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## Epidemiology of Adolescent and Young Adult Hospital Utilization for Alcohol and Drug Use, Poisoning, and Suicide Attempts in the United States


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## INTRODUCTION

Adolescents and young adults are at a unique period in the lifespan, with injuries to health often coming from behaviors rather than infectious or pathological disease. Behaviors and habits developed in this period influence both short- and long-term health. Survey data is readily available to evaluate patterns and trends in self-reported health behaviors such as alcohol and drug use, ingestions of hazardous substances, and suicide attempts. National estimates based on self-reported survey data indicate that these are serious threats to the health of adolescents and young adults.

Alcohol use increases substantially between adolescence and young adulthood, with 39% of 12th graders reporting past-month use in 2011 (Eaton et al., 2012). While reported rates of alcohol use have been relatively steady over time, reported past-month use of illicit drugs has increased and was 15.8% for 9-12<sup>th</sup> graders and 21.4% for 18-25 year olds in 2011 (SAMHSA, 2012). Poisonings represent an additional behavioral threat to the health of this age group as previous research has shown that many reported poisonings in this age group may be overdose attempts, with more than half of the deaths from poisonings found to be probable suicides (Olfson, Gameroff, Marcus, Greenberg, & Shaffer, 2005; Reith, Whyte, Carter, & McPherson, 2003). In 2009 the rate of suicide was 7.21 per 100,000 adolescents and young adults aged 10-24 (National Center for Injury Prevention and Control, 2010). Suicide attempts were reported by 7.8% of high school students in 2011 (Eaton et al., 2010). Combined, these behaviors are likely causing substantial morbidity and are certainly resulting in mortality as unintentional injury is the leading cause of death for ages 15 to 24 and suicide is the second leading cause of death for this age group (National Center for Injury Prevention and Control, 2010).

Self-reported survey data have been the primary source of knowledge of the impact of these behaviors for this population. However, there is potential for bias in these reports. Given this limitation and the complex health behavior issues in this age group, additional study of other sources of information is needed to further understand the impact of these health threats in adolescents and young adults. Examination of the patterns and characteristics of individuals who were admitted to the hospital for these conditions would allow for an understanding of the more serious consequences of these behaviors. Additionally, this is an important step in understanding the health care utilization attributable to these conditions. This study presents an examination of the patterns and characteristics of individuals admitted to the hospital for alcohol and drug use, poisonings, and suicide attempts. In addition, the characteristics of the hospital stay, including admission, discharge, and payment factors are examined.

## **METHODS**

### **Sample**

The data for this investigation came from the 2010 National Hospital Discharge Survey (NHDS) which was an annual nationwide probability survey conducted by the National Center for Health Statistics. This survey was designed to provide information on the characteristics of inpatients discharged from non-federal short stay hospitals in the United States. NHDS collected data in a three-stage sampling design procedure to allow for national estimates of hospital discharges. Each sample record is assigned a weight to calculate national estimates. Each record has a maximum of seven diagnostic codes abstracted in addition to demographic and utilization data.

The sample for this report included the records of all individuals 10-25 years of age who were discharged from the hospital with a diagnosis of alcohol or drug abuse or dependence, poisoning, or suicide attempt. Records were included if they had any of these diagnoses abstracted. The diagnosis for one of these conditions did not have to be the primary diagnosis; as long as the diagnosis was listed, the record was included. This enables us to estimate a more complete impact of these behaviors. For example, an individual admitted with a primary diagnosis of a fracture and an additional diagnosis for alcohol use is included in this sample.

## **Measures**

ICD-9-CM 2009 codes were utilized to identify records with diagnoses of interest. Alcohol and drug use was identified with all codes beginning with 303-305, representing both acute and dependent abuse of these substances. Poisonings, overdoses, wrong substances taken or given and intoxication were identified with codes 960 – 989. Suicides attempts were identified by codes 950-959. National estimates were calculated utilizing the weighted number of discharges and the U.S. Census Bureau population data for this age group for 2010 (62,799,000).

## **Statistical Analyses**

The National Hospital Discharge Survey utilized a complex survey design that requires analytic techniques to address the complex sampling strategy of the survey. Analyses were conducted with SAS ver 9.3 (SAS Institute, Cary, NC) utilizing the procedures for complex survey design. These procedures use the Taylor series expansion method to provide estimates of the design-based variances. Weights assigned to each record were utilized in all of the analyses. All estimates reported have an unweighted sample size of 30 or greater and a relative standard

error less than or equal to 30%. Rao-Scott Chi square tests were performed to evaluate differences between groups and all significance tests were two-sided using  $p < 0.05$  as the level of statistical significance.

