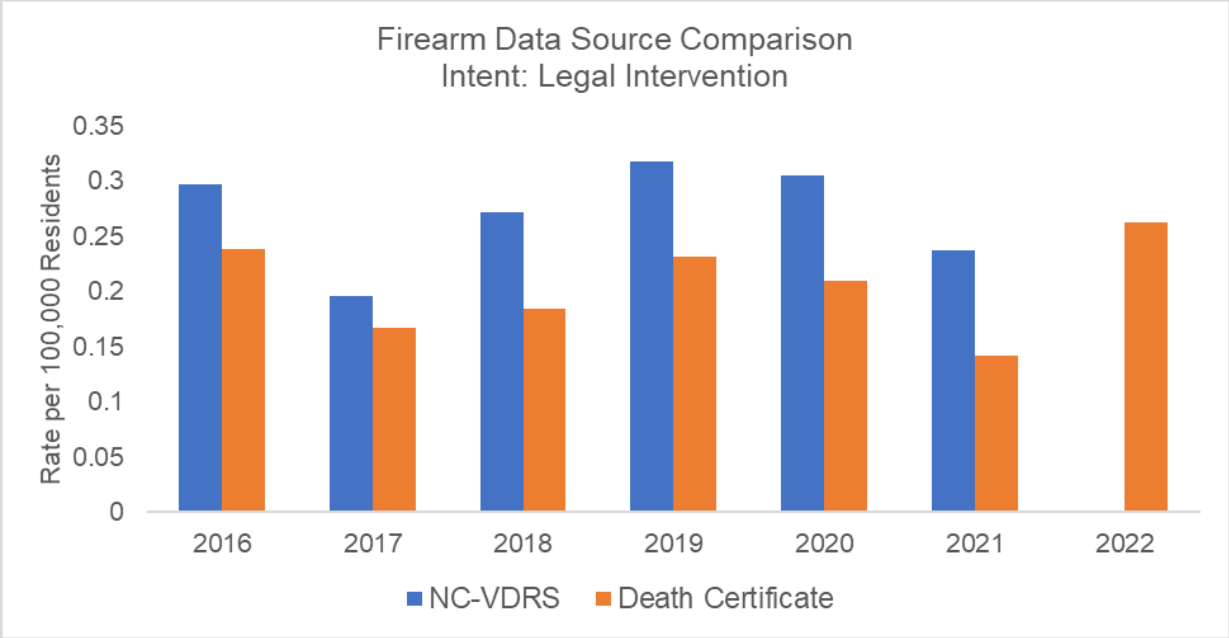
Figure 15: Firearm Injury Data Source Comparison: Intentional Self-Harm/Suicide



Legal Intervention

While ICD-10-CM does include codes for legal intervention involving firearm discharge, these codes are not used systematically in the ED visit data and therefore are not reported here (Figure 16). Manual review of EMS data identified mention of legal intervention in the narrative for some encounters, but legal intervention ICD-10-CM codes were not used systematically in the EMS injury cause field. Additional review of legal intervention related firearm injury in the ED and EMS data is needed. The more detailed data abstraction and review involved in NC-VDRS data collection allows for more accurate identification of firearm deaths involving legal intervention.

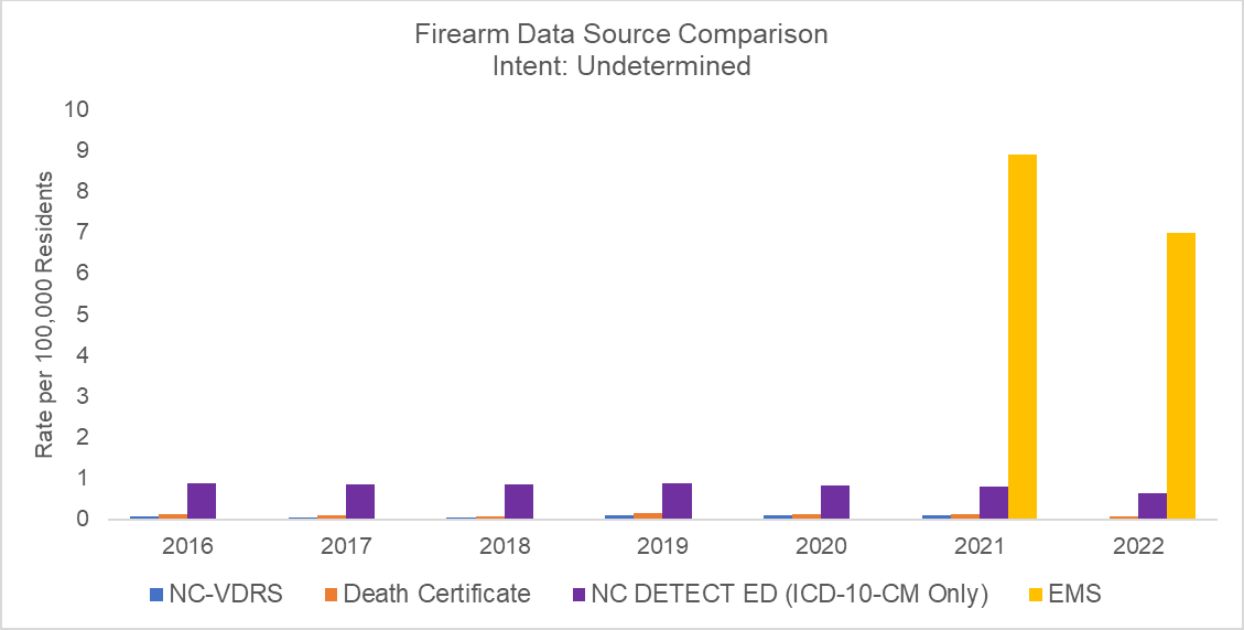
Figure 16: Firearm Injury Data Source Comparison: Legal Intervention



Undetermined

Additional ED visit data output based just on ICD-10-CM codes was included for the undetermined intent category since the official CDC unintentional firearm injury definition includes both unintentional and undetermined ICD-10-CM codes. Even after manual review of the EMS data, many EMS encounters were not able to be classified into a specific intent category and were therefore binned into undetermined. Both ED visit and EMS encounter data show higher rates of undetermined intent than either source of fatality data (Figure 17).

