

## Preplanned Studies

# Characteristics of Poisoning Cases Admitted to Outpatient and Emergency Department — China, 2019

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## Summary

### What is already known about this topic?

Poisoning constitutes a significant cause of mortality among individuals aged 1 to 44 in China. Nonetheless, the epidemiological understanding of poisoning incidents within emergency departments remains fragmented across the region.

### What is added by this report?

In 2019, the NISS recorded 31,382 cases of poisoning, predominantly among males (62.85%) and individuals aged 25–44 (44.13%). In all poisoning cases, 82.60% were unintentional. The predominant substances exposure in poisoning cases presenting to outpatient and emergency departments were alcohol (56.38%), medications (14.21%), and pesticides (9.78%).

### What are the implications for public health practice?

This study has shed light on the evidence for nonfatal poisoning prevention to a variety of different groups, and informed special attention needed for high-risk population and substance exposed.

Poisoning remains a serious global public health concern (1). The World Health Organization (WHO) reported that in 2019, unintentional poisoning was responsible for an estimated 84,278 deaths worldwide. Furthermore, approximately 20% of suicides globally are attributed to pesticide self-poisoning, a trend most prevalent in rural, agricultural regions of low- and middle-income countries (2). In China, poisoning is a leading cause of mortality among individuals aged 1 to 44 years. Data from 2020 indicates that unintentional poisoning ranked as the eighth leading cause of death for those aged 1–4 and 15–29, and the ninth for those aged 5–14 and 30–44 (3). Poisoning also constitutes a common reason for emergency hospital visits in many nations (1). Despite its prevalence, comprehensive knowledge on the epidemiology of poisoning incidents in emergency departments is lacking in China. To bridge this informational shortfall, we utilized data from the national injury surveillance system to

investigate the epidemiological characteristics of poisoning cases in outpatient and emergency settings within China for the year 2019.

The research included data on poisoning cases reported by a network of 252 national surveillance hospitals connected to the national injury surveillance system (NISS) from January 1 to December 31, 2019. The NISS, established by the Ministry of Health, acts as an efficient information gathering system capturing the epidemiological characteristics of patients admitted to outpatient and emergency departments across China for injuries. The distribution of surveillance sites and the methodology for data collection have been thoroughly detailed in previously published research (4).

For this study, we employed the “clinical diagnosis” text variable from the reported poisoning cases to recode the categorization of the substances involved. This recoding was founded on a coding dictionary developed for the study, which was informed by resources such as the Poison Information Package for Developing Countries (INTOX). It is important to note that the term “poisoning” within the scope of this research is confined to instances of acute poisoning and does not encompass chronic poisoning or pathological conditions such as allergic or infectious diseases induced by external substances.

Descriptive analysis was conducted on demographic information, occurrence information and clinical information of poisoning case by age, gender, intent and type of substance exposed. Chi-square test was used to compare the constituent ratios,  $P < 0.05$  was considered to be significant. Software SAS (version 9.4, SAS Institute Inc., Cary, USA) was used for statistical analysis.

In 2019, the NISS recorded 31,382 cases of poisoning, predominantly among males (19,723 cases, 62.85%) and individuals aged 25–44 (13,849 cases, 44.13%). The majority of these poisoning incidents were unintentional, accounting for 82.60% of the total cases. The intent behind the poisonings varied significantly by age group ( $\chi^2 = 355.73$ ,  $P < 0.05$ ) and

gender ( $\chi^2=743.48$ ,  $P<0.05$ ). The proportion of poisonings with self-harm or suicidal intent was highest in the elderly aged 65 and older (14.57%) among all age groups, and it was higher in females (11.92%) than in males (4.12%).

