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POISON CENTRE

# Abuse, misuse, and suicidal substance use by children on school property

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**Objective.** The purpose of this study was to characterize the epidemiological trends associated with substances used in intentional exposures among children while on school property reported to the U.S. National Poison Data System (NPDS). **Materials and Methods.** NPDS was queried for intentional (abuse, misuse, suspected suicide, and unknown intentional) exposures reported to occur on school property between calendar years 2004 and 2013. Records were restricted to children 6–18 years of age. Demographic, exposure, and clinical characteristics were assessed. **Results.** A total of 56,882 substances were intentionally used on school property by 50,379 children, of which 39.8% were females ( $n = 20,070$ ), 57.7% were males ( $n = 29,084$ ), and 2.4% were unknown gender ( $n = 1,225$ ). The most frequent pharmaceutical exposures reported included sedatives ( $n = 4,096$ ; 8.1%), analgesics ( $n = 4,022$ ; 8.0%), and cough and cold preparations ( $n = 3,529$ ; 7.0%). The majority of exposures were managed on site ( $n = 21,464$ ; 42.6%), followed by care at a healthcare facility ( $n = 20,048$ ; 39.7%). Serious outcomes (moderate or major effects and death) accounted for nine percent of all reported exposures. Compared to reference groups, female gender, teenagers 17–18 years, and pharmaceutical substances (Prevalence Ratios = 4.6, 9.4, and 9.9, respectively) were associated with suspected suicides when compared with other intentional exposures. **Conclusions.** Along with other national data about behaviors in the adolescent and teenage population, additional trends in risky behavior may be gleaned by surveillance through poison centers. With over 5,000 annual reports to the poison centers about intentional exposures on school property, school personnel and parents/guardians must be vigilant about the range of pharmaceutical and non-pharmaceutical substances that are used for abuse, misuse, or suicide.

**Keywords :** *School epidemiology, students, intentional exposure, poison centers*

## Introduction

Young children and adolescents present a unique subset of the population with rapidly changing behaviors, perceptions, and risk profiles for substance abuse or misuse. There are a number of national estimates that either target substance abuse or misuse among adolescents specifically or the general population over age 12 years. However, these studies are limited in their scope of substances or location of where these behaviors occur. For instance, the National Survey on Drug Use and Health (NSDUH) can provide age-specific estimates of specific substances such as illicit drug use, alcohol, and non-medical use of prescription products (i.e., pain relievers, tranquilizers, stimulants, or sedatives) and mental health measures for

those 12–17 years of age.<sup>1</sup> Yet NSDUH does not capture other types of substances, including over-the-counter medications. Monitoring the Future (MTF) also provides national data on smoking, drinking, illicit substance, and only select over-the-counter psychoactive agent use (i.e., diet aids and stimulants) among 8th, 10th, and 12th graders across the United States (U.S.).<sup>2,3</sup> The Centers for Disease Control and Prevention's (CDC) Youth Risk Behavioral Surveillance System (YRBSS) monitors alcohol, tobacco, illicit drug, and non-medical prescription use of substances.<sup>4,5</sup> The YRBSS reports on risky or deviant behaviors (e.g., bullying, carrying weapons, and violence) that children engage in while on school property and evaluates the prevalence of smoking cigarettes, taking part in the illicit drug trade, and use of marijuana on school property. This dataset also measures the extent to which these children consider or attempt suicide.

Despite the wealth of data that come from these sources, these are still cross-sectional survey data that may not truly reflect substances to which children are exposed. Furthermore, it is difficult to identify the types of substances children are intentionally ingesting, smoking, or otherwise exposing themselves to on school property. Despite the presence of teachers and administrators, school

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grounds still present a unique arena for experimenting with new substances, taking part in pranks, and sharing substances of all kinds.

An alternate source of information concerning trends in risky behavior or range of misused substances may be gleaned from surveillance by poison centers. The American Association of Poison Control Centers (AAPCC) National Poison Data System (NPDS) represents a unique data source with three fundamental capabilities that may address the limitations identified with other surveys or databases. First, all poison centers use the Micromedex POISINDEX<sup>®</sup> System, which captures over 350,000 chemicals, drugs, plants, and commercial products.<sup>6,7</sup> This enables poison centers to categorize or classify a wide array of reported substances. Second, poison center personnel who record call data are able to use information provided by the caller to categorize the intent of the call, thereby having the ability to distinguish between intentional and unintentional exposures (e.g., accidents and therapeutic errors). Finally, poison centers also identify the site of the reported exposure, thus isolating exposures that occur in specific locations.