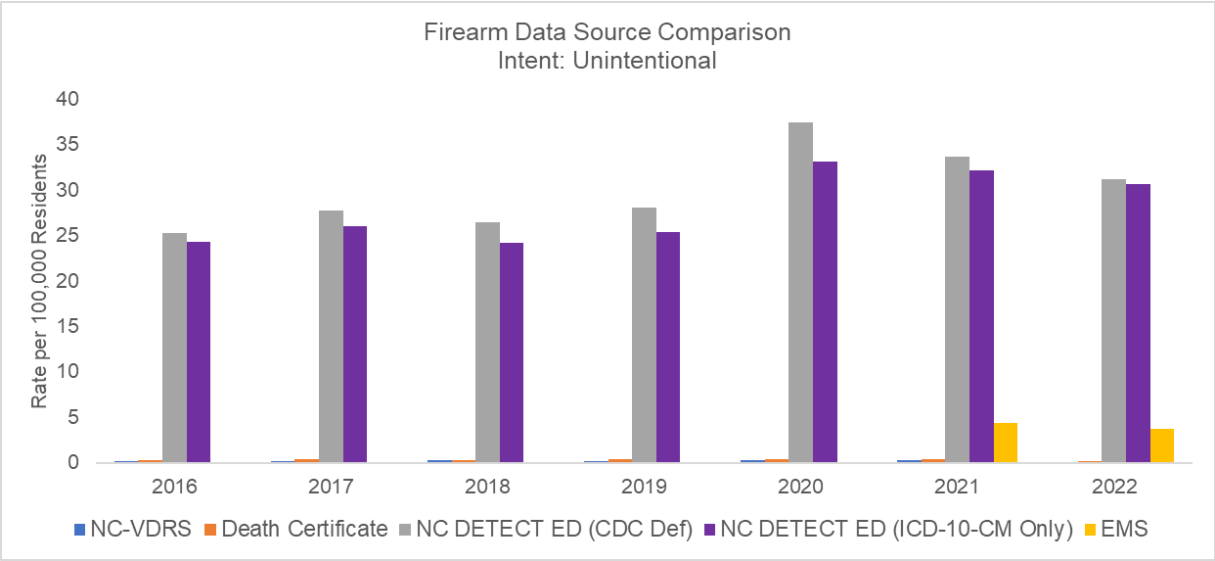
Figure 17: Firearm Injury Data Source Comparison: Undetermined



Unintentional

For unintentional intent, we included the official CDC unintentional definition that includes both unintentional and undetermined ICD-10-CM codes and chief complaint terms, as well as an unintentional definition based on ICD-10-CM codes alone. This intent category has the highest rates in the ED visit data but is an overrepresentation of the true rate of nonfatal unintentional firearm injury. (Figure 18)

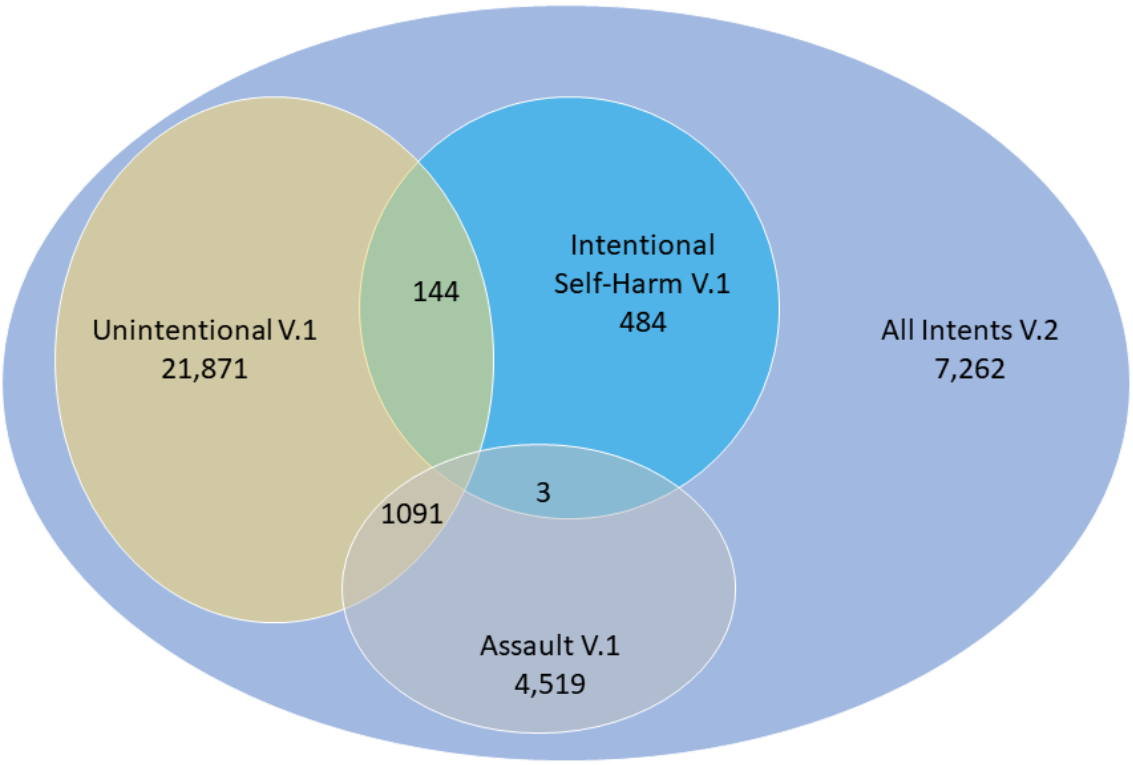
Figure 18: Firearm Injury Data Source Comparison: Unintentional



Co-Occurring Intent Codes in NC DETECT ED Visit Data

ED visits can receive more than one firearm injury ICD-10-CM code and these codes can have conflicting intent (Figure 19). From 2016 to 2022, for example, 1,091 ED visits had ICD-10-CM codes for both unintentional firearm injury and assault firearm injury. In this same period, 144 ED visits had ICD-10-CM codes for both unintentional and intentional self-harm firearm injury, and three ED visits had ICD-10-CM codes for both assault and intentional self-harm firearm injury.

