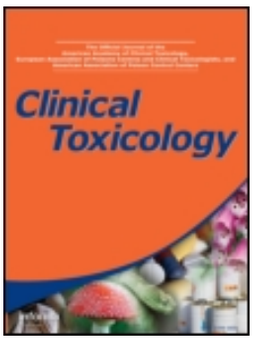

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RESEARCH ARTICLE

Hospital outcomes and economic costs from poisoning cases in Illinois

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Context. Since 2009, poisonings have been the leading cause of fatal injuries in the United States (US) and remain a continuing public health issue. Because of the varying definitions for what constitutes a poisoning case, there are inconsistencies in the annual number of cases reported among national health surveys. *Objectives.* The main objective of this study was to describe poisonings treated in Illinois hospitals by type of exposure, as well as to detail demographic characteristics, acute outcomes, and general cost estimates for those exposed to poisoning. We also compared a broad definition for poisoning used in our analysis with the definitions used by four national health surveys in order to assess the adequacy of various definitions in capturing poisonings for surveillance. *Material and methods.* We conducted a comprehensive analysis of outpatients and inpatients treated in Illinois hospitals in 2010 using the Illinois hospital database. Age-adjusted incidence rates were calculated. *Results.* In Illinois, 425,491 patients were treated in hospitals for poisoning in 2010, of whom 222,339 were inpatients. The age-adjusted incidence rate was 3,189 per 100,000 persons, with an average length of stay among inpatients of 5.5 days. The cumulative hospital charges were $7.9 billion. *Discussion and conclusion.* The definitions used in national surveys miss 60–90% of poisoning cases. Poisoning is the leading cause of fatal injuries in the U.S., but as this study shows broadening the definition for poisoning may provide a more accurate representation of the direct and indirect effects of poisoning in the US.

Keywords Poisonings; Ethnic disparities; Health care costs

Introduction

In 2009, poisonings became the leading cause of fatal injuries in the US, surpassing transportation-related fatal injuries and gun-related deaths.[1] With more than 70 million substances registered worldwide, approximately 72 million chemical mixtures commercially available to the public, more than 3.7 billion prescriptions filled in the US each year, and the near-endless number of substances made toxic by dose alone, it is not surprising that there are more than 2.3 million cases of human poisonings reported to poison control centers in the US annually.[2] In 2012, the Centers for Disease Control and Prevention (CDC) reported more than 1.24 million total non-fatal poisonings treated in hospitals and 42,197 fatal poisonings.[1,3] The profile of poisoning cases range across all age groups, with adults accounting for more than 90% of all fatal poisonings.[2]

Incidence data in the US primarily comes from poison center data and national health surveys. Poison center data provides comprehensive information of both aggregate and substance-specific exposures, in addition to dose, severity, and outcomes; however, poison center data are composed primarily of exposures not requiring treatment in health care facilities. In contrast, national health surveys capture patients treated in outpatient and inpatient settings.[4–7] The national health surveys provide aggregated information on the more severe cases; however, the inclusion criteria used to identify "poisoning" cases substantially differ, resulting in widely varying statistics of the number of annual poisoning cases between surveys. Furthermore, these national surveys do not publish information regarding specific exposures, acute outcomes (such as length of stay, in-hospital mortality, and percent requiring mechanical ventilation), or general cost estimates.

Despite the fact that poisoning are the leading cause of injury in the US, there has been no systematic effort to describe serious poisoning cases treated in hospitals in detail, which makes it difficult to identify and compare exposures of concern, assess the burden on society, track changes of exposures across time, and make informed decision regarding the allocation of resources for interventions. The main objective of this study was to describe the scope of poisoning cases treated in Illinois hospitals by major exposure categories, in addition to detailing demographic characteristics, acute outcomes, and general cost estimates for those exposed. A second objective was to compare the impact of different definitions for poisoning used in four national health surveys on estimated incidence rates.

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Methods

Data sources

For this analysis, billing records of outpatients and inpatients treated in Illinois hospitals in 2010 were analyzed. The outpatient database includes all patients treated in emergency rooms for less than 24 h who were not admitted to the hospital. The inpatient database includes all patients treated for 24 h or more in any Illinois hospitals for any medical reason. Both datasets include information on patients demographics (age, race, and sex), exposure information, health outcomes (diagnoses, hospital procedures, and discharge status), and economic outcomes (hospital charges and payor source). Based on the annual state audit of hospitals, the hospitals included in the datasets used for this analysis comprise 96.5% of all patient admissions statewide.[8] The Institutional Review Board or IRB of the University of Illinois at Chicago (UIC) approved this work (#2012-0116).

Ascertainment criteria

This analysis was not limited to primary diagnoses. Each patient in the datasets has up to 25 International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9 -CM) diagnosis codes. In addition, there are two fields for the reason for the visit (outpatient only), one field for the admission diagnosis (inpatient only), and three fields for cause of injury (all patients; ICD-9-CM E-codes). All the fields were used to identify patients suffering from a poisoning. The definition of poisoning used for this study was any health outcome resulting from reported exposure(s) requiring treatment in a hospital, which includes negative health outcomes from prescribed medications, and substance abuse/dependence withdrawal. Exposure in the context of this study is defined as "any intentional or unintentional ingestion, inhalation, or dermal absorption of a drug, medicinal, or biological substance resulting in a poisoning." The definition of exposure in this study is also consistent with that in the ICD-9-CM codes used for the diagnosis of poisonings. This study does not include most health conditions exacerbated or caused by unreported/unknown chronic exposures (e.g., cancer and heart disease). This study includes the following ICD-9-CM N-codes: 291.0–292.0, 303.0–305.9, 357.5–357.7, 506, and 960.0–989.9 and E-codes: E850.0–E853.2, E853.8–E854.3, E854.8–E855.6, E855.8–E869.9, E905.0, E930.0–E952.9, E962.0–E962.3, and E980.0–E989.9. A detailed description of the ICD-9-CM codes used for this analysis is attached as an appendix in the SAS code (Supplementary Appendix A, to be found online at http://informahealthcare.com/doi/abs/10.3109/15563650.2015.1030677). Tobacco exposure was classified as "tobacco dependence or acute toxic effects from tobacco." Only patients with acute toxic effects from tobacco were included in this analysis. Patients with only an exposure related to tobacco dependence were excluded from the final analysis ($N = 386{,}178$).

Categorization of exposures

In order to provide continuity in this analysis, ICD-9 -CM exposures were categorized into 71 major exposure classifications used by the American Association of Poison Control Centers (AAPCC). The AAPCC is the only organization to report detailed data by exposure category, albeit mostly for cases not requiring treatment in hospitals. A past study found a strong association between the poison control center data and emergency department codes.[9] Exposure categories are not independent and an individual with multiple exposures was counted more than once in the stratified exposure categories but not for calculating incidence rates. Supplementary Appendix A provides a crosswalk between ICD-9-CM and AAPCC major exposure categories.

Categorization of urban–rural areas

The US Department of Agriculture (USDA)'s Rural–Urban Continuum Codes were used to identify patients living in rural or urban areas. According to the USDA, these Rural–Urban Continuum Codes are a classification scheme that distinguishes metropolitan counties by the population size of their metro area, and non-metropolitan counties by degree of urbanization and adjacency to a metro area.[10] The 2013 Rural–Urban Continuum Codes are based on the 2010 population in Illinois, which matches our population in this study.

Comparison with national surveys

Public use data files were collected for the following four national surveys: National Electronic Injury Surveillance System (NEISS), National Health Interview Survey (NHIS), National Hospital Discharge Survey (NHDS), and the National Hospital Ambulatory Medical Care Survey (NHAMCS). The poisoning diagnosis criteria defined by each of the four national health surveys vary, resulting in the use of different ICD-9-CM N-codes and E-codes. The case definition for poisoning cases described above and each of the national dataset's respective case definitions were compared in order to describe the level of overlap of the different cases definitions. The N-codes and E-codes used by four national surveys, which are detailed below, were applied to the Illinois hospital data.

