

BRIEF REPORT

The spectrum of intoxication and poisonings among adolescents: surveillance in an urban population

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Injury Prevention 2006;12:129–132. doi: 10.1136/ip.2005.010710

Aim: Among adolescents, poisoning is a leading cause of injury mortality in the United States. This study describes the epidemiology of poisonings, intoxication, and maladaptive effects of drugs among adolescents age 10–19 years in a large city.

Methods: An injury surveillance system used records at seven hospitals, medical examiner records, and vital records over a two year period.

Results: Of 633 cases (618 injuries/100 000/year), 6% were unintentional, 36% self-inflicted, 41% alcohol intoxication, and 15% maladaptive effects of drugs. Alcohol was involved in 45% of cases, 23% illegal drugs, 23% non-prescription drugs, 19% prescription drugs; 19% involved more than one substance. Hospitalization was required in 20%; 8% transferred to another hospital; one died from intoxication. The authors found high rates of self-inflicted poisoning, intoxication, and maladaptive effects of drugs among this urban population.

Conclusion: The study highlights the need to broadly define poisonings among adolescents and the challenge of assessing intent in some cases.

Poisoning is a leading cause of death among adolescents including unintentional poisoning, suicide, and homicide.^{1,2} Adolescence is also an initiation time for risky health behaviors including substance use.³ Understanding when normative health risking, attention seeking, or suicidal thoughts become harmful and pathologic is critical. There is little literature describing the epidemiology of acute poisoning and intoxication presenting to medical care among adolescents.

Traditionally, E-code classification from the International Classification of Diseases, ninth revision⁴ is used for poisoning surveillance. However, suggestions have been made to extend “beyond the traditional classification by E-codes to include deaths for which the underlying cause of death was the nondependent abuse of drugs. ICD-9 codes 305.0–305.9.”² If the primary ICD-9 CM discharge diagnosis is in the 305.0–305.9 range then it is not considered an injury and there is no E-code assigned. Assessing poisonings from only E-codes may miss important cases of adolescent risk behavior and underestimate morbidity.

Another coding challenge is the categorization of E-coded poisonings as unintentional, intentional, or of undetermined intent. Suicidality may not be recognized when youth present for care^{5,6} and true motives and intent in intoxication and poisonings may be difficult to assess. “A new paradigm of injury intentionality” differentiates intent of an *act* and the *outcome* and suggests a spectrum of intentionality.⁷ Ascertaining intentionality of the act and outcome in an

individual case may be difficult but is critical for clinical management and preventive counseling. Some feel that adolescent suicide attempters cannot be distinguished from at-risk adolescents and that suicide attempts are “one point on a continuum of adolescent problem behaviors”.^{8,9} The aim of this study was to provide a descriptive epidemiology of adolescent poisonings including E-coded poisoning, intoxication, and maladaptive effects of drugs with a focus on intent in an urban predominantly African-American population.

METHODS

Data from the District of Columbia Adolescent Injury Surveillance System were used with methodology previously described.¹⁰ A case was defined as an episode of poisoning resulting in an emergency department (ED) visit, hospitalization, or death among residents age 10–19 between June 15 1996 and 1998. Poisonings included (1) an ICD-9 CM E-coded poisoning (E850-869, E950-952, E962, E972, E980-982) or (2) alcohol intoxication or maladaptive effects of drugs (ICD-9CM 305.0–305.9).

Study sites included EDs of all six designated hospital trauma centers in DC. An additional hospital was included because it received the second highest number of emergency medical service transports of adolescents in the city. These seven hospitals saw the vast majority of adolescents transported by emergency medical services. Information on deaths was obtained from hospital records and the Office of the Chief Medical Examiner. The DC population was 67% African-American¹¹ with median household income of \$34,980 at the time of the surveillance.¹² Approvals were obtained from the institutional review boards at each site.

Research assistants reviewed ED logs or charts at each hospital to identify eligible cases and abstracted data directly onto laptop computers. Codes were assigned by a trained coder and checked by a second coder with E-codes grouped into mechanism-by-intent categories.¹³ Repeat visits for the same or a different injury were identified by matching on a unique identifier. Denominator data for rates were derived from US Census Bureau estimates.

