Preplanned Studies

Unintentional Injury Mortality Among Children Under Five Years — China, 2006–2017

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Summary

What is already known about this topic?

Unintentional injuries among children aged under five years is still a serious public health problem in China. Epidemiological characteristics of under-five unintentional injury are reported in single provinces and cities for China but not nationally based on the Disease Surveillance Points (DSPs) dataset.

What is added by this report?

Unintentional injury mortality rates for under-five decreased substantially between 2006 and 2017 in China, with the decrease occurring primarily for males and rural children. Children living in rural areas and males had higher unintentional injury mortality rates than children in urban areas and females. The major fatal types of under-five unintentional injury were drowning and road injury.

What are the implications for public health practice?

Further interventions need to be taken in accordance with the main types of unintentional injuries, especially effective prevention strategies used in other countries or recommended by the World Health Organization (WHO). Even with equal access to injury prevention and control services for different sexes, policy efforts should focus on higher-risk populations, especially children aged under five years who are males or reside in rural areas.

Unintentional injury is a serious public health problem for Chinese children under age five, and no reports examine the latest trends of unintentional injury mortality for children under age five in China at a national level. Using China's Disease Surveillance Points (DSPs) data, percent change in mortality between 2006 and 2017 was estimated based on the mortality rate ratio, which was obtained via negative binomial regression. This study reported that unintentional injury mortality rates for children under age five decreased substantially between 2006 and 2017 in China, with the decrease occurring primarily for males and for children residing in rural areas, and that the major types of fatal unintentional injury were drowning and road injury. In the future, further unintentional injury interventions should be taken based on the major types of unintentional injury and populations that are at higher risk. Effective prevention strategies used in other countries or recommended by the World Health Organization (WHO) should be considered for implementation in China.

Unintentional injury was the third leading cause of under-five mortality in China and the first leading cause of death for children aged between one to five years in China in 2015 (*1*). To date, no the national level studies examine unintentional injury mortality by sex, by geographic area (rural or urban), and by type nor the latest trends for children under age five in China.

Limited published evidence reported under-five unintentional injury mortality trends in China were from single provincial-level administrative divisions (PLADs) or for single types, such as one conducted in Sichuan Province (*2*) and another for unintentional suffocation (*3*).

Using China's DSPs dataset, the report examine the changes of under-five unintentional injury mortality by location (urban/rural), sex, and type from 2006 to 2017 to analyze the epidemiological characteristics of unintentional injuries for children under-five in China, which may help policy-makers make well-informed decisions to promote the prevention and control of unintentional injuries.

Mortality data were extracted from the DSPs data set, and the methods have been described elsewhere (*3*). The causes of death are determined by trained coders from local hospitals and China CDC based on the 10th edition of the International Classification of Diseases (ICD-10) (*4*). ICD-10 codes of unintentional injuries in DSP system is "V01-X59".

Sex, type of geographic residence (urban or rural), and specific types of unintentional injury were considered in data analysis. Under-five mortality rates from 2006–2017 were calculated as number of deaths

divided by the corresponding population. Unintentional injury was divided into six groups according to the types: 1) road injury (V01-V98), 2) drowning (W65-W74), 3) falling (W00-W19), 4) poisoning (X40-X49), 5) fire (X00-X09), and 6) other unintentional injuries (W20-W64, W75-W99, X10-X39, X50-X59).

Percent change in mortality between 2006 and 2017 was estimated based on mortality rate ratio, which was calculated as (mortality rate ratio – 1) ×100%*. Using standard errors of regression coefficients, 95% confidence intervals (95% CI†) of mortality rate ratio and percent change in mortality between 2006 and 2017 were calculated furtherly. Stata 16 software (StataCorp LLC. Texas, USA) was used for data analysis. $p<0.05$ was considered statistically significant.

For children under-five years, unintentional injury mortality showed a fluctuating downward trend from 2006 to 2017. Under-five unintentional injury mortality rates showed a general increasing trend from 2006 to 2008, rising from 25.27 to 34.70 per 100,000 population. Between 2008 and 2017, the mortality rates continuously decreased to 17.55 per 100,000 population in 2017.

