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Documentation of Psychiatric Disorders Among U.S. Adolescents Who Died by Firearm Suicide: A Population-Based CDC WONDER Analysis, 2018–2024

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Abstract

Background

Mortality records may capture the mechanism of adolescent suicide more consistently than the psychiatric history preceding it. We examined how frequently psychiatric disorders were documented among U.S. adolescents who died by firearm suicide and whether documentation varied across demographic and firearm-mechanism groups.

Methods

We conducted a population-based cross-sectional analysis of CDC WONDER Multiple Cause of Death data from 2018–2024. We identified U.S. adolescents aged 10–19 years who died by firearm suicide (ICD-10 X72–X74). The primary outcome was documentation of any mental or behavioral disorder (F01–F99) as a multiple cause of death. Secondary outcomes included mood disorders (F30–F39), psychoactive substance-use disorders (F10–F19), and neurotic, stress-related, and somatoform disorders (F40–F48). Documentation was compared by age, sex, race/ethnicity, and firearm mechanism. Temporal trends were assessed using Poisson/negative binomial regression.

Results

Among 8,885 adolescent firearm-suicide deaths, only 386 (4.34%; 95% CI, 3.93%–4.79%) had a documented psychiatric disorder. Mood disorders accounted for 229 cases (2.58% of all deaths; 59.33% of documented psychiatric cases), while psychoactive substance-use disorders were documented in 29 (0.33%). No neurotic, stress-related, or somatoform disorders were documented. Psychiatric documentation differed significantly by age ($p < 0.001$) and race ($p < 0.001$): no psychiatric disorders were documented among 1,378 decedents aged 10–14 years or among 1,202 Black decedents in the available race-stratified data, compared with documentation among 5.14% of those aged 15–19 years and 4.83% of White decedents. Documentation did not differ by sex (4.42% vs 3.85%; $p = 0.408$) and showed no significant annual change ($p = 0.461$). Firearm-suicide mortality likewise showed no significant temporal trend (IRR, 0.991; $p = 0.962$).

Conclusions

Psychiatric disorders were documented in fewer than 1 in 20 adolescent firearm-suicide deaths, highlighting the limited psychiatric information captured in mortality records. The complete absence of documented psychiatric disorders among younger adolescents and Black decedents is particularly notable and may reflect differences in diagnostic recognition, access to clinical records, informant reporting, or death-investigation practices rather than absence of psychiatric morbidity. These findings

highlight a critical surveillance blind spot: absence of documentation should not be interpreted as absence of psychiatric risk. More standardized approaches to capturing psychiatric history during adolescent suicide investigations and linking mortality data with clinical records may improve surveillance and identify populations whose psychiatric risk is being missed.

1. Introduction

Adolescent mental health has emerged as a substantial public health concern over the past decade [1, 2]. Recent epidemiologic data suggest that adolescents report higher rates of mental health problems than previous generations [3]. Although debate continues regarding the extent to which these trends reflect changes in underlying morbidity versus increased recognition and screening, the public health significance of adolescent mental health concerns remains substantial. According to the National Health Interview Survey–Teen (NHIS-Teen) conducted by the National Center for Health Statistics, among U.S. adolescents aged 12–17 in 2021–2023, nearly one in five (18%) teens reported having symptoms of depression, while an additional 20% reported symptoms of anxiety in the past two weeks [4].

Paralleling the increase in mental health issues in adolescents is the rate of youth mortality due to suicide [5, 6, 7], with suicide being the second-most common cause of death among youth ages 10–14 and third-most common cause for adolescents aged 15–24 [8]. Data collected in 2023 among U.S. high school students highlight the critical nature of this distress: 40% of these students reported persistent feelings of sadness or hopelessness in the past year. Among these students, 20% reported seriously considering suicide, 16% reported making a suicide plan, and 9% reported at least one suicide attempt during the preceding year [9].

While suicidal ideation and behaviors are multi-factorial, the specific mechanism chosen matters significantly in terms of fatality. Analysis of data from the NVDRS Violent Deaths Report (2018–2023, all funded areas) reveals that out of 11,189 documented adolescent suicide deaths, firearms accounted for the single largest proportion at 45.2% (n = 5,053), followed by hanging/suffocation (39.6%) and then poisoning (7.2%) [10]. This broadly aligns with the national data: firearms are the leading cause (53.6%) of mortality due to suicide for all age groups across the United States according to CDC WISQARS Fatal Injury Reports data (2018–2024) [11]. Given their substantial contribution to suicide mortality, firearm access and firearm safety have consequently been extensively studied as potentially modifiable factors in suicide prevention [12–14].