RESULTS

Over the two year period there were 633 cases presenting to participating EDs among 609 adolescents (event based injury rate 618 injuries/100 000 adolescents/year). Hospitalization was required in 20% of cases with another 8% transferred to another facility and one death from alcohol intoxication. Cases included 38 (6%) classified as unintentional poisoning, 229 (36%) self-inflicted, three (<1%) homicidal, and eight (1%) undetermined intent with an additional 257 (41%) presenting with diagnoses of alcohol intoxication and 97 (15%) with maladaptive effects of drugs. Of all cases, 45% involved alcohol, 23% illicit drugs, 23% non-prescription drugs, 19% prescription drugs, 2% corrosives and caustics, and 1% gases and vapors.

Table 1 Annual event based poisoning rates per 100 000 population by age and gender, rate (n), (n = 633)

Poisoning type	Male		Female	
	10–14 years	15–19 years	10–14 years	15–19 years
Unintentional, "accidental"				
Drugs (E850–858)	0	7.9 (2)	15.6 (4)	35.3 (9)
Solid and liquid substances gases, vapors (E860–869)	15.6 (4)	19.6 (5)	27.3 (7)	27.5 (7)
Intentional self-inflicted				
Drugs (E950–950.5)	27.3 (7)	161 (41)	124.6 (32)	526.2 (134)
Corrosives and caustics (E950.7)	0	11.8 (3)	3.9 (1)	31.4 (8)
Other unspecified solid and liquids (E950.9)	0	0	0	11.8 (3)
Intentional assault (E962)	0	7.9 (2)	3.9 (1)	0
Undetermined intent				
Drugs (E980–980.5)	3.9 (1)	3.9 (1)	15.6 (4)	7.9 (2)
Solid and liquid substances gases, vapors (E980.6, 982.9)	3.9 (1)	0	0	0
Alcohol intoxication	77.9 (20)	557.6 (142)	54.5 (14)	318.1 (81)
Maladaptive effect of drugs	39 (10)	196.3 (50)	27.3 (7)	117.8 (30)
Total	167.5 (43)	966 (246)	272.6 (70)	1054 (274)

Table 1 depicts annual event based rates by cause. Rates increased with age and were higher in females compared to males in self-inflicted poisonings, but higher in males for alcohol intoxication and drug effects. Of all cases, 18% arrived during the hours of 08:00–14:00, 39% 14:00–20:00, 37% 20:00–02:00, and 6% during 02:00–08:00. Those with alcohol intoxication or maladaptive effects of drugs did not differ from those with unintentional and self-inflicted poisonings in regard to time of presentation, but they were more likely to present on weekends (58% v 40%, $p = 0.0023$). Table 2 presents rates by transportation method and disposition. Overall, 49% of cases were transported to the hospital by air or ground ambulance and 13% by police. Those with alcohol intoxication or maladaptive effects of drugs were more likely to be transported by police (18% v 7%, $p < 0.0001$).

For intentional poisonings, analgesics including acetaminophen and non-steroidal anti-inflammatory medication were most commonly used (46%) with prescription drugs involved in 44%. Of all visits, 19% involved more than one substance. In self-inflicted poisoning, 29% involved more than one substance with 3% alcohol or illegal drugs.

For alcohol intoxication, stupor and vomiting were the most common clinical presentation (53%) with 13% presenting with suicidal, depressive, or assaultive behavior. Beer (51%) and vodka (19%) were the most commonly documented type of alcohol with marijuana (78%) and phencyclidine (10%) the most commonly documented illegal drugs.

Over the two year study, 23 adolescents (4% of total) presented to an ED more than once for poisoning. Seven (30%) presented more than once with self-inflicted injuries. Five (22%) presented with a combination of self-inflicted injuries and alcohol intoxication or maladaptive effects of drugs, while 11 (48%) presented more than once with alcohol intoxication or maladaptive effects of drugs. Of these 23 adolescents, one presented three times over two years with repeated suicide attempts with prescription drug overdoses; another presented on three occasions with bizarre and violent behavior related to PCP and cocaine.

