The Changes of Trend and Distribution of Childhood Injury Related Mortality in Tianjin, China, 1999-2011

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Abstract

Objectives: The aim of the study was to address the trend and distribution of injury related mortality among childhood in order to identify priority issues with childhood injury in Tianjin.

Methods: This retrospective study analyzed the annual all-cause of death records for 1999–2011 provided provincial data of injury mortality including cause, sex, age, and geography. Trend analyses were conducted using Poisson regression.

Results: From 1999–2011, the injury related death was the first leading cause of childhood mortality. The injury mortality rates of children remained around 10-15/100,000 while death rates of male and rural were two- four times more than that in female and urban, also much higher than the total. The unintentional injury was up to over 75% in total. Traffic mortality of age 5-15 had a significant decline trend during the study period.

Conclusions: Traffic mortality decreased in school-age children due to comprehensive traffic safety measures had been implemented and enforced in Tianjin. It is testify that injury death is preventable. More similar efforts will be required to diminish the burden of other injury and the entire population, such as safety education, risk warning, regulation enforcement and facility installation.

Keywords: Childhood injury; Surveillance; Mortality; Trend

Introduction

Injury is the leading cause of childhood death and a significant contributor to childhood morbidity, mortality, long term disability, and healthcare costs worldwide [1,2]. Around 830 000 children die from injuries every year, nearly 2300 each day. Injury is responsible for about 950 000 deaths in children under the age of 18 years each year. Unintentional injuries account for almost 90% of these cases. It is said that more than 1000 of these children could be saved if proven injury prevention measures were applied worldwide [3]. China is a developing country with large population of childhood under 20 years old. Childhood injury has also been a serious public health problem in recent several decades in China [4]. It is estimated that the numbers of child deaths caused by injuries were over 50 thousand per year, and drowning is the first leading cause of injury mortality among 1-14 childhood [5]. Tianjin is the third largest provincial city of China that is located in the northeast of the North China Plain with the Bohai Sea to its east and Yanshan Mountain to its north, and covers an area of 11,920 square km. The resident population was over 10 million with 40% urban population and 60% rural population and the proportion of child under 20 is about 22% of the total. The Tianjin Bureau of Public Health's report shows that over 75% annual childhood injury death was caused by unintentional injury [6]. More children lives could be saved if proven methods is implemented in Tianjin.

This retrospective descriptive study aimed to identify differences and disparities in injury mortality among sexes, ages and geographic with the data collected by the Tianjin All-Cause of Death Reporting System, the epidemiological transition of childhood injury mortality in recent 13 years, in order to identify priority issues with childhood injury and to make recommendations for prevention and control. It is necessary for Tianjin to develop a system to adjust interventions or countermeasures in response to changes in injury pattern.

Methods

We used annual underlying cause-of-death data from the Tianjin All-Cause Death Reporting System to describe provincial patterns and trends in fatal injury for the period 1999-2011.The retrospective study analyzed death data of children who had official residential permits in Tianjin died of injury between 1999 and 2011 with confirmed medical death certificates. Cause of death classification was based on the International Classification of Diseases ICD-9 and ICD-10. ICD-9 was used to code deaths between 1999 and 2002, whilst ICD-10 was used for deaths between 2003 and 2011.The classifications of ICD-9 codes were traffic accident (E800-E807, E810-E819, E826-E848), poisoning (E850-869), drowning (E910), suicide (E950-959), assault (E960-969).The classifications of ICD-10 codes were traffic accident (V01-V99), poisoning (X40-X49), drowning (W65-W74), suicide (X60-X84), assault (X85-Y09).

Death data were collected for this study through the All-Cause Death Reporting System, maintained by the Tianjin Centers for

Disease Control and Prevention (CDC), which monitors the entire residential population in Tianjin. It has been granted by Tianjin CDC Ethics Committee. According to municipal and local regulations, death certificates are required to be filled out and entered into the All-Cause Death Reporting System by all the hospitals and community clinical centers in the Tianjin. The district or county CDCs oversee and check the daily reported deaths at the primary level, on a case-by-case basis. Nonhospital deaths are included in the All-Cause Death Reporting System through collecting from the police station and the government mortuary, then interview the deceased relatives by community clinicians with verbal autopsy questionnaire on a face to face basis. The district or county CDCs are responsible for collecting and verifying these additional medical death certificates, and then adding them into the All-Cause Death Reporting System on a weekly basis. Tianjin CDC carries out secondary data verification, investigation of missing reports, as well as quality control, sorting and analysis of the data. It also provides periodical technical training and daily support to the staff involved in the reporting process.