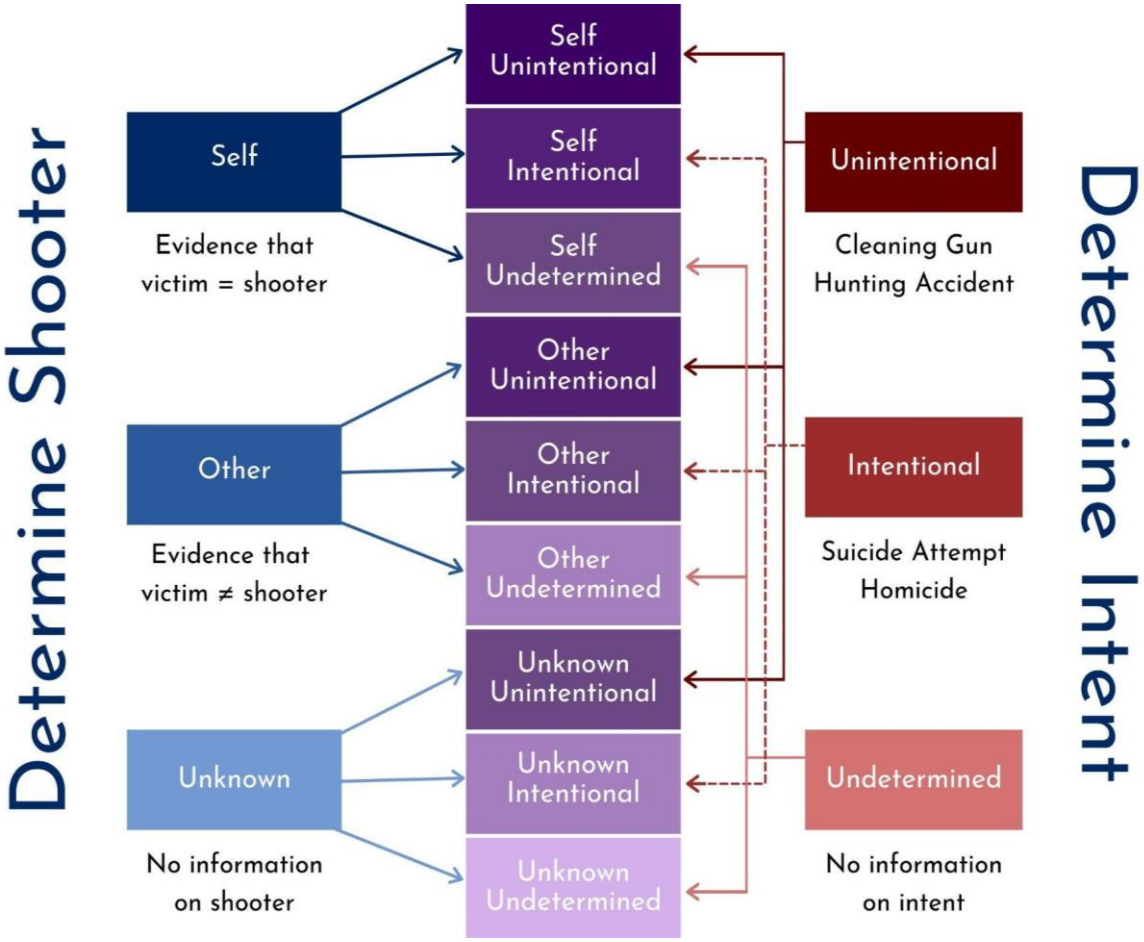
Figure 19: Euler Diagram of ED Visit Overlap Among CDC Firearm Definitions, 2016-2022 (Figure is not to scale.)



Documenting the Shooter Across All Firearm Injury Intent Categories

As previously described, ICD-10 and ICD-10-CM include codes to document firearm injury intent, including unintentional, undetermined, assault/homicide, and intentional self-harm/suicide. Information on the shooter is not documented in these standards when the intent is undetermined or unintentional. In 2021, we developed an approach to documenting shooter across all intent categories (Figure 20). Quantifying the shooter across all intent categories, when possible, can inform prevention messaging.

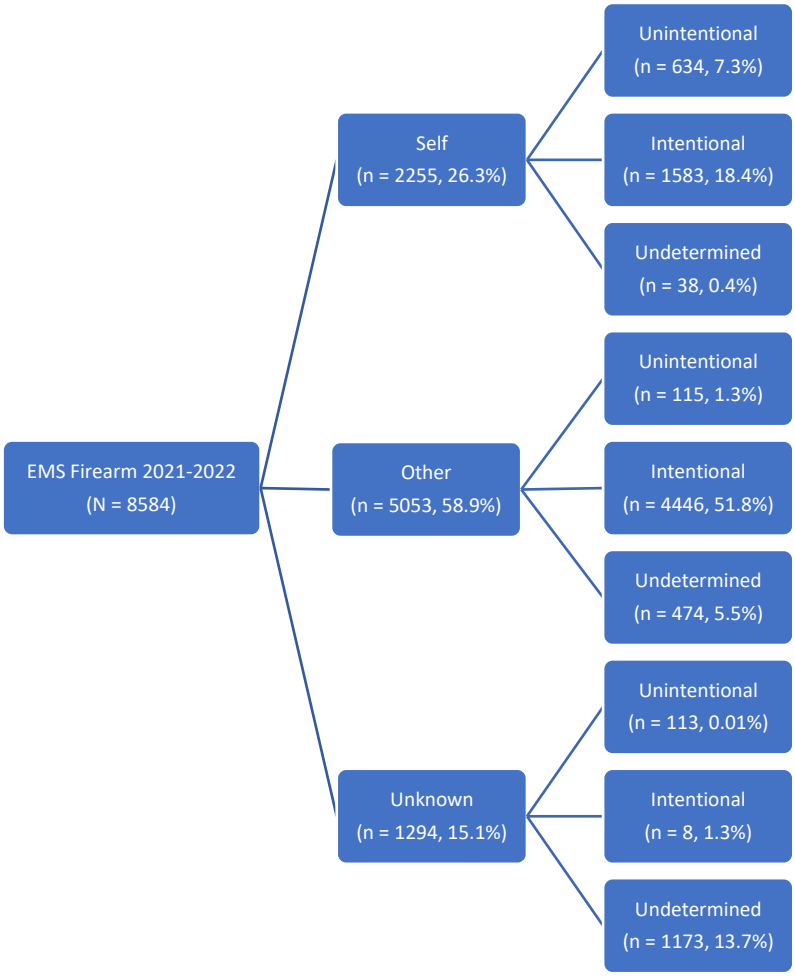
Figure 20: Schematic for determining shooter and intent.



