

# National Study of US Emergency Department Visits for Attempted Suicide and Self-Inflicted Injury, 1997-2001

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**Study objective:** We describe the epidemiology of emergency department (ED) visits for attempted suicide and self-inflicted injury.

**Methods:** Data were obtained from the National Hospital Ambulatory Medical Care Survey, a national probability sample of ED visits. All visits for attempted suicide or self-inflicted injury (E950 to E959) during 1997 to 2001 were included in these analyses.

**Results:** During the 5-year period, there were approximately 412,000 annual ED visits for attempted suicide and self-inflicted injury, or 0.4% of all ED visits. The annual visit rate was 1.5 (1.3 to 1.7) visits per 1,000 US citizens. The mean patient age was 31 years, and visits were most common among patients aged 15 to 19 years, at a rate of 3.3 (95% confidence interval 2.1 to 4.4). ED visit rates were higher among female patients (1.7) than male patients (1.3) and among blacks (1.9) than whites (1.5). Visit rates did not differ by metropolitan status or US region. The most common method of injury was poisoning (68%), followed by cutting or piercing (20%). One third of visiting patients were admitted to the hospital, with 31% of admissions going to the ICU. A psychiatric disorder was coded for 55% of visits, with depressive disorder accounting for 34% and alcohol abuse for 16%.

**Conclusion:** ED visits for attempted suicide and self-inflicted injury are relatively common, serious, and most frequent among adolescents and young adults. Self-poisoning is the most common method. The high prevalence of psychiatric and substance abuse disorders in this population suggests these issues should be considered during management and disposition. [Ann Emerg Med. 2005;46:369-375.]

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## INTRODUCTION

Suicide is an important public health problem. In 2000, there were about 10 suicide deaths for every 100,000 people.<sup>1</sup> Every day, more than 1,500 Americans attempt suicide, and approximately 86 succeed in taking their own life.<sup>2</sup> Although suicide is relatively common, it is amenable to both primary prevention through population strategies and secondary prevention through efforts directed at those who attempt but do not complete their suicide.<sup>2</sup>

The attempted-to-completed suicide ratio is approximately 8:1.<sup>3</sup> However, most epidemiologic studies focus on completed suicide rather than attempted suicide and intentional self-injury. Consequently, previous epidemiologic studies of suicide do not reflect the patterns of “suicide cases” seen in most emergency departments (EDs) where such patients are much more likely to

represent a suicide attempt. Approximately 70% of all nonfatal self-inflicted injuries treated in the ED are the result of failed suicide attempts.<sup>4</sup> Moreover, an ED visit related to deliberate self-harm is a positive predictor of future completed suicide.<sup>5</sup> In conjunction with mental health consultants, ED providers have the potential to serve a unique role in suicide prevention.

A better understanding of ED patients who present with attempted suicide and self-inflicted injury may encourage development of tailored and effective models for intervention. This article describes ED visits for attempted suicide and self-inflicted injury using nationally representative data from the National Hospital Ambulatory Medical Care Survey (NHAMCS). Although several summaries of NHAMCS data exist,<sup>6-11</sup> none have focused on suicide attempts and intentional self-injury.

### Editor's Capsule Summary

#### *What is already known on this topic*

Although the epidemiology of completed suicide has been extensively studied, the epidemiology of suicide attempt is less well characterized. Suicide attempt is a marker for future suicide.

#### *What question this study addressed*

How frequently do patients visit hospital emergency departments (EDs) for attempted suicide or self-inflicted injury? What are the characteristics of this population?

#### *What this study adds to our knowledge*

This study, based on the analysis of 5 years of National Hospital Ambulatory Medical Care Survey data, provides information about patients who survive their suicide attempt and present to the ED. Attempted suicides accounted for 0.4% of ED visits. Suicide attempt was most common among female adolescents.

#### *How this might change clinical practice*

Although this information does not directly affect patient care, knowledge about patients who attempt suicide may help guide efforts at primary and secondary prevention. Emergency physicians should practice with the awareness that such patients need interventions aimed at lowering their risk of suicide.