The most widely used and accessible injury reporting system in the US is CDC's Web-based Injury Statistics Query and Reporting System (WISQARS) based on NEISS data. The definition used by WISQARS does not include harmful effects from normal therapeutic drugs.[4, 11] WISQARS defines poisoning as "ingestion, inhalation, absorption through the skin, or injection of so much of a drug, toxin (biologic or non-biologic), or other chemical that a harmful effect results, such as drug overdoses; this category does not include harmful effects from normal therapeutic drugs (i.e., unexpected negative health outcomes to a drug administered correctly to treat a condition) or bacterial illnesses."[11] The N-codes used in the NEISS case definition were 960 through 989 and E-codes E850.0–E869.9, E950.0–E952.9, E962.0–E962.9, E972.0, and E980.0–E982.9.[12–14]

The NHIS monitors the health of the US population through the collection and analysis of data on a broad range of health topics while incorporating demographic and socio-

economic characteristics through a cross-sectional survey.[5] NHIS classifies poisoning episodes as the event from ingestion of or contact with harmful substances, including overdoses or misuse of any drug or medication.[15] Based on the NHIS survey description document, poisoning cases included N-codes 960–989.9 with an accompanying E-code of E850–E869.9, E905, and E950–E983.[16]

The NHDS captures characteristics of inpatients discharged from non-Federal short-stay hospitals in the US, including poisonings.[6] NHDS does not specifically have definition for what constitutes poisoning cases, but rather cases are defined by N-codes 960–989.[17,18]

The NHAMCS collects data on the utilization of ambulatory care services in hospital emergency and outpatient departments and in ambulatory surgery centers and specifically evaluates visits due to an injury, poisoning, or adverse effect of medical treatment, as well as the intent, cause, and diagnosis.[7,19] Like NHDS, NHAMCS does not have a specific definition for what qualifies as a poisoning case. Based on the self-reported responses regarding poisoning status, answers were coded as N-codes 960–989 and E-codes E860–E869, E928.9, E930–E949, E950.6–E950.7, E958.9, E962, E968.9, and E980–E989.[20–22]

Statistical analysis

SAS software (v 9.3, Cary, NC) was used for all statistical analyses. Prevalence of demographic characteristics, exposure variables, and hospitalization characteristics are described for both outpatients and inpatients. Cumulative proportions were calculated for the number of exposures, age category, sex, median length of stay, median total charges, and the sum of the total charges for each major exposure category. Total charges reflect all charges relating to the course of treatment, in addition to the treatment of poisoning. Age-specific rates among Illinois residents were only computed based on the 2000 standard population.[23] An adjusted Elixhauser Comorbidity Index score was calculated for poisonings.[24] Alcohol abuse and drug abuse were removed from the calculation only for the adjusted Elixhauser Comorbidity Index score.

Results

In total, there were 425,491 patients treated in Illinois hospitals for poisoning in 2010, of whom 222,339 were inpatients (52.3%). The age-adjusted incidence rate was 3,189 per 100,000 persons. Of the patients treated in Illinois hospitals for poisonings, 48.8% ($n = 207,490$) had the exposure listed as their primary diagnosis, reason for visit, or reason for admission. A total of 151,622 (35.6%) had an E-code relating to a listed exposure. In total, 62.7% of the cases had a primary diagnosis, reason for visit, reason for admission, or an E-code for poisoning. Approximately 71% of outpatients had only one exposure, but inpatients had a greater proportion of multiple exposures (48%; Table 1). Treatment for consumable alcohol exposures were the most common exposure for both outpatients and inpatients (37.9% and 21.7%, respectively).

Demographic characteristics of poisoning cases are shown in Table 1. In general, a greater proportion of outpatient cases were children and young adults, while the inpatient cases were older with a quarter of the cases over 65 years of age. The age-adjusted incidence rate per 100,000 residents was 3,756 for males and 2,651 for females. The age-adjusted incidence rates per 100,000 Illinois residents by race/ethnicity are as follows: white non-Hispanic, 2,823; African American, 6,101; Hispanic/Latinos, 2,420; and all other races, 3,175. The age-adjusted incidence rates of persons seeking care for substance-abuse-related exposures were as follows (including alcohol; per 100,000 residents): white non-Hispanics, 1,765; African Americans, 4,806; Hispanic/Latinos, 1,590; and all other races, 1,891. In contrast, the ethnic disparities were not as stark for adverse effects from therapeutic agents (age-adjusted rates per 100,000 residents): white non-Hispanics, 811; African Americans, 1,001; Hispanic/Latinos, 691; and all other races, 1,020. In addition, we observed smaller disparities by ethnicity for all other types of exposures excluding substances of abuse and adverse effects from therapeutic agents (age-adjusted rates per 100,000 residents): white non-Hispanics, 341; African Americans, 415; Hispanic/Latinos, 213; and all other races, 353. Approximately 64.3% of outpatients and 75.7% of inpatients live in metropolitan counties with a population of one million or more (Table 1).

Based on the adjusted Elixhauser Comorbidity Index, 64.7% of all outpatients and 14.4% of all inpatients had zero or one comorbidities. For both outpatients and inpatients, the in-hospital mortality rate was low (0.78% and 1.82%, respectively). Less than one percent of both outpatients ($N = 290$) and inpatients ($N = 3,202$) had dementia listed as a comorbidity (ICD-9-CM code of 290, 294.1–294.2, 331.0–331.2, 331.82, and 797). The proportion identified as self-harm cases was relatively low for both outpatients ($N = 5,517$, 1.3%) and inpatients ($N = 7,700$, 1.8%). Correspondingly, only 8,096 and 6,384 of outpatients and inpatients were discharged or transferred to a psychiatric facility.

The average total hospital charges among outpatients was \$3,398 ± 4,081 USD (median = \$2,152) and \$32,391 ± 60,115 USD for inpatients (median = \$16,396). The cumulative hospital charges in Illinois in 2010 for outpatient cases were \$690,400,129 and \$7,201,628,216 for inpatients. For outpatients (Table 2), the five most common exposures were alcohol consumables ($N = 90,146$), combined drug dependence and abuse ($N = 23,288$), cannabis and hallucinogens ($N = 16,694$), opioid analgesics ($N = 15,204$), and cocaine ($N = 12,611$). For outpatients, 68.8% of consumable alcohol cases, 68.6% of substance abuse cases, 53.2% of therapeutic agents cases, and 58.1% of non-pharmaceutical cases occurred in urban settings, or in counties in metro areas with populations of one million or more. Additionally, among all outpatient cases, exposures to toxic animals and plants were common ($n = 8,678$; 3.7%). As for inpatients (Table 3), the five most common exposures were consumable alcohols ($N = 69,553$) followed by combined drug dependence and abuse ($N = 40,623$), cannabis and hallucinogens ($N = 29,029$), cocaine ($N = 26,530$), and

Table 1. Demographic and hospitalization characteristics of poisoning cases in Illinois, 2010.

	Outpatients (*N* = 203,152) *N*, %	**Inpatients** (*N* = 222,339) *N*, %
Mean age in years (SD)	38.0 (18.2)	51.4 (19.1)
Under 18 years	23321 (11.5%)	7809 (3.5%)
18–24 years	28259 (13.9%)	13208 (5.9%)
25–34 years	38106 (18.8%)	22626 (10.2%)
35–44 years	37191 (18.3%)	34421 (15.5%)
45–54 years	42632 (21.0%)	52119 (23.4%)
55–64 years	19376 (9.5%)	36711 (16.5%)
65 years and older	14267 (7.0%)	55445 (24.9%)
Race/Ethnicity		
White, Non-Hispanic	121812 (60.0%)	128305 (57.7%)
Black or African American	46843 (23.1%)	64710 (29.1%)
Hispanic or Latino	23082 (11.4%)	17074 (7.7%)
Asian	1655 (0.8%)	1998 (0.9%)
American Indian or Alaska Native	348 (0.2%)	863 (0.4%)
Native Hawaiian or Pacific Island	75 (0%)	73 (0%)
Other	9337 (4.6%)	9316 (4.2%)
Sex		
Male	120017 (59.1%)	124075 (55.8%)
Female	83128 (40.9%)	98262 (44.2%)
Unspecified	7 (0%)	2 (0%)
Mean number of exposures (SD)	1.4 (0.68)	1.7 (0.98)
1	144606 (71.2%)	115628 (52.0%)
2	46524 (22.9%)	69169 (31.1%)
3	8895 (4.4%)	24739 (11.1%)
4 or more combined exposures	3127 (1.5%)	12803 (5.8%)
Mean length of stay in days (SD)	0 (0)	5.5 (6.70)
0	203152 (100%)	0 (0%)
1	0 (0%)	30512 (13.7%)
2	0 (0%)	35869 (16.1%)
3 or more days	0 (0%)	155958 (70.1%)
Median hospital charges (N, obs)		
Anesthesiology	$955 (488)	$1613 (25456)
Laboratory	$910 (135802)	$2581 (212575)
Oncology	$600 (61)	$5277 (1936)
Operating room	$861 (1523)	$5361 (42317)
Pharmacy	$155 (134344)	$1799 (215631)
Radiology	$1233 (73808)	$2480 (140584)
Room	$1313 (121)	$5105 (222333)
Other	$1105 (203001)	$3984 (196570)
Labor/Delivery	$259 (92)	$2492 (2347)
Ancillary	$2152 (203152)	$10726 (222119)
Population by county		
Urban, Metro - Counties in metro areas of 1 million population or more	130571 (64.3%)	168300 (75.7%)
Suburban, Metro - Counties in metro areas of 250,000 to 1 million population	18943 (9.3%)	14457 (6.5%)
Suburban, Metro - Counties in metro areas of fewer than 250,000 population	21522 (10.6%)	16074 (7.2%)
Suburban, Non-metro - Counties with urban population of 20,000 or more, adjacent to a metro area	9515 (4.7%)	6940 (3.1%)
Suburban, Non-metro - Counties with urban population of 20,000 or more, not adjacent to a metro area	2793 (1.4%)	2477 (1.1%)
Rural, Non-metro - Counties with urban population of 2,500–19,999, adjacent to a metro area	9300 (4.6%)	6026 (2.7%)
Rural, Non-metro - Counties with urban population of 2,500–19,999, not adjacent to a metro area	4597 (2.3%)	2720 (1.2%)
Rural, Non-metro - Counties with completely rural or less than 2,500 urban population, adjacent to a metro area	413 (< 1%)	329 (< 1%)
Rural, Non-metro - Counties with completely rural or less than 2,500 urban population, not adjacent to a metro area	5501 (2.7%)	5016 (2.3%)