The occurrences of poisoning were distributed evenly throughout all seasons but were slightly higher in winter (27.83%) and summer (27.40%). Home was the most frequent location for poisoning incidents among females (64.98%) in contrast to males (41.53%) ( $\chi^2=1766.33$ ,  $P<0.05$ ). Severely affected cases made up 52.11% of the total, with moderate injuries comprising 39.90%. A significantly higher proportion of severe poisoning was observed in children aged 0–4 years (63.17%) ( $\chi^2=1024.35$ ,  $P<0.05$ ), and was more common in males (53.66%) than in females (49.48%) ( $\chi^2=145.81$ ,  $P<0.05$ ).

Post-treatment outcomes, including observation, admission, or transfer to another hospital, were noted in 57.46% of poisoning cases, and there were 141 fatalities (0.45%). The disposition of poisoning cases demonstrated significant differences when analyzed by age group ( $\chi^2=647.18$ ,  $P<0.05$ ) and gender ( $\chi^2=275.49$ ,  $P<0.05$ ) (Table 1).

In 2019, out of 31,382 reported poisoning incidents recorded in the NISS database, 96.46% were successfully categorized by identified substances after undergoing re-coding. The predominant substances involved in poisoning cases presenting to outpatient and emergency departments were alcohol (56.38%), medications (14.21%), and pesticides (9.78%). The analysis revealed statistically significant variations in the distribution of involved substances by age group ( $\chi^2=7243.55$ ,  $P<0.05$ ), by gender ( $\chi^2=3939.79$ ,  $P<0.05$ ), and by intention ( $\chi^2=6,119.54$ ,  $P<0.05$ ). The leading substances exposed of child poisoning were medications both in the 0–4 age group (42.08%) and 5–14 age group (25.68%). Similarly, among seniors aged 65 and older, medications (24.51%) were the leading cause of poisoning. Alcohol-related poisonings constituted 69.5% of the cases in males, which was more than twice the rate observed in females. With regard to the intent of poisoning, alcohol was implicated in 61.02% of unintentional poisonings, while medications were involved in 46.19% of cases with suicidal intent (Table 2).

Throughout the year, seasonal trends are evident in the incidence of various poisoning types. Drug poisoning peaked during the spring, accounting for 27.16% of cases, while pesticide poisoning and incidents involving toxic flora and fauna were most

frequent in summer, representing 32.68% and 58.37% of cases, respectively. Winter saw the majority of alcohol poisoning, carbon monoxide (CO) poisoning, and chemical poisoning cases, with prevalences of 28.94%, 59.87%, and 33.45%, respectively.

Location-wise, alcohol poisoning was primarily concentrated in commercial and service areas, constituting 42.56% of incidents. Conversely, other poisonings predominantly occurred in residential settings. In terms of post-incident care, alcohol poisoning cases frequently resulted in discharge following treatment, comprising 53.31% of the outcomes. However, other poisoning types were commonly subject to observation, admission, or transfer (Table 3).

## DISCUSSION

Based on data from the NISS 2019, our analysis identified males and middle-aged individuals in China as the demographics most frequently admitted to outpatient services and emergency departments for poisoning. Notably, the majority of poisoning incidents were unintentional, yet the prevalence of suicidal poisoning presents a significant concern, with higher proportions observed among women and older adults, and with larger case number within the 25–44 age cohort. These observations align with research conducted in the United States (5). The elevated risk of poisoning in men may be attributed to factors such as increased exposure to occupational hazards, a greater propensity for risk-taking behaviors, and higher instances of alcohol consumption (6). The pressures faced by middle-aged individuals, arising from critical life milestones such as career development and marriage, may contribute to psychological vulnerabilities and, consequently, a higher risk of extreme responses to stress (7). The study's findings also highlight a greater propensity for self-poisoning among women, paralleling the patterns of suicide prevalence in China (7). The study's findings also show the concern of self-poisoning among women and elderly population, paralleling the patterns of suicide prevalence and depression in China (7).

Compared to the full spectrum of injuries presenting in outpatient and emergency department settings, poisoning cases exhibit a higher level of severity and require more medical resources, underscoring the need for heightened efforts in poisoning prevention. Our study revealed that in 2019, the fraction of poisoning cases classified as severe and the rate at which patients

TABLE 1. The characteristics of poisoning cases from NISS in China, 2019.