Documenting Shooter and Intent in EMS & ED Data

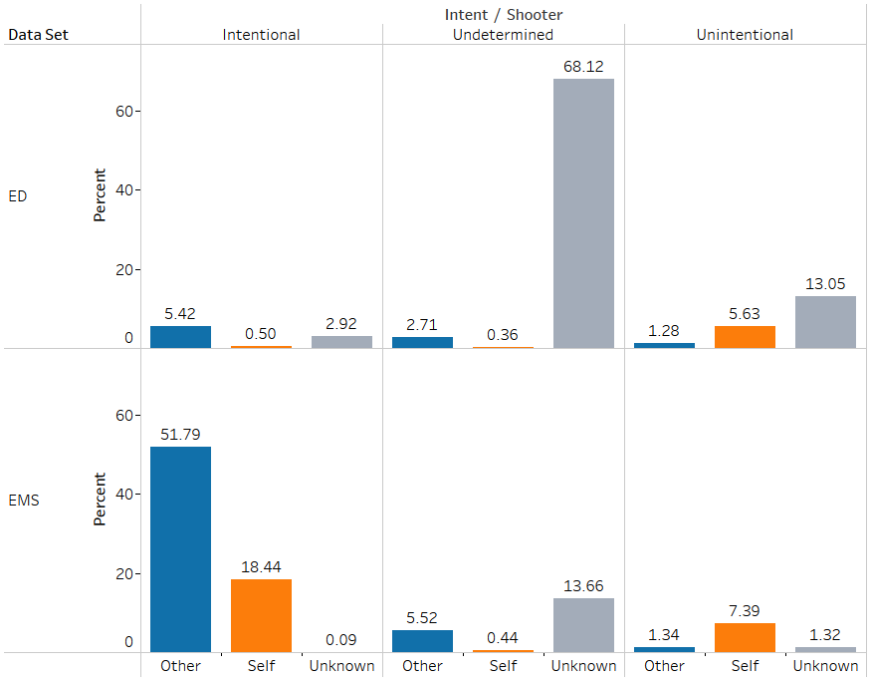
We used the approach in Figure 20 to capture shooter and intent for firearm injuries in 2021-2022 NC EMS data in NC DETECT. We identified 9,557 encounters from January 1, 2021, through December 31, 2022. Of these, 973 (10%) were identified as false positives and removed, leaving 8,584 for this analysis. For the 8,584 EMS firearm injuries reviewed and coded, 26.3% (n = 2,255) of the shooters were self, 59% (n = 5,053) of the shooters were other, and 15% (n = 1,294) of the shooters were unknown/undetermined. Data on shooters were further divided into three subgroups, unintentional, intentional, and undetermined, as shown in Figure 21. Notably, where the shooter was identified as self, the intent was primarily intentional/suicidal (n = 1,583, 18%). Where the shooter was identified as other, the intent was primarily intentional/assault (n = 4,446, 52%). Finally, when the shooter was identified as unknown/undetermined, the intent was often identified as unknown/undetermined. The primary cause of firearm related injury in 2021-2022 EMS encounter data was assault, which encompassed just over half (52%) of all recorded events. This was followed by intentional self-harm, which included 18% of all EMS firearm injury encounters in 2021-2022. The number of self-inflicted **unintentional** injuries is significant (7.3%) and a potential focus for intervention messaging, e.g., safe cleaning and handling training/reminders.

Figure 21: EMS firearms injuries by shooter and intent.



When comparing the 2021-2022 EMS firearm injury data to the sample of ED firearm injury data used in the 2021 syndrome validation report, we see that we can identify intent more readily in the EMS data than in the ED data. Both data sets involved manual review of the available data, including free text fields. The EMS narrative is more substantive than ED chief complaint and triage notes. The absence of accurate ICD-10-CM intent coding available in the ED data limits our ability to assign accurate intent even with manual record review (Figure 22). For ED data, unknown shooter/undetermined intent is identified for 68.12% of all events, followed by unknown shooter/unintentional intent (13.05%). In future work, we hope to develop rules-based definitions for the EMS data that will group firearm injuries by intent to complement the existing all intents definition.

Figure 22: Shooter/Intent comparison of ED (select samples (n = 1475) from 2019-2020), and EMS data sets (n = 8584, complete years 2021 and 2022). Indicators are reported as percent of total samples in each data set.



Firearm Injury in EMS Data

We leveraged the manually reviewed 2021-2022 EMS firearm injury data to conduct additional descriptive analyses. We categorized firearm injury intent by key demographics, revealing several important differences by sex, age group, and race/ethnicity, as shown in Table 5. Notably, EMS firearm injuries were more than 7.0 times more likely to occur among males in comparison to females. Males were also 4.7 times more likely to be involved in an assault-related firearm injury and 6.2 times more likely to be involved in an intentional self-inflicted firearm injury requiring EMS service compared to females. With respect to age group, the highest rate of firearms related assaults was among those aged 19 to 24 (112.77 per 100,000), followed by those aged 15 to 18 (92.90 per 100,000). These results suggest that firearms interventions targeted towards middle and high school students may be helpful in reducing assaults among these slightly older age

groups. In contrast, those aged 65+, followed closely by those aged 19 to 24 years of age, were more likely to be involved in an intentional self-inflicted firearm injury requiring EMS service, with rates of 23.31 per 100,000 and 19.28 per 100,000, respectively. Interventions aimed at preventing intentional self-inflicted firearm injuries, such as suicide prevention programs tailored to these two age groups, may help reduce firearm related suicides. For race/ethnicity, the NH Black or African American race category was 13.3 times more likely to be involved in a firearm injury related to assault in comparison to the NH White race-ethnicity category, while the NH White race-ethnicity category had the highest rate of intentional self-inflicted firearm-related injury. Notably, NH American Indian / Alaskan Native groups had the second highest rate of assault firearm injury, which was 3.9 times higher than the NH White race-ethnicity category, at 41.43 per 100,000.

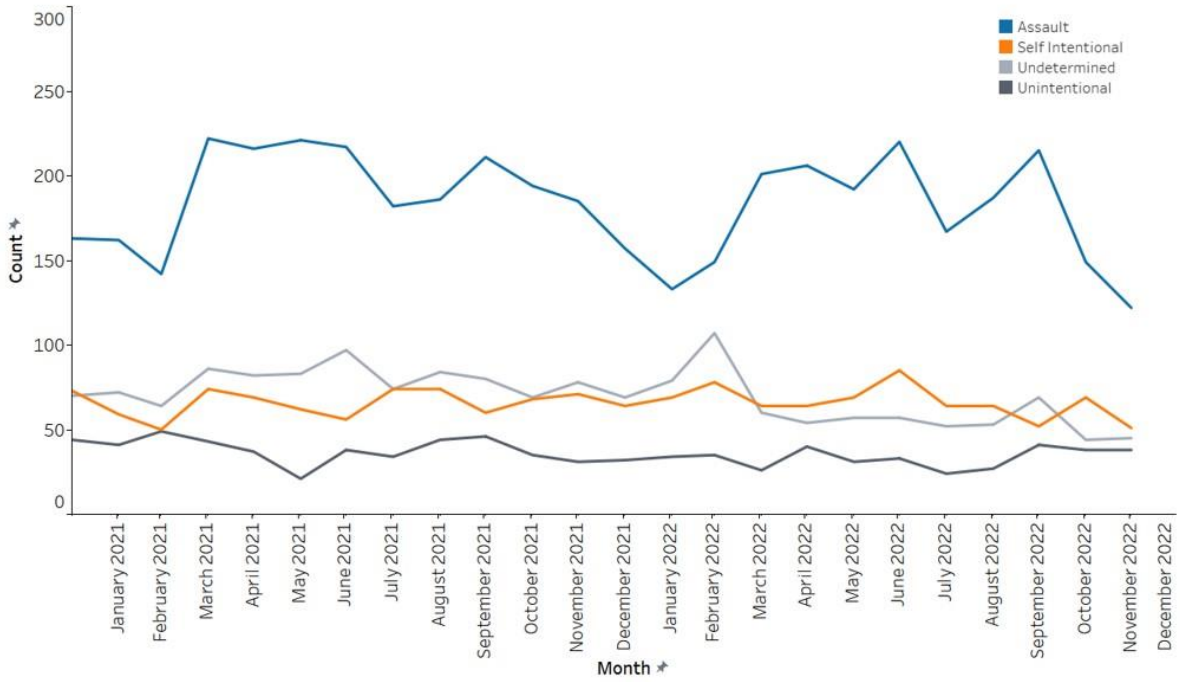
Table 5: EMS Firearm Injury Demographics, 2021-2022, Counts (Rates/100,000 residents)