barbiturates and benzodiazepine ($N = 23{,}970$). Among the top five exposure types in inpatient cases, more than half were male with two exposures or more, but greater than 70% were routinely discharged. For inpatients, 75.5% of consumable alcohol cases, 78.3% of substance abuse cases, 70.5% of therapeutic agents cases, and 68.2% of non-pharmaceutical cases occurred in counties where the population is one million or more. The highest in-hospital mortality rates were observed among patients with adverse exposures to anticoagulants (5.1%), and antineoplastic and immunosuppressive drugs (4.9%).

Among all poisoning cases treated in Illinois hospitals in 2010, the top six exposure classifications for patients 18 years old or younger were cannabis and hallucinogens, consumable alcohol, combined drug dependence and abuse, analgesics/antipyretics/antirheumatics, antibiotics and anti-infectives, and toxic animals or plants. For patients between 18 and 44 years old, the top six exposures were alcohol consumables, combined drug dependence and abuse, cocaine, opioid analgesics, barbiturates and benzodiazepine, and cannabis and hallucinogens. For patients between 45 and 64 years old, the top six exposures were consumable alcohol, combined drug dependence and abuse, cocaine, opioid analgesics, barbiturates and benzodiazepine, and cannabis and hallucinogens. The top six exposure categories for patients 65 years and older were consumable alcohol, anticoagulants, hormones and synthetic substitutes, antineoplastic and immunosuppressive drugs, other unspecified drugs, antidotes deterrent excipient, and antibiotics and anti-infectives.

The top six exposure categories requiring ventilation, by proportion, were chlorinated pesticides, blood products and substitutes, alkalizing agents, hormones and synthetic substitutes, other central nervous system depressants and anesthetics, and other central nervous system stimulants. By proportion, the top six exposure classification categories with comorbidity for dementia were anticoagulants, consumable alcohol, antidotes and deterrent excipient, combined drug dependence and abuse, hormone and synthetic substitutes, and other unspecified drugs. The top six exposure categories with the highest in-hospital mortality rate by proportion were anticholinergics, alkalizing agents, blood products and substitutes, antineoplastic and immunosuppressive drugs, and electrolytic, caloric, and water-balance agents. The top six exposure categories with the lowest routine discharge rates were other sedative and hypnotics, cholinergics, heavy metals, anticoagulants, diuretics, and agents affecting the blood. The six exposure categories with the highest median costs were other unspecified non-drugs, alkalizing agents, blood products and substitutes, gamma globulin, enzymes not elsewhere classified, glues and adhesives, and coagulants.

The highest proportion of patients came to a hospital from either a physician referral or non-health care facility point of origin (30.4% of outpatients and 27.7% of inpatients) or emergency department (15.8% of outpatients and 14.4% of inpatients). Among the inpatients, the majority (70.1%) were hospitalized for three or more days, with an average length of stay of 5.5 ± 6.7 days. Overall the primary payor was Medicaid for 25.9% of the patients, and 23.7% were covered by Medicare, 23.8% by private insurance, and 22.7% were uninsured (33.6% of outpatients and 12.7% of inpatients were uninsured). Overall, majority of outpatients (87.6%) and inpatients (67.3%) had a routine discharge, either to home or self-care.

The proportion identified as self-harm cases was relatively low for both outpatients ($N = 5{,}517$, 1.3%) and inpatients ($N = 7{,}700$, 1.8%). The three most common exposures identified among both outpatient and inpatient self-harm cases were as follows: sedatives/hypnotics ($N = 2{,}370$ and 4,032, respectively), analgesics/antipyretics/antirheumatics ($N = 1{,}949$ and 2,901, respectively), and barbiturates/benzodiazepines ($N = 1{,}227$ and 2,344, respectively). Correspondingly, only 8,096 and 6,384 of outpatients and inpatients were discharged or transferred to a psychiatric facility.

Comparison of incidence rates by definitions used in national surveys

The definitions for poisoning from each respective national survey are applied to the Illinois hospital dataset, and age-specific and age-adjusted rates are shown in Table 4. Using the broad definition defined in our study that includes exposures listed in any of the diagnosis fields, the incidence rate of poisoning was 2.5- to 11-fold greater than what would be identified using inclusion criteria of the major national surveys. Among the national surveys, the definition used in NHAMCS captures the broadest number of cases, but it was still 2.6-fold lower than the rate based on our case definition. The percent of poisoning cases not identified within each national survey compared with the broad definition used is as follows: 86.9% were missed in NEISS, 91.4% missed in NHIS, 90.3% missed in NHDS, and 60.7% were missed in NHAMCS.

Discussion

In 2010, 425,491 patients were treated in Illinois hospitals for poisonings, with an age-adjusted incidence rate of 3,189 cases per 100,000 persons, and the cumulative hospital charges for treating these patients was almost $8 billion USD (2010 real dollars). The incidence rates for poisoning cases based on our inclusion criteria surpasses the total US estimates reported nationally by four prominent surveys. The main difference between the case definition used in this analysis and that used by NEISS, NHIS, NHDS, and NHAMCS was the inclusion of substances of abuse, adverse effects from therapeutic drugs, and not restricting the analysis to poisonings listed as a primary diagnosis. Thus, consideration of broadening the diagnosis criteria for poisoning cases may provide a more accurate representation of the direct and indirect effects of poisoning in the US.

Poisoning cases represent a significant financial burden on society and comprises many elements beyond hospital costs. Nationally, poisonings have become the most common cause of fatal injuries,[1] and in this study the cases are costly and severe. Our case definition includes all poisoning cases regardless of the reason for admission, since these exposures

Table 2 Characteristics of Outpatient Poisoning Cases Treated in Illinois Hospitals by Exposure Type, 2010.

