

## Preplanned Studies

## Characteristics of Injury Diagnosis among Primary and Secondary School Students — China, 2018

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### Summary

#### What is already known about this topic?

Child injury is a serious public health problem in China. The epidemiological characteristics injuries related to primary and secondary school students were usually reported from school-based population surveys conducted in developed regions of China. Medical and health institution-based data were rarely adopted to explore the typical patterns of injury occurrence among primary and secondary school students in China.

#### What is added by this report?

This study found that among primary and secondary school students with injury diagnosis in the National Injury Surveillance System (NISS), the high-risk group of primary and secondary school students with injury diagnosis was male students. The frequent incidence season was spring and early summer. Noon was the peak incidence time. Falling was the most common cause of injury among students, but other frequent causes of injury differs in students with different education levels. Home and school were the most common places where injury occurs. Students were more likely to suffer injury when they were engaged in leisure and sport activities. Limbs and the head were easily injured with contusions/bruises.

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

Medical and health institution-based data could be an additional data source for student-related injury research. Typical patterns could be summarized to provide data-driven basis for the improved formulation of injury prevention and control strategies and measures towards students. The characteristics of injury events differs in students with different education levels and requires more specific attentions towards students when conducting relevant programs in school and school-related places.

Child injury has become a public health issue attracting widespread concern in the world (1). In China, injury is also an important threat to children's

health and safety, particularly for those in schools (2). This study uses data from the National Injury Surveillance System (NISS) in China to depict the characteristics of primary and secondary school students with injury diagnosis in 2018 in order to provide evidence for better formulation of relevant strategies and measures towards primary and secondary school student-related injury prevention and control.

In the world, more than 95% of child injury deaths occur in low- and middle-income countries every year (1). In developed countries, the absolute number of child injury mortality is relatively low, but injury is still the main cause of death among children, accounting for about 40% of child deaths (2). In China, about 42 million primary and secondary school students suffer from various injuries every year, of which about 400,000 are disabled (3).

At present, the epidemiological characteristics of primary and secondary school student-related injury were usually reported from school-based population surveys conducted in developed regions of China, such as Beijing, Shanghai, Guangdong Province, and Zhejiang Province (4-5). However, data derived from medical and health institutions are rarely adopted to explore typical patterns of injuries among primary and secondary school students in China.

The NISS was established and operated by the National Center for Chronic and Noncommunicable Disease Control and Prevention of the Chinese Center for Disease Control and Prevention (NCNCD, China CDC) in 2006. Currently, it covers 84 counties and districts in 31 provincial level administrative divisions (PLADs), including 252 medical and health institutions (6). This study used NISS 2018 data to descriptively analyze the characteristics of injury event and injury-induced clinical outcome of primary and secondary school students.

All data in this study were from NISS in 2018. The working mechanism, data collection process, quality control, and report card data domains and other detailed information of NISS can be found in published articles (6-7). In this study, patients who

met all following criteria will be considered as primary and secondary school students and included in the final analysis: 1) aged between 6 and 18 years old (8); 2) education level was self-reported or reported by other guardians as primary school, junior high school, or senior high school (equivalent to high school); 3) the occupation was self-reported or reported by other guardians as student. Software Stata (version 15.1; College Station, TX, USA), was adopted to perform the analysis in this study.

In 2018, there were 147,018 cases in line with the definition of primary and secondary school students in the NISS, accounting for 10.61% of all injury cases including 100,104 male students and 46,914 female students, and 72,616, 34,202, and 40,200 cases for primary, junior, and senior high school students, respectively. There were more male students than females in each education level.