Males and rural children aged under five years of age had higher unintentional injury mortality rates than females and urban children across the study time period. Sex subgroups followed a similar changing pattern in the unintentional injury mortality rate from 2006 to 2017. However, under-five unintentional injury mortality rates in rural areas fluctuated greatly from 2006 to 2017, with one peak in 2008 (35.78 per 100,000 population) and another peak in 2011 (35.07 per 100,000 population). The under-five unintentional injury mortality in rural areas rose by 18.63% between 2006 and 2008 and then decreased by 45.08% between 2008 and 2017. The under-five unintentional injury mortality in urban areas had a little fluctuation with one peak in 2011 (19.57 per 100,000 population) and rose by 28.49% between 2006 and 2011 before decreasing by 32.04% between 2011 and 2017. The mortality rate in urban areas did not change significantly over time for urban children [–13%, 95% CI (–25%, 1%)], but decreased substantially for males [–34%, 95% CI (–40%, –29%)], females [–26%, 95% CI (–33%, –18%)], and rural children [–35%, 95% CI (–40%, –30%)] between 2006 and 2017. (Table 1)

As shown in Figure 1, road injury is the most common type of unintentional injuries for children aged under five years, accounting for 57.44% of fatal unintentional injuries among that age group between 2006 and 2017. In addition, drowning caused 35.53% of unintentional injury mortality. Drowning mortality decreased 49.95% between 2006 and 2017 from 10.43 to 5.22 per 100,000 persons for children aged under five years. However, road injury mortality for children under five decreased only by 7.56%, from 4.63 to 4.28 per 100,000 persons between 2006 and 2017.

Discussion

This study reports three major findings: 1) unintentional injury mortality rates for children under five years old decreased substantially between 2006 and 2017 in China, with the decrease occurring primarily

TABLE 1. Change in unintentional injury mortality for children aged under five years in China, 2006–2017.

Sex/Geographic residence	Mortality rate (per 100,000 persons)												Percent change in rate(%)* (95% CI)	Pseudo r-Squared
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017		
Total	25.27	26.60	34.70	33.01	31.47	30.31	27.89	23.73	23.70	19.92	19.96	17.55	−30 (−35, −25)†	0.37
Sex														
Male	30.37	30.60	40.79	37.63	38.36	36.59	31.74	27.00	26.81	23.20	22.51	19.84	−34 (−40, −29)†	0.36
Female	19.94	22.27	28.13	28.02	24.03	23.47	23.33	19.82	19.94	15.98	16.90	14.80	−26 (−33, −18)†	0.34
Geographic residence														
Urban	15.23	16.80	17.93	17.03	19.00	19.57	14.94	18.45	17.94	15.11	15.32	13.30	−13 (−25, 1)	0.26
Rural	30.16	31.39	35.78	33.16	29.76	35.07	34.24	26.18	26.37	22.22	22.20	19.65	−35 (−40, −30)†	0.35

Abreviation: CI=Confidence Interval.
* Percent change in rate was calculated as (mortality in 2017 / mortality in 2006 − 1) × 100%.
† $p<0.05$.

* Mortality rate ratio is denoted as "eb" and obtained via negative binomial regression; e approximately equals 2.7183 and b signifies the regression coefficient.
† CI=Confidence Interval.

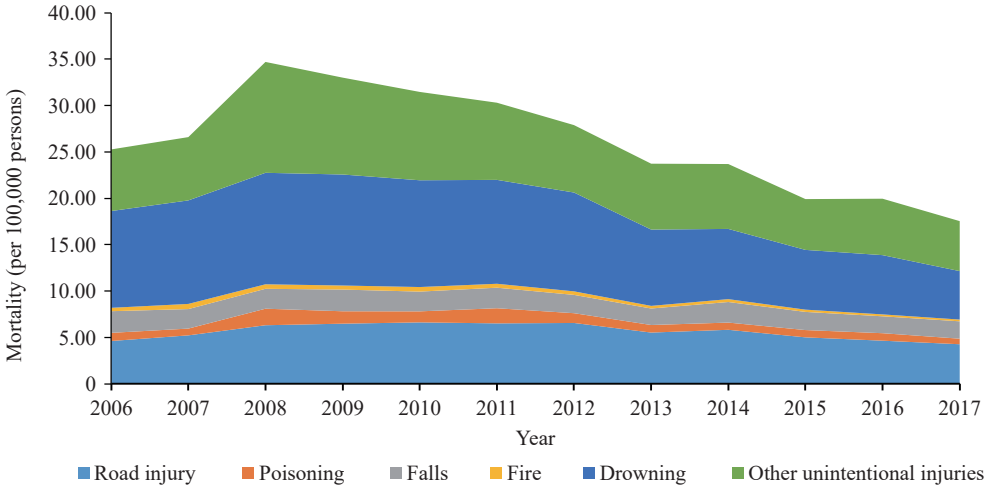

FIGURE 1. Unintentional injury mortality among children under five years by specific types in China, 2006–2017.

for males and for rural children; 2) children living in rural areas and males had higher unintentional injury mortality rates than children in urban areas and females; and 3) the major types for fatal unintentional injury were drowning and road injury.