	Total Cases	Primary diagnosis of poisoning		2 or more exposures		Under 18 years		18–44 years		45–64 years		65 years and Older		Male		Routine discharge*		Total charges	
Exposure type	*N*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	Median	Sum
Pharmaceutical agents																			
Acidifying Agents	2	2	100.0%	2	100.0%	2	100.0%	0	0%	0	0%	0	0%	0	0%	0	0%	$ 3,380.00	$ 6,760.00
Agents Affecting Blood	225	119	52.9%	160	71.1%	62	27.6%	15	6.7%	63	28.0%	85	37.8%	105	46.7%	206	91.6%	$ 1,816.00	$ 824,911.12
Agents Affecting Gastrointestinal System	402	186	46.3%	121	30.1%	147	36.6%	119	29.6%	71	17.7%	65	16.2%	141	35.1%	353	87.8%	$ 1,284.75	$ 1,012,292.39
Alkalizing Agents	15	10	66.7%	12	80.0%	5	33.3%	8	53.3%	1	6.7%	1	6.7%	12	80.0%	15	100.0%	$ 1,146.16	$ 44,899.94
Analgesic and Antipyretics	8291	5828	70.3%	4302	51.9%	1825	22.0%	4581	55.3%	1392	16.8%	493	5.9%	3831	46.2%	6435	77.6%	$ 2,581.35	$ 29,784,149.04
Anti-Allergic and Antiemetic	1168	723	61.9%	862	73.8%	482	41.3%	470	40.2%	158	13.5%	58	5.0%	450	38.5%	938	80.3%	$ 2,317.00	$ 3,577,009.71
Anti-asthmatics/Respiratory Drugs	226	107	47.3%	128	56.6%	142	62.8%	37	16.4%	27	11.9%	20	8.8%	100	44.2%	214	94.7%	$ 1,069.00	$ 492,843.16
Antibiotics and Anti-Infectives	6555	402	6.1%	677	10.3%	2028	30.9%	2506	38.2%	1148	17.5%	873	13.3%	2165	33.0%	6331	96.6%	$ 887.00	$ 11,339,506.51
Anticholinergics	158	47	29.7%	64	40.5%	27	17.1%	64	40.5%	34	21.5%	33	20.9%	59	37.3%	147	93.0%	$ 1,890.78	$ 503,246.64
Anticoagulants	4126	134	3.2%	321	7.8%	861	20.9%	1259	30.5%	720	17.5%	1286	31.2%	1806	43.8%	3754	91.0%	$ 1,485.75	$ 11,042,078.21
Anticonvulsant/Anti-Parkinson Drugs	1766	596	33.7%	650	36.8%	248	14.0%	716	40.5%	508	28.8%	294	16.6%	838	47.5%	1333	75.5%	$ 3,091.86	$ 7,516,829.43
Antidepressants	1216	512	42.1%	717	59.0%	210	17.3%	616	50.7%	267	22.0%	123	10.1%	418	34.4%	1084	89.1%	$ 2,077.33	$ 3,445,783.44
Antidotes/Deterrents/ Excipients	7418	134	1.8%	711	9.6%	1489	20.1%	2947	39.7%	1822	24.6%	1160	15.6%	2754	37.1%	7146	96.3%	$ 1,111.50	$ 16,968,573.13
Antineoplastic/ Immunosuppressive Drugs	781	28	3.6%	135	17.3%	36	4.6%	100	12.8%	329	42.1%	316	40.5%	277	35.5%	713	91.3%	$ 4,206.00	$ 5,262,440.69
Antipsychotics/ Tranquilizers	3364	2141	63.6%	2439	72.5%	750	22.3%	1825	54.3%	663	19.7%	126	3.7%	1598	47.5%	2539	75.5%	$ 2,872.25	$ 12,634,490.54
Anti-Sympathomimetics	284	105	37.0%	145	51.1%	41	14.4%	38	13.4%	64	22.5%	141	49.6%	127	44.7%	248	87.3%	$ 2,910.34	$ 1,383,736.42
Antitussive/Expectorants/ Cold Medicines	486	313	64.4%	372	76.5%	233	47.9%	193	39.7%	44	9.1%	16	3.3%	227	46.7%	409	84.2%	$ 2,172.30	$ 1,441,752.54
Blood Products Subs	14	0	0%	1	7.1%	1	7.1%	4	28.6%	7	50.0%	2	14.3%	7	50.0%	14	100.0%	$ 2,164.98	$ 47,587.20
Cholinergics	43	12	27.9%	10	23.3%	6	14.0%	2	4.7%	1	2.3%	34	79.1%	20	46.5%	38	88.4%	$ 2,592.02	$ 160,225.53
Coagulants	11	1	9.1%	2	18.2%	1	9.1%	1	9.1%	3	27.3%	6	54.5%	5	45.5%	10	90.9%	$ 1,421.75	$ 17,360.26
Dental Medications	5	4	80.0%	4	80.0%	3	60.0%	1	20.0%	0	0%	1	20.0%	4	80.0%	5	100.0%	$ 680.15	$ 6,922.65
Diagnostic Agents	1324	1130	85.3%	1229	92.8%	505	38.1%	498	37.6%	195	14.7%	93	7.0%	578	43.7%	1021	77.1%	$ 2,398.05	$ 3,964,628.61
Dietetics and Lipotropic Drugs	833	637	76.5%	681	81.8%	305	36.6%	319	38.3%	132	15.8%	77	9.2%	351	42.1%	790	94.8%	$ 1,425.00	$ 1,896,581.21
Diuretics	456	117	25.7%	148	32.5%	55	12.1%	53	11.6%	137	30.0%	211	46.3%	183	40.1%	389	85.3%	$ 5,023.50	$ 2,772,568.56
Ear, Nose, and Throat Medications	351	215	61.3%	215	61.3%	178	50.7%	97	27.6%	53	15.1%	22	6.3%	171	48.7%	337	96.0%	$ 679.25	$ 423,528.22
Electrolytic, Caloric, and Water-Balance Agents	192	83	43.2%	98	51.0%	70	36.5%	49	25.5%	36	18.8%	27	14.1%	53	27.6%	164	85.4%	$ 1,992.50	$ 669,598.82
Enzymes, Not Elsewhere Classified	5	0	0%	0	0%	1	20.0%	1	20.0%	0	0%	3	60.0%	1	20.0%	5	100.0%	$ 533.50	$ 3,022.01
Gammaglobulin	10	0	0%	1	10.0%	3	30.0%	2	20.0%	3	30.0%	2	20.0%	4	40.0%	10	100.0%	$ 5,449.61	$ 67,209.77
Heavy Metal Antagonists	4	2	50.0%	3	75.0%	2	50.0%	0	0%	1	25.0%	1	25.0%	3	75.0%	4	100.0%	$ 697.66	$ 14,828.47
Hormone Synthetic Substitute	3063	835	27.3%	576	18.8%	250	8.2%	779	25.4%	1034	33.8%	1000	32.6%	1226	40.0%	2750	89.8%	$ 1,968.00	$ 11,418,718.83
Liver Preps Folic Acid	26	14	53.8%	19	73.1%	13	50.0%	8	30.8%	2	7.7%	3	11.5%	11	42.3%	23	88.5%	$ 1,394.92	$ 102,136.12
Muscle Relaxants	611	429	70.2%	470	76.9%	259	42.4%	212	34.7%	82	13.4%	58	9.5%	257	42.1%	524	85.8%	$ 1,981.80	$ 1,993,508.95
Other CNS Depressants and Anesthetics	605	338	55.9%	349	57.7%	78	12.9%	315	52.1%	170	28.1%	42	6.9%	304	50.2%	500	82.6%	$ 3,222.01	$ 2,718,197.36