There have been previous studies exploring pediatric exposures in the school environment through the use of poison center data.<sup>8–11</sup> However, these studies have either focused on narrower age groups or geographies. Furthermore, these studies explored all types of exposure reasons including unintentional exposures and adverse reactions. The purpose of this study was to more clearly delineate the epidemiological trends associated with substances used for intentional purposes (including misuse, abuse, and suspected suicide) among children at school. Primarily, we identified the type of intentional use by age and gender. We further investigated the range of non-pharmaceutical and pharmaceutical substances most frequently used intentionally, and analyzed factors associated with suspected suicide cases.

## Methods

### *National Poison Center System*

The NPDS captures information from calls received by all U.S. poison centers. The data are documented using standard data fields and definitions by poison centers staff and are auto-uploaded to NPDS, averaging every 8.08 minutes in 2013.<sup>12</sup> Calls to the poison centers may be classified as information (e.g., drug information, drug identification, poison information, environmental information, etc.) or a potential/actual exposure call (ingestion, inhalation, dermal, ocular, etc.). Exposures do not necessarily denote a poisoning or overdose by a specific product. Product information is entered by staff using the AAPCC generic and product codes. In general, substances may be categorized as non-pharmaceutical (e.g., chemicals, alcohol, and pesticides) or pharmaceutical substances (e.g., prescription medications, over-the-counter medications, supplements, stimulants, and street drugs). The exposure site (residence, workplace, healthcare facility, school, etc.)

are obtained and entered into the record. Known medical outcomes (no effect, minor effect, moderate effect, major effect, and death) and other cases that are not followed (due to non-toxic exposures with no clinical effects expected, minimal clinical effects expected, cases where the poison center is unable to follow, or others) are also a part of the NPDS record. The management site for the case is recorded and captures whether the patient was managed on site (e.g., a residence, school, and restaurant) or at a healthcare facility (includes cases that are recommended by the poison center to be managed at the healthcare facility).

The poison center staff also obtains the circumstances surrounding the exposure, allowing staff to classify the reason behind the exposure (intentional, unintentional, adverse reactions, and other). Intentional exposures consist of suspected suicidal exposures, misuse, abuse, or unknown intentional exposures.<sup>13</sup> Suspected suicidal exposures are defined as an exposure resulting from the inappropriate use of a substance for self-harm or for self-destructive or manipulative reasons and can include suicides, suicide attempts, and suicide gestures, whether suspected or confirmed. Intentional misuse is defined as an exposure resulting from the intentional improper or incorrect use of a substance for reasons other than the pursuit of a psychotropic effect. Intentional abuse is defined as an exposure resulting from the intentional improper or incorrect use of a substance where the patient was likely attempting to gain a “high,” euphoric effect, or some other psychotropic effect, including recreational use of a substance for any effect. Finally, intentional unknown is defined as an exposure that is determined to be intentional but the specific motive is unknown.

### *Study design and population*

This observational study was a review of de-identified NPDS records. NPDS was queried for all intentional exposures (suspected suicide, misuse, abuse, and unknown) where the exposure site was on school property (defined as any school, child care center, college, university, classroom, schoolyard, dormitory, or school-sponsored activity) between January 1, 2004 through December 31, 2013. Records were restricted to children between the ages of 6 through 18 years to exclude adult exposures (e.g., school staff) on school property. This study was approved by the site’s Institutional Review Board.