Items	Age (years)						Gender		Total, N (%)
	0-4, N (%)	5-14, N (%)	15-24, N (%)	25-44, N (%)	45-64, N (%)	≥65, N (%)	Male, N (%)	Female, N (%)	
Intention									
Unintentional	1,144 (92.41)	771 (80.82)	4,566 (81.23)	11,537 (83.31)	6,351 (83.05)	1,552 (74.87)	16,944 (85.91)	8,977 (77.00)	25,921 (82.60)
Self-harm/suicide	0 (0.00)	72 (7.55)	455 (8.09)	826 (5.96)	547 (7.51)	302 (14.57)	812 (4.12)	1,390 (11.92)	2,202 (7.02)
Violence/assault	0 (0.00)	16 (1.68)	122 (2.17)	240 (1.73)	119 (1.56)	35 (1.69)	267 (1.35)	265 (2.27)	532 (1.69)
Unknown	94 (7.59)	95 (9.96)	478 (8.50)	1,246 (9.00)	630 (8.24)	184 (8.88)	1,700 (8.62)	1,027 (8.81)	2,727 (8.69)
Season									
Spring	383 (30.94)	241 (25.26)	1,263 (22.47)	3,006 (21.71)	1,713 (22.40)	531 (25.62)	4,506 (22.85)	2,631 (22.57)	7,137 (22.74)
Summer	363 (29.32)	231 (24.21)	1,590 (28.29)	3,687 (26.62)	2,212 (28.93)	516 (24.89)	5,367 (27.21)	3,232 (27.72)	8,599 (27.40)
Autumn	265 (21.41)	201 (21.07)	1,290 (22.95)	3,057 (22.07)	1,645 (21.51)	454 (21.90)	4,364 (22.13)	2,548 (21.85)	6,912 (22.03)
Winter	227 (18.34)	281 (29.45)	1,478 (26.29)	4,099 (29.60)	2,077 (27.16)	572 (27.59)	5,486 (27.82)	3,248 (27.86)	8,734 (27.83)
Site									
Home	1,150 (92.89)	767 (80.40)	2,116 (37.64)	5,750 (41.52)	4,257 (55.67)	1,727 (83.31)	8,191 (41.53)	7,576 (64.98)	15,767 (50.24)
Commercial and service area	3 (0.24)	35 (3.67)	1,863 (33.14)	4,370 (31.55)	1,569 (20.52)	73 (3.51)	6,021 (30.53)	1,892 (16.23)	7,913 (25.22)
Public residential institution	11 (0.89)	41 (4.30)	794 (14.13)	1,891 (13.65)	762 (9.96)	97 (4.68)	2,705 (13.71)	891 (7.64)	3,596 (11.46)
School and school-related areas	41 (3.31)	72 (7.55)	519 (9.23)	751 (5.42)	331 (4.33)	35 (1.69)	1,204 (6.10)	545 (4.67)	1,749 (5.57)
Farm/farmland	22 (1.78)	12 (1.26)	17 (0.30)	136 (0.98)	255 (3.33)	92 (4.44)	308 (1.56)	226 (1.94)	534 (1.70)
Road/street	4 (0.32)	10 (1.05)	103 (1.83)	271 (1.96)	125 (1.63)	12 (0.58)	426 (2.16)	99 (0.85)	525 (1.67)
Industrial and construction area	1 (0.08)	3 (0.31)	51 (0.91)	292 (2.11)	157 (2.05)	7 (0.34)	308 (1.56)	203 (1.74)	511 (1.63)
Sports and athletics area	2 (0.16)	4 (0.42)	8 (0.14)	28 (0.20)	13 (0.17)	3 (0.14)	45 (0.23)	13 (0.11)	58 (0.18)
Others	1 (0.08)	5 (0.52)	29 (0.52)	82 (0.59)	47 (0.61)	8 (0.39)	119 (0.60)	53 (0.45)	172 (0.55)
Unknown	3 (0.24)	5 (0.52)	121 (2.15)	278 (2.01)	131 (1.71)	19 (0.92)	396 (2.01)	161 (1.38)	557 (1.77)
Severity									
Mild	97 (7.84)	69 (7.23)	292 (5.19)	797 (5.75)	785 (10.27)	469 (22.62)	1,311 (6.65)	1,198 (10.28)	2,509 (8.00)
Moderate	359 (29.00)	317 (33.23)	2,262 (40.24)	5,506 (39.76)	3,170 (41.45)	906 (43.70)	7,828 (39.69)	4,692 (40.24)	12,520 (39.90)
Severe	782 (63.17)	568 (59.54)	3,067 (54.56)	7,546 (54.49)	3,692 (48.28)	698 (33.67)	10,584 (53.66)	5,769 (49.48)	16,353 (52.11)
Disposition									
Discharged after treatment	397 (32.07)	296 (31.03)	2,501 (44.49)	6,357 (45.90)	2,961 (38.72)	431 (20.79)	8,831 (44.78)	4,112 (35.27)	12,943 (41.24)
Observed/admitted/ transferred	822 (66.40)	644 (67.51)	3,058 (54.40)	7,343 (53.02)	4,565 (59.70)	1,599 (77.13)	10,647 (53.98)	7,384 (63.33)	18,031 (57.46)
Dead	2 (0.16)	5 (0.52)	15 (0.27)	41 (0.30)	55 (0.72)	23 (1.11)	78 (0.40)	63 (0.54)	141 (0.45)
Others	17 (1.37)	9 (0.94)	47 (0.84)	108 (0.78)	66 (0.86)	20 (0.96)	167 (0.85)	100 (0.86)	267 (0.85)
Total	1,238 (100.00)	954 (100.00)	5,621 (100.00)	13,849 (100.00)	7,647 (100.00)	2,073 (100.00)	19,723 (100.00)	11,659 (100.00)	31,382 (100.00)