Other CNS Stimulants	650	518	79.7%	587	90.3%	35	5.4%	380	58.5%	227	34.9%	8	1.2%	433	66.6%	518	79.7%	$ 4,091.51	$ 3,596,281.55
Other Sedatives/Hypnotics	3230	2418	74.9%	2612	80.9%	479	14.8%	1802	55.8%	696	21.5%	253	7.8%	1183	36.6%	1801	55.8%	$ 3,875.95	$ 15,235,127.75
Oxytocic Agents	13	3	23.1%	8	61.5%	2	15.4%	10	76.9%	1	7.7%	0	0%	0	0%	11	84.6%	$ 2,465.75	$ 45,575.84
Serums, Toxoids, and Vaccines	465	11	2.4%	17	3.7%	237	51.0%	114	24.5%	66	14.2%	48	10.3%	191	41.1%	459	98.7%	$ 581.82	$ 640,148.80
Sympathomimetics	349	137	39.3%	95	27.2%	103	29.5%	120	34.4%	71	20.3%	55	15.8%	133	38.1%	317	90.8%	$ 1,213.00	$ 866,713.50
Topical Skin Treatments	604	206	34.1%	253	41.9%	212	35.1%	213	35.3%	118	19.5%	61	10.1%	216	35.8%	577	95.5%	$ 664.23	$ 785,188.34
Vitamins	166	114	68.7%	128	77.1%	102	61.4%	43	25.9%	12	7.2%	9	5.4%	70	42.2%	148	89.2%	$ 826.85	$ 311,695.75
Other Unspecified Drugs	3383	1218	36.0%	39	1.2%	692	20.5%	884	26.1%	873	25.8%	934	27.6%	1416	41.9%	2811	83.1%	$ 2,214.80	$ 11,805,155.48
Substances of Abuse																			
Alcohol (Consumable)	90146	46771	51.9%	25743	28.6%	2769	3.1%	48003	53.3%	35495	39.4%	3879	4.3%	63873	70.9%	79620	88.3%	$ 2,705.85	$ 353,981,896.00
Amphetamine and Other Stimulants	1616	774	47.9%	1033	63.9%	359	22.2%	1051	65.0%	189	11.7%	17	1.1%	963	59.6%	1349	83.5%	$ 2,567.50	$ 5,668,509.17
Barbiturates/ Benzodiazepines	5084	3308	65.1%	3907	76.8%	434	8.5%	2997	58.9%	1379	27.1%	274	5.4%	2333	45.9%	3640	71.6%	$ 3,260.35	$ 20,788,353.51
Cannabis and Hallucinogens	16694	3842	23.0%	10499	62.9%	2357	14.1%	11554	69.2%	2623	15.7%	169	1.0%	10735	64.3%	13890	83.2%	$ 2,751.94	$ 70,279,491.54
Cocaine	12611	2797	22.2%	8403	66.6%	148	1.2%	7204	57.1%	5143	40.8%	116	0.9%	8057	63.9%	9824	77.9%	$ 3,477.90	$ 64,595,165.71
Combined Drug Dependence/Abuse	23288	10058	43.2%	11539	49.5%	1265	5.4%	15099	64.8%	6297	27.0%	627	2.7%	13395	57.5%	19291	82.8%	$ 2,171.13	$ 74,911,054.77
Opioid Analgesics	15204	6702	44.1%	9349	61.5%	361	2.4%	9731	64.0%	4373	28.8%	739	4.9%	8586	56.5%	12793	84.1%	$ 2,287.09	$ 54,088,960.46
Tobacco Acute Toxic Effects	42	31	73.8%	37	88.1%	29	69.0%	7	16.7%	4	9.5%	2	4.8%	24	57.1%	40	95.2%	$ 753.13	$ 74,745.42
Non-Pharmaceutical Agents																			
Agricultural Chemicals and Fertilizers	38	34	89.5%	37	97.4%	13	34.2%	19	50.0%	4	10.5%	2	5.3%	24	63.2%	27	71.1%	$ 2,197.75	$ 108,452.35
Aromatics / Acids / Alkalis	842	659	78.3%	224	26.6%	340	40.4%	326	38.7%	127	15.1%	49	5.8%	417	49.5%	776	92.2%	$ 888.80	$ 1,268,482.99
Asbestos	2	0	0%	0	0%	0	0%	2	100.0%	0	0%	0	0%	2	100.0%	0	0%	$ 555.25	$ 1,110.50
Carbon Monoxide	1117	954	85.4%	319	28.6%	298	26.7%	482	43.2%	270	24.2%	67	6.0%	556	49.8%	986	88.3%	$ 1,400.30	$ 2,616,699.05
Chlorinated Pesticides	0	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	$ -	-
Cosmetics	31	17	54.8%	19	61.3%	22	71.0%	7	22.6%	2	6.5%	0	0%	18	58.1%	31	100.0%	$ 642.00	$ 31,124.70
Detergents / Disinfectants / Soaps	276	223	80.8%	116	42.0%	159	57.6%	54	19.6%	40	14.5%	23	8.3%	135	48.9%	258	93.5%	$ 666.94	$ 312,306.04
Fertilizers	6	3	50.0%	4	66.7%	1	16.7%	2	33.3%	3	50.0%	0	0%	4	66.7%	6	100.0%	$ 540.93	$ 3,559.33
Glues and Adhesives	81	57	70.4%	67	82.7%	48	59.3%	16	19.8%	14	17.3%	3	3.7%	35	43.2%	80	98.8%	$ 547.26	$ 75,342.58
Heavy Metals	425	332	78.1%	355	83.5%	94	22.1%	242	56.9%	77	18.1%	12	2.8%	196	46.1%	246	57.9%	$ 3,265.73	$ 1,689,098.71
Latex	43	27	62.8%	36	83.7%	2	4.7%	33	76.7%	6	14.0%	2	4.7%	9	20.9%	42	97.7%	$ 837.14	$ 52,620.09
Non-consumable Alcohols	124	110	88.7%	124	100.0%	38	30.6%	53	42.7%	31	25.0%	2	1.6%	73	58.9%	112	90.3%	$ 2,773.10	$ 488,604.16
Noxious Substances Eaten as Food	2780	784	28.2%	228	8.2%	1074	38.6%	1141	41.0%	463	16.7%	102	3.7%	1632	58.7%	2745	98.7%	$ 627.48	$ 3,515,364.71
Organophosphates, Carbamate, and Other Pesticides	334	269	80.5%	85	25.4%	196	58.7%	78	23.4%	37	11.1%	23	6.9%	167	50.0%	310	92.8%	$ 736.88	$ 438,886.36
Other Gases, Fumes, and Vapors	3812	2002	52.5%	679	17.8%	1636	42.9%	1322	34.7%	640	16.8%	215	5.6%	1951	51.2%	3537	92.8%	$ 1,070.75	$ 6,986,622.28
Paints	32	15	46.9%	28	87.5%	9	28.1%	9	28.1%	13	40.6%	1	3.1%	21	65.6%	32	100.0%	$ 929.58	$ 51,322.22
Petroleum Products or Solvents	286	231	80.8%	77	26.9%	147	51.4%	97	33.9%	33	11.5%	9	3.1%	174	60.8%	264	92.3%	$ 1,038.00	$ 525,548.44
Polishes	282	216	76.6%	250	88.7%	132	46.8%	90	31.9%	40	14.2%	20	7.1%	138	48.9%	273	96.8%	$ 812.50	$ 343,489.52
Silicone	16	12	75.0%	16	100.0%	14	87.5%	2	12.5%	0	0.0%	0	0.0%	6	37.5%	16	100.0%	$ 507.45	$ 17,571.27
Toxic Animals or Plants	8678	6903	79.5%	480	5.5%	2266	26.1%	3435	39.6%	2132	24.6%	845	9.7%	4458	51.4%	8547	98.5%	$ 576.40	$ 7,914,741.05
Other Unspecified Non-Drugs	0	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	$ –	–
Other Unspecified Drugs or Non-Drugs	876	565	64.5%	39	4.5%	392	44.7%	319	36.4%	129	14.7%	36	4.1%	463	52.9%	815	93.0%	$ 849.50	$ 1,240,747.25

*Routine discharge means that patient was discharged to home or self-care and not discharged to another short-term hospital, skilled nursing facility, intermediate care facility, another type of institution, home health care service, rehab facility, long-term care facility or needing hospice care.

Table 3. Characteristics of Inpatient Poisoning Cases Treated in Illinois Hospitals by Exposure Type, 2010.