### *Data analysis*

Age (6–12 years, 13–14 years, 15–16 years, 17–18 years, and teen of unknown age) and gender distributions were analyzed. Frequencies of intentional exposures and the proportion of all exposures occurring at school (obtained from annual reports of NPDS from the AAPCC) were evaluated.<sup>12, 14–22</sup> Simple linear regression was performed for measuring changes in the number of intentional exposures overall as well as pharmaceutical and non-pharmaceutical substances at school per year. The frequencies and

proportions of substances [pharmaceutical, non-pharmaceutical, and select illicit drugs (marijuana, cocaine, heroin, LSD, PCP, methamphetamines, hallucinogenic amphetamines, other street drugs, etc.)], management sites (i.e., healthcare facility or non-healthcare facility), and medical outcomes were evaluated. For records with known management site, we further categorized level of care provided for the children as high (admitted to critical care unit, non-critical care unit, or psychiatric facility) versus low (not managed in a healthcare facility, or treated/evaluated/released when managed at a healthcare facility). Correlates of suspected suicide exposures were compared with other intentional exposures. The prevalence of characteristics in each category, univariate analyses of the prevalence ratios (PRs) comparing the two categories, 95% confidence intervals, and *p* values were evaluated with alpha set at 0.05. For multiple comparisons involving select substances between the suicide and non-suicide group, the analysis was Bonferroni-corrected and the PRs, 95% confidence intervals, and *p* values were evaluated with alpha set at 0.005. All data analysis was performed using SAS 9.4 software (SAS Institute Inc., Cary, NC).

## Results

### Demographics

The characteristics of this population are presented in Table 1. Between 2004 and 2013, there were 50,379 children reported to intentionally use one or more substances while on school property, of which males accounted for the majority of exposures ( $n = 29,084$ ; 57.7%). By age and gender, males aged 6–12 years represented the largest demographic of intentional exposures ( $n = 11,511$ ; 22.8%).

**Table 1.** Population characteristics of intentional exposures on school property among children aged 6–18 years reported to the National Poison Data System between 2004 and 2013.

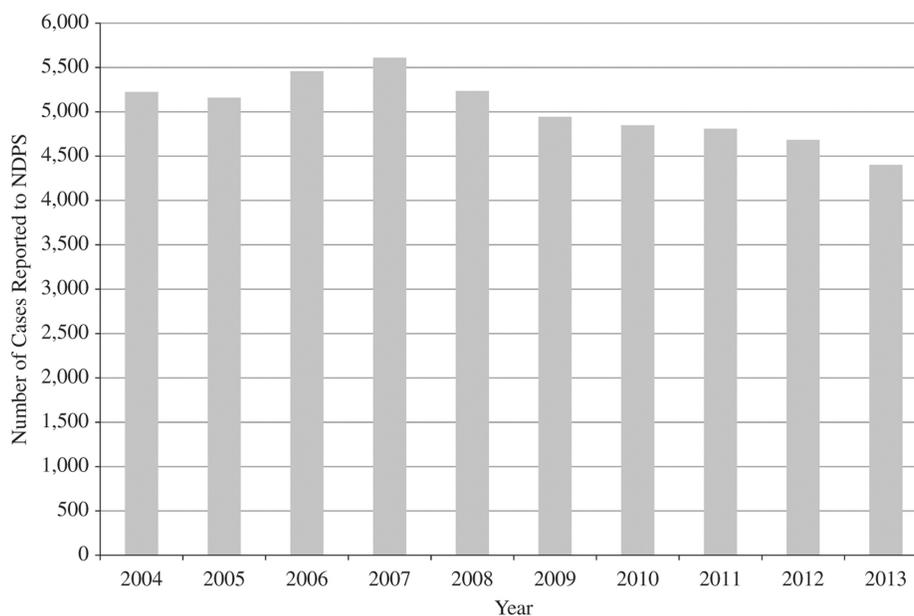
Demographics	Total		Male		Female	
	<i>n</i> *	%	<i>n</i>	% <sup>†</sup>	<i>n</i>	% <sup>†</sup>
Total	50,379	100.0	29,084	57.7	20,070	39.8
Age (years)						
6–12	17,783	35.3	11,511	64.7	5,671	31.9
13–14	12,426	24.7	6,576	52.9	5,753	46.3
15–16	12,844	25.5	6,903	53.7	5,895	45.9
17–18	5,351	10.6	3,214	60.1	2,129	39.8
Teen, unknown age	1,975	3.9	880	44.6	622	31.5
Exposure Reason						
Abuse	13,065	25.9	7,129	54.6	5,614	43.0
Misuse	27,004	53.6	17,655	65.4	8,643	32.0
Suspected Suicide	4,843	9.6	1,150	23.7	3,676	75.9
Unknown	5,467	10.9	3,150	57.6	2,137	39.1

\*Includes 1,225 students of unknown gender.