Demographic	Assault	Intentional Self-Harm	Undetermined	Unintentional
Sex				
Male	3622 (70.36)	1344 (26.11)	1396 (27.12)	742 (14.41)
Female	807 (14.77)	230 (4.21)	268 (4.90)	112 (2.05)
Unknown	7 (--)	4 (--)	6 (--)	2 (--)
Age Group				
Infant (0-1)	7 (2.94)	0 (0)	10 (4.20)	4 (1.68)
PreSchool (2-4)	12 (3.37)	1 (0.28)	9 (2.53)	22 (6.17)
Elementary School (5-9)	23 (3.80)	1 (0.17)	18 (2.97)	14 (2.31)
Middle School (10-14)	86 (12.23)	22 (3.38)	36 (5.54)	32 (4.92)
High School (15-18)	515 (92.90)	66 (11.91)	199 (35.90)	53 (9.56)
College (19-24)	1012 (112.77)	173 (19.28)	354 (39.45)	175 (19.50)
Young Adult (25-44)	2073 (75.21)	434 (15.75)	746 (27.07)	310 (11.25)
Middle Aged (45-64)	580 (21.41)	443 (16.35)	227 (8.38)	155 (5.72)
Senior (65+)	91 (4.93)	430 (23.31)	51 (2.76)	90 (4.88)
Unknown/Missing	47 (--)	13 (--)	35 (--)	7 (--)
Race/Ethnicity[‡]				
American Indian/Alaskan Native	74 (41.43)	6 (3.36)	61 (34.15)	12 (6.72)
Asian/Pacific Islander	22 (5.63)	17 (4.35)	7 (1.79)	11 (2.82)
Black or African American	3102 (139.24)	212 (9.52)	1018 (45.69)	266 (11.94)
Hispanic or Latino	281 (24.24)	56 (4.83)	86 (7.42)	45 (3.88)
White	802 (10.85)	1247 (16.87)	348 (4.71)	484 (6.55)

[‡] Race/Ethnicity Missing = 420

To better understand trends in EMS by intent, we examined intent by month from January 2021 to December 2022 (Figure 23). Assaults predominate all firearm injury events across both years, with an increase in cases between March and June and another spike in September for both years. We will continue to monitor monthly firearm injury trends in EMS data to inform ongoing surveillance efforts.

Figure 23: Monthly trends in EMS Encounter Counts for Firearm Injuries by Intent



Data Linkage

In addition to comparing firearm rates across data sources, we have also led efforts to link data to improve our understanding of firearm injury in NC. Linking data can provide additional insights into causes of and potential interventions for firearm injury that may not be evident when looking at each data source individually.

LEADS Linkage of NC-VDRS to ED Visit Data

As part of a collaboration between the **Linking ESSENCE and Death Surveillance (LEADS)** project and an **American Public Health Association Data Science Demonstration** project, we were able to successfully link ED visit data to NC Violent Death Reporting System (NC-VDRS) death records. North Carolinians who died due to a violent injury in 2019 or 2020 were eligible for record linkage, regardless of the how the injury occurred or the intent behind it.

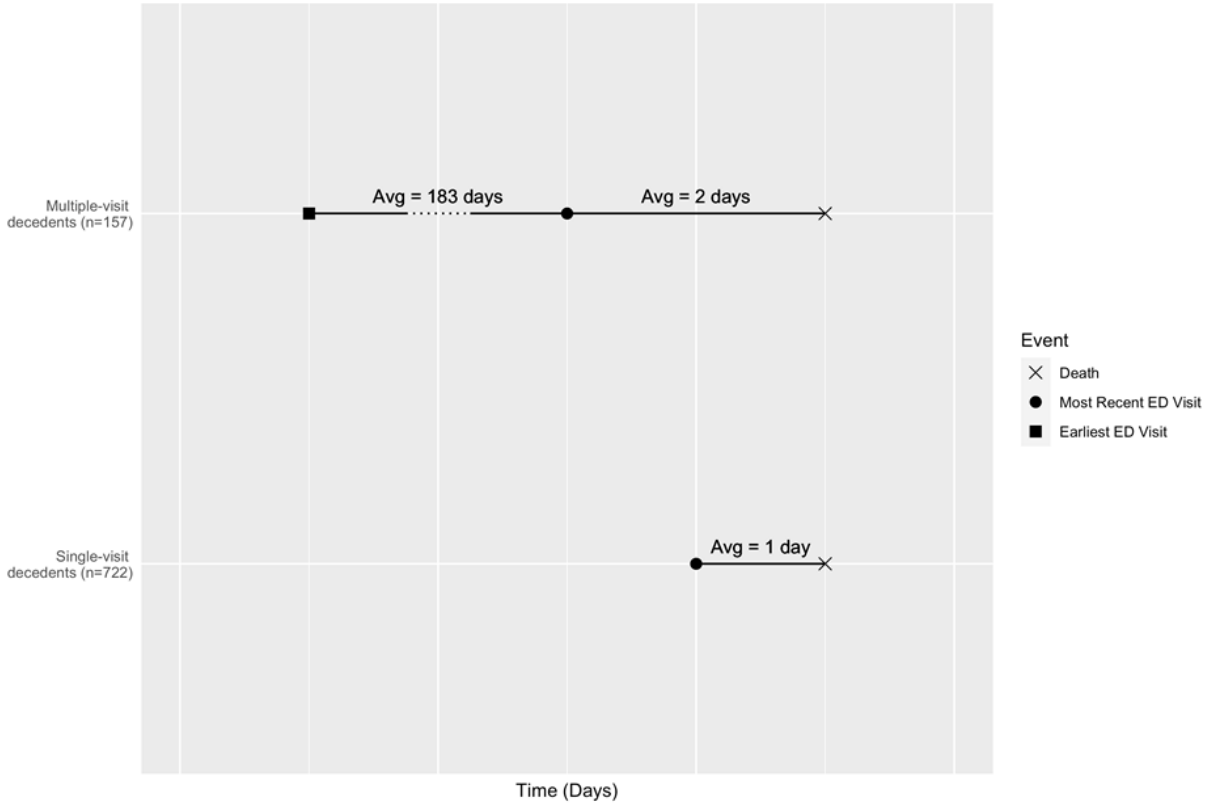
The data linkage process consisted of four stages: (1) pre-linkage filtering, (2) probabilistic data linkage, (3) post-linkage filtering, and (4) manual review. Through this process, we were able to link 1340 of 4768 decedents (28%) to at least one ED visit in the month prior to their death. Additional information on the data linkage process can be found here. Each linked ED visit has an internal tracking ID allowing us to identify all of the individual's previous visits to that same ED. Following the initial linkage process, these tracking IDs were used to identify ED visits within one-year of the decedent's violent death. Of the 1340 linked decedents, 1010 had a single prior-year ED visit and 330 had two or more prior-year ED visits.