Although firearm access and firearm lethality are well-established components of adolescent suicide prevention, substantially less attention has been given to how psychiatric conditions are captured in mortality surveillance data. A substantial gap therefore remains in understanding how consistently psychiatric diagnoses are identified and documented among adolescent suicide decedents [15].

This potential documentation gap reflects the fundamentally different purposes of mortality surveillance and comprehensive psychiatric assessment. The immediate mechanism of suicide is generally more readily identifiable and systematically coded through ICD-10 external-cause codes (e.g., X72–X74),

whereas psychiatric history may require information from prior clinical records, family members, or other sources that may not be available during the death investigation.

This tracking challenge is rooted in how psychiatric information is captured. Proper recording and classification of these underlying psychiatric markers depend on multiple underlying systemic factors: whether the past medical records were available to the certifier; whether the examiner was aware of the decedent's history; whether the certifier relied on retrospective data with potential bias among informants; or even whether this information was simply treated as secondary administrative detail [16]. Furthermore, it is important to note that these systemic gaps do not affect all decedents equally. A national Multiple Cause-of-Death (MCOD) analysis of all-age suicide decedents found that psychiatric comorbidities were significantly less frequently documented on the death certificates of Black and Hispanic individuals compared to White individuals, suggesting that psychiatric documentation in mortality records may vary systematically across demographic groups [17, 18]. Whether this pattern extends to adolescent firearm suicide decedents specifically, however, remains uncharacterized.

Collectively, these factors may result in psychiatric information being omitted, incompletely captured, or inconsistently reported in mortality surveillance data.The resulting data gaps create a surveillance blind spot. Although psychiatric disorders and psychological distress are important contributors to suicide risk [19, 20], the extent to which psychiatric disorders are captured in national mortality data remains poorly characterized, with undocumented cases even carrying higher odds of misclassification as undetermined rather than suicide [18]. Characterizing these documentation patterns is therefore important for interpreting national mortality surveillance data and understanding the extent to which psychiatric conditions are represented in population-level suicide statistics.

To address this gap, this study used the Centers for Disease Control and Prevention (CDC) Wide-ranging Online Data for Epidemiologic Research (WONDER) database to conduct a population-based, cross-sectional analysis of documented psychiatric disorders among U.S. adolescents aged 10–19 years who died by firearm suicide between 2018 and 2024.

We hypothesized that psychiatric disorders would be documented in a minority of adolescent firearm-suicide deaths and that documentation would vary across demographic groups and firearm mechanisms. We further hypothesized that documentation would increase with age and that mood disorders would represent the most frequently documented psychiatric category.

To test these hypotheses, the investigation is guided by two central objectives. The primary objective is to determine the prevalence and temporal trends of documented psychiatric disorders among U.S. adolescents who died by firearm suicide between 2018 and 2024. The secondary objective is to determine which psychiatric disorder categories [specifically mood disorders (F30–F39), neurotic, stress-related, and somatoform disorders (F40–F48), and substance use disorders (F10–F19)] appear more frequently in this population and to examine and characterize how this documentation varies across demographic and mechanistic subgroups, such as age group (early adolescence, 10–14 years,

versus late adolescence, 15–19 years, as well as single-year age trends), sex, race, ethnicity, and firearm mechanism (handgun, rifle/shotgun, or other/unspecified firearm).

Characterizing psychiatric documentation patterns in adolescent firearm-suicide mortality may help clinicians, researchers, and policymakers better interpret national mortality surveillance data and identify populations in which psychiatric conditions may be less consistently documented. These findings may also inform future efforts to improve death-investigation practices, clinical documentation, and linkage between behavioral health records and mortality surveillance systems. For pediatric and child and adolescent psychiatry practitioners, these findings reinforce the importance of universal suicide-risk screening and routine firearm-safety counseling, particularly when the absence of documented psychiatric history might otherwise be misinterpreted as low risk. For public health surveillance systems, understanding the magnitude and nature of this documentation gap is an essential initial step toward obtaining more precise national estimates of psychiatric comorbidity in adolescent suicide and toward establishing more uniform, standardized certification practices across different jurisdictions. Bridging this gap between psychiatric morbidity and its recognition in mortality statistics may facilitate the earlier detection of at-risk youth and more effective suicide prevention strategies.

2. Methods

Study Design

This population-based cross-sectional study examined documentation of psychiatric disorders among U.S. adolescents who died by firearm suicide between 2018 and 2024. Mortality and population denominator data were extracted from the Centers for Disease Control and Prevention Wide-ranging Online Data for Epidemiologic Research (CDC WONDER) Multiple Cause of Death database [21], which consists of mortality statistics and demographic data from U.S. death certificates across all 50 states and the District of Columbia.