Mortality data that we analyzed included the number of deaths by cause, sex, age and urban/rural areas since 1999. Death records with missing fields were excluded from the study. Statistical software SPSS 16.0 was used for data analysis. The mortality rates and proportions of deaths from different causes of injury were analyzed. Chi-square test was used to test the association significance in mortality rates and proportions. Time trends were calculated by using Poisson regression. A significance level of 0.05 (two-sided) was used.

Results

The total 3382 cases of injury mortality were collected and analyzed in the retrospective descriptive study. During the entire study period of 13 years, the injury-related death rates were fluctuating in the age groups (0-5, 1-5, 15).

However, the age group 15- had the highest injury mortality rates of 23.60 (/100000/year) in the year 2010. Meanwhile, the mortality rates had the significant decline trend in the age groups 5-10 and 10-15 (P<0.01). Table 1 showed the secular trend of injury mortality rates in the five different age groups.

Age group (years)	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Regression Coefficient B	χ2	P-value
0-	18.77	18.25	12.07	13.63	10.27	16.07	19.85	12.42	11.26	12.07	11.63	18.23	14.6	0.057	4.74	0.03
	(4.89, 32.64)	(4.76, 31.75)	(1.51, 22.62)	(2.75, 24.52)	(0.23, 20.32)	(4.19, 27.95)	(8.15, 31.55)	(5.95, 18.89)	(2.95, 19.58)	(3.73, 20.41)	3.60, 19.66	(8.36, 28.10)	(6.01, 23.19)			
1-	11.52	11.79	8.67	10.35	12.63	10.82	12.54	3.56	12.45	10.41	13.7	7.66	7.65	0.004	0.08	0.782
	(7.58, 15.46)	(7.69, 15.88)	(5.09, 12.25)	(6.42, 14.28)	(8.31, 16.95)	(6.79, 14.85)	(8.18, 16.90)	(1.80, 5.33)	(8.26, 16.64)	(6.74, 14.08)	(9.67, 17.33)	(4.71, 10.61)	(4.76, 10.54)			
5-	11.72	14.67	10.05	10.65	10.35	10.43	9.51	7.96	11.21	7.66	10.76	12.21	7.92	-0.062	27.69	<0.001
	(8.91, 14.54)	(11.34, 18.00)	(7.18, 12.92)	(7.61, 13.70)	(7.25, 13.46)	(7.22, 13.64)	(6.37, 12.64)	(5.21, 10.70)	(7.75, 14.67)	(4.77, 10.56)	(7.31, 14.22)	(8.58, 15.84)	(5.04, 10.80)			
10-	10.93	10.42	9.82	8.79	11.7	12.88	11.28	10.88	10.35	12	11.9	9.44	11.61	-0.06	36.72	<0.001
	(8.63, 13.24)	(8.18, 12.66)	(7.60, 12.04)	(6.60, 10.98)	(9.06, 14.34)	(9.97, 15.80)	(8.40, 14.17)	(8.13, 13.63)	(7.39, 13.31)	(8.71, 15.29)	(8.53, 15.28)	(6.37, 12.51)	(8.16, 15.06)			
15-	13.59	13.45	11.99	16.47	20.5	20.96	20.06	16.7	22.29	17.62	19.91	23.6	19.66	0.009	1.64	0.2
	(10.98, 16.20)	(10.90, 16.01)	(9.60, 14.39)	(13.64, 19.31)	(17.34, 23.65)	(17.82, 24.10)	(17.00, 23.11)	(13.99, 19.41)	(18.90, 25.67)	(14.47, 20.76)	(16.40, 23.43)	(19.56, 27.64)	(15.83, 23.50)			
Z	0.273	-0.1885	0.7241	1.4691	2.3301	2.5221	1.9298	1.7814	2.621	2.1206	1.7296	2.8463	2.6034	-	-	-
P-value	0.7849	0.8505	0.469	0.1346	0.0198	0.0117	0.0536	0.0748	0.0088	0.034	0.0837	0.0044	0.0092			

Table 1: Children Injury mortality rates (/100000/year) and 95% confidence intervals (in brackets) by age groups, Tianjin 1999-2011.