## MATERIALS AND METHODS

### Study Design and Setting

Data from the 1997 to 2001 NHAMCS were combined to generate national estimates of ED visits for attempted suicide and self-inflicted injury. NHAMCS is conducted annually by the Centers for Disease Control and Prevention's (CDC's) National Center for Health Statistics. It is a 4-stage probability sample of visits to noninstitutional general and short-stay hospitals, excluding federal, military, and Veterans Affairs hospitals, in the United States.<sup>6-11</sup> NHAMCS samples from geographic primary sampling units, hospitals within the primary sampling units, EDs within the hospitals, and patients within the EDs. The number of participating EDs differed each year, with 392 in 1997, 398 in 1998, 376 in 1999, 376 in 2000, and 397 in 2001. National estimates are obtained through use of assigned patient visit weights and are rounded to the nearest thousand. This study was approved by our institutional review board.

### Selection of Participants

ED visits for attempted suicide and self-inflicted injury were defined by an *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* code of E950 to E959 in the primary diagnosis field. These correspond to the diagnoses of suicide and self-inflicted poisoning by solid or

liquid (E950); poisoning by gases in domestic use (E951); poisoning by other gases (E952); hanging, strangulation, or suffocation (E953); drowning (E954); firearms (E955); cutting or piercing (E956); jumping from a high place (E957); other and unspecified means (E958); and late effects of self-inflicted injury (E959).

### Methods of Measurement

Hospital staff collect data by medical record review during a randomly assigned 4-week period for each of the sampled hospitals during each year of the study period. Once the data collection forms are completed, they are sent to Analytical Sciences, Inc, in Durham, NC, where they are coded and keyed using the *ICD-9-CM*. More detail on the methods of abstraction can be found elsewhere.<sup>6-11</sup>

### Primary Data Analysis

We performed all analyses using STATA 7.0 (Stata Corporation, College Station, TX). Confidence intervals (CIs) for ED visit rates were calculated using the relative standard error of the estimate. Because the stratification variables are masked to prevent hospital or patient identification, the National Center for Health Statistics used Survey Data Analysis software to compute variance estimation curves based on real data and then computed equations for relative standard error of the estimate. All estimates presented were based on at least 30 raw cases and had a relative standard error of the estimate less than 30%. All odds ratios are reported with 95% CIs. We performed analyses in STATA to obtain weighted proportions and weighted totals. These data were then inserted into equations provided by the National Center for Health Statistics to calculate 95% CIs around the point estimates.

Formulas were specific to 1 year, 2 years, or greater than 2 years of data, depending on how many years were being analyzed (ie, the formula to calculate relative standard error of the estimate for 2 years of data took 80% of the relative standard error of the estimate computed based on the last year of data and applied it to the estimate). Trend analyses were performed by first obtaining weighted estimates for each year (using methods described above) and then performing trend analysis on already weighted data in STATA.

In addition to the estimated absolute number of ED visits, we calculated ED visit rates using midyear age, sex, and race-specific population estimates for 1997 through 2001 from the US Census Bureau.<sup>12</sup> Ethnicity (eg, Hispanic status) was not analyzed, because it was not well reported. We also examined ED visit rates by region (Northeast, Midwest, South, and West) and metropolitan statistical area status of the hospital. Region and metropolitan statistical area categories represent standardized geographic divisions defined by the US Census Bureau. All rates were reported per 1,000 individuals per year for the US population. The attempted suicide and self-inflicted injury ED visit rates were calculated for each year and the entire 5-year period. A least-squares linear regression was used to analyze whether ED visit rates for attempted suicide

changed over time, with  $P < .05$  considered statistically significant.

Visits were classified by “season” (January to March, April to June, July to September, October to December) and time of ED presentation. We examined the visit “urgency” as determined at triage, with visits coded as “urgent/emergency” if they were supposed to be treated in “less than 15 minutes” or “15 to 60 minutes,” and as “nonurgent” if recorded as “greater than 1 to 2 hours.” We also examined the “waiting time” until they actually were treated (data collected for 1997 to 2001). Although waiting time is available for only 72% of cases (and 66% of all ED visits), it acts to validate the triage assessment. We also examined the methods of injury and comorbid conditions, such as mental disorders (*ICD-9-CM* codes 290 to 319), alcohol abuse (*ICD-9-CM* codes 291, 303, or 305), and depressive disorders (*ICD-9-CM* code 311). Two aspects of ED management that were deemed clinically relevant to suicide attempts were examined: performance of a mental status examination and blood alcohol concentration testing. Finally, we examined the disposition of the ED visit, including admission rates to the ICU.