<sup>†</sup>Percentages go across exposure category and may not add up to 100% due to missing gender.

There were significant differences in exposure reason by gender; males were predominantly identified to abuse ( $n = 7,129$ ; 54.6%;  $p < 0.001$ ) or misuse ( $n = 17,655$ ; 65.4%;  $p < 0.001$ ) substances compared with females. Females were more likely to use substances for suspected suicides ( $n = 3,676$ ; 75.9%;  $p < 0.001$ ) compared with males. By age, approximately 50% of cases due to intentional misuse of substances were those aged 6–12 years, while 68% of intentional abuse was among 13–16-year olds.

Across the 10-year time period, there was an average of 5,037.9 exposures per year, with the lowest volume in 2013 ( $n = 4,403$ ) and the highest volume in 2007 ( $n = 5,612$ ) [Fig. 1]. There was a decrease over time, with approximately 100 fewer cases reported to the poison center per calendar year ( $p = 0.003$ ). While exposure volumes varied



**Fig. 1.** Annual number of intentional exposures on school property among children ages 6–18 years reported to the National Poison Data System.

**Table 2.** Frequencies of select substances reported as intentional exposures on school property among children aged 6–18 years reported to the National Poison Data System between 2004 and 2013.\*.

Non-pharmaceutical substances	<i>n</i>	%
Total	26,259	52.1
Office Supplies	3,831	7.6
Plants	3,443	6.8
Cosmetics/Personal Care Products	3,267	6.5
Foreign Bodies/Toys/Miscellaneous	2,655	5.3
Chemicals	2,008	4.0
Food	1,510	3.0
Cleaning Substances (Household)	1,496	3.0
Alcohol	1,476	2.9
Hydrocarbons	817	1.6
Adhesives	753	1.5
Heavy Metals	514	1.0
Alcohol (Other)	356	0.7
Unknown Non-drug Substances	1,392	2.8

Pharmaceutical substances	<i>n</i>	%
Total	24,760	49.2
Sedatives	4,096	8.1
Analgesics	4,022	8.0
Cough and Cold Preparations	3,529	7.0
Opioids	1,845	3.7
Unknown Drug	1,836	3.6
Antidepressants	1,727	3.4
Amphetamines	1,031	2.0
Antihistamines	1,002	2.0
Marijuana	747	1.5
Caffeine	729	1.4
Dietary Supplements/Herbals/Homeopathic Substances	728	1.4
Methylphenidate	583	1.2
Anticonvulsants	534	1.1
Muscle Relaxants	528	1.0
Cardiovascular Drugs	380	0.8
Hallucinogenic Amphetamines	183	0.4
Other/Unknown Street Drug	67	0.1
Cocaine	66	0.1
LSD	30	0.1
PCP	21	< 0.1
Methamphetamines	20	< 0.1
Heroin	11	< 0.1

\*Frequencies represent the number of children who had these exposures (e.g., 4,096 children (8.1% of all students) ingested sedatives. These frequencies do not add up to the total number of children in the study due to multiple exposures.

by month, the average counts across the study period peaked in October (avg = 515.8), March (avg = 620.9), and May (avg = 679.8) when school was in session.

### Substances

The frequencies of substances reported are presented in Table 2. There were 56,882 total substances identified, and the number of substances reported for each child ranged between one substance only ( $n = 45,822$ ; 91.0%) and 19 substances ( $n = 2$ ; < 0.1%). Among non-pharmaceutical substances, children most frequently intentionally used office supplies [pens/inks, pencils, or correction fluids ( $n = 3,831$ ; 7.6%)], plants [those containing gastrointestinal irritants, skin irritants, oxalates, or cardiac glycosides ( $n = 3,443$ ; 6.8%)], and cosmetics/personal care products [hand

**Table 3.** Medical management and medical outcomes of intentional exposures on school property among children aged 6–18 years reported to the National Poison Data System between 2004 and 2013.