Among cases with different levels of education,

injuries mainly occurred in the year from March to June and in a day at noon. As for injury cause, the top three causes in primary school students were fall (52.21%), animal injury (14.06%), and blunt injury (11.09%). In junior high school students, the three causes were fall (52.42%), blunt injury (12.36%), and animal injury (10.16%). In senior high school students, these causes were fall (45.46%), blunt injury (14.25%), and road traffic injury (12.06%). As for location of injury, the top three locations in primary school students were home (33.28%), school and school-related public places (28.96%), and roads/streets (17.27%). In junior high school students, the top three locations were school and school-related public places (35.99%), home (23.85%), and road/street (19.46%), respectively. In senior high school students, these locations were schools and school-related public places (34.71%), roads/streets (22.00%), and homes (20.91%). (Table 1)

TABLE 1. The characteristics of injury diagnosis among primary and secondary school students in China, 2018

	Primary school N (%)	Junior high school N (%)	Senior high school N (%)	Total N (%)
<b>Sex</b>				
Male	48,074 (66.20)	24,259 (70.93)	27,771 (69.08)	100,104 (68.09)
Female	24,542 (33.80)	9,943 (29.07)	12,429 (30.92)	46,914 (31.91)
<b>Causes</b>				
Road traffic injury	6,066 (8.35)	3,305 (9.66)	4,850 (12.06)	14,221 (9.67)
Fall	37,911 (52.21)	17,930 (52.42)	18,276 (45.46)	74,117 (50.41)
Blunt object injury	8,051 (11.09)	4,227 (12.36)	5,727 (14.25)	18,005 (12.25)
Firearm	52 (0.07)	32 (0.09)	20 (0.05)	104 (0.07)
Sharp object injury	5,336 (7.35)	2,784 (8.14)	4,055 (10.09)	12,175 (8.28)
Burn	1,197 (1.65)	306 (0.89)	463 (1.15)	1,966 (1.34)
Suffocation	226 (0.31)	88 (0.26)	83 (0.21)	397 (0.27)
Drowning	44 (0.06)	14 (0.04)	14 (0.03)	72 (0.05)
Poisoning	223 (0.31)	242 (0.71)	675 (1.68)	1,140 (0.78)
Animal injury	10,210 (14.06)	3,476 (10.16)	3,766 (9.37)	17,452 (11.87)
Sexual assault	4 (0.01)	1 (<0.001)	1 (<0.001)	1 (<0.001)
Others	2,215 (3.05)	1,321 (3.86)	1,726 (4.29)	5,262 (3.58)
Unknown	1,081 (1.49)	476 (1.39)	544 (1.35)	2,101 (1.43)
<b>Places</b>				
Home	24,167 (33.28)	8,156 (23.85)	8,407 (20.91)	40,730 (27.70)
Public residential institution	9,367 (12.90)	3,524 (10.30)	3,831 (9.53)	16,722 (11.37)
School and school-related area	21,032 (28.96)	12,311 (35.99)	13,955 (34.71)	47,298 (32.17)
Sports and athletics area	2,635 (3.63)	2,369 (6.93)	3,241 (8.06)	8,245 (5.61)
Road	12,542 (17.27)	6,654 (19.46)	8,844 (22.00)	28,040 (19.07)
Commercial and serve area	1,027 (1.41)	370 (1.08)	916 (2.28)	2,313 (1.57)
Industrial and construction area	179 (0.25)	90 (0.26)	216 (0.54)	485 (0.33)

TABLE 1. (Continued)