## RESULTS

We examined 127,655 cases from 1997 to 2001. The estimated number of US ED visits attributable to attempted suicide and self-inflicted injury from 1997 to 2001 was 2,060,000, which averages to 412,000 visits per year. Visits for attempted suicide and self-inflicted injury accounted for 0.4% of the total 513,600,000 ED visits from 1997 to 2001. Overall, the estimated annual rate of ED visits attributable to attempted suicide and self-inflicted injury was 1.5 (1.3 to 1.7) visits per 1,000 people. ED visit rates for attempted suicide and self-inflicted injury did not change significantly during the 5-year period from 1997 to 2001 ( $P$  for trend=.25). The slope for this model was to 9.4 (95% CI -29.2 to 10.4).

ED visits for attempted suicide and self-inflicted injury varied according to age, sex, and race (Table 1). The mean patient age was 31 years, and visits were most common among patients aged 15 to 19 years. Figure 1 shows the relation of age and sex to attempted suicide and self-inflicted injury rates. In the 15- to 19-year-old age group, where suicide attempts peak, female patients (4.2; 95% CI 2.3 to 6.1) had twice the visits rate of their male counterparts (2.4; 95% CI 1.0 to 3.7).

The most common method of attempted suicide and self-inflicted injury treated in the ED was poisoning, followed by cutting or piercing. Hanging- and firearms-related visits were rare (Table 2). Among the poisoning cases, poisoning by unspecified drugs or medicinal substances accounted for the highest number of cases (28%), followed by tranquilizers and other psychotropic agents (27%), and then analgesics, antipyretics, and antirheumatics (25%).

Visit rates did not differ markedly by season, with winter accounting for 27% of visits (95% CI 21% to 33%), spring 26% (95% CI 20% to 33%), summer 24% (95% CI 20% to 28%) and fall 23% (95% CI 15% to 30%). The group’s average

**Table 1.** ED visits for attempted suicide according to demographic factors.

Variable	Visits in Thousands, No.	Percent	Rate per 1,000	95% CI for Rate
Overall	2,060	100	1.5	(1.3–1.7)
<b>Age, y</b>				
0–14	161	8	0.5	(0.3–0.7)
15–19	326	16	3.3	(2.1–4.4)
20–29	542	26	2.9	(2.1–3.6)
30–49	856	42	2.0	(1.6–2.5)
50+	175	8	0.5	(0.3–0.7)
<b>Sex</b>				
Male	881	43	1.3	(1.0–1.6)
Female	1,179	57	1.7	(1.4–2.0)
<b>Race</b>				
White	1,674	81	1.5	(1.3–1.7)
Black	345	17	1.9	(1.2–2.7)
Other*	41	2	NA	NA
<b>Region</b>				
Northeast	406	20	1.6	(1.1–2.0)
Midwest	404	20	1.3	(0.9–1.6)
South	678	33	1.4	(1.1–1.7)
West	573	28	1.9	(1.4–2.4)
<b>Metropolitan statistical area</b>				
Yes	1,713	83	1.6	(1.4–1.9)
No	348	17	1.1	(0.7–1.5)

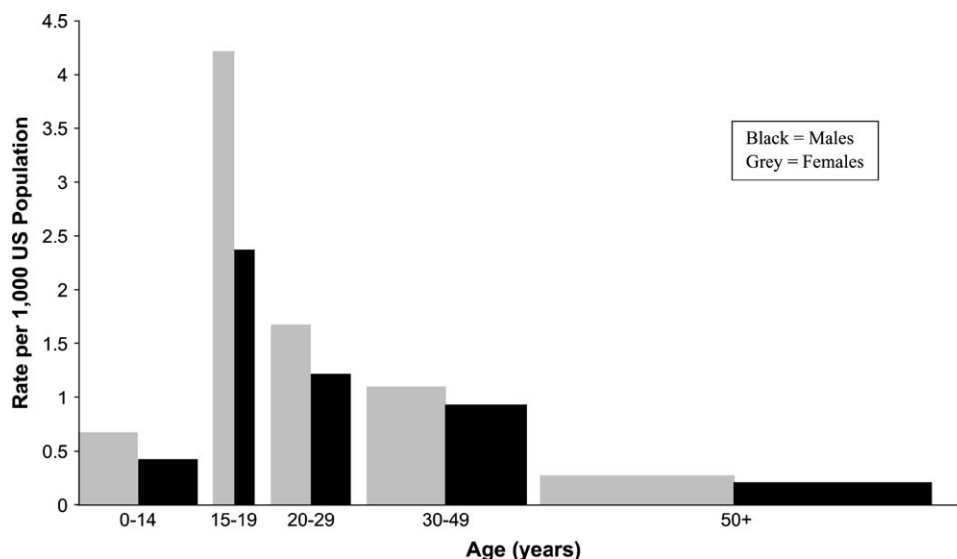
NA, Not available (because of small numbers).