Management Site	<i>n</i>	%
Managed on site (non-healthcare facility)	21,464	42.6
Managed in healthcare facility	20,048	39.8
Treated, evaluated, and released	11,063	22.0
Admitted to critical care unit	1,192	2.4
Admitted to noncritical care unit	1,105	2.2
Admitted to psychiatric facility	1,399	2.8
Patient lost to follow-up/left AMA	1,641	3.3
Unspecified level of care	3,648	7.2
Other/unknown	8,867	17.6

Medical Outcome	<i>n</i>	%
No Effect	8,970	17.8
Minor Effect	10,427	20.7
Moderate Effect	4,215	8.4
Major Effect	226	0.4
Death	1	< 0.1
Not Followed/Unable to Follow	25,539	50.7
Judged as nontoxic exposure (clinical effects not expected)	6,564	13.0
Minimal clinical effects possible (no more than minor effect possible)	15,116	30.0
Judged as a potentially toxic exposure	3,859	7.7
Other	1,001	2.0

sanitizers, perfumes/colognes/aftershave, or mouthwashes containing ethanol ( $n = 3,267$ ; 6.5%). Among pharmaceutical substances, sedatives [benzodiazepines, antipsychotics, or anti-anxiety medications ( $n = 4,096$ ; 8.1%)], analgesics [aspirin, acetaminophen, or non-steroidal anti-inflammatory drugs ( $n = 4,022$ ; 8.0%)], and cough and cold preparations [preparations containing dextromethorphan, acetaminophen, or phenylpropanolamine ( $n = 3,529$ ; 7.0%)] were most frequently intentionally used. Stimulants and street drugs were less frequent exposures on school property [Table 2]. Over time, there were approximately 92 fewer pharmaceutical substances reported each year ( $p < 0.001$ ), while there was no statistically significant difference in the annual number of non-pharmaceutical substances ( $p = 0.675$ ).

### Medical management and outcomes

The highest proportion of children ( $n = 21,464$ ; 42.6%) were managed on site (outside of a healthcare facility), while 20,048 children (39.8%) were managed/recommended to be managed at a healthcare facility (Table 3). The most frequently reported substances among those requiring a higher level of care were all pharmaceutical substances: analgesics ( $n = 782$ ; 21.2%), sedatives ( $n = 754$ ; 20.4%), cough/cold preparations ( $n = 563$ ; 15.2%), antidepressants ( $n = 505$ ; 13.7%), and opioids ( $n = 292$ ; 7.9%). The vast majority of children ( $n = 41,077$ ; 81.5%) had no more than minor/minimal effects reported or expected. Less than 10% had moderate or more severe outcomes, and only one death was reported during this time frame due to a combination of two opioids and a sedative.

**Table 4.** Exposures due to suspected suicide versus other intentional exposures on school property among children aged 6–18 years reported to the National Poison Data System between 2004 and 2013.

Demographic	Suicide only <i>n</i> (%)	Total <i>n</i>	Prevalence ratio*		
			PR	95% CI	<i>p</i> value
Gender					
Male	1,150 (4.0)	29,084	<i>Ref</i>		
Female	3,676 (18.3)	20,070	4.6	4.3–4.9	< 0.001
Age					
6–12 years	349 (2.0)	17,783	<i>Ref</i>		
13–14 years	1,368 (11.0)	12,426	5.6	5.0–6.3	< 0.001
15–16 years	2,030 (15.8)	12,844	8.1	7.2–9.0	< 0.001
17–18 years	987 (18.4)	5,351	9.4	8.4–10.6	< 0.001
Level of Care					
Lower	1,814 (5.6)	32,527	<i>Ref</i>		
Higher	1,676 (45.4)	3,696	8.1	7.7–8.6	< 0.001
Substance Type					
Non-pharmaceutical Only	461 (1.8)	25,619	<i>Ref</i>		
Pharmaceutical Only	4,294 (17.8)	24,120	9.9	9.0–10.9	< 0.001
Both	88 (13.8)	640	7.6	6.2–9.5	< 0.001