DISCUSSION

In this urban population many adolescents experienced poisoning, intoxication, and maladaptive effects of drugs resulting in a hospital visit. These visits accounted for

Table 2 Annual event based intoxication and poisoning rates per 100 000 population by disposition and transportation method, rate, (n)*

Poisoning type	Disposition (n = 617)			Transportation method (n = 617)			
	Discharged	Hospitalized	Transferred	EMS†	Non-EMS	Police	Unknown
Unintentional, "accidental"							
Drugs, medicinal substances and biologicals (E850–858)	13.7 (14)	1.0 (1)	0	3.9 (4)	6.8 (7)	0	2.9 (3)
Other solid and liquid substances, gases, vapors (E860–869)	21.5 (22)	0	0	7.8 (8)	10.8 (11)	1.0 (1)	2.9 (3)
Intentional self-inflicted							
Drugs (E950–950.5)	77.4 (79)	97.0 (99)	34.3 (35)	92.1 (94)	80.3 (82)	14.7 (15)	19.6 (20)
Corrosives and caustics (E950.7)	3.9 (4)	3.9 (4)	3.9 (4)	6.8 (7)	1.9 (2)	1.9 (2)	1.0 (1)
Other unspecified solid and liquids (E950.9)	2.9 (3)	0	0	1.0 (1)	1.0 (1)	1.0 (1)	0
Intentional assault (E962)	2.9 (3)	0	0	1.0 (1)	2.0 (2)	0	0
Undetermined intent							
Drugs (E980–980.5)	3.9 (4)	1.0 (1)	0	3.9 (4)	0	0	1.0 (1)
Solid and liquid substances gases, vapors (E980.6, 982.9)	0	0	0	0	0	0	1.0 (1)
Alcohol intoxication	225.3 (230)	10.7 (11)	7.8 (8)	144.0 (147)	42.1 (43)	50.0 (51)	8.8 (9)
Maladaptive effect of drugs	78.1 (80)	7.8 (8)	6.8 (7)	35.3 (35)	38.2 (39)	11.8 (12)	8.8 (9)
Total	429.6 (439)	121.4 (124)	52.8 (54)	295.8 (301)	183.2 (187)	80.4 (82)	46.0 (47)

*Annual rates are presented with numbers for the two year study period.

†EMS, emergency medical services including ambulance or helicopter.

significant morbidity and expenditure of resources. Resource use included the hospital visit and frequent use of ambulances and police transportation. This study highlights the spectrum of poisoning and intoxication presentations to hospitals from “accidental” poisonings or intoxication to self-inflicted use, abuse, and suicidal gestures.

We found an event based intentional self-inflicted poisoning rate of 367/100 000/year among 15–19 year olds. This is higher than the rate reported by the Consumer Product Safety Commission’s National Electronic Injury Surveillance System (168/100 000/year)¹⁴ and the National Hospital Ambulatory Medical Care Survey (215/100 000/year)¹⁵ (assuming 65% of non-fatal self-inflicted injuries treated in a hospital are a result of poisoning¹⁴). The fact that our rates were higher is noteworthy in this urban and predominantly African-American population. African-American youth have historically had lower suicide rates than whites; however, the Centers for Disease Control and Prevention reported that between 1980–95 suicidal behavior for all youth increased with larger increases among African-Americans.¹⁶ Our study confirms Youth Risk Behavior Surveillance data that show high percentages of DC public high school students who report attempting suicide (12.1% in DC compared to 6.6–11.9% in 32 states surveyed)¹⁷ and reinforces the need to explore reasons for high rates of poisonings among African-American youth.

This study illustrates the many primary presentations of poisonings among adolescents. Of these, 56% were accounted for by alcohol intoxication and maladaptive effects of drugs that would not be included if the traditional E-code definition of poisoning was used. As has been suggested for poisoning mortality, a comprehensive view of adolescent morbidity needs to consider E-coded injuries as well as intoxication and maladaptive effects of drugs.² In addition, many patients presented with polysubstance use involving prescription and non-prescription medication as well as alcohol and illegal drugs. There exists clinical and epidemiologic evidence that substance use is a powerful independent risk factor for suicidal behavior and self-inflicted injury.^{18–19} This emphasizes the need to view adolescent poisonings with a broader lens that includes intoxication and maladaptive effects of drugs for accurate epidemiology and for clinical assessment and management.