	Total Cases	Primary Diagnosis of Poisoning 1		2 or More Exposures		Under 18		18–44 years		45–64 years		65 years and Older		Male		Routine Discharge*		Length of Stay	Total Charges	
Exposure Type	*N*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*Median*	Median	Sum
Pharmaceutical Agents																				
Acidifying Agents	1	1	100.0%	1	100.0%	1	100.0%	0	0%	0	0%	0	0%	0	0%	1	100.0%	4	$ 1,921.00	$ 1,921.00
Agents Affecting Blood	910	82	9.0%	534	58.7%	9	1.0%	63	6.9%	244	26.8%	593	65.2%	474	52.1%	530	58.2%	4	$ 26,971.42	$ 44,443,575.34
Agents Affecting Gastrointestinal System	507	72	14.2%	241	47.5%	29	5.7%	104	20.5%	135	26.6%	239	47.1%	312	61.5%	273	53.8%	4	$ 20,929.86	$ 22,569,069.34
Alkalizing Agents	9	1	11.1%	6	66.7%	1	11.1%	0	0%	3	33.3%	5	55.6%	4	44.4%	1	11.1%	9	$ 49,993.15	$ 1,447,342.25
Analgesic and Antipyretics	10295	3886	37.7%	5946	57.8%	644	6.3%	3606	35.0%	2984	29.0%	3061	29.7%	4174	40.5%	5982	58.1%	3	$ 18,675.50	$ 332,278,193.00
Anti-Allergic and Antiemetic	1036	512	49.4%	811	78.3%	115	11.1%	205	19.8%	215	20.8%	204	19.7%	379	36.6%	548	52.9%	2.5	$ 14,380.05	$ 30,525,982.71
Anti-asthmatics/ Respiratory Drugs	314	9	2.9%	130	41.4%	78	24.8%	67	21.3%	69	22.0%	100	31.8%	117	37.3%	239	76.1%	3	$ 19,416.26	$ 10,673,466.37
Antibiotics and Anti-Infectives	7950	128	1.6%	2176	27.4%	401	5.0%	1508	19.0%	2385	30.0%	3656	46.0%	3167	39.8%	4272	53.7%	5	$ 27,544.25	$ 459,116,757.00
Anticholinergics	188	56	29.8%	127	67.6%	18	9.6%	57	30.3%	54	28.7%	59	31.4%	75	39.9%	95	50.5%	3.5	$ 19,443.15	$ 6,076,023.42
Anticoagulants	10818	132	1.2%	2088	19.3%	12	0.1%	401	3.7%	1963	18.1%	8442	78.0%	4909	45.4%	4058	37.5%	5	$ 30,405.10	$ 522,106,376.00
Anticonvulsant/Anti-Parkinson Drugs	3442	748	21.7%	1593	46.3%	164	4.8%	894	26.0%	1227	35.6%	1147	33.3%	1557	45.2%	1580	45.9%	4	$ 18,247.44	$ 111,083,256.00
Antidepressants	1140	282	24.7%	781	68.5%	70	6.1%	335	29.4%	337	29.6%	398	34.9%	414	36.3%	678	59.5%	3	$ 16,336.33	$ 30,793,144.07
Antidotes / Deterrents / Excipients	6280	101	1.6%	1906	30.4%	93	1.5%	809	12.9%	1970	31.4%	3408	54.3%	2710	43.2%	3149	50.1%	5	$ 31,505.93	$ 373,024,518.00
Antineoplastic/ Immunosuppressive Drugs	11341	65	0.6%	2755	24.3%	287	2.5%	1376	12.1%	4394	38.7%	5284	46.6%	5200	45.9%	6355	56.0%	5	$ 30,336.00	$ 652,668,213.00
Antipsychotics/ Tranquilizers	3638	1957	53.8%	2916	80.2%	234	6.4%	1682	46.2%	1136	31.2%	586	16.1%	1760	48.4%	1848	50.8%	3	$ 14,613.74	$ 91,534,270.89
Anti-Sympathomimetics	887	77	8.7%	777	87.6%	9	1.0%	57	6.4%	209	23.6%	609	68.7%	476	53.7%	538	60.7%	3	$ 19,299.00	$ 28,521,542.50
Antitussive / Expectorants / Cold Medicines	183	120	65.6%	166	90.7%	28	15.3%	113	61.7%	20	10.9%	22	12.0%	101	55.2%	112	61.2%	1	$ 11,328.41	$ 3,262,484.23
Blood Products Subs	228	0	0%	66	28.9%	6	2.6%	79	34.6%	58	25.4%	85	37.3%	114	50.0%	129	56.6%	6	$ 47,839.03	$ 20,282,741.56
Cholinergics	148	14	9.5%	48	32.4%	1	0.7%	3	2.0%	9	6.1%	135	91.2%	51	34.5%	56	37.8%	3	$ 18,408.10	$ 3,743,625.64
Coagulants	38	1	2.6%	9	23.7%	0	0%	2	5.3%	11	28.9%	25	65.8%	24	63.2%	19	50.0%	6	$ 34,688.19	$ 3,241,471.24
Dental Medications	3	2	66.7%	2	66.7%	1	33.3%	4	133.3%	0	0%	1	33.3%	1	33.3%	2	66.7%	1	$ 10,918.90	$ 54,844.22
Diagnostic Agents	426	327	76.8%	415	97.4%	52	12.2%	214	50.2%	122	28.6%	38	8.9%	152	35.7%	197	46.2%	2	$ 11,662.00	$ 8,033,329.97
Dietetics and Lipotropic Drugs	130	83	63.8%	112	86.2%	11	8.5%	48	36.9%	41	31.5%	30	23.1%	52	40.0%	92	70.8%	2	$ 15,509.29	$ 3,018,310.61
Diuretics	4196	104	2.5%	1410	33.6%	34	0.8%	188	4.5%	958	22.8%	3016	71.9%	1653	39.4%	2096	50.0%	4	$ 23,882.91	$ 172,535,522.00
Ear, Nose, and Throat Medications	105	23	21.9%	49	46.7%	20	19.0%	21	20.0%	25	23.8%	39	37.1%	43	41.0%	68	64.8%	3	$ 18,688.75	$ 4,240,660.41
Electrolytic, Caloric, and Water-Balance Agents	419	39	9.3%	200	47.7%	28	6.7%	62	14.8%	119	28.4%	210	50.1%	163	38.9%	199	47.5%	4	$ 23,087.50	$ 28,645,278.68
Enzymes, Not Elsewhere Classified	7	0	0%	4	57.1%	0	0%	0	0.0%	5	71.4%	2	28.6%	3	42.9%	3	42.9%	2	$ 38,419.65	$ 818,726.77
Gammaglobulin	45	0	0%	13	28.9%	5	11.1%	12	26.7%	14	31.1%	14	31.1%	17	37.8%	29	64.4%	5	$ 38,139.00	$ 3,373,385.83
Heavy Metal Antagonists	2	2	100.0%	2	100.0%	1	50.0%	0	0%	0	0%	1	50.0%	1	50.0%	0	0%	7	$ 23,821.84	$ 47,643.67
Hormone Synthetic Substitute	15591	520	3.3%	4938	31.7%	299	1.9%	2533	16.2%	5347	34.3%	7412	47.5%	6308	40.5%	8679	55.7%	5	$ 29,272.65	$ 831,487,729.00
Liver Preps Folic Acid	16	2	12.5%	8	50.0%	0	0%	4	25.0%	1	6.3%	11	68.8%	6	37.5%	5	31.3%	4.5	$ 26,130.10	$ 495,674.88
Muscle Relaxants	562	258	45.9%	429	76.3%	44	7.8%	218	38.8%	145	25.8%	155	27.6%	233	41.5%	274	48.8%	3	$ 15,630.74	$ 17,199,955.25
Other CNS Depressants and Anesthetics	1276	322	25.2%	641	50.2%	48	3.8%	364	28.5%	425	33.3%	439	34.4%	561	44.0%	767	60.1%	3	$ 28,976.25	$ 63,595,432.14