Select Substances	Suicide only <i>n</i> (%)	Other <i>n</i> (%)	Prevalence ratio†		
			PR	95% CI	<i>p</i> value
Analgesics	1,943 (40.1)	2,079 (4.6)	7.7	7.4–8.1	< 0.001
Sedatives	617 (12.7)	3,479 (7.6)	1.7	1.5–1.8	< 0.001
Cough and Cold Preparations	395 (8.2)	3,134 (6.9)	1.2	1.1–1.3	< 0.001
Opioids	278 (5.7)	1,567 (3.4)	1.6	1.4–1.8	< 0.001
Antidepressants	682 (14.1)	1,045 (2.3)	4.6	4.1–5.2	< 0.001
Antihistamines	298 (6.2)	704 (1.5)	3.2	2.9–3.6	< 0.001
Methylphenidate	97 (2.0)	486 (1.1)	1.7	1.5–2.1	< 0.001
Amphetamines	96 (2.0)	935 (2.1)	1.0	0.8–1.2	0.740
Alcohol	86 (1.8)	1,390 (3.1)	0.6	0.5–0.7	< 0.001
Illicit Substances	31 (0.6)	1,138 (2.5)	0.3	0.2–0.5	< 0.001

\*Prevalence ratio is a measure of the proportion of each variable that was considered a suicide exposure compared to the reference group of that variable. For example, the proportion of females that reported suicide exposures was 4.6 times greater than the proportion of males that reported suicide exposures.

†Prevalence ratio is a measure of the proportion of suicide exposures that involved a substance compared to the proportion of non-suicide exposures (reference group) that reported that substance. Measures are Bonferroni-corrected for multiple comparisons, and *p* values are evaluated with an alpha of 0.005.

### Characteristics of population with suspected suicide exposures

The correlates of suspected suicide exposures are presented in Table 4. Females were 4.6 times more likely to use substances on school property for suspected suicide compared with males (95% confidence interval [CI]: 4.3–4.9; *p* < 0.001). Compared with the youngest age group (6–12 years), teenagers of all ages were more likely to intentionally use substances for suspected suicide, with the greatest risk among those aged 17–18 years (PR = 9.4; 95% CI: 8.4–10.6; *p* < 0.001).

Pharmaceutical substances alone or in combination with a non-pharmaceutical substance were 9.9 times more likely (95% CI: 9.0–10.9; *p* < 0.001) or 7.7 times more likely (95% CI: 6.2–9.5; *p* < 0.001), respectively, to be used in a suspected suicide exposure when compared with non-pharmaceutical substances alone.

### Discussion

This study captures a unique subset of intentional exposures in children within a seemingly safe and secure

environment and presents a number of implications for healthcare providers, parents, and school staff members. First, approximately 5,000 calls are made annually to the poison centers regarding intentional exposures of substances on school property by children. The reasons vary by age, as half of all intentional misuse of substances were reported among those aged 6–12 years, while the majority of cases of intentional abuse were among those aged 13–14 years. Intent also varied by gender, as males were more likely to abuse or misuse substance on school property while females represented the vast majority of suspected suicide exposures. From a clinical aspect, though approximately 43% of these exposures were managed on site at school or at home, a similar proportion of cases (40%) were managed at or referred to a healthcare facility by the poison centers. This represents a significant burden of visits to pediatricians/primary care physicians, emergency department visits, and hospitalizations. Despite a significant proportion of cases that were managed at a healthcare facility in this study, we found that approximately 80% had no more than minimal clinical effects observed or expected. These findings are consistent with previous

studies regarding school exposures in children, despite focusing on intentional exposures only.<sup>10–11</sup>

Second, these data highlight the range of substances used over a 10-year window and patterns in use by age and gender. The significant burden of pharmaceutical products implies the ease with which these substances are available to children in households, through purchase in stores, or diverted through friends. The key over-the-counter substances (analgesics, sedatives, and cough and cold preparations) identified in this study are consistent with a previous study investigating emergency department visits among teenagers due to the misuse of pharmaceutical substances.<sup>23</sup> These types of studies and data emphasize the need for greater vigilance of medications at home by parents and caretakers as well as by teachers and administrators at school. Teachers, school nurses, counselors, and administrators can better educate children on the misuse of these substances through the use of poison center personnel or curriculum tailored to this topic.