## RESULTS

The 2010 NHDS had a total sample of 203 responding hospitals with 151,551 records. Of these records, 11,567 (7.63%) were for patients ages 10-24. This represents an estimated 3,208,631 hospital discharges for this age range. There were significantly more females (73.38%) compared to males (26.62%) discharged ( $p < 0.001$ ) in this age group and significantly more white youth discharged compared to any other group (White 53.15%, Black/African American 18.85%, all others 7.71%, with 20.29% not stated;  $p < 0.0001$ ). Out of the 11,567 adolescents and young adults included in the survey sample 1,421 had alcohol or drug use diagnoses, 242 had poisoning diagnoses, and 50 had suicide-related diagnoses. National estimates of the rate of adolescents and young adults discharged from the hospital each year with one of these diagnoses is included in Table 1. These diagnosis groups account for 13.00% of all of the discharges for this age group.

**Table 1. National rate of hospital discharge for alcohol and drug use, poisonings, and suicide attempts in adolescents and young adults**

Condition	Discharge Rate in Adolescents and Young Adults
All causes	510.9 per 10,000
Alcohol and drug use	54.1 per 10,000
Poisonings	9.3 per 10,000
Suicide attempts	2.94 per 10,000

## Alcohol and Drug Use

It is estimated that 339,807 10-24 year olds were discharged from the hospital with an alcohol or drug use diagnosis in 2010. This accounts for 10.59% of all hospital discharges for this age group. Significantly more males (56.22%) than females (43.78%) had this diagnosis ( $p < 0.002$ ). As in the total sample for adolescents and young adults, there were significant differences in discharge rates among racial groups, with white youth comprising the majority of the discharges (62.04%) followed by blacks (13.68%) ( $p < 0.0001$ ). Alcohol and drug use discharges are greater in young adults in their 20's and lowest in adolescents (see Figure 1).

An examination of utilization factors indicates that the majority of admissions were classified as either an emergency (52.55%) or urgent (23.09%), with most of the admissions coming from the emergency room (37.07%) or from a non-health care setting (36.37%). The majority of patients were discharged directly to home (86.13%). Public health insurance systems are expected to be the largest category of payers, accounting for 39.84% of expected payment sources. Private insurance payments are the primary expected sources of payment for 34.65%, with an additional 19.18% expected to be self-pay patients. Further, the data indicate that there is a peak in April of alcohol and drug-related discharges (see Figure 2). Finally, there is significant regional variation in discharges, with the Midwest and the South accounting for approximately twice as many discharges for this diagnosis as the Northeast and West (see Table 2).

**Table 2. Percent of total discharges by region for alcohol and drug use, poisonings, and suicide attempts in adolescents and young adults**

Region	Alcohol & Drug	Poisoning	Suicide
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	Use		
Northeast	19.44%	18.41%	15.49%
Midwest	30.42%	29.93%	23.77%
South	30.60%	39.08%	44.75%
West	19.53%	12.58%	15.99%

## Poisoning

The national estimate for discharges related to poisonings for adolescents and young adults is 58,659 individuals in 2007. There was no significant difference in the proportion of males (48.26%) and females (51.74%) in this diagnostic category. As with alcohol and drug use discharges, there were significant differences in the discharge rates among racial groups, with white youth again accounting for the majority of discharges (68.82%) followed by blacks (10.9%) ( $p < 0.0001$ ). Poisoning-related discharges are higher in teens compared to early adolescents, and remain elevated throughout the teen years and into the young adult period (see Figure 1).

The majority of poisoning-related discharges were admitted as either an emergency (73.14%) or an urgent case (14.97%), with most admitted from the emergency room (61.30%) or from a non-health care setting (23.30%). While some patients are discharged to a short-term care facility (8.50%), most are discharged to home (64.02%). Private insurance is expected to be the main method of payment for 47.14% of the discharges, with public insurance programs expected to be the main method of payment for 36.25% of the discharges, and 13.35% expected to self-pay. Poisoning related discharges are twice as prevalent in the Midwest and the South compared to the Northeast and the West (see Table 2).

## **Suicide**

It is estimated that 18,480 adolescents and young adults were discharged from the hospital with a suicide-related diagnosis in 2010. There were no significant gender differences in discharges (46.35% female). It is not possible to conduct analyses utilizing race in this diagnostic category as there are subgroups in the un-weighted data with less than 30 records, making estimates unreliable.