\*Estimate does not meet NHAMCS criteria for reliability (unweighted  $n < 30$ ).

time of arrival to the ED resembled the pattern for overall ED visits, with an early-evening peak and most patients arriving between noon and midnight. However, visits for attempted suicide and self-inflicted injury were more frequent from 6 AM to 6 PM (Figure 2). Nearly three fourths (71%) of visits were coded as urgent/emergency. Consistent with this observation, approximately 40% of cases were treated in less than 15 minutes, and 70% were treated in less than an hour, which was much faster than the typical ED visit (21% and 52%, respectively).

Psychiatric disorders were coded in more than half of the visits, with depressive disorder being present in 18% of all attempted suicide and self-inflicted injury visits and representing 34% of all patients with psychiatric disorders. A significant percentage of the visits were coded for alcohol abuse: 9% of all attempted suicide and self-inflicted injury visit, which accounted for 16% of all patients with psychiatric disorders. Approximately 43% of patients were given a mental status examination, and 25% of patients received testing for blood alcohol concentration (Table 2).

One third of attempted suicide and self-inflicted injury visits resulted in direct hospitalization (Table 2). Among these hospitalizations, 31% (95% CI 20% to 42%) were admitted to the ICU. One third of the patients in the sample were transferred to another facility, none died while in the ED, and most of the remaining cases were referred to another provider or setting (eg, social services).



**Figure 1.** ED visits for attempted suicide according to age and sex.

## LIMITATIONS

Our study has several potential limitations. The most important is the NHAMCS data collection and reporting process itself. Because the majority of the data were collected by medical record review, the accuracy of the results could have been compromised; for example, by errors in record review and coding. Nevertheless, our study represents the most comprehensive national data set on this topic, and comparable studies on this topic (ie, National Electronic Injury Surveillance System to All Injury Database) also use record review as their primary methodology.<sup>4</sup> Another potential limitation is that *ICD-9-CM* coding may miss some suicide attempts of a more dramatic or “atypical” nature. For example, a patient with

**Table 2.** ED visits for attempted suicide according to method of injury, comorbid conditions, and ED course.

Variable	Percentage (%)	95% CI
<b>Method of injury</b>		
Poisoning	68	(61–75)
Cutting/piercing instruments	20	(15–26)
Hanging*	<1	NA
Firearms*	<1	NA
<b>Comorbid conditions</b>		
Mental disorders	55	(48–62)
Depressive disorders	18	(12–25)
Alcohol abuse	9	(3–14)
<b>ED evaluation</b>		
Mental status examination	43	(36–49)
Blood alcohol concentration	25	(21–30)
<b>Disposition</b>		
Hospital admission	32	(26–37)
Transfer to another facility	30	(24–36)
Referred to other physician/clinic	22	(16–28)
Other	18	(12–23)

