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

Pengpeng Ye; Yuliang Er; Yuan Wang; Leilei Duan

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 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 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 | Junior high school | Senior high school | Total       |
|----------------|----------------|--------------------|--------------------|-------------|
|                | N (%)          | N (%)              | N (%)              | N (%)       |
| Sex            |                |                    |                    |             |
| 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) |
| Causes         |                |                    |                    |             |
| 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) |
| Places         |                |                    |                    |             |
| 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** | 0.27                  | 0.36                     | 0.26                     | 0.29        |
| **Others**       | 0.14                  | 0.09                     | 0.14                     | 0.13        |
| **Unknown**      | 1.89                  | 1.68                     | 1.56                     | 1.75        |
| **Activities**   |                       |                          |                          |             |
| **Paid work**    | 0.38                  | 0.54                     | 0.98                     | 0.58        |
| **Housework**    | 1.94                  | 2.86                     | 3.85                     | 2.67        |
| **Education**    | 5.52                  | 6.94                     | 6.10                     | 6.01        |
| **Sports activities** | 11.67            | 18.83                    | 18.95                    | 15.33       |
| **Leisure activities** | 49.75            | 39.55                    | 36.8                     | 43.84       |
| **Life activity** | 11.03                 | 10.03                    | 10.26                    | 10.58       |
| **Driving/riding vehicles** | 5.95            | 8.48                     | 11.11                    | 7.95        |
| **Walking**      | 9.87                  | 9.14                     | 8.23                     | 9.25        |
| **Others**       | 1.03                  | 0.89                     | 1.06                     | 1.00        |
| **Unknown**      | 2.85                  | 2.75                     | 2.66                     | 2.78        |
| **Intent**       |                       |                          |                          |             |
| Unintentional    | 96.77                 | 94.16                    | 92.09                    | 94.88       |
| Self-harm/suicide| 0.08                  | 0.32                     | 0.60                     | 0.28        |
| Intentional (Violence/Assault) | 2.13            | 4.59                     | 6.41                     | 3.87        |
| Others           | 0.91                  | 0.83                     | 0.77                     | 0.85        |
| Unknown          | 0.12                  | 0.09                     | 0.13                     | 0.11        |
| **Severity**     |                       |                          |                          |             |
| Minor            | 0.85                  | 0.82                     | 0.83                     | 0.84        |
| Moderate         | 0.14                  | 0.17                     | 0.16                     | 0.15        |
| Severe           | 0.01                  | 0.01                     | 0.01                     | 0.01        |
| **Nature**       |                       |                          |                          |             |
| Fractures        | 8.28                  | 11.48                    | 7.44                     | 8.80        |
| Sprain/pull      | 10.62                 | 15.63                    | 17.12                    | 13.56       |
| Sharp injury, bites and open | 29.41            | 22.89                    | 24.5                     | 26.55       |
| **Injuries**     |                       |                          |                          |             |
| Contusions/bruises | 43.9            | 43.24                    | 42.51                    | 43.37       |
| Burn             | 1.69                  | 1.03                     | 1.25                     | 1.42        |
| Concussion/Cerebral contusion | 2.30            | 2.00                     | 2.25                     | 2.22        |
| Organ system injury | 1.00            | 1.09                     | 2.03                     | 1.31        |
| Others           | 1.98                  | 1.92                     | 2.24                     | 2.04        |
| Unknown          | 0.81                  | 0.72                     | 0.65                     | 0.74        |
| **Body part injured** |                |                          |                          |             |
| Head             | 33.56                 | 23.26                    | 23.18                    | 28.33       |
| Upper limbs      | 29.16                 | 32.66                    | 28.74                    | 29.86       |
| Lower limbs      | 32.55                 | 30.58                    | 32.15                    | 28.38       |
| Trunk            | 5.56                  | 5.93                     | 6.13                     | 5.80        |
| Multiple parts   | 3.39                  | 4.67                     | 5.98                     | 4.39        |
| Whole body       | 0.59                  | 0.99                     | 1.72                     | 1.00        |
| Others           | 1.92                  | 1.38                     | 1.52                     | 1.68        |
| Unknown          | 0.57                  | 0.53                     | 0.57                     | 0.56        |
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 occur. 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.

* Corresponding author: Leilei Duan, duanleilei@ncncd.chinacdc.cn.

1 Division of Injury Prevention and Mental Health, National Center for Chronic and Noncommunicable Disease Control and Prevention, Chinese Center for Disease Control and Prevention, Beijing, China.

Submitted: March 04, 2020; Accepted: March 17, 2020

REFERENCES

1. World Health Organization. World report on child injury prevention. Geneva: World Health Organization, 2008. https://www.who.int/violence_injury_prevention/child/injury/world_report/en/. [2020-03-01].

2. Ye PP, Jin Y, Er YL, Deng X, Wang Y, Gao X, et al. Disease burden of injuries in children aged 0–14-year-old in 1990 and 2013, in China. Chin J Epidemiol 2017;38(10):1335 – 41. http://dx.doi.org/10.3760/cma.j.issn.0254-6450.2017.10.008. (In Chinese).

3. Hu RJ, Gao HM, Jiang ZX. Research on the status quo and countermeasures of primary and secondary school students’ first aid training. China Health Ind 2019;16(9):190 – 2. http://dx.doi.org/10.16659/j.cnki.1672-5654.2019.09.190. (In Chinese).

4. Wang XD, Xiong JJ, Xu WY. Research status of injury prevalence and intervention among primary and middle school students in China. Shanghai J Prev Med 2011;23(12):624 – 6. http://dx.doi.org/10.3969/j.issn.1004-9231.2011.12.020. (In Chinese).

5. Chen TJ, Ji CY, Xing Y, Hu PJ, Song Y. Study on incidences and effect factors of injuries among middle school students in 18 provinces, China. Chin J Epidemiol 2007;28(2):154 – 6. http://dx.doi.org/10.3760/cma.j.issn.0254-6450.2007.02.012. (In Chinese).

6. Duan LL, Deng X, Wang Y, Wu CM, Jiang W, He SR, et al. The national injury surveillance system in China: a six-year review. Injury 2015;46(4):572 – 9. http://dx.doi.org/10.1016/j.injury.2014.12.013.

7. Duan LL, Ye PP, Wang LH. Future challenges and solutions for safety in China: CDC’s exploration of injury prevention strategies. Glob Health J 2018;2(2):14 – 23. http://dx.doi.org/10.1016/S2414-6447(19)30135-6.

8. National People’s Congress of the People’s Republic of China. Compulsory education law of the People’s Republic of China. 2018. http://www.npc.gov.cn/npc/c30834/201901/21b0be5b9e54c5088bf17903853abd.shtml. [2020-03-04]. (In Chinese).

9. Ye PP, Jin Y, Ji CR, Er YL, Duan LL, Li ZX. Disease burden of animal injury in China, 1990–2016. Chin J Epidemiol 2019;40(1):52 – 8. http://dx.doi.org/10.3760/cma.j.issn.0254-6450.2019.01.011. (In Chinese).

10. Ye PP, Jin Y, Duan LL. Mortality of road traffic injury among children aged 0–14 years in China from 1990 to 2015. Chin J Dis Control Prev 2018;22(7):656 – 62. http://dx.doi.org/10.16462/j.cnki.zjhbzkx.2018.07.002. (In Chinese).