Ethics and Data Availability

This study used publicly available, de-identified aggregate mortality data from the CDC WONDER Multiple Cause of Death database. Because of this, no individual-level identifying information was accessed or reported. Data were used solely for statistical reporting and analysis in accordance with CDC WONDER data-use restrictions.

Study Population

The study population consisted of U.S. adolescents aged 10 through 19 years whose underlying cause of death was classified as intentional self-harm involving firearm discharge. In accordance with the International Classification of Diseases, Tenth Revision (ICD-10) [22], firearm suicide cases were identified using underlying cause-of-death codes X72 (intentional self-harm by handgun discharge), X73 (intentional self-harm by rifle, shotgun, and larger firearm discharge), and X74 (intentional self-harm by

other and unspecified firearm discharge). This overall adolescent firearm-suicide cohort served as the primary denominator population for all subsequent psychiatric documentation analyses.

Outcome Measures and Definitions

The primary outcome was documentation of any mental or behavioral disorder, defined as the presence of one or more ICD-10 Chapter V codes (F01–F99) listed as a multiple cause of death. For consistency throughout this manuscript, these conditions are referred to as documented psychiatric disorders. Secondary psychiatric outcomes evaluated specific diagnostic categories: mental and behavioral disorders due to psychoactive substance use (F10 through F19), mood or affective disorders (F30 through F39), and neurotic, stress-related, and somatoform disorders (F40 through F48).

Demographic variables extracted from the database included five-year age groups (10 to 14 years and 15 to 19 years), single-year ages (10 through 19 years), sex (male and female), single race (restricted to White and Black adolescents due to federal sample size constraints and data suppression thresholds), Hispanic origin or ethnicity (Hispanic or Latino versus not Hispanic or Latino), and specific firearm mechanism (X72, X73, or X74). Because CDC WONDER suppresses death counts below 10 to protect confidentiality, race- and ethnicity-specific analyses were restricted to categories for which reportable counts were available.

Statistical Analysis

Descriptive statistics were calculated to summarize the demographic characteristics of the study population and the frequencies of documented psychiatric conditions. Crude annual firearm-suicide mortality rates per 100,000 population were computed using corresponding U.S. Census Bureau population estimates provided within CDC WONDER. Pearson chi-square tests were used to compare the proportion of decedents with documented psychiatric disorders across demographic and firearm-mechanism groups. When expected cell counts were insufficient for chi-square testing, exact tests were considered.

Temporal trends in annual firearm-suicide mortality from 2018 through 2024 were evaluated using Poisson and negative binomial regression models, with incidence rate ratios (IRRs) and 95% confidence intervals reported. Model fit and overdispersion were assessed to determine the appropriate model specification. Given the limited number of annual observations, trend estimates were interpreted cautiously. In accordance with federal data standards, any CDC WONDER estimates or cell counts involving fewer than ten deaths were suppressed to ensure data reliability and suppressed cells were excluded from statistical testing. All statistical tests were two-sided, with significance established at an alpha level of 0.05. The study adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines for cross-sectional observational research [23].

3. Results

Overall Firearm Suicide Trends and Rates

Between 2018 and 2024, a total of 8,885 adolescent firearm-suicide deaths occurred among U.S. youth aged 10 through 19 years. Annual death counts fluctuated across the study period, starting at 1,296 deaths in 2018 (crude rate of 3.09 per 100,000 population), peaking in 2021 with 1,420 deaths (rate of 3.33 per 100,000), and 1,219 deaths in 2024 (2.80 per 100,000) (Table 1). No statistically significant temporal trend in firearm-suicide mortality was detected during the study period (IRR, 0.991; p = 0.962) (Table 1 & Table 2). Annual crude mortality rates for documented psychiatric disorders (F01-F99) also remained stable, ranging from 0.11 to 0.17 per 100,000 population (Table 2).

Table 1
Annual Firearm-Suicide Mortality

Year	Deaths	Population	Rate/100,000	95% CI
2018	1,296	41,976,748	3.09	2.92–3.26
2019	1,167	41,852,838	2.79	2.63–2.95
2020	1,293	41,715,352	3.1	2.93–3.27
2021	1,420	43,012,450	3.3	3.13–3.48
2022	1,238	42,525,631	2.91	2.75–3.08
2023	1,252	42,910,044	2.92	2.76–3.08
2024	1,219	43,276,979	2.82	2.66–2.98

Table 2
Annual Mortality Rates for Documented Psychiatric Disorders (2018–2024)