The total mortality rate of childhood injury was approximate 12 per hundred thousand from 1999-2011, the big waves were observed in lines of male and rural while a little fluctuant were in lines of female and urban. Also, the male and the rural had the top level of injury death with two or three more times higher than that in female and urban, and around one time higher than the total (Figure 1).
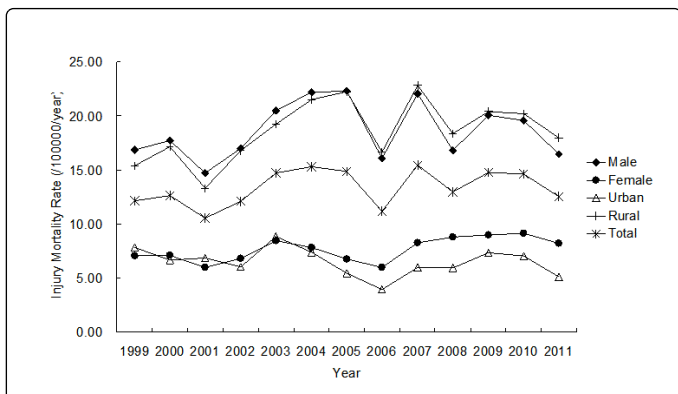
Figure 1: Children injury mortality rate by sex and urban/rural areas, Tianjin 1999-2011. Poisson regression for trend : Male : $\chi2=0.17$, P=0.6764 ; Female : $\chi2=0.77$, P=0.3814 ; Urban : $\chi2=0.41$, P=0.5232 ; Rural : $\chi2=1.30$, P=0.2550 ; Total : $\chi2=0.35$, P=0.5534.

Regarding injury mechanism, the distribution of five leading causes was addressed in Figure 2, the rank was according to its proportion of all injury death every year. The most injury death over 80% attributed to such five leading causes. The traffic was the first leading cause and the proportions increased from 34% to over 40%, even was up to 51% in year 2007, then there was a decline trend during the 2008-2011. The drowning was the second cause of injury death. The third top reason was poisoning followed by suicide and assault. The average proportion of unintentional injury was up to 75% of the total childhood injury death. The others included 20 causes followed the five leading causes with miner proportions, respectively.
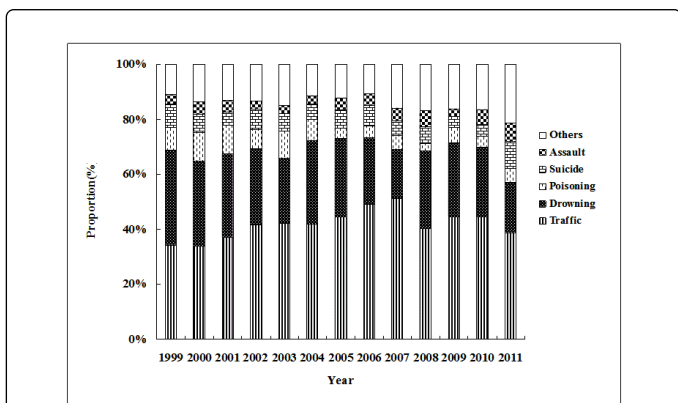

Figure 2: Children Injury mortality proportion of 5 leading causes of death, Tianjin 1999-2011.