With the data linkage process completed, we **investigated the linked firearm injury decedents**, including their demographics, the events surrounding their death, and ICD-10-CM diagnosis codes for their prior-year ED visits, to identify potential prevention opportunities. From 2019 through 2020, 3128 North Carolinians died due to a firearm-related injury. We were able to link 879 (28%) to at least one prior-year ED visit. Linked firearm decedents with a single prior-year visit (n=722) were similar regarding age, sex, race, and ethnicity compared to those with multiple prior-year visits (n=157). ICD-10-CM codes indicative of self-harm or suicidal ideation were more prevalent among firearm decedents with multiple prior-year ED visits (24%) relative to single-visit decedents (8%). Several additional clinical indicators for comparison between single- and multiple-visit decedents are being developed and will be reported in the future.

Multiple-visit decedents had an average of 183 days between their earliest prior-year ED visit and their most recent visit (Figure 24). Notably, single-visit decedents had an average of one day between their most recent (final) ED visit and the date of their death, compared to two days for multiple-visit decedents. We believe the short period of time between the final visit and date of death may be due to many of the final visits being associated with the decedents' fatal injuries. A expanded description of these firearm-specific results can be found in our final LEADS report.

We hope to further leverage this linkage work for several projects in the future, if additional funding is obtained. Further avenues of research include the comparison of single- and multiple- ED visit violent death decedents with the general population of North Carolinians presenting to the ED, investigating variation in ED visit patterns by time until the decedent's date of death, and fine-tuning our linkage process to increase the initial one-month lookback period for eligible ED visits prior to death.

Figure 24: Average (Avg) time from ED visits to death among linked firearm decedents, 2019-2020



Note: Most recent (circle) and earliest (square) ED visit refers to ED visits in the year prior to the decedent's date of death. The most recent ED visit for single-visit decedents is also their earliest ED visit.

EMS-ED Data Linkage

Using an established deterministic data linkage methodology for NC EMS encounter and ED visit data available in NC DETECT, we intend to link EMS encounters for firearm injuries transported to an ED in NC DETECT to the corresponding ED visit record. The linked data will be used to compare intent categorizations as well as to quantify health outcomes. This information will be published in the upcoming 2023 Syndrome Validation Report (July 2023).

Additional Resources

In addition to the annual reports and quarterly data updates available on the NC-FASTER Website the following materials have been produced related to firearm-injury in NC.

Neuroth LM, Johnson LC, Fliss MD, Waller AE, Harmon, KJ. (2022) Applying a probabilistic data linkage approach to identify prior-year emergency department visits among violent death decedents in North Carolina, 2019-2020. Paper presented at the Society for the Advancement Violence and Injury Research (SAVIR) (See Abstract 1, appendix)

Johnson LC, Neuroth LM, Fliss MD, Waller AE, Harmon, KJ. (2022) Novel application of a data linkage framework for suicide deaths in NC-VDRS. Paper presented at the Society for the Advancement Violence and Injury Research (SAVIR) (See Abstract 2, appendix)

Neuroth LM, Proescholdbell SK, Geary S, Ising AI, Waller AE. (2022) Trends in firearm-related emergency department visits surrounding the COVID-19 pandemic: Findings from NC-FASTER, 2019-2021. Poster presented at the Firearms Research Conference (See Poster 1, appendix)

Tilson B, Proescholdbell S, Waller A, Hatcher K, Lassiter W, Pilgreen SA. (2023). Firearm Injuries and Deaths: From Data to Action. Panel presentation and discussion at the North Carolina Public Health Leadership Conference on March 16, 2023. (Slides available upon request.)

Waller AE, Harmon KJ, Neuroth LM, Johnson LC, Fliss MD, Geary S, Ising A, Proescholdbell S. (2023) NC LEADS: Linking NC-VDRS and NC DETECT Emergency Department Visit Data for Firearm Deaths in North Carolina, 2019-2020. Presented at the Faster Reverse Site Visit on May 17, 2023. (See Abstract 3, appendix)

Neuroth LM, Johnson LC, Fliss MD, Waller A, Geary S, Proescholdbell S. (2023) Linking North Carolina Violent Death Reporting System and NC DETECT Emergency Department Visit Data for Firearm Deaths. Presented at the NC LEADS final presentation to CDC and other FASTER states. (Slides available upon request)

Neuroth LM, Johnson LC, Fliss MD, Waller AE, Harmon KJ. (2023) Feasibility of linking violent death decedents to prior-month emergency department visits in North Carolina, 2019-2020. Inj Prev. doi: 10.1136/ip-2022-044821. Epub ahead of print.

Appendix

Abstract 1

Title: Applying a probabilistic data linkage approach to identify prior-year emergency department visits among violent death decedents in North Carolina, 2019-2020

Authors: Lucas M. Neuroth[1,2], Lois C. Johnson[1,2], Michael Dolan Fliss[2], Anna E. Waller[2,3,4], and Katherine J. Harmon[2,5]

1. Department of Epidemiology, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States.
2. Injury Prevention Research Center, University of North Carolina at Chapel Hill, NC, United States.
3. Department of Emergency Medicine, University of North Carolina School of Medicine, Chapel Hill, NC, United States.
4. Carolina Center for Health Informatics, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States.
5. Highway Safety Research Center, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States.

Statement of Purpose: To identify prior-year emergency department (ED) visits among violent death decedents in North Carolina and to describe differences based on visit frequency.

Methods/Approach: North Carolina Violent Death Reporting System (NC-VDRS) records from 1/1/2019-12/31/2020 (n=4,768) were linked to the most recent ED visit corresponding to each tracking ID obtained from NC DETECT (n=5,086,654) using probabilistic linkage methods. For decedents linking to ED visit records, tracking IDs were used to identify prior-year visits for a given medical facility. Descriptive analyses compared characteristics between decedents, stratified by prior-year visit frequency: one, two, or three or more ED visits.

Results: Of the 4,768 NC-VDRS decedents, 28% (n=1,336) linked to least one prior-year ED visit. Prior-year ED visit frequency ranged from 1-43, with most decedents (71%) having one visit. Single prior-year visit decedents were more likely to be younger and male, as compared to multiple-visit decedents. Firearms were the most common mechanism of death; firearm deaths were higher among persons with one visit compared to three or more visits (72% vs. 44%). Among single-visit decedents, frequencies of assault (48%) and suicide (47%) were similar; however, suicide was more common among persons with two (52%) or three or more (64%) prior-year visits. Relative to multiple-visit decedents, more single-visit decedents died within one week (94% vs. 87%) or one day (84% vs. 68%) of their final ED visit.