Year	F01-F99 Deaths (n)	Population	Crude Rate (per 100,000)
2018	64	41,976,748	0.15
2019	49	41,852,838	0.12
2020	45	41,715,352	0.11
2021	72	43,012,450	0.17
2022	54	42,525,631	0.13
2023	50	42,910,044	0.12
2024	52	43,276,979	0.12

Baseline Demographic Characteristics

As detailed in Table 3, the majority of adolescent firearm-suicide deaths were in the older 15 to 19 age group (n = 7,507; 84.5%), compared to early adolescents aged 10 to 14 years (n = 1,378; 15.5%). Single-

year age distributions showed an upward trajectory peaking sharply at age 19 with 2,084 deaths (23.5%) and age 18 with 1,761 deaths (19.8%), while very few deaths occurred at ages 10 and 11. Males accounted for the majority of deaths (n = 7,690; 86.6%) compared to females (n = 1,195; 13.4%). Among decedents with reportable race data, White adolescents represented 85.1% (n = 6,876) and Black adolescents represented 14.9% (n = 1,202) of deaths. Other racial categories were not included in the race-stratified analysis because of CDC WONDER suppression requirements. Among decedents with reportable ethnicity data, 7,553 (85.3%) were non-Hispanic and 1,300 (14.7%) were Hispanic or Latino. Additional or suppressed observations were excluded from the ethnicity-stratified analysis in accordance with CDC WONDER reporting requirements. Regarding firearm mechanism, other or unspecified firearms (X74) were involved in 62.3% of deaths (n = 5,532), followed by handguns (X72) at 23.4% (n = 2,075) and rifles, shotguns, or larger firearms (X73) at 13.8% (n = 1,227).

Table 3
Characteristics of Adolescent Firearm-Suicide Decedents, 2018–2024

Characteristic	Total Deaths (n)	Percentage (%)
Total Deaths	8,885	100%
Year		
2018	1,296	14.60%
2019	1,167	13.10%
2020	1,293	14.60%
2021	1,420	16.00%
2022	1,238	13.90%
2023	1,252	14.10%
2024	1,219	13.70%
Age Group		
10–14 years	1,378	15.50%
15–19 years	7,507	84.50%
Single-Year Age		
10 years	0*	0.0%*
11 years	29	0.30%
12 years	152	1.70%
13 years	376	4.20%
14 years	689	7.80%
15 years	999	11.20%
16 years	1,233	13.90%
17 years	1,430	16.10%
18 years	1,761	19.80%
19 years	2,084	23.50%
Sex		
Male	7,690	86.60%
Female	1,195	13.40%

Characteristic	Total Deaths (n)	Percentage (%)
Race		
White	6,876	85.1%**
Black	1,202	14.9%**
Ethnicity		
Non-Hispanic	7,553	85.3%**
Hispanic	1,300	14.7%**
Firearm Mechanism		
X72 (Handgun)	2,075	23.40%
X73 (Rifle/Shotgun)	1,227	13.80%
X74 (Other/Unspecified)	5,532	62.30%

*Indicates that the specific cell count was suppressed by the CDC WONDER database (or was absolute zero) due to death counts under 10.

**Percentages for race and ethnicity are calculated out of the available subgroup totals (8,078 for Race; 8,853 for Ethnicity) rather than the grand total to account for unstated or suppressed demographic data.

Primary and Secondary Psychiatric Outcomes

Among 8,885 adolescent firearm-suicide decedents, 386 (4.34%; 95% CI, 3.93%–4.79%) had at least one documented psychiatric disorder (ICD-10 codes F01 through F99) listed on their death certificate (Table 4). Mood disorders (F30-F39) were the most frequently documented category, occurring in 229 decedents (2.58% of all firearm-suicide deaths) and accounting for 59.33% of decedents with any documented psychiatric disorder (Table 4 & Table 5). Psychoactive substance-use disorders (F10-F19) were documented in 29 deaths (0.33% of all firearm suicides; 7.51% of psychiatric cases) (Table 4 & Table 5). Neurotic, stress-related, and somatoform disorders (F40-F48) yielded zero documented cases in the national dataset.