Abbreviation: NISS=national injury surveillance system.

TABLE 2. The distribution of substances exposed in poisoning cases from NISS in China, 2019.

Type of substance	Age (years)					Gender		Intention			Total, N (%)	
	0–4, N (%)	5–14, N (%)	15–24, N (%)	25–44, N (%)	45–64, N (%)	≥65, N (%)	Male, N (%)	Female, N (%)	Unintentional, N (%)	Self-harm/ suicide, N (%)		Violence/ assault, N (%)
Alcohol	17 (1.37)	97 (10.17)	3,804 (67.67)	9,504 (68.63)	3,996 (52.26)	276 (13.31)	13,707 (69.50)	3,987 (34.20)	15,816 (61.02)	83 (3.77)	247 (46.43)	17,694 (56.38)
Medication	521 (42.08)	245 (25.68)	944 (16.79)	1,441 (10.41)	799 (10.45)	508 (24.51)	1,585 (8.04)	2,873 (24.64)	2,912 (11.23)	1,017 (46.19)	139 (26.13)	4,458 (14.21)
Pesticide	198 (15.99)	107 (11.22)	266 (4.73)	976 (7.05)	1029 (13.46)	493 (23.78)	1,509 (7.65)	1,560 (13.38)	1,750 (6.75)	937 (42.55)	115 (21.62)	3,069 (9.78)
CO	50 (4.04)	200 (20.96)	285 (5.07)	759 (5.48)	752 (9.83)	391 (18.86)	1,071 (5.43)	1,366 (11.72)	2,206 (8.51)	19 (0.86)	3 (0.56)	2,437 (7.77)
Toxic flora and faunat	55 (4.44)	168 (17.61)	117 (2.08)	548 (3.96)	617 (8.07)	234 (11.29)	844 (4.28)	895 (7.68)	1,592 (6.14)	6 (0.27)	2 (0.38)	1,739 (5.54)
Chemical	176 (14.22)	50 (5.24)	99 (1.76)	299 (2.16)	161 (2.11)	49 (2.36)	421 (2.13)	413 (3.54)	709 (2.74)	40 (1.82)	6 (1.13)	834 (2.66)
Combined poisoning*	1 (0.08)	1 (0.10)	4 (0.07)	22 (0.16)	8 (0.10)	3 (0.14)	16 (0.08)	23 (0.20)	23 (0.09)	11 (0.50)	3 (0.56)	39 (0.12)
Unspecified	220 (17.77)	86 (9.01)	102 (1.81)	300 (2.17)	285 (3.73)	119 (5.74)	570 (2.89)	542 (4.65)	913 (3.52)	89 (4.04)	17 (3.20)	1,112 (3.54)
Total	1,238 (100.00)	954 (100.00)	5,621 (100.00)	13,849 (100.00)	7,647 (100.00)	2,073 (100.00)	19,723 (100.00)	11,659 (100.00)	2,5921 (100.00)	2,202 (100.00)	532 (100.00)	31,382 (100.00)