Conclusion: Decedents with one prior-year ED visit were distinct from multiple-visit decedents. Multiple-visit decedents were more likely to die via suicide, less likely to die by firearm, and had more time elapse after their last ED visit.

Significance/Contribution: Decedents with multiple prior-year ED visits present intervention opportunities for the prevention of violent death. A better understanding of these individuals and the circumstances of their ED visits can contribute to more effective, targeted interventions.

Funding: This work was partly supported an AHPA/CDC Data Science Demonstration Project Award (2022-0007) to the University of North Carolina Injury Prevention Research Center. All

findings and conclusions reported here are those of the authors and do not necessarily represent the views of the CDC and/or APHA.

Data attribution & disclaimer: NC DETECT is a statewide public health syndromic surveillance system, funded by the NC Division of Public Health (NC DPH) Federal Public Health Emergency Preparedness Grant and managed through collaboration between NC DPH and UNC-CH Department of Emergency Medicine's Carolina Center for Health Informatics. The NC DETECT Data Oversight Committee does not take responsibility for the scientific validity or accuracy of methodology, results, statistical analyses, or conclusions presented.

Abstract 2

Title: Novel application of a data linkage framework for suicide deaths in NC-VDRS

Authors: Lois C. Johnson[1,2,4], Lucas M. Neuroth[1,2], Michael Dolan Fliss[2], Anna E. Waller[2,3,4], and Katherine J. Harmon[2,5]

1. Department of Epidemiology, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States.
2. Injury Prevention Research Center, University of North Carolina at Chapel Hill, NC, United States.
3. Department of Emergency Medicine, University of North Carolina School of Medicine, Chapel Hill, NC, United States.
4. Carolina Center for Health Informatics, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States.
5. Highway Safety Research Center, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States.

Statement of Purpose: Emergency departments (EDs) are a critical setting for screening suicide risk. Linking death data to ED visit data can provide insights into care-seeking behaviors prior to suicide, ultimately informing prevention efforts. Using a data linkage framework, we sought to identify and describe individuals who visited the ED prior to suicide death. **Methods/Approach**: From 1/1/2019–12/31/2020, 4,798 violent death records were obtained from the NC Violent Death Reporting System (NC-VDRS) and 5,086,654 ED visit records eligible for linkage were sourced from NC DETECT. NC-VDRS records were linked to the decedent's last ED visit using probabilistic data linkage (linkage variables: date of birth, sex, 3-digit zip code, county of residence, and mechanism of injury). Demographics of linked records were compared to the entire sample and by place of death. **Results**: There were 2,884 suicide deaths in NC-VDRS over the study period. Approximately 85% of those who died in a medical facility (363/428) linked to at least one ED visit in the month prior to death. Males accounted for 70% of suicide deaths in a medical facility (n=300) and had higher linkage rates (87%) than females (79%). Linkage rates were high when decedent race was known, ranging from 84% (White) to 100% (American Indian/Alaskan Native). Among linked suicide decedents who died in a medical facility, firearms were the most common cause of fatal injury (50%), followed by suffocation (23%), and poisoning (20%). **Conclusion**: Linked suicide decedents were demographically similar to NC-VDRS suicide deaths overall. The generalizability of the linked decedents suggests the usefulness of these data to address future research questions. **Significance/Contribution**: Future studies should investigate common diagnoses, ED dispositions, and narrative themes among data linked through this framework to identify prevention opportunities in the ED for suicide deaths.

Funding: This work was partly supported by an AHPA/CDC Data Science Demonstration Project Award (2022-0007) to the University of North Carolina Injury Prevention Research Center. All findings and conclusions reported here are those of the authors and do not necessarily represent the views of the CDC and/or APHA.

Data attribution & disclaimer: NC DETECT is a statewide public health syndromic surveillance system, funded by the NC Division of Public Health (NC DPH) Federal Public Health Emergency Preparedness Grant and managed through collaboration between NC DPH and UNC-CH Department of Emergency Medicine's Carolina Center for Health Informatics. The NC DETECT Data Oversight Committee does not take responsibility for the scientific validity or accuracy of methodology, results, statistical analyses, or conclusions presented.

Abstract 3

Title: NC LEADS: Linking NC-VDRS and NC DETECT Emergency Department Visit Data for Firearm Deaths in North Carolina, 2019-2020

Authors: Anna E. Waller, Katherine J. Harmon, Lucas M. Neuroth, Lois C. Johnson, Michael Dolan Fliss, Shana Geary, Amy Ising and Scott Proescholdbell

Presented By: Scott Proescholdbell

Statement of Purpose: To identify prior-year emergency department (ED) visits among firearm decedents in North Carolina through data linkage and compare those who matched to those who do not.

Methods/Approach: From 1/1/2019–12/31/2020, 4,798 violent death records were obtained from the NC Violent Death Reporting System (NC-VDRS) and 5,086,654 ED visit records eligible for linkage were sourced from NC DETECT. NC-VDRS records were linked to the decedent's last ED visit using probabilistic linkage methods (linkage variables: date of birth, sex, 3-digit zip code, county of residence, and mechanism of injury). For decedents linking to ED visit records, NC DETECT tracking IDs were used to identify additional prior-year ED visits for a given medical facility.

Results: Most NC-VDRS violent deaths in 2019-2020 were firearm deaths (65.6%, n=3,128), and most firearm deaths were suicides (54.2%, n=1,696). Of the 3,128 NC-VDRS firearm deaths, 28% linked to at least one ED visit in the year prior to death, similar to the overall linkage rate between NC-VDRS and ED visit data. Firearm decedents identified as Black or American Indian/Alaskan Native and those who died in a medical facility (ED, hospital inpatient, or outpatient clinic) were overrepresented among the population with linked records. Firearm decedents where the intent was unintentional were the most likely to link to an ED visit while those identified as suicide deaths were the least likely to link. Most of these firearm deaths (78%) linked to only one ED visit in the year prior to death, often the ED visit associated with the fatal event. Of the 197 firearm deaths with multiple ED visits identified in the year prior to death, 18% had a coded history of self-harm, suicidal ideations, or both during those prior ED visits. Firearm deaths linking to more than one ED visit in the year prior to death were demographically very similar to those linking to one ED visit in the year prior to death; however, they were slightly more likely to be female, younger, and to die by suicide.

Conclusion: Successful linkage of NC-VDRS firearm deaths with prior year ED visits was possible. Linked firearm decedents differed from NC-VDRS firearm deaths overall by race and injury intent. Decedents with multiple prior-year ED visits present intervention opportunities for the prevention of future firearm deaths. A better understanding of these individuals and the circumstances of their ED visits can contribute to more effective, targeted interventions. Future studies should investigate common diagnoses, ED dispositions, and narrative themes among linked NC-VDRS and ED visit data.