Table 4
Documented Psychiatric Disorders Among Adolescent Firearm-Suicide Decedents

Category	n	%	95% CI
Any F01–F99	386	4.34%	3.93–4.79%
F10–F19 (Substance-use)	29	0.33%	0.22–0.47%
F30–F39 (Mood disorders)	229	2.58%	2.26–2.93%
F40–F48 (Neurotic/stress)	0	0.00%	0.00–0.04%

Table 5
Proportionate Distribution of Specific Psychiatric Diagnoses

Secondary Psychiatric Outcome	n	Proportion of Total Psychiatric Cases (%)
F30-F39 (Mood/Affective Disorders)	229	59.33%
F10-F19 (Substance-Use Disorders)	29	7.51%
F40-F48 (Neurotic/Stress-Related)	0	0.00%

Demographic Documentation Disparities

Documentation of psychiatric disorders varied significantly across several demographic groups (Table 4 and Table 6). Documentation differed significantly by age group ($p < 0.001$). No psychiatric disorders were documented among decedents aged 10–14 years, whereas all 386 documented cases occurred among decedents aged 15–19 years (5.14%) (Table 4 and Table 6). Race also showed striking disparities ($p < 0.001$): no psychiatric disorders were documented among Black decedents in the available race-stratified data, compared with 4.83% among White decedents ($p < 0.001$) (Table 4 and Table 6). By contrast, documentation did not differ significantly by sex (4.42% among males vs 3.85% among females; $p = 0.408$) (Table 3). Yearly documentation rates also stayed flat throughout the study period ($p = 0.461$).

Table 6
Psychiatric Documentation by Demographic Characteristics

Variable	Total deaths	Psychiatric documented n (%)	No psychiatric documentation n (%)	P-value
Age 10–14	1,378	0 (0.00%)	1,378 (100%)	< 0.001
Age 15–19	7,507	386 (5.14%)	7,121 (94.86%)	
Male	7,690	340 (4.42%)	7,350 (95.58%)	0.408
Female	1,195	46 (3.85%)	1,149 (96.15%)	
White	6,876	332 (4.83%)	6,544 (95.17%)	< 0.001
Black	1,202	0 (0.00%)	1,202 (100%)	

4. Discussion

This population-based analysis of 8,885 U.S. adolescents who died by firearm suicide between 2018 and 2024 found that 4.34% had a psychiatric disorder documented on their death certificate. Importantly, this estimate should be interpreted as the prevalence of psychiatric diagnoses documented on death certificates rather than the true lifetime prevalence of psychiatric disorders among these decedents. The low proportion of documented psychiatric disorders suggests that death certificates may provide an incomplete representation of psychiatric history among adolescent firearm-suicide decedents. Psychological autopsy research has repeatedly shown that up to 90% of youth who die by suicide carry at least one diagnosable psychiatric disorder once their history is reconstructed through interviews, records, and clinical review [24], using methods far more thorough than a death certificate is designed to capture [19, 20]. The contrast between findings from psychological autopsy studies and the much lower level of psychiatric documentation observed in mortality records highlights the limitations of death certificates as a source of psychiatric history.

Several factors may contribute to limited psychiatric documentation in mortality records, including incomplete access to prior medical or behavioral health records, differences in diagnostic recognition, variability in information provided by family or other informants, and differences in death-investigation practices across jurisdictions. However, the present study cannot determine which of these factors account for the observed documentation patterns. Death certification is primarily intended to establish the causes and circumstances of death rather than provide a comprehensive reconstruction of psychiatric history. Consequently, information available to the certifier may not capture the full extent of a decedent's prior psychiatric history. The likelihood that a psychiatric history is documented may depend on whether relevant clinical records are available, whether family members or other informants report a history of mental illness, whether the condition was previously diagnosed, and whether such information is incorporated into the death-investigation process.

Among the 386 cases with a documented psychiatric disorder, mood or affective disorders made up nearly 60% (59.33%), while substance use disorders made up only 7.51%, and neurotic, stress-related, and somatoform disorders were documented in zero cases nationally. This pattern probably reflects differential capture rather than differential true prevalence. A study linking Veterans Affairs clinical diagnoses to violent death surveillance records found that surveillance data correctly captured only 49% of documented depression cases and 45% of documented PTSD cases, but just 17% of documented anxiety cases and 56% of substance use disorder cases, showing that even when a condition is clinically documented in life, mortality surveillance disproportionately misses anxiety, stress related, and substance use diagnoses relative to mood disorders [25]. The higher documentation of mood disorders may reflect differences in diagnostic recognition, prior clinical documentation, treatment history, or the availability of information to death investigators; however, these mechanisms could not be evaluated using the present dataset.

The most notable findings concerned differences in psychiatric documentation rather than differences in underlying clinical morbidity. Not one documented psychiatric diagnosis was recorded among the 1,378 adolescents aged 10 to 14, and not one was recorded among the 1,202 Black adolescents in this cohort in the available race-stratified data, although the absence of documentation cannot be interpreted as evidence that psychiatric morbidity was absent in either group. The absence of documented psychiatric disorders among decedents aged 10–14 years may reflect differences in duration of exposure to mental health services, diagnostic recognition, availability of prior records, or documentation practices. However, because the study did not include longitudinal clinical information, these explanations cannot be distinguished.