	Primary school N (%)	Junior high school N (%)	Senior high school N (%)	Total N (%)
Farm/farmland	193 (0.27)	122 (0.36)	106 (0.26)	421 (0.29)
Others	100 (0.14)	32 (0.09)	56 (0.14)	188 (0.13)
Unknown	1,374 (1.89)	574 (1.68)	628 (1.56)	2,576 (1.75)
<b>Activities</b>				
Paid work	276 (0.38)	183 (0.54)	395 (0.98)	854 (0.58)
Housework	1,408 (1.94)	977 (2.86)	1,547 (3.85)	3,932 (2.67)
Education	4,011 (5.52)	2,374 (6.94)	2,453 (6.10)	8,838 (6.01)
Sports activities	8,477 (11.67)	6,440 (18.83)	7,618 (18.95)	22,535 (15.33)
Leisure activities	36,128 (49.75)	13,527 (39.55)	14,793 (36.8)	64,448 (43.84)
Life activity	8,007 (11.03)	3,429 (10.03)	4,125 (10.26)	15,561 (10.58)
Driving/riding vehicles	4,324 (5.95)	2,900 (8.48)	4,467 (11.11)	11,691 (7.95)
Walking	7,170 (9.87)	3,126 (9.14)	3,308 (8.23)	13,604 (9.25)
Others	746 (1.03)	304 (0.89)	425 (1.06)	1,475 (1.00)
Unknown	2,069 (2.85)	942 (2.75)	1,069 (2.66)	4,080 (2.78)
<b>Intent</b>				
Unintentional	70,270 (96.77)	32,206 (94.16)	37,021 (92.09)	139,497 (94.88)
Self-harm/suicide	56 (0.08)	111 (0.32)	242 (0.60)	409 (0.28)
Intentional (Violence/Assault)	1,546 (2.13)	1,570 (4.59)	2,576 (6.41)	5,692 (3.87)
Others	660 (0.91)	284 (0.83)	308 (0.77)	1,252 (0.85)
Unknown	84 (0.12)	31 (0.09)	53 (0.13)	168 (0.11)
<b>Severity</b>				
Minor	62,004 (0.85)	28,187 (0.82)	33,412 (0.83)	123,603 (0.84)
Moderate	10,057 (0.14)	5,722 (0.17)	6,392 (0.16)	22,171 (0.15)
Severe	555 (0.01)	293 (0.01)	396 (0.01)	1,244 (0.01)
<b>Nature</b>				
Fractures	6,016 (8.28)	3,926 (11.48)	2,992 (7.44)	12,934 (8.80)
Sprain/pull	7,710 (10.62)	5,346 (15.63)	6,882 (17.12)	19,938 (13.56)
Sharp injury, bites and open	21,353 (29.41)	7,830 (22.89)	9,849 (24.5)	39,032 (26.55)
<b>Injuries</b>				
Contusions/bruises	31,882 (43.9)	14,789 (43.24)	17,090 (42.51)	63,761 (43.37)
Burn	1,227 (1.69)	353 (1.03)	503 (1.25)	2,083 (1.42)
Concussion/Cerebral contusion	1,673 (2.30)	684 (2.00)	904 (2.25)	3,261 (2.22)
Organ system injury	728 (1.00)	373 (1.09)	818 (2.03)	1,919 (1.31)
Others	1,441 (1.98)	655 (1.92)	901 (2.24)	2,997 (2.04)
Unknown	586 (0.81)	246 (0.72)	261 (0.65)	1,093 (0.74)
<b>Body part injured</b>				
Head	24,372 (33.56)	7,956 (23.26)	9,319 (23.18)	41,647 (28.33)
Upper limbs	21,172 (29.16)	11,171 (32.66)	11,555 (28.74)	43,898 (29.86)
lower limbs	18,332 (25.25)	10,460 (30.58)	12,925 (32.15)	41,717 (28.38)
Trunk	4,040 (5.56)	2,029 (5.93)	2,464 (6.13)	8,533 (5.80)
Multiple parts	2,460 (3.39)	1,596 (4.67)	2,405 (5.98)	6,461 (4.39)
Whole body	431 (0.59)	339 (0.99)	693 (1.72)	1,463 (1.00)
Others	1,395 (1.92)	471 (1.38)	610 (1.52)	2,476 (1.68)
Unknown	414 (0.57)	180 (0.53)	229 (0.57)	823 (0.56)

TABLE 1. (Continued)

	Primary school N (%)	Junior high school N (%)	Senior high school N (%)	Total N (%)
<b>Disposition</b>				
Discharged after treatment	67,240 (92.6)	30,987 (90.60)	36,168 (89.97)	134,395 (91.41)
Observed	1,082 (1.49)	575 (1.68)	969 (2.41)	2,626 (1.79)
Admitted	529 (0.73)	300 (0.88)	225 (0.56)	1,054 (0.72)
Transferred	3,400 (4.68)	2,163 (6.32)	2,608 (6.49)	8,171 (5.56)
Dead	10 (0.01)	11 (0.03)	23 (0.06)	44 (0.03)
Others	355 (0.49)	166 (0.49)	207 (0.51)	728 (0.50)
<b>Total</b>	<b>72,616 (100.00)</b>	<b>34,202 (100.00)</b>	<b>40,200 (100.00)</b>	<b>147,018 (100.00)</b>

