

Syndromic Surveillance of Nonfatal Firearm Injuries in Rhode Island, 2022–2024

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BACKGROUND

Firearm injuries are a leading cause of death among those 1–44 years old in the United States.¹ In Rhode Island (RI), a total of 267 firearm deaths occurred during 2019–2023, with approximately 60% of these deaths being suicides and approximately 37% being homicides.² Firearm-related deaths that are ruled accidental, undetermined, or by legal intervention (law enforcement officers acting in the line of duty) are also reported in RI, but in small numbers. Morbidity related to nonfatal firearm injuries is also important to consider, as those who survive an injury may experience long-term consequences. More than 70% of medically treated, nonfatal firearm injuries have been found to be related to assaults, while around 20% have been associated with accidental injuries.¹

In RI, hospital discharge data (HDD) and syndromic surveillance data from RI’s Electronic Surveillance System for the Early Notification of Community-based Epidemics (ESSENCE) are both sources of data for nonfatal firearm-related injuries from emergency departments (EDs); however, related visits are identified in different ways. From HDD, injuries are identified from diagnosis codes reported by the hospitals, while combinations of diagnosis codes and keyword terms in chief complaint text are used to identify visits from syndromic surveillance. Syndromic surveillance data are reported in near real-time, thus can be useful in identifying potential increases in firearm-related injuries or other health conditions more quickly than HDD.

This analysis focuses on nonfatal firearm injury trends and characteristics in RI using ED data from 2022–2024. The utility of syndromic surveillance data is evaluated by comparing firearm-injury trends and characteristics identified from ESSENCE to those observed in HDD during the same three-year period.

METHODS

Using 2022–2024 HDD, ED visits in RI related to firearm injuries were identified based on the presence of select International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) codes in any of the reported diagnoses or the external cause of injury fields. Visits were identified and classified by intent as summarized in **Table 1**.

Table 1. Summary of codes from the International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) used to identify firearm-related injuries.

ICD-10-CM Code(s)*	Description
W32, W33, W34.00, W34.09, W34.10, W34.19	Accidental discharge or malfunction of firearm
X72, X73, X74.8, X74.9	Intentional self-harm by firearm
X93, X94, X95.8, X95.9	Assault by firearm
Y38.4	Terrorism involving firearms
Y22, Y23, Y24.8, Y24.9	Firearm discharge of undetermined intent
Y35.00–Y35.03, Y35.09	Legal intervention involving firearm discharge

*Only included if the 7th character of the code is A or missing to reflect initial encounter, active treatment.

To ensure visits were for the initial injury encounter, visits were only included where the seventh character of the ICD-10-CM code was either ‘A’ or missing. Deaths and visits from specialty hospitals were excluded from the analysis.

Firearm-related ED visits in RI during 2022–2024 were also identified in ESSENCE using the firearm injury version 2 syndrome definition developed by the Centers for Disease Control and Prevention (CDC).³ This syndrome definition includes the same diagnosis codes used for HDD; however, it also identifies firearm-related visits using keyword terms such as ‘gunshot wound’ or ‘GSW’. Visits related to accidental firearm injuries, intentional firearm injuries, and assault firearm injuries were also identified using the developed CDC syndrome definitions for these conditions.^{4–6} ESSENCE data were reported from the same facilities as HDD, and deaths were similarly excluded from analysis.

Data from HDD and ESSENCE were imported in SAS (version 9.4) for cleaning and analysis. Due to small numbers, 2022–2024 data were combined and summarized by month, based on visit date. Variables were created to classify visits by year (2022, 2023, 2024), sex (male, female), age group (<25, 25–34, 35–54, 55), race/ethnicity (Hispanic, White, not Hispanic, Black, not Hispanic, other not Hispanic), and injury intent (accidental, intentional, assault, other). Proportions were calculated for each characteristic and chi-square tests ($\alpha=0.05$) were performed to identify potential differences between ESSENCE and HDD.

RESULTS

During 2022–2024, a total of 272 ED visits related to firearm injuries were identified from ESSENCE compared to 295 from HDD. Similar trends were observed by visit month, with visits peaking during July, in both ESSENCE and HDD [Figure 1].

No significant differences in the proportions of firearm-related ED visits between ESSENCE and HDD were identified by year, sex, age group, and race/ethnicity (Table 2, p-values >0.05). Most visits were observed among males, individuals less than 25 years old, and Hispanic and Black, non-Hispanic individuals. While most injuries were classified as accidental in both ESSENCE and HDD, a statistically significant difference was observed by injury classification between these data sources (Table 2, $p < 0.0001$).

DISCUSSION

This analysis found similar trends and characteristics of nonfatal firearm injuries using two sources of RI ED data. Overall firearm-related injury counts were similar by year and visit month when compared between RIDOH's syndromic surveillance system (ESSENCE) and HDD. Counts of firearm injuries were observed to be higher during warmer months and peaked in July, which is consistent with findings using data from other jurisdictions.⁷ Both data sources found the highest burden of injuries among males, younger individuals, and Hispanic and Black individuals, which is also consistent with observations nationally.¹

Given the similarities, the findings support the use of data from RI's ESSENCE syndromic surveillance system, as these data are reported in near real-time. While ED data from HDD are considered more of a 'gold standard' source, these data undergo further preparation and review and are typically delayed by approximately three months from the end of a calendar quarter.