As expected, the majority of admissions for suicide attempts were either an emergency (53.91%) or urgent (22.5%), and most came from the emergency department (58.6%) or from a non-health care setting (27.72%). While the majority of cases were discharged to their homes (74.26%), 6.08% were discharged to a short-term care facility and 7.46% died. Hospitals reported that they expected the majority of these patients to pay for services through a private insurance company (46.06%), with 32.85% expected to be covered by public insurance programs, 6.97% expected to self-pay, and 14.12% not charged or not reported. Examination of the time trend of discharges for suicide-related diagnoses indicates that there are peaks in both September and December (see Figure 2).

## **DISCUSSION**

Adolescence and young adulthood is an important transitional period during which morbidity and mortality often arise from individuals' behaviors. Self-report survey data regarding health behaviors are readily available; however, little data from objective sources have been reported and minimal study of health care utilization, particularly hospital utilization, related to these behaviors has been conducted. The results of this study indicate that approximately 5.11% of U.S. adolescents and young adults were discharged from the hospital in



2010 and a significant portion of these discharges were related to alcohol and drug use, poisonings, and suicide attempts. These results are important given that previous research has found a link between emergency visits by young people for an episode of self-harm and a subsequent diagnosis of a mental disorder and mental health problems later in life (Hawton & Harris, 2007; Portzky & van Heeringen, 2007). Understanding the patterns and characteristics of harmful behaviors can inform the development of interventions and can assist health care providers in planning.

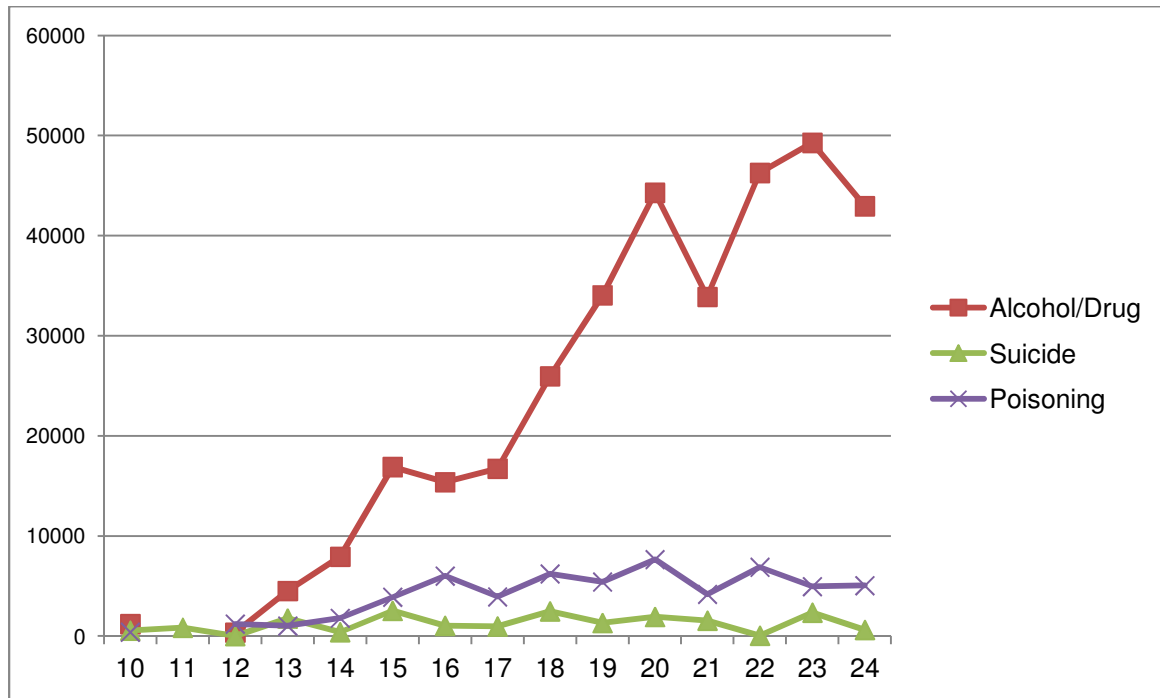
The observed demographic trends are consistent with survey findings for these behaviors. For example, the gender differences in discharges related to suicide attempts are in keeping with U.S. national trends in suicide deaths which find that males are much more likely to commit suicide compared to females (Portzky & van Heeringen, 2007). Further, increases in the rate of emergency visits for harmful behaviors tended to increase with patient age and was higher for whites compared to other racial groups as has been seen in previous studies (Olsson, Gameroff, Marcus, Greenberg, & Shaffer, 2005; Spicer & Miller, 2000).