As for activity at the time of injury, the top three activities in primary school students were leisure activities (49.75%), sports activities (11.67%), and life activities (11.03%). In junior high school students, the top three activities were leisure activities (39.55%), sports activities (18.83%), and life activities (10.03%). The three activities in senior high school students when injuries occurred were leisure activities (36.80%), sports activities (18.95%), and driving/riding vehicles (11.11%). More than 90% of the cases with different education levels were unintentional injuries. For intentional injury, the proportion of self-harm/suicide was highest in senior high school students (0.60%), followed by junior high school students (0.32%), and primary school students (0.08%). The proportion of other intentional injuries in senior high school students was 6.41%, which is more than that in junior high school students (4.59%), and primary school students (2.13%).

The characteristics of clinical outcomes in cases with different levels of education are very similar. More than 80% of injury cases were mild at each education level. The major body part injured is limbs and head. The most common nature of injury is contusions/bruises. More than 90% of injury cases can be discharged after medical treatment. There were only 44 injury-related deaths among primary and secondary school students in NISS, but the proportion of death in senior high school students was more than twice as high as that in junior high school and primary school students.

## DISCUSSION

According to the findings from NISS 2018, the high-risk group of primary and secondary school students with injury diagnosis is male students. The frequent incidence season is spring and early summer. Noon is the peak incidence time. Fall is the most

common cause of injury among students, but other frequent causes of injury differ in students with different education levels. Home and school are the most common places where injuries occurs. Students are more likely to suffer injuries when they are engaged in leisure and sport activities. Limbs and head are easily injured with contusions and bruises.

These findings are similar to previous research results. Therefore, male students could be prioritized as a target population in school-based injury prevention and control programs. Leisure and sports activities in school carried out in spring and summer should be taken into great consideration when implementing injury prevention programs. The potential risk of injury-related risk factors in school and school-related places should be regularly checked and reduced to improve the safety of students' daily life.

As for students at lower education levels, they are prone to suffer animal injury likely due to strong curiosity but less protective awareness and ability when they come into contact or play with animals. Therefore, it is important to help them establish a good awareness of preventing animal injury, for instance, dog or cat scratches and bites. Learning how to identify the living habits and behavioral characteristics of common animals, such as dogs, cats, etc., is essential for avoiding unintentional behaviors that could cause animal attacks and for understanding protective measures when an animal attacks (9).

As for students at higher education levels, the publicity and education of road traffic safety should be encouraged to be implemented in school and school-related places, which could provide more opportunities for students to strengthen their awareness of road traffic safety responsibilities. The target population of road traffic safety education could be expanded from students to their teachers, families, and other guardians. The proper behavioral norms of adults complying with road traffic regulations could promote

students to form better road traffic behaviors (10).

In addition, in the perspective of tertiary prevention, it is also strongly suggested that self-rescue skill training could be provided for students to learn some simple but effective first-aid techniques, such as wound cleaning, bandaging to stop bleeding, etc. Timely and proper first-aid treatments could help students improve their self-rescue ability and reduce the severity of injury.

There are also some limitations in this study. First, the age range of primary and secondary school students are defined by researchers according to the requirement of laws and common sense, which arbitrarily excluded the possibility of people being a student under the age of 6 or over 18 years old in this study. Second, the data of this study from the NISS are not a representative sample of a certain population, and the findings could not fully reflect the actual situation of injuries among primary and secondary school students in China. Third, given the self-reported information of injuries or information reported by students' guardians, recall bias or mistakes could occur in the data collection of demographic characteristics and injury events. Fourth, given the lack of unified guidelines for the diagnosis and treatment of injuries, the reliability of injury-related clinical outcomes could be affected by the experience and perception of medical staff and health care providers in different medical and health institutions.

This is the first study reporting the typical patterns of injuries among primary and secondary school students based on NISS. The findings of this study could be a good supplement for existing student-related injury studies and provide additional data for improving corresponding prevention and control strategies and measures.

The data utilization of National Injury Surveillance System had been reviewed and approved by the Ethical Review Committee of the National Center for Chronic and Noncommunicable Disease Control

and Prevention, Chinese Center for Disease Control and Prevention. The ethical application grant number is 201502.

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