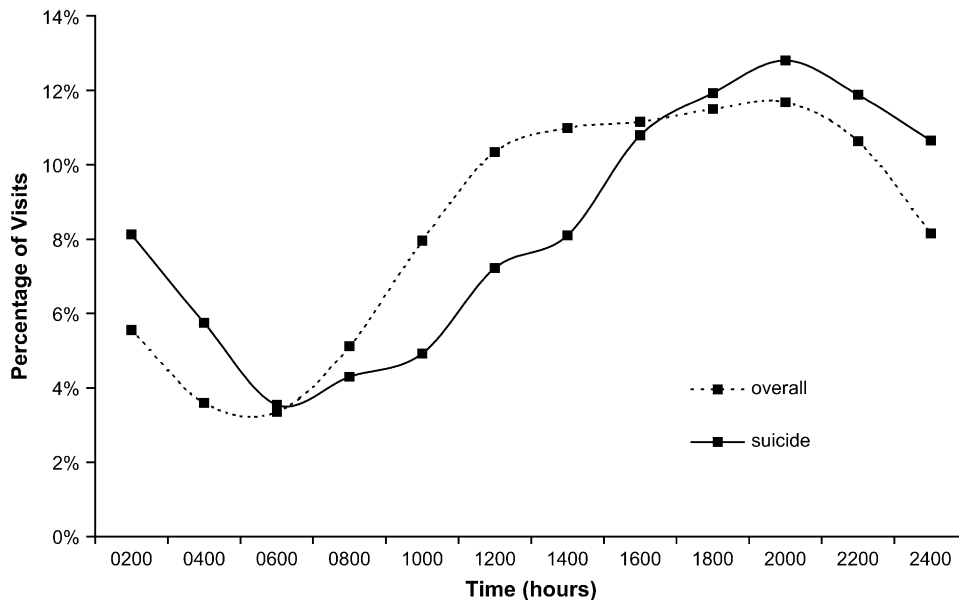
\*Estimate does not meet NHAMCS criteria for reliability (unweighted  $n < 30$ ).

multiple traumatic injuries who intentionally drove his car into a telephone pole may not be coded as a case of “self-inflicted” injury. This problem besets all suicide research and reinforces the importance of increasing academic focus on this neglected problem; improved provider awareness might lead to better recognition (and subsequent coding) of these suicide attempts. Finally, the estimates of suicide attempts in the NHAMCS database is nearly twice that of estimates obtained from the National Electronic Injury Surveillance System to All Injury Database. Although we do not know precisely why these rates differ so dramatically, it could be due to methodologic differences between the 2 studies, namely, the National Electronic Injury Surveillance System to All Injury Database is a review of only ED visits that were “injury related,” whereas NHAMCS is a review of all ED visits within a given period. Nevertheless, it is unlikely that the NHAMCS represents an overestimation.

## DISCUSSION

In the United States, suicide is the eighth leading cause of death and is responsible for approximately 30,000 deaths each year.<sup>13</sup> The present study demonstrates that attempted suicide and self-inflicted injury account for more than 400,000 ED visits per year, or 0.4% of all ED visits. Existing studies and reports on suicide have a lack of specificity for emergency health care providers because they focus on data from all patient populations rather than on data for ED visits only. These studies, therefore, may overrepresent completed suicide and underrepresent attempted suicide. The current study describes national data on ED visits for attempted suicide and self-inflicted injury to provide a foundation on which to advance efforts to improve the monitoring, management, and prevention of this important public health problem.

Cases of attempted suicide and self-inflicted injury differ significantly from cases of completed suicide in terms of



**Figure 2.** ED visits for attempted suicide according to time of presentation.\*This uses a moving average of 2 values.

demographic characteristics, methods used, and other predisposing factors.<sup>14</sup> For example, suicide completers are often older, men, living alone, or physically ill. Also, they are more likely to use lethal methods, such as firearms, rather than poisoning or cutting or piercing instruments.<sup>15</sup> By contrast, attempted suicide and self-inflicted injury have been found to be higher among women, youths, and those with other psychosocial risk factors such as depression, substance abuse, and other mental disorders.<sup>16</sup> Racial differences are also commonly noted. White men and women have been shown to have a 2-fold higher risk for completed suicide than black men and women.<sup>17</sup> Considerable evidence shows that once a person has made an attempt at deliberate self-harm, the risk that he or she will eventually complete a suicide attempt is significantly increased.<sup>18</sup>

Our 5-year national study reveals that suicide attempts were especially common among adolescents and young adults. Suicide is the third leading cause of death among 15- to 24-year-olds and the fifth leading cause of death for 5- to 14-year-olds.<sup>1</sup> The most common age group to present to the ED with attempted suicide and self-inflicted injury is 15- to 19-year-olds. Many teenagers are confronted with issues in which they experience feelings of stress, self-doubt, pressure to succeed, and role confusion. In some teenagers with other predisposing risk factors, such as depression and substance abuse, these fears and stresses may lead to suicide attempts.<sup>19</sup> The ED may be their first point of contact with health care. These vulnerable adolescents should be recognized, diagnosed, and given appropriate treatment plans to help prevent them from attempting suicide in the future. A 4-item screening questionnaire has been developed to assess suicidal ideation in children and adolescents who visit the ED and may help in