The change patterns revealed by this study in China are similar to those reported by previous studies based on the World Health Organization (WHO) mortality dataset (*5*). It also is consistent with the trends reported for Sichuan Province based on the National Health Statistics Survey (NHSS) data (*2*). The downward unintentional injury mortality trends may benefit from public health policies and attempts to reduce unintentional injuries in China such as the Ministry of Health (now the National Health Commission) in China incorporating injury control into the scope of disease control in 2002, the establishment of the National Injury Surveillance System (NISS) in 2006, and the issuing of a series of technical guidelines for injury intervention in 2011.

The overall unintentional injury mortality from the DSP dataset (ranging from 25.27 to 17.55 per 100,000 persons from 2006 to 2017) is lower than the estimate from the Global Burden of Disease (GBD) 2017 update over the same time period (from 67.57 to 31.06) (*6*). The difference may be interpreted as the result of using different data sources and adjustment methods. For instance, the GBD study group adopts multiple data sources for China and then adjusts by reallocating inferior codes that reflect inaccurate or ambiguous data (*7*).

Across the study time period, under-five males were at higher risk of fatal unintentional injuries compared to females, which is corroborated by similar relationships found in other countries such as India (*8*). This difference may be caused mainly by differences in biological temperament, cognitive strategies, exposure opportunity, and gender socialization. More dangerous and impulsive activities and consequent increased environmental exposure or lower parental restraint have been suggested as explanations for the increased mortality due to injuries among males. Compared to 2006, however, the gap of unintentional injury mortality rate in gender in 2017 is decreasing, revealing that having equal access to injury prevention and control services for different sexes in China might affect the mortality outcomes.

Compared to urban areas, children aged under five years in rural areas were at a higher risk of fatal unintentional injuries. The result is consistent with other studies observed in single PLADs in China, such as Chongqing Municipality (*9*). This may be caused by the inadequate adult supervision, low safety awareness, and less knowledge among rural adult caretakers of children and relatively weak prehospital aid and hospital treatment for the injured children (*8*). However, due to the rapid urbanization and infrastructural development of China and the enhanced safety awareness and injury knowledge among caregivers, the unintentional injury mortality for children under five years old in rural areas decreased substantially.

Across the study time period, drowning and road injury were the two leading fatal unintentional injury types in China. Deaths due to drowning were the most common in rural parts of low- and middle-income countries where exposure is greater to open natural bodies of water (unintentional falls occur most often in

natural bodies of water). Furthermore, reliable adult supervision is relatively rare in China and most natural bodies of water are not surrounded by physical barriers. Young children are at higher risk owing to lack of ability to identify and avoid water danger. But with urbanization, industrialization, and a series of effective interventions, the drowning mortality decreased substantially in China (*10*). Road injuries among children under five years old are also notable in China as the high risk of road injuries for children under five years old may be related to several factors including young children lacking the ability to identify and avoid road traffic danger when playing outside, young children have difficulty being seen in traffic due to their short stature, and the caregiver's perception of risk plays an important role in protecting young children from the risks of traffic injury. In response to rapid urbanization in China, the Chinese government implemented several effective interventions and regulations to prevent road injuries, which decreased associated mortality to an extent.

This study is subject to at least one limitation. Web-based reporting systems for the DSPs had been set up in 2008, which may have caused some fluctuations in unintentional injuries mortality rates because changing reporting methods created potential bias in unintentional injuries death reporting compared with prior years.

The findings have policy implications. First, the study reports a general decreasing trend in unintentional injury mortality among children aged under five years in China from 2006 to 2017. Although a series of measures to prevent unintentional injuries in China have been taken, having a population of 1.4 billion people require further unintentional injury interventions to be taken based on the major types of unintentional injury. Second, male children and children residing in rural areas were at higher risk of fatal unintentional injuries. Even having equal access to injury prevention and control services for different sexes, policy efforts might focus on those higher at-risk populations. In the future, effective prevention strategies used in other countries or recommended by the WHO might be introduced to China and culturally tailored for dissemination including removing or covering water hazards, strengthening traffic safety education of caregivers, and requiring using child restraints properly.

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