Third, this study identifies key characteristics of children suspected of suicidal attempts. While it has been previously established that older teenage females are more likely to attempt suicide,<sup>4,24</sup> our study also characterizes the extent to which pharmaceutical substances—specifically analgesics, antidepressants, cardiovascular drugs, and muscle relaxants—were more likely to be utilized in a suicide attempt compared with other reasons such as intentional abuse and misuse. Suspected suicide exposures were eight times more likely to require a higher level of care and accounted for nearly two-thirds of all cases admitted to a psychiatric facility. These aspects underscore the severity of the utilization of these pharmaceutical products as well as the economic impact on the healthcare system.

Pharmaceuticals are administered daily in schools across the U.S. Previous research has highlighted the problem of medication non-adherence at school.<sup>25–26</sup> Even though the data utilized in this study do not clearly distinguish the timing of the initial exposure (e.g., prior to arrival to the school versus on the school grounds proper), the results highlight the importance of schools implementing clear student medication carry policies.<sup>27–28</sup> Nearly half of exposures in this study involved pharmaceutical products. Theoretically, an enforced student carry policy which limits students' access to medications on school grounds could result in a decrease in intentional use and attempted suicide while at school, and may assure student medication compliance via supervised medication administration by a school nurse or another adult.

The major limitations to this study stem from the nature of the poison center system. NPDS is a passive surveillance system that is dependent on calls reported to poison centers; this results in an underestimate of the true number of exposures in the general population and potential underreporting of less severe outcomes. There may also be potential errors in coding of substances or the nature of the exposure or variations in practices in coding between poison centers. Without reviewing each individual case's

notes (a field that is unavailable in NPDS), it is not possible to verify these practices. Finally, while an individual poison center data set may capture the context or situational factors (e.g., pranks, medical/psychiatric histories, and stressors/reasons) surrounding each case, this level of detail is not available at the national level. These factors would help to better characterize and understand the nature or motives driving such behaviors among children.

The U.S. has been experiencing an epidemic of pharmaceutical product abuse, of which the vast majority is due to prescription painkiller overdoses.<sup>29</sup> According to the Drug Abuse Warning Network, non-medical use of pharmaceuticals increased overall by 132% while drug-related suicides (almost all of which involved a prescription drug or over-the-counter medication) increased 41% from 2004 to 2011.<sup>30</sup> Though rates of non-medical use of pharmaceuticals in children is almost half that of more high-risk age groups, they are undoubtedly intentionally using and abusing a wide range of substances—particularly over-the-counter analgesics, cough and cold preparations, and sedatives. Whether due to self-purchase or availability within their homes, children are able to access these products and use them on school property. Compared with other substances that may generate odors or are more apparent such as cigarettes and marijuana, many of these substances are easier to abuse or misuse without attracting much attention from school officials. Finally, as this study shows, when compared with non-pharmaceutical substances, the nearly ten-fold increase in the likelihood of utilizing pharmaceutical products in suspected suicides is alarming within a young population. Through increased vigilance at home and school as well as education regarding misuse of these substances, there exists a potential for a reduction in the abuse or misuse of such products within the adolescent population.

## Conclusions

Between 2004 and 2013, there was an annual average of 32,134 cases of exposures occurring on a school site reported to poison centers overall. Our study demonstrates that approximately 16% of all exposures occurring on a school site are due to children intentionally using substances for abuse, misuse, or suspected suicide. While there appears to be a decrease in the burden of these cases over time, school personnel and parents/guardians should remain vigilant of trends of non-medical use of various substances by children on school property.

## Disclaimer

The American Association of Poison Control Centers ([www.aapcc.org](http://www.aapcc.org)) maintains the national database of information logged by the 57 US poison control centers. Case records in this database are from self-reported calls; they reflect only information provided when the public or healthcare professionals report an actual or potential

exposure to a substance (e.g., an ingestion, inhalation, or topical exposure) or request information. Exposures are not necessarily poisonings or overdoses. The AAPCC is not able to completely verify the accuracy of every report made to member centers. Additional exposures may go unreported to poison control centers, and data referenced from the AAPCC should not be construed to represent the complete incidence of national exposures to any substance(s).

### Declaration of interest

Preliminary results of this study were presented at the 2015 International Congress of the European Association of Poisons Centres and Clinical Toxicologists in Malta.

The authors report no declarations of interest.

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