The absence of documented psychiatric disorders among Black decedents in the available race-stratified data is particularly notable and is consistent with prior literature describing racial and ethnic differences in psychiatric documentation and suicide-related mortality surveillance. Prior national analyses have found psychiatric comorbidity documented markedly less often on the death certificates of Black and Hispanic suicide decedents than White decedents [17], that Black deaths are much more likely to be misclassified as undetermined rather than suicide because of sparser investigative information [18], and that these same racial gaps in documented mental health problems and preceding circumstances persist specifically among adolescent decedents aged 10 to 19 [26]. Potential contributors include differences in access to mental health care, availability of prior clinical records, diagnostic recognition, informant reporting, and jurisdictional death-investigation practices. These findings should not be interpreted as evidence that psychiatric morbidity was absent among Black adolescents; rather, they identify a substantial disparity in documented psychiatric information that warrants further investigation.

Because mortality records may incompletely capture psychiatric history, the absence of a documented psychiatric diagnosis should not be interpreted as evidence of low suicide risk. Clinical identification of suicide risk must therefore occur prospectively rather than relying on retrospective mortality documentation. Prior work has found that as many as 83% of youth who attempt suicide are not identified as being at risk by healthcare providers, even when they were seen by a primary care clinician

beforehand [27]. These findings reinforce the importance of prospective identification of suicide risk in routine clinical care, including universal, annual suicide risk screening starting at age 12, as the American Academy of Pediatrics now recommends [28]. Because firearms are involved in the largest share of adolescent suicide deaths and carry an extremely high case fatality rate, proactive lethal means counseling, meaning discussing and reducing firearm access for at-risk youth along with medication and other means restriction, should be a core part of pediatric anticipatory guidance rather than an afterthought, consistent with current AAP guidance on firearm injury prevention and harm reduction [29]. This matters especially for younger adolescents and Black adolescents, the two groups showing the lowest levels of documented psychiatric information in this study. Clinicians should not assume that a lack of documented history in these groups reflects a lack of risk.

At the systems level, these findings support consideration of standardized approaches to capturing psychiatric history during adolescent suicide investigations. Where legally and operationally feasible, structured access to relevant prior medical and behavioral health records could improve the completeness of information available to death investigators. Standardized documentation fields addressing prior psychiatric diagnoses, treatment history, psychotropic medication use, prior self-harm, and recent mental health care may also improve consistency across jurisdictions.

5. Limitations

Several limitations should be considered when interpreting these findings. First, CDC WONDER mortality data capture psychiatric conditions documented on death certificates and therefore should not be interpreted as a measure of the true prevalence of psychiatric disorders during life. Undocumented conditions may reflect absence of a diagnosis, lack of available clinical information, differences in diagnostic recognition, or omission during death certification; these possibilities cannot be distinguished using the present dataset. Second, the use of aggregate CDC WONDER data prevented individual-level multivariable analyses and limited the ability to evaluate overlapping demographic characteristics or potential confounding. Third, the data suppression restricted the ability to conduct analyses of small racial, ethnic, and mechanistic subgroups. Fourth, race- and ethnicity-specific totals did not encompass the entire study population because of data availability and suppression constraints. Fifth, firearm mechanism categories were based on ICD-10 external-cause codes, with X74 combining other and unspecified firearm discharges, limiting more granular interpretation of firearm type. Sixth, psychiatric documentation and death-investigation practices may vary across jurisdictions, introducing potential heterogeneity that cannot be evaluated using aggregate national data. Finally, the study period included only seven annual observations, limiting the precision with which temporal trends can be estimated. As a cross-sectional analysis of mortality surveillance data, the study identifies patterns of psychiatric documentation but cannot establish causal relationships or determine whether undocumented psychiatric disorders were actually present.

6. Conclusion

This study identifies a substantial gap between psychiatric conditions that may underlie adolescent firearm suicide and what is captured in official mortality records. Among 8,885 adolescent firearm-suicide deaths in the United States from 2018–2024, 4.34% had a psychiatric disorder documented on the death certificate, highlighting the substantially greater consistency with which the fatal mechanism is captured compared with psychiatric information that may be documented during the death investigation.

These findings highlight an important surveillance blind spot. The striking differences in psychiatric documentation by age and race, including the complete absence of documented psychiatric disorders among adolescents aged 10–14 and among Black decedents in this dataset, underscore that the absence of a diagnosis on a death certificate should not be interpreted as the absence of psychiatric morbidity. Rather, these patterns may reflect limitations and disparities in how psychiatric histories are identified, communicated, and recorded during death investigations.