the development of appropriate treatment plans for this population.<sup>20</sup>

In addition, we found that ED visit rates for female patients tended to be higher than for male patients, especially among 15- to 19-year-olds (Figure 1). Previous studies also have found that girls outnumbered boys 4:1 in ED visits for attempted suicide.<sup>21</sup> Although more than 4 times as many men as women complete suicide,<sup>22</sup> women attempt suicide 2 to 3 times as often as men do,<sup>23</sup> which likely explains the higher ED visit rates. There are 2 likely explanations for these trends: men tend to not only have greater suicidal intent<sup>24</sup> but also to use more lethal means such as firearms or hanging than women.

Our results on age and sex were consistent with those provided by the National Electronic Injury Surveillance System to All Injury Database.<sup>4</sup> In terms of race, however, the National Electronic Injury Surveillance System to All Injury Database suggested that rates were highest among white non-Hispanic male patients.<sup>4</sup> We found that blacks and whites tended to have similar rates, with that of blacks being slightly higher. Although our results are not consistent with most of the extant literature,<sup>4,25</sup> a recent study of suicide-related hospitalizations and ED visits in 8 states also found higher rates of attempted suicide among blacks.<sup>14</sup> Moreover, the 2001 Youth Behavior Surveillance report by the CDC also reported a slightly greater prevalence of attempted suicide by black and Hispanic adolescents compared with white adolescents.<sup>26</sup> The issue of race, ethnicity, and attempted suicide is difficult to untangle and bears further scrutiny in prospective studies.

Attempted suicide visits tended to be more common at night than the trend for overall ED visits. One previous study showed that there were more young people presenting for visits related to self-injury in the evening and up to midnight,<sup>21</sup>

which is likely to be because they are out of school during the evening and may not be under constant supervision. Unfortunately, "after-hours" presentations make it more difficult for emergency health care providers to obtain the relevant information and multidisciplinary consultation required for optimal treatment, which has important implications for suicide prevention programs integrated into the ED setting.

The comorbidity results reaffirm the contention that mental health and social services consultation may be important in treating suicidal patients. Many studies have shown that there is a strong link between psychiatric illness and suicide.<sup>17</sup> Although most people with a psychiatric illness are not suicidal, it does increase the risk of attempting suicide compared with that of people without a psychiatric disorder.<sup>27</sup> Despite the commonality of psychiatric disorders, mental status examinations were documented in only 43% of the visits in our study. Potential explanations for this low figure include communication difficulties because of profound alterations in mental status or, more likely, poor documentation of mental status examinations.

Alcohol abuse is highly associated with near-lethal suicide attempts.<sup>28</sup> Between 40% and 60% of individuals who die by suicide are intoxicated at death. Nevertheless, only 25% of the patients had blood alcohol testing documented. It is possible but unlikely that bedside breathalyzers were used and results not documented. It is also possible that many patients were obviously intoxicated based on physical signs and symptoms and, therefore, did not need blood alcohol testing. The NHAMCS data do not provide information on these indicators, so it is difficult to assess how this affected screening rates. Even considering these caveats, 25% seems low and probably represents underscreening.

Finally, examining ED disposition provides some insight about how the patients may have been treated after they were stabilized in the ED. Because a previous suicide attempt is one of the biggest risk factors for suicide completion, close monitoring of these patients would be an important part of secondary prevention efforts. About one third of the visits resulted in hospital admission, and almost another third were transferred to another facility. These statistics suggest the presentations were not for trivial injuries. Supporting this suggestion is that 31% of the hospital admissions were to the ICU. The meaning of ICU admissions, however, is not always clear. Some hospitals may require that patients be admitted to the ICU for maintenance of "suicide precautions."

In summary, suicide is a common and serious problem in the United States, and epidemiologic studies such as this one are crucial to elucidating the types of patients who present to the ED with attempted suicide and self-inflicted injury. We found that ED visits for attempted suicide and self-inflicted injury were especially common among adolescents, young adults, and female patients. In addition, there is a high prevalence of psychiatric disorders, especially depression, in this patient population. Emergency health care personnel should take note

of these results because they are generally the first points of contact of primary care for these patients. An appropriate assessment and clinical management of these patients when they arrive in the ED may help lead to prevention of suicide and suicide attempts.<sup>13,29</sup>

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