Hospitalization for these behaviorally-related admissions poses a burden on the public as 36.31% of these discharges are expected to be paid by Medicare, Medicaid or another publicly-funded health insurance system. Self-pay is the primary expected source of payment for 13.12% of the discharges. This indicates that these patients did not have private or public health insurance. Despite the fact that they will be responsible for all of the costs for their care, they still sought treatment for one of these conditions, emphasizing the emergency nature of these conditions.

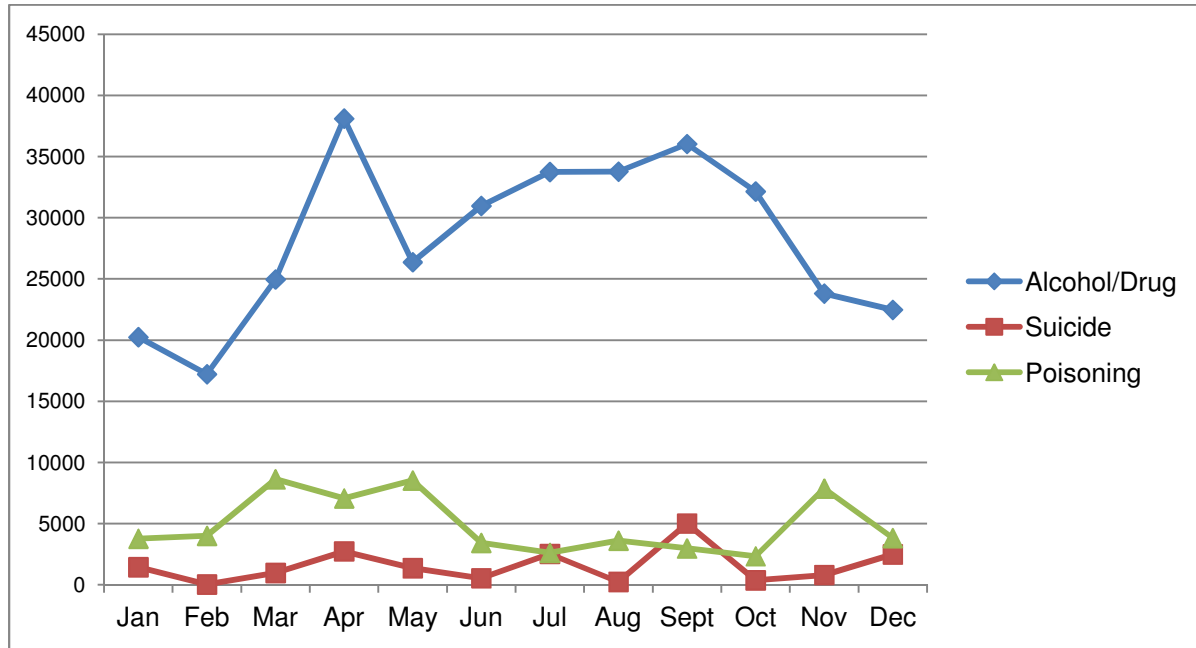
It is interesting to note that seasonal and regional trends were observed in discharge patterns. Discharges related to suicide peak in both September and December. This may be associated with stress related to the beginning of the school year and to holidays. Discharges for alcohol and drug use appear to peak in April. Awareness of seasonal trends would allow hospitals to anticipate and prepare for these peaks.

Several limitations of this report should be noted. The National Hospital Discharge Survey only allows for examination of those admitted to the hospital. Patients who present to the emergency department but are not admitted to the hospital are not included in this data set. While this is most useful for examining issues related to hospital utilization, additional investigation of ambulatory care related to these diagnoses is warranted. Diagnostic codes, particularly for suicide, may be biased due to the lack of knowledge of how the injury occurred. Intentional ingestion of hazardous substances is the most likely misdiagnosis for unreported suicide. Patients may present as an accidental poisoning in order to avoid the negatively perceived diagnosis of suicide attempt, resulting in incorrect classification in these analyses. It was for this reason that the poisoning category was included in this report; however, further investigation to examine this issue is needed. Finally, NHDS reports no data on the costs of the health services utilized. Additional investigation regarding the health care cost burden of admissions related to these diagnoses would be valuable.

**Figure 1. Discharges by age for alcohol and drug use, poisonings, and suicide attempts**



**Figure 2. Discharges by month for alcohol and drug use, poisonings, and suicide attempts**



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