Improving understanding of adolescent firearm suicide will require not only accurate classification of the fatal mechanism but also more systematic approaches to capturing relevant psychiatric history. Potential strategies include standardized psychiatric-history fields within adolescent suicide investigations, improved access to relevant clinical and behavioral health records where appropriate, and greater consistency in documenting psychiatric conditions across jurisdictions. Such improvements are essential for generating more accurate public health estimates, identifying populations whose mental health needs may be underrecognized, and informing more effective suicide-prevention strategies.

Ultimately, this study underscores that what is not documented is not necessarily what was not present. Strengthening the connection between clinical mental health documentation, forensic death investigation, and mortality surveillance is an important step toward ensuring that national suicide statistics capture not only how adolescents die, but also the psychiatric and psychosocial circumstances that may precede these deaths. Future research linking mortality records with longitudinal clinical data could determine the extent to which psychiatric disorders documented during life are captured at the time of death and identify populations in which documentation gaps are greatest. Such efforts could improve the interpretation of national suicide surveillance and inform more targeted approaches to suicide prevention.

Declarations

Ethics Approval and Consent to Participate: This study used de-identified, publicly available, population-level mortality data from the Centers for Disease Control and Prevention Wide-ranging Online Data for Epidemiologic Research (CDC WONDER) database. No individually identifiable information was accessed or used. Therefore, this secondary analysis of publicly available mortality surveillance data did not require institutional review board or research ethics committee approval, and informed consent was not applicable.

Consent for Publication: Not applicable.

Availability of Data and Materials: The data analyzed in this study are publicly available from the Centers for Disease Control and Prevention Wide-ranging Online Data for Epidemiologic Research (CDC WONDER) database at https://wonder.cdc.gov/. The data are available to researchers and the public through the CDC WONDER platform.

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Author Contribution

MB utilized the public CDC WONDER database to extract, clean and validate the relevant data with statistical analysis, as well as drafted the methods, results, and limitations.QSMA drafted the results, tables, and introduction with references.CHA drafted the discussion with references.SS drafted the conclusion. MZ facilitated the research, providing mentorship and guidance throughout the process.All authors reviewed the manuscript.

References

1. Abbasi J. Surgeon general sounds the alarm on social media use and youth mental health crisis. JAMA. 2023;330(1):11–2. 10.1001/jama.2023.10262.
2. American Academy of Pediatrics. AAP-AACAP-CHA declaration of a national emergency in child and adolescent mental health. Published October 19. 2021. Available from: https://www.aap.org/en/advocacy/child-and-adolescent-healthy-mental-development/aap-aacap-cha-declaration-of-a-national-emergency-in-child-and-adolescent-mental-health/
3. Borg ME, Heffer T, Willoughby T. Generational shifts in adolescent mental health: a longitudinal time-lag study. J Youth Adolesc. 2025;54(4):837–48. 10.1007/s10964-024-02095-3.
4. National Center for Health Statistics. National Health Interview Survey—Teen, 2021–2023. Generated interactively May 12. 2025. Available from: https://wwwn.cdc.gov/NHISDataQueryTool/NHIS_TEEN/index.html
5. Curtin SC. State suicide rates among adolescents and young adults aged 10–24: United States, 2000–2018. Natl Vital Stat Rep. 2020;69(11):1–10.
6. Miron O, Yu KH, Wilf-Miron R, Kohane IS. Suicide rates among adolescents and young adults in the United States, 2000–2017. JAMA. 2019;321(23):2362–4. 10.1001/jama.2019.5054.