This study highlights the difficulty in ascertaining motives and intent for coding and appropriate intervention. Some adolescents with alcohol intoxication also were depressed and had suicidal ideation and behavior. Whether alcohol ingestion contributed to depression and suicidality or vice versa is unclear. In the death due to alcohol poisoning it is unknown whether the act of imbibing or the outcome of self harm were intentional. Misclassification regarding intent must be considered when assessing the burden of injury and potential interventions. Since the majority of individuals presenting with intoxication and poisonings were discharged from the hospital and a proportion had repeat visits, accurate screening for risk, referral for treatment, and follow up mechanisms are critical. Our data and other literature suggest that individuals with self-inflicted injury, intoxication, and drug use are all frequent visitors to EDs and the visit may be an important time to initiate interventions.^{19–21} Alcohol interventions in trauma centers have been associated with reduction in alcohol consumption and reduced risk of trauma recidivism.^{22–25} Development and evaluation of ED assessment protocols and interventions with adolescents warrant further study.

Limitations

The rate of adolescent poisoning was underestimated as we did not include all healthcare facilities to which youth may

Key points

- There is little literature on the epidemiology of intoxication and poisoning morbidity among adolescents.
- In this urban predominantly African-American population, there were high rates of self-inflicted poisoning, intoxication, and maladaptive effects of drugs requiring medical attention and substantial resource use.
- Ascertaining motives and intent regarding intoxication and poisoning may be difficult though critical for appropriate clinical care and prevention.
- Reliance on E-coded poisoning morbidity alone provides a limited view of adolescent poisoning; inclusion of intoxication and maladaptive effects of drugs provides a broader view of adolescent poisoning with implications for clinical assessment and management.

have gone, excluded “minor” events that did not present for hospital care, and excluded secondary diagnoses. Results from this urban city may not be generalizable to other populations. Finally, valid calculation of rates is dependent on accurate population estimates. Projecting migration patterns is especially difficult for adolescents because after high school graduation, college students are included in the US Census at their college and not their permanent address.

CONCLUSION

This study found high rates of self-inflicted poisoning, intoxication, and maladaptive effects of drugs among this urban predominantly African-American population. These data provide a broader look at the spectrum of adolescent poisonings by including alcohol intoxication and maladaptive effects of drugs. Reliance on E-coded poisoning morbidity alone provides a limited view of adolescent poisoning. This study highlights the need for further, more detailed screening and surveillance with greater focus on the circumstances of poisonings and intoxications, intent, and ED assessment and management.

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Support: This project was supported by the Centers for Disease Control and Prevention (R49/CCR311657-01), DC-Baltimore Research Center on Child Health Disparities Grant Number P20 MD00165 from the National Center on Minority Health and Health Disparities, and the Robert Wood Johnson Foundation Generalist Faculty Scholars Program (Dr Cheng). This work was performed when Dr Cheng and Ms Pearson Fields were at Children’s National Medical Center, Children’s Research Institute, George Washington University School of Medicine and Public Health. This work was presented in a poster at the World Injury Conference, Vienna, Austria, 7 June 2004.

Competing interests: none.

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Accepted 19 February 2006

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Editorial independence

If editors cannot print what they believe to be of value to their readers because their publishers object, the value of journals of all stripes is hugely diminished. In the case of clinical journals or those that bear on policy matters, the concern is perhaps even greater. Unlike several other leading journals whose editors were either forced to resign or were fired (Annals of Internal Medicine, JAMA, NEJM, and now, the CMAJ) Injury Prevention is blessed with publishers who accept the principal of editorial independence. The recent firing of the CMAJ editor, John Hoey and his deputy, Ann-Marie Todkill, is deplorable and has prompted an outcry among Journal editors world-wide. Personally, I agree with ex-NEJM editor, Kassirer who called on the CMA to fire the publisher.¹

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