A significantly different proportion of ED visits related to accidental firearm injuries was observed in ESSENCE (87%) compared to HDD (59%). Both percentages are higher than the national estimate of 20% for nonfatal accidental firearm injuries,¹ suggesting misclassification by intent in both datasets. Given that intentional firearm injuries are typically fatal, and accidental firearm deaths are not frequently observed in RI (<5 deaths during 2019–2023),² assault-related visits likely represent a larger proportion of nonfatal injuries. A higher proportion of assault-related injuries was observed in HDD, likely because diagnosis codes undergo additional review and are updated prior to submission. Thus, misclassification by intent likely occurred at a lower rate in HDD, but findings by intent are likely not reliable for either source of ED data. Misclassification of firearm injuries by intent has been noted in other studies. One study that reviewed available clinical notes found that 28% of assault-related firearm injuries were misclassified as accidents.⁸ In North Carolina,

Figure 1. Nonfatal firearm-related emergency department visits in Rhode Island by visit month, syndromic surveillance (ESSENCE) versus hospital discharge data (HDD), 2022–2024 combined.

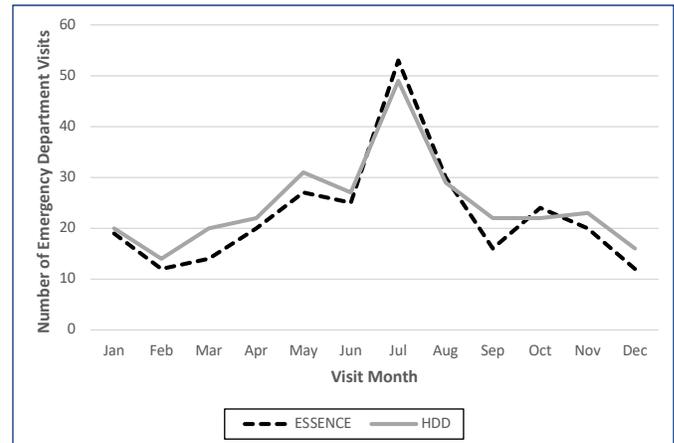


Table 2. Comparison of select characteristics of firearm-related emergency department visits identified via RIDOH's syndromic surveillance system (ESSENCE) and hospital discharge data (HDD), 2022–2024.

Visit Characteristic	ESSENCE N=272 n (%)	HDD N=295 n (%)	P-value [*]
Year			
2022	108 (39.7)	109 (39.6)	0.7454
2023	101 (37.1)	111 (37.6)	
2024	63 (23.2)	75 (25.4)	
Sex[†]			
Male	235 (86.4)	255 (86.4)	0.9236
Female	36 (13.2)	40 (13.6)	
Age Category[†]			
<25	96 (37.9)	109 (39.6)	0.9743
25-34	81 (32.0)	100 (33.9)	
35-54	59 (23.3)	67 (22.7)	
55+	17 (6.7)	19 (6.4)	
Race/Ethnicity[†]			
Hispanic	83 (30.5)	103 (34.9)	0.7850
White, Not Hispanic	71 (26.1)	72 (24.4)	
Black, Not Hispanic	98 (36.0)	102 (34.6)	
Other, Not Hispanic	16 (5.9)	17 (5.8)	
Injury Classification			
Accidental	236 (86.8)	174 (59.0)	<0.0001 [§]
Assault	9 (‡)	108 (36.6)	
Intentional	6 (‡)	7 (‡)	
Other	0 (‡)	6 (‡)	

^{*}Chi-square test; $\alpha=0.05$.

[†]Counts do not add up to totals due to missing data. Percent calculations are based on available data.

[‡]Percent not reported due to reliability concerns/small numerator.

[§]Accidental category compared to all other categories for this calculation.

another study found that the records of Emergency Medical Services (EMS) were better able to classify intent compared to available data from the ED.⁹ Given known challenges in classification, looking at overall firearm-injury trends, but not drawing conclusions based on intent, is recommended when using ED data. Further research using RI EMS data and other data sources should be conducted to identify more specific insights by intent.

Efforts should also be made by providers to improve intent coding, when possible. Past ICD-10-CM coding guidelines likely contributed to intent misclassification and the findings of this analysis, as they mentioned intent should be coded as accidental when the injury intent was unknown or unspecified.¹⁰ However, recent guidelines went into effect in October 2025 and provide updated recommendations around how firearm injuries should be coded.¹¹ Specifically, firearm injury intent is now listed as an exception that can be coded using medical documentation from other clinicians involved in the care of a patient, besides the patient's provider. By utilizing notes and clinical documentation available from other clinicians involved in a patient's care, coding may become more reliable over time and allow trends to be more thoroughly evaluated by intent.

Providers should also consider the importance of mental health screening and other health services, as people who survive firearm injuries may suffer long-term consequences. Research has found firearm injuries are associated with impacts on physical well-being, along with psychological, economic, and impact quality of life.¹² Beyond the patient, impacts can also extend to their families and at the community level, supporting the need for more research and access to real-time data sources, such as ESSENCE, to enhance prevention activities. In addition to injury intent misclassification, the main limitation of this analysis was the need to aggregate data across several years due to small sample sizes. Despite this limitation, this analysis was able to highlight similarities in nonfatal firearm-related injuries across different sources of ED data. Future analyses should include more recent data to explore any changing patterns in overall injuries and trends by intent, as recent coding guidance continues to be implemented.

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