7. Wang J, Sumner SA, Simon TR, Crosby AE, Annor FB, Gaylor E, et al. Trends in the incidence and lethality of suicidal acts in the United States, 2006 to 2015. JAMA Psychiatry. 2020;77(7):684–93. 10.1001/jamapsychiatry.2020.0596.
8. Centers for Disease Control and Prevention. WISQARS Leading Causes of Death Visualization Tool. 2022. Available from: https://wisqars.cdc.gov/lcd/
9. Centers for Disease Control and Prevention. Youth Risk Behavior Survey data summary & trends report: 2013–2023. Atlanta (GA): US Department of Health and Human Services; 2024.
10. Centers for Disease Control and Prevention, National Center for Injury Prevention and Control. National Violent Death Reporting System (NVDRS): violent deaths report, 2018–2023 [Internet]. WISQARS (Web-based Injury Statistics Query and Reporting System). Accessed July 11. 2026. Available from: https://wisqars.cdc.gov/nvdrs/
11. Centers for Disease Control and Prevention, National Center for Injury Prevention and Control, Fatal Injury WISQARS, Reports. 2018–2024, United States, all ages, all races, both sexes [Internet]. Accessed July 11, 2026. Available from: https://wisqars.cdc.gov/fatal-reports/
12. Brent DA, Perper JA, Allman CJ, Moritz GM, Wartella ME, Zelenak JP. The presence and accessibility of firearms in the homes of adolescent suicides: a case-control study. JAMA. 1991;266(21):2989–95.
13. Price JH, Khubchandani J. Adolescent homicides, suicides, and the role of firearms: a narrative review. Am J Health Educ. 2017;48(2):67–79. 10.1080/19325037.2016.1272507.
14. Studdert DM, Zhang Y, Swanson SA, Prince L, Rodden JA, Holsinger EE, et al. Handgun ownership and suicide in California. N Engl J Med. 2020;382(23):2220–9. 10.1056/NEJMsa1916744.
15. Currie DW, Schwab-Reese LM, Runyan CW. Psychiatric diagnoses are associated with means selection in United States suicide deaths. Soc Psychiatry Psychiatr Epidemiol. 2021;56(10):1791–9. 10.1007/s00127-020-01999-2.
16. National Center for Health Statistics. Possible solutions to common problems in death certification. Centers for Disease Control and Prevention. Published January 1997. Accessed July 11. 2026. Available from: https://www.cdc.gov/nchs/nvss/writing-cod-statements/death_certification_problems.htm
17. Rockett IR, Lian Y, Stack S, Ducatman AM, Wang S. Discrepant comorbidity between minority and white suicides: a national multiple cause-of-death analysis. BMC Psychiatry. 2009;9:10. 10.1186/1471-244X-9-10.
18. Rockett IR, Wang S, Stack S, De Leo D, Frost JL, Ducatman AM, et al. Race/ethnicity and potential suicide misclassification: window on a minority suicide paradox? BMC Psychiatry. 2010;10:35. 10.1186/1471-244X-10-35.
19. Pacchioni F, Bosia M, Moretti G, Barbieri C, Bellumore S, Travaini G. Mind the past: a systematic review on psychological autopsy. Behav Sci Law. 2023;41(5):343–72. 10.1002/bsl.2619.
20. Lee S, Kyung S, Lee D. Psychological autopsy in adolescent suicide: evaluating risk factors and research methods. Psychiatry Investig. 2025;22(5):475–89. 10.30773/pi.2024.0256.

21. Centers for Disease Control and Prevention. Multiple Cause of Death 2018–2024 on CDC WONDER Online Database. National Center for Health Statistics. Available from: https://wonder.cdc.gov/
22. World Health Organization. International Statistical Classification of Diseases and Related Health Problems. 10th rev. Geneva, Switzerland: World Health Organization.
23. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP, STROBE Initiative. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. Lancet. 2007;370(9596):1453–7.
24. Posner K, Melvin GA, Stanley B, Oquendo MA, Gould M. Factors in the assessment of suicidality in youth. CNS Spectr. 2007;12(2):156–62. 10.1017/S1092852900020678.
25. Carlson KF, Gilbert TA, DeFrancesco S, Wright DA, Shen X, Cook LJ. Accuracy of behavioral health variables in Oregon National Violent Death Reporting System data: a linked cohort study. Inj Epidemiol. 2022;9:29. 10.1186/s40621-022-00393-7.
26. Ali B, Rockett IRH, Miller TR, Leonardo JB. Racial/ethnic differences in preceding circumstances of suicide and potential suicide misclassification among US adolescents. J Racial Ethn Health Disparities. 2022;9(1):296–304. 10.1007/s40615-020-00957-7.
27. Horowitz LM, Ballard ED, Pao M. Suicide screening in schools, primary care and emergency departments. Curr Opin Pediatr. 2009;21(5):620–7. 10.1097/MOP.0b013e3283307a89.
28. Hua LL, Lee J, Rahmandar MH, Sigel EJ, American Academy of Pediatrics Committee on Adolescence. Council on Injury, Violence, and Poison Prevention. Suicide and suicide risk in adolescents. Pediatrics. 2024;153(1):e2023064800. 10.1542/peds.2023-064800.
29. Lee LK, Fleegler EW, Goyal MK, Fraser Doh K, Laraque-Arena D, Hoffman BD. American Academy of Pediatrics Council on Injury, Violence, and Poison Prevention. Firearm-related injuries and deaths in children and youth: injury prevention and harm reduction. Pediatrics. 2022;150(6):e2022060070. 10.1542/peds.2022-060070.