Abbreviation: NISS=national injury surveillance system; CO=carbon monoxide.

\* Combined poisoning refers to the exposure of a poisoning case to two or more substances.

were observed, admitted, or transferred following outpatient and emergency treatment were 52.11% and 57.46%, respectively. These rates significantly exceed the corresponding rates for all types of injury cases, which stood at 1.77% and 13.96% in the same year (8). Such a distribution aligns with the established pyramid model of poisoning and mirrors trends observed in injury surveillance data from the United States (9). Specifically, in the United States in 2019, 28.39% of emergency department visits for poisoning resulted in hospitalization or transfer, compared to just 12.86% for all injury-related visits (9).

In 2019, the substances most frequently implicated in poisoning cases among both men and women in China were alcohol, medications, and pesticides. This pattern diverges from the distribution observed in fatal poisonings within China and nonfatal poisonings reported in other nations. Data from 2016 indicate that the predominant substances associated with poisoning fatalities in China were pesticides, alcohol, and toxic gases for men, and pesticides, toxic gases, and medications for women. In contrast, the leading exposures in poisoning cases in the United States have been pharmaceuticals, household cleaning products, and personal care products (5). Additionally, research in Europe highlights medications misuse and chemicals as the principal substances involved in poisoning fatalities (10).

Enhancing awareness of medications and chemical poisoning among children in China is crucial, particularly as these incidents already constitute a significant health concern in high-income countries. In China, the proportion of medication poisoning among all child poisoning cases admitted to outpatient and emergency department aged 0–4 years and 5–14 years has risen from 31.25% to 42.08% and from 17.81% to 25.68%, respectively, between 2006 and 2019. Research indicates that pharmaceuticals are the primary cause of non-fatal poisoning in children, with analgesics, non-steroidal anti-inflammatory drugs, and antihistamines being the substances most frequently ingested by children between the ages of 1 and 5 (5,10).

Regarding chemical poisonings, they represent a smaller proportion of the total: 2.66%. However, in the 0–4-year age group, chemical poisonings make up 14.22% of poisoning cases admitted to outpatient and emergency department in China. To put this into perspective, in the United States, over 120,000 children under the age of 6 were poisoned by common household cleaning agents, including laundry

TABLE 3. The characteristics of different types of poisoning according to substances exposed from NISS in China, 2019.