Trends in firearm-related emergency department visits surrounding the COVID-19 pandemic: Findings from NC-FASTER, 2019-2021

GILLINGS SCHOOL OF GLOBAL PUBLIC HEALTH
SCHOOL OF MEDICINE

Lucas M. Neuroth[1,2,3], Scott K. Proescholdbell[3,4], Shana Geary[4], Amy I. Ising[2], Anna E. Waller[2,3]

[1]Department of Epidemiology, Gillings School of Global Public Health, UNC-Chapel Hill
[2]Carolina Center for Health Informatics, Department of Emergency Medicine, School of Medicine, UNC-Chapel Hill
[3]Injury Prevention Research Center, UNC-Chapel Hill
[4]Injury and Violence Prevention Branch, Division of Public Health, North Carolina Department of Health and Human Services

NC DEPARTMENT OF HEALTH AND HUMAN SERVICES
Division of Public Health

Background

- Firearm-related emergency department (ED) visits in North Carolina occurred at a rate of 51.4 per 100,000 residents/year from 2019-2021.
- Despite decreases in overall ED utilization, firearm injuries were one of the few mechanisms where the frequency of ED visits increased during the COVID-19 pandemic.
- To better understand firearm-related ED visits during this period, we (1) compared patient demographics from 2019-2021 and (2) estimated trends in monthly ED visits by patient disposition.

Methods

Data

- North Carolina's statewide syndromic surveillance system (NC DETECT) was used to obtain ED visit records from 1/1/2019 through 12/31/2021.
  - Data from all civilian, 24/7, acute care hospital-affiliated EDs in NC are included.
- Firearm-related ED visits identified using version 2 of the CDC's all intents firearm injury syndrome; injury intent was determined using version 1 of the CDC's firearm-related injury intent syndromes.

Analysis

- Descriptive analysis:
  - Visits aggregated by year and stratified by patient/injury characteristics.
  - Differences across years compared with chi-square tests or one-way ANOVA.
- Trend analysis:
  - Visits aggregated by month and fit with LOWESS smoothed curves.

Table 1. Characteristics of firearm-related ED visits in NC, 2019-2021

	2019	2020	2021	
n	4669	5868	5416	P-value
Integer age (mean (SD))	31.2 (14.4)	30.8 (14.4)	30.8 (14.3)	0.221
Age category (Col. %)				0.001
0 - 14 years	160 (3.4)	203 (3.5)	226 (4.2)	
15 - 18 years	497 (10.6)	695 (11.8)	591 (10.9)	
19 - 24 years	1148 (24.6)	1439 (24.5)	1323 (24.4)	
25 - 44 years	2061 (44.1)	2573 (43.8)	2387 (44.1)	
45 - 64 years	576 (12.3)	730 (12.4)	628 (11.6)	
65+ years	175 (3.7)	186 (3.2)	172 (3.2)	
Missing	52 (1.1)	42 (0.7)	89 (1.6)	
Sex (%)				<0.001
Male	3956 (84.7)	4969 (84.7)	4478 (82.7)	
Female	652 (14.0)	828 (14.1)	805 (14.9)	
Missing	61 (1.3)	71 (1.2)	133 (2.5)	
Race and Ethnicity (Col. %)				<0.001
Black	2696 (57.7)	3542 (60.4)	2910 (53.7)	
White	1339 (28.7)	1514 (25.8)	1509 (27.9)	
Hispanic	207 (4.4)	232 (4.0)	235 (4.3)	
Other*	189 (4.0)	231 (3.9)	138 (2.5)	
American Indian	78 (1.7)	154 (2.6)	128 (2.4)	
Missing	160 (3.4)	195 (3.3)	496 (9.2)	
Disposition (Col. %)				<0.001
Left Without Advice	70 (1.5)	84 (1.4)	108 (2.0)	
Discharged	2396 (51.3)	3103 (52.9)	3064 (56.6)	
Admitted**	1436 (30.8)	1674 (28.5)	1107 (20.4)	
Transferred	418 (9.0)	577 (9.8)	634 (11.7)	
Died	167 (3.6)	224 (3.8)	237 (4.4)	
Missing	182 (3.9)	206 (3.5)	266 (4.9)	
Unintentional*** (%)	3074 (65.8)	4103 (69.9)	3847 (71.0)	<0.001
Assault*** (%)	864 (18.5)	890 (15.2)	656 (12.1)	<0.001
Self harm*** (%)	71 (1.5)	74 (1.3)	60 (1.1)	0.182

*Other includes Asian, Pacific Islander, and Other race categories
**Admitted includes Admitted, Psych Admit, and Observation
***Proportion of visits with syndrome

Figure 2. Trends of firearm-related ED visits in NC by disposition, 2019-2021

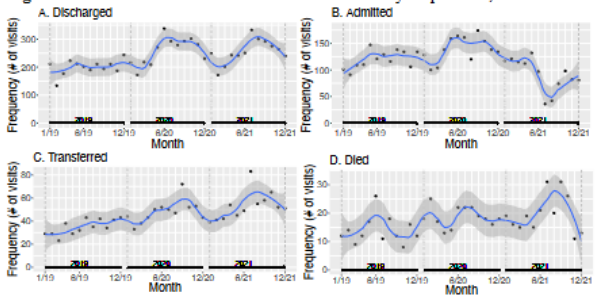
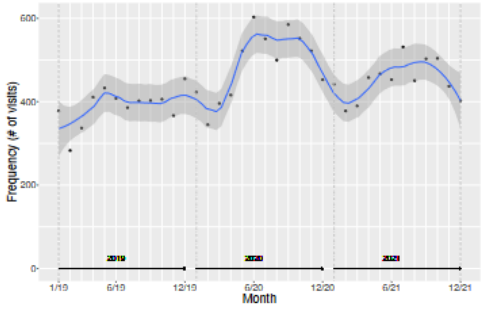


Figure 1. Overall trend of firearm-related ED visits in NC, 2019-2021



Key Findings

- Significant changes in the distribution of race/ethnicity, disposition, unintentional injuries, and assaults were observed across years.
- Overall, firearm-related ED visits began to increase in March 2020 and remained elevated above 2019 levels through 2021.
  - Distinct seasonality observed.
- When stratified by disposition, discharges followed the general overall trend.
  - Admissions trended downward following a spike at the beginning of the COVID-19 pandemic.
  - Transfers and deaths trended upward.

Acknowledgements

- NC DETECT is funded with federal funds by North Carolina Division of Public Heath (NC DPH), Public Health Emergency Preparedness Grant (PHEP), and managed through a collaboration between NC DPH and the University of North Carolina at Chapel Hill Department of Emergency Medicine's Carolina Center for Health Informatics (UNC CCHI). The NC DETECT Data Oversight Committee does not take responsibility for the scientific validity or accuracy of methodology, results, statistical analyses, or conclusions presented.