Other CNS Stimulants	1356	1039	76.6%	1281	94.5%	21	1.5%	546	40.3%	694	51.2%	95	7.0%	835	61.6%	910	67.1%	2	$ 16,592.42	$ 38,782,671.13
Other Sedatives Hypnotics	7108	3277	46.1%	5246	73.8%	322	4.5%	2933	41.3%	2215	31.2%	1638	23.0%	2755	38.8%	3198	45.0%	3	$ 15,580.65	$ 224,327,442.00
Oxytocic Agents	14	1	7.1%	5	35.7%	3	21.4%	10	71.4%	1	7.1%	0	0%	2	14.3%	12	85.7%	3	$ 15,723.10	$ 902,291.20
Serums, Toxoids, and Vaccines	87	3	3.4%	23	26.4%	15	17.2%	18	20.7%	23	26.4%	31	35.6%	37	42.5%	69	79.3%	3	$ 17,136.18	$ 2,532,044.82
Sympathomimetics	307	39	12.7%	134	43.6%	15	4.9%	72	23.5%	92	30.0%	128	41.7%	139	45.3%	195	63.5%	3	$ 19,230.08	$ 13,861,554.04
Topical Skin Treatments	242	27	11.2%	98	40.5%	18	7.4%	47	19.4%	79	32.6%	98	40.5%	106	43.8%	166	68.6%	3	$ 16,380.20	$ 8,841,310.31
Vitamins	80	25	31.3%	59	73.8%	8	10.0%	16	20.0%	21	26.3%	35	43.8%	20	25.0%	45	56.3%	3	$ 19,126.00	$ 2,326,227.84
Other Unspecified Drugs	5868	293	5.0%	9	0.2%	90	1.5%	335	5.7%	1334	22.7%	4109	70.0%	2321	39.6%	3247	55.3%	3	$ 21,235.50	$ 211,036,607.00
Substances of Abuse																				
Alcohol (Consumable)	69553	19198	27.6%	41334	59.4%	1554	2.2%	25121	36.1%	34888	50.2%	7990	11.5%	49743	71.5%	50678	72.9%	3	$ 14,874.88	$ 1,957,192,914.00
Amphetamine and Other Stimulants	1669	564	35.9%	1377	87.8%	138	8.8%	1079	68.8%	411	26.2%	41	2.6%	847	54.0%	1235	78.7%	3	$ 11,285.28	$ 31,359,454.46
Barbiturates/ Benzodiazepines	23970	18432	76.9%	22405	93.5%	322	1.3%	10586	44.2%	11655	48.6%	1407	5.9%	13921	58.1%	18937	79.0%	3	$ 7,201.25	$ 326,262,562.00
Cannabis and Hallucinogens	29029	3811	13.1%	21036	72.5%	3711	12.8%	16640	57.3%	7755	26.7%	923	3.2%	18108	62.4%	23729	81.7%	4	$ 12,700.76	$ 621,146,834.00
Cocaine	26530	7479	28.2%	23047	86.9%	216	0.8%	11664	44.0%	14138	53.3%	512	1.9%	16943	63.9%	21050	79.3%	3	$ 11,771.63	$ 553,583,166.00
Combined Drug Dependence/Abuse	40623	24564	60.5%	32404	79.8%	1238	3.0%	17298	42.6%	18888	46.5%	3199	7.9%	24362	60.0%	32024	78.8%	3	$ 7,789.00	$ 722,449,485.00
Opioid Analgesics	21049	5340	25.4%	15325	72.8%	317	1.5%	8670	41.2%	9175	43.6%	2887	13.7%	10877	51.7%	14611	69.4%	3	$ 15,822.78	$ 629,936,218.00
Tobacco Acute Toxic Effects	7	2	28.6%	5	71.4%	0	0.0%	5	71.4%	2	28.6%	0	0.0%	5	71.4%	6	85.7%	3	$ 30,379.50	$ 211,137.78
Non-Pharmaceutical Agents																				
Agricultural Chemicals and Fertilizers	28	20	71.4%	27	96.4%	1	3.6%	13	46.4%	12	42.9%	2	7.1%	15	53.6%	11	39.3%	4	$ 10,995.75	$ 469,170.54
Aromatics / Acids / Alkalis	134	97	72.4%	76	56.7%	23	17.2%	64	47.8%	37	27.6%	10	7.5%	65	48.5%	91	67.9%	2	$ 12,809.29	$ 2,915,835.66
Asbestos	1	0	0%	1	100.0%	0	0%	0	0%	0	0%	1	100.0%	1	100.0%	1	100.0%	1	$ 9,200.12	$ 9,200.12
Carbon Monoxide	169	115	68.0%	121	71.6%	15	8.9%	59	34.9%	71	42.0%	24	14.2%	84	49.7%	112	66.3%	2	$ 12,012.00	$ 5,954,240.12
Chlorinated Pesticides	1	1	100.0%	1	100.0%	0	0%	1	100.0%	0	0%	0	0%	1	100.0%	1	100.0%	2	$ 31,965.00	$ 31,965.00
Cosmetics	1	1	100.0%	1	100.0%	0	0%	0	0%	0	0%	1	100.0%	1	100.0%	0	0%	4	$ 16,995.42	$ 16,995.42
Detergents / Disinfectants / Soaps	14	9	64.3%	11	78.6%	1	7.1%	6	42.9%	4	28.6%	3	21.4%	9	64.3%	8	57.1%	2	$ 12,077.40	$ 270,057.67
Fertilizers	2	2	100.0%	2	100.0%	0	0%	0	0%	1	50.0%	1	50.0%	2	100.0%	2	100.0%	4	$ 22,240.63	$ 44,481.25
Glues and Adhesives	5	1	20.0%	3	60.0%	0	0%	1	20.0%	3	60.0%	1	20.0%	0	0%	4	80.0%	4	$ 38,139.58	$ 198,288.36
Heavy Metals	716	567	79.2%	685	95.7%	54	7.5%	405	56.6%	239	33.4%	18	2.5%	354	49.4%	332	46.4%	2	$ 12,828.77	$ 15,831,184.58
Latex	5	0	0%	4	80.0%	1	20.0%	2	40.0%	1	20.0%	1	20.0%	1	20.0%	5	100.0%	4	$ 21,741.25	$ 287,993.56
Nonconsumable Alcohols	48	37	77.1%	47	97.9%	2	4.2%	20	41.7%	21	43.8%	5	10.4%	31	64.6%	39	81.3%	2	$ 14,780.85	$ 1,123,818.51
Noxious Substances Eaten as Food	181	104	57.5%	40	22.1%	62	34.3%	63	34.8%	39	21.5%	17	9.4%	84	46.4%	166	91.7%	1	$ 8,964.00	$ 2,605,422.84
Organophosphates, Carbamate, and Other Pesticides	59	46	78.0%	56	94.9%	4	6.8%	29	49.2%	18	30.5%	8	13.6%	32	54.2%	35	59.3%	2	$ 11,101.00	$ 891,819.35
Other Gases, Fumes, and Vapors	555	239	43.1%	243	43.8%	82	14.8%	149	26.8%	173	31.2%	151	27.2%	265	47.7%	398	71.7%	3	$ 16,081.00	$ 24,039,178.00
Paints	6	6	100.0%	6	100.0%	5	83.3%	0	0%	1	16.7%	0	0%	4	66.7%	6	100.0%	3	$ 8,577.11	$ 81,240.08
Petroleum Products or Solvents	97	76	78.4%	85	87.6%	15	15.5%	44	45.4%	29	29.9%	9	9.3%	65	67.0%	39	40.2%	4	$ 30,829.05	$ 4,750,139.27
Polishes	6	4	66.7%	5	83.3%	0	0%	2	33.3%	3	50.0%	1	16.7%	3	50.0%	5	83.3%	2.5	$ 10,070.20	$ 106,326.18
Silicone	0	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	$ -	-
Toxic Animals or Plants	203	74	36.5%	63	31.0%	26	12.8%	65	32.0%	79	38.9%	33	16.3%	108	53.2%	183	90.1%	2	$ 9,086.93	$ 3,136,488.05
Other Unspecified Non-Drugs	0	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	$ -	-
Other Unspecified Drugs or Non-Drugs	58	18	31.0%	9	15.5%	9	15.5%	12	20.7%	15	25.9%	22	37.9%	37	63.8%	31	53.4%	3	$ 14,715.14	$ 1,458,356.74

*Routine discharge means that patient was discharged to home or self-care and not discharged to another short-term hospital, skilled nursing facility, intermediate care facility, another type of institution, home health care service, rehab facility, long-term care facility or needing hospice care.

Table 4. Age-adjusted rates per 100,000 persons for Illinois poisoning cases compared with that of four national health surveys, 2010.

	Illinois Hospitals			WISQARS/NEISS*			NHIS*			NHDS*			NHAMCS*		
Age Groups	Cases**	Age-Specific Rate	Percent of Cases	Cases**	Age-Specific Rate	Percent of Cases	Cases**	Age-Specific Rate	Percent of Cases	Cases**	Age-Specific Rate	Percent of Cases	Cases**	Age-Specific Rate	Percent of Cases
00–04	9424	1148.5	2.3%	6440	770.7	11.5%	4375	523.6	12.0%	4504	539.0	10.9%	9292	1112.0	5.6%
05–09	3309	390.9	0.8%	1851	215.4	3.3%	639	74.4	1.8%	752	87.5	1.8%	3236	376.5	1.9%
10–14	5111	588.9	1.2%	2110	239.9	3.8%	1122	127.6	3.1%	1289	146.6	3.1%	3332	378.9	2.0%
15–19	23540	2618.6	5.7%	5941	644.3	10.6%	4412	478.5	12.1%	4932	534.9	12.0%	8565	928.9	5.1%
20–24	29251	3449.1	7.0%	5459	621.1	9.8%	3887	442.2	10.7%	4325	492.1	10.5%	9097	1035.0	5.4%
25–29	29811	3381.2	7.2%	4776	524.7	8.6%	3189	350.3	8.7%	3653	401.3	8.9%	8700	955.8	5.2%
30–34	29082	3460.2	7.0%	4102	473.8	7.3%	2723	314.5	7.5%	3148	363.6	7.6%	8203	947.6	4.9%
35–39	30982	3723.9	7.5%	4038	471.8	7.2%	2641	308.6	7.2%	3037	354.9	7.4%	8330	973.4	5.0%
40–44	38822	4567.6	9.3%	4028	462.9	7.2%	2701	310.4	7.4%	3077	353.6	7.5%	8993	1033.6	5.4%
45–49	47790	5185.8	11.5%	4444	472.7	8.0%	2950	313.8	8.1%	3410	362.7	8.3%	10914	1160.9	6.5%
50–54	45088	4942.1	10.8%	3760	404.0	6.7%	2444	262.6	6.7%	2789	299.6	6.8%	11616	1248.0	6.9%
55–59	32765	4135.8	7.9%	2703	334.6	4.8%	1731	214.3	4.7%	1993	246.7	4.8%	11053	1368.3	6.6%
60–64	22172	3408.2	5.3%	1786	268.4	3.2%	1025	154.0	2.8%	1224	183.9	3.0%	10823	1626.5	6.5%
65–69	17152	3624.5	4.1%	1273	262.4	2.3%	739	152.4	2.0%	860	177.3	2.1%	11097	2287.8	6.6%
70–74	14352	4014.5	3.5%	977	268.1	1.7%	531	145.7	1.5%	632	173.4	1.5%	10953	3005.1	6.6%
75–79	12753	4481.2	3.1%	828	286.1	1.5%	483	166.9	1.3%	592	204.6	1.4%	10771	3722.0	6.4%
80–84	11781	5083.2	2.8%	646	274.4	1.2%	394	167.4	1.1%	489	207.7	1.2%	10622	4512.7	6.4%
85+	12454	5349.2	3.0%	673	286.5	1.2%	465	197.9	1.3%	555	236.3	1.3%	11620	4946.5	6.9%
Age-Adjusted Rate	415639	3188.9	100.0%	55835	435.3	100.0%	36451	284.9	100.0%	41261	322.2	100.0%	167217	1277.5	100.0%
Incident Rate Ratios* **	–			7.32 (CI95%: 7.21, 7.44)			11.19 (CI95%: 11.02, 11.37)			9.90 (CI95%: 9.74, 10.06)			2.50 (CI95%: 2.45, 2.54)		
N-codes	291.0–292.0, 303.0–305.9, 357.5–357.7, 506, 960.0–989.9			960–989			960–989.9			960–989.9			960–989.9		
E-codes	E850.0-E853.2, E853.8-E854.3, E854.8-E855.6, E855.8-E869.9, E905.0, E930.0-E952.9, E962.0-E962.3, E980.0-E989.9			E850.0-E869.9, E950.0-E952.9, E962.0-E962.9, E972.0, and E980.0-E982.9			E850-E869.9, E905, E950-E983			–			E860-E869, E928.9, E930-E949, E950.6-E950.7, E958.9, E962, E968.9, E980-E989		