Items	Alcohol poisoning	Medication poisoning	Pesticide poisoning	CO poisoning	Toxic flora and fauna poisoning	Chemical poisoning
Intention						
Unintentional	15,816 (89.39)	2,912 (65.32)	1,750 (57.02)	2,206 (90.52)	1,592 (91.55)	709 (85.01)
Self-harm/suicide	83 (0.47)	1,017 (22.81)	937 (30.53)	19 (0.78)	6 (0.35)	40 (4.80)
Violence/assault	247 (1.39)	139 (3.12)	115 (3.75)	3 (0.12)	2 (0.11)	6 (0.72)
Unknown	1,548 (8.75)	390 (8.75)	267 (8.70)	209 (8.58)	139 (7.99)	79 (9.47)
Season						
Spring	3,881 (21.93)	1,211 (27.16)	813 (26.49)	487 (19.98)	223 (12.82)	196 (23.50)
Summer	4,704 (26.59)	1,176 (26.38)	1,003 (32.68)	158 (6.48)	1015 (58.37)	196 (23.50)
Autumn	3,988 (22.54)	1,084 (24.32)	668 (21.77)	333 (13.66)	423 (24.32)	163 (19.54)
Winter	5121 (28.94)	987 (22.14)	585 (19.06)	1,459 (59.87)	78 (4.49)	279 (33.45)
Site						
Home	4,814 (27.21)	3,846 (86.27)	2,608 (84.98)	2,035 (83.50)	1,145 (65.84)	435 (52.16)
Commercial and service area	7,531 (42.56)	118 (2.65)	17 (0.55)	132 (5.42)	50 (2.88)	15 (1.80)
Public residential institution	3,076 (17.38)	159 (3.57)	78 (2.54)	80 (3.28)	117 (6.67)	35 (4.20)
School and school-related areas	1,286 (7.27)	214 (4.80)	72 (2.35)	58 (2.38)	59 (3.39)	36 (4.32)
Farm/farmland	13 (0.07)	23 (0.52)	219 (7.14)	7 (0.29)	245 (14.09)	3 (0.36)
Road/street	401 (2.27)	22 (0.49)	13 (0.42)	10 (0.41)	44 (2.53)	6 (0.72)
Industrial and construction area	28 (0.16)	12 (0.27)	30 (0.98)	80 (3.28)	32 (1.84)	276 (33.09)
Sports and athletics area	36 (0.20)	3 (0.07)	1 (0.03)	0 (0.00)	7 (0.40)	10 (1.20)
Others	100 (0.57)	10 (0.22)	4 (0.13)	23 (0.94)	24 (1.38)	10 (1.20)
Unknown	409 (2.31)	51 (1.14)	27 (0.88)	12 (0.49)	16 (0.92)	8 (0.96)
Severity						
Mild	360 (2.03)	572 (12.83)	980 (31.93)	332 (13.62)	86 (4.95)	50 (6.00)
Moderate	6,666 (37.67)	2,096 (47.02)	1,237 (40.31)	1,065 (43.70)	770 (44.28)	249 (29.85)
Severe	10,668 (60.29)	1,790 (40.15)	852 (27.76)	1,040 (42.68)	883 (50.78)	535 (64.15)
Disposition						
Discharged after treatment	9,432 (53.31)	1,099 (24.65)	447 (14.57)	626 (25.69)	638 (36.69)	323 (38.73)
Observed/admitted/transferred	8,126 (45.93)	3287 (73.73)	2,537 (82.67)	1,738 (71.32)	1,081 (62.16)	507 (60.79)
Dead	5 (0.03)	17 (0.38)	56 (1.82)	51 (2.09)	0 (0.00)	3 (0.36)
Others	131 (0.74)	55 (1.23)	29 (0.94)	22 (0.90)	20 (1.15)	1 (0.12)

Abbreviation: NISS=national injury surveillance system.



detergents and bleach, in the year 2019 alone (5).

Limitations of this study: 1) The incidence of poisoning cases in China could not be estimated due to the lack of NISS sampling data; 2) The NISS surveillance hospitals are all comprehensive medical institutions at all levels, and professional institutions related to the diagnosis and treatment of occupational poisoning, such as occupational prevention, hospitals are not included, so the study results mainly reflect the characteristics of non-occupational poisoning cases.

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