*The definitions for poisoning used by the respective national survey was applied to the Illinois Hospital Data.
**Only includes Illinois residents in the calculation of incidence rates; non-Illinois residents are excluded.
***The IRRs represent the differences in case definitions using the broad definition to the definition used by National Survey.

complicate clinical assessments, treatment, and prognosis for these patients. Although 62.7% of the patients in this analysis had a poisoning identified as their primary diagnosis, reason for visit/admission, or cause of injury (E-code), the measure of hospital charges does not differentiate between procedures specific to managing the "poisoning" and procedures to treat other comorbidities. Furthermore, hospital charges generally do not reflect the true direct cost of care or the amount hospitals recover in terms of payments. Reimbursement rates and cost-to-charge ratios fluctuate over time and by diagnosis (e.g., Diagnosis related group), but for inpatient cases in Illinois in 2010, CMS data reports average cost-to-charge rates of 33%.[25] In addition, hospital charges represent only one component of direct costs and do not reflect indirect costs to individuals and society. Regardless of the final cumulative reimbursement rate, extent of direct and indirect costs, and proportion of charges related directly to the poisoning, based on charges alone, the financial burden on the system appears to be substantial. If simple models assuming a 33% reimbursement rate and that only 25% of the proportion of medical charges were directly related to treating the poisoning were used, then the cumulative acute care cost in Illinois is estimated at $650 million in 2010 alone. In models which assume that 75% of the charges are directly related to treating the poisoning, the cumulative estimated hospital costs are approximately $2 billion USD.

We observed both gender and ethnic disparities in this study. The overall rate ratio between males and females was 1.42; however, within specific exposure subgroups, such as exposures typically associated with occupation (e.g., pesticides, chemicals, and petroleum products) and substance abuse, the proportion of males was much higher (60–75%). The difference in incidence rates between white non-Hispanics and African Americans was driven primarily by differences in substance abuse exposures. However, national surveys show that the disparity of substance abuse and dependence is minimal,[26] while utilization of public hospitals by African Americans is substantially higher than that by white non-Hispanics.[26] Based on the Substance Abuse and Mental Health Services Administration or SAMHSA data, only 38% of individuals seeking treatment for alcohol or illicit drug use receive care as outpatients or inpatients in hospitals.[26] The ethnic disparities observed in this study likely reflect how different segments of the population seek treatment for substance abuse rather than an indication of a disparity in actual exposure.

All national surveys exclude health outcomes from exposures to alcohol and drugs (N-codes 291.0–292.9), as well as non-dependent abuse of drugs (N-codes 305.0–305.9). In addition, only NHAMCS includes adverse health outcomes from therapeutic drugs (E-codes E930.0–E949.9). From a toxicological perspective, there is no reasonable justification for omitting these cases.[27] The difference in inclusion criteria between the studies explains the 2.6–11.5-fold higher annual incidence rate reported in this study.

Consumable alcohol alone represented 44.4% of outpatients and 31.3% of inpatients. In this analysis, the 69.8% of the substance abuse cases had their exposure listed as the primary diagnosis, reason for visit or reason for admission, of which 76% had an exposure to only one substance of abuse. This indicates that the majority were not simply cases admitted for an unrelated comorbidity with their substance abuse screening results incidentally listed. Substances of abuse were the most common exposures and represent an enormous burden on the system, with cumulative charges of $4,245,250,694.

Patients who were treated for adverse health outcomes from therapeutic agents are largely excluded from the four national health surveys. In the Illinois data, adverse health outcomes from therapeutic agents accounted for 32% of the cases and cumulative charges of $4,078,591,306. Not surprisingly, they are also older (average age of 52 vs. 42 years) and have more comorbidities (average number of comorbidities was 2.7 vs. 1.3). Although 68.7% of the patients treated for adverse health outcomes from therapeutic agents had only one exposure listed, only 23.5% of patients had their exposure listed as their primary diagnosis, reason for visit, or reason for admission. By excluding these patients, a substantial proportion of poisonings are being neglected by national health surveys, as well as overlooking important medical safety issues.

Limitations

In current analyses of billing datasets, determination of exposure to a poison is based on ICD-9-CM codes. ICD-9 codes do not provide information on dose. These datasets do not provide laboratory confirmation of the exposures, or information on recency, duration, frequency, or quantity. Furthermore, ICD-9 codes aggregate exposures at the major class level; therefore, information regarding specific substances is generally unavailable. It is also difficult to determine to what degree the exposure played a role in the diagnosis, treatment, and/or prognosis. Finally, since the ultimate purpose of billing datasets is to obtain the highest rate of reimbursement for the health care facility, the order of listed diagnoses may not reflect the sequence of treatment or immediate threat to life. All of these elements may lead to misclassification and omission of exposures, in particular in the national surveys where analyses are restricted to cause of injury codes and primary diagnoses.

Although this analysis included a more comprehensive list of exposure classification categories than those used in the four national health surveys, the differences in incidence rates may also reflect regional or local differences in exposure patterns. However, Illinois is an average state, with a population of 13 million, a workforce of 6.6 million, with approximately two million people classified as living in rural areas, the fifth highest Hispanic immigrant population in the US, and general demographics that has led to Illinois being labeled the "most typical state" in the US.[28] Demographic characteristics, employment patterns, substance abuse rates, and overall morbidity rates in Illinois closely mirror the US as a whole.[28] Although state by state variation is expected, the findings in Illinois are likely generalizable to most of the other states and the US as a whole.

Conclusions

The perspective that poisonings are primarily associated with curious children and forgetful elderly individuals is not supported by this study's findings, although this is partly true when analyzing datasets that predominately capture less severe exposures.[2] The majority of cases treated in Illinois hospitals for poisonings are adults with substance abuse issues or adverse effects caused by therapeutic agents. In recent years, poisoning surpassed motor vehicle crashes as the leading cause of fatal injuries, but as this study shows the magnitude of non-fatal cases may be substantially underestimated. Using a broad definition for poisoning to account for toxicological principles and coding practices, the incidence of poisoning requiring treatment at hospitals is substantially higher than what has been reported in various national surveys. The more restrictive definitions miss between 60 and 90% of cases treated at hospitals. In particular, the omission of cases with adverse exposures to alcohol, illicit drugs, and therapeutic drugs misses patients suffering serious injuries, as well as leads to underestimation of the cost burden to individuals, hospitals, and society. By broadening the inclusion criteria, we get a clearer idea of the magnitude of personal and financial consequences of poisonings.

Author contributions

Alison Krajewski was involved in the conception and design, analysis and interpretation of data, acquisition of the national health survey data, drafting and revisions of the manuscript, and approval of the final version. Dr. Lee Friedman had full access to all the Illinois hospital data analyzed in this study. He was also involved in data acquisition, conception and design, analysis and interpretation of data, drafting and revisions of the manuscript, and approval of the final version.

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Supplementary material available online

Supplementary Appendix A.