From 1999 to 2011, there were obvious disparities in the epidemiology distribution of five leading deaths of injury by sexes and urban/rural. Figure 3 described that the demographic tendency of top five ranks of injury mortality. The rural had the top proportion of the five leading causes of the injury death. Particularly, it had the highest proportions with the traffic, drowning and poisoning. Comparatively, the male had the top level with assault and suicide, the second higher proportions of the traffic, drowning and poisoning.
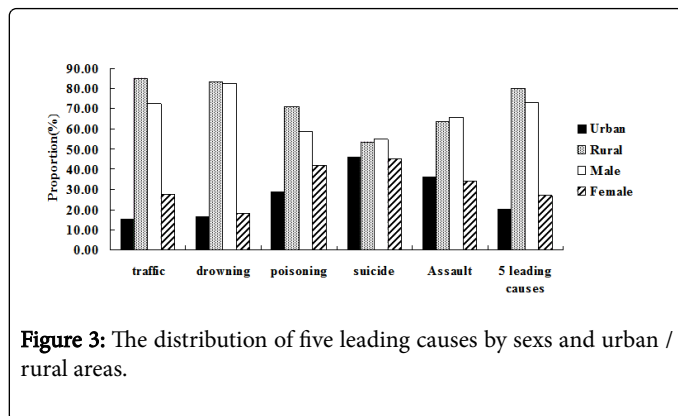

Figure 3: The distribution of five leading causes by sexes and urban / rural areas.

Discussion

The injury is the first leading cause of death in childhood age under 20 in Tianjin from 1999-2011, then followed by the perinatal causes, congenital malformation, malignant neoplasm and diseases of the nervous system. This retrospective study analyzed the 3382 injury death cases and addressed the secular trend, demography distribution, priority causes so that the pertinent strategies of injury prevention would be developed in Tianjin, even more child lives could be saved, and more disables could be prevented [7,8].

The major finding of this study is that the five leading reasons of injury death were traffic, drowning, poisoning, suicide and assault, which were up to over 80% of the total children injury death. The top two causes were same as the global rank of childhood injury mortality [3]. However, it was different with our national rank that drowning was the first leading cause of injury mortality of childhood in China [9]. The obvious disparities existed between sexes, ages and urban/rural areas in Tianjin. The serious burden of injury death was in the male and rural childhood with 2-4 times higher mortality rates compare to the female and urban. There was a rising tendency of injury mortality in the children age over 15. Similarly, in most regions and countries, the gender gap for fatal injuries increases with age. At the global level in children aged 5–9 years, male death rates over a third higher than female rates, a discrepancy that increases to 60% among those aged 10–14 years [10-12]. However, adolescents aged 15–17 years show an adult profile, with males in that age group accounting for more than 86% of all injury deaths [12-14]. The phenomena reminded the injury should be an emphasis of prevention along with the child growing up. The proportion and mortality rates of traffic were climbing significantly in Tianjin during the study period. It is very common that motor vehicle drivers did not seal the safe belt and people did not wear headpiece with the auto bike and bicycle which induced the traffic accidents to be the first leading cause of injury death in urban and rural areas [12-15]. The serious burden in the rural area caused by poor road condition, no pedestrian lanes, motor vehicle bicycle mixed road and less signal light at intersection [16]. Also, the male child has higher mortality rate since the boys are more active and naughty than girls in the daily life, particularly in physical activity [17,18]. Consequently, the boys and rural children became the target population of injury prevention in Tianjin [19-21].

A majority of injury is preventable and the death rate can be reduced over 20% by effective methods. The valuable finding of our study is that the traffic mortality had a significant declined tendency in the population age from 5-15 years old in Tianjin in the recent years,

and the proportion of traffic death in childhood declined from 2007-2011 . This is partially consistent with the findings of other studies, which found that transport injury-related deaths have declined among children and adolescents [22]. The positive result might be induced by several reasons in Tianjin, particularly, the enforcement of new laws and regulations. Firstly, 20-30 km/h limit speed regulation was implemented in the areas around the schools and the traffic police was arranged on duty at the entrance of the schools at the time before and after school [23]. Secondly, drunk driving would be revoked the drive licence, even should be investigated criminal duty [24]. Thirdly, a great amount cameras were installed at intersections in order to supervise and punish the drivers against the traffic rules as soon as possible [25]. Also, it is the rapid increased amount of private home cars (over 29 cars/ per hundred homes) in Tianjin that can give the ride for children decreasing the pedestrian going for school [26]. The series of prevention and intervention were taken out in succession after 2003 and significantly intensified after 2007 [27]. Based on such positive results, the Tianjin government should further strengthen the law enforcement and advocate the public to learn and abide the related regulations. Meanwhile, much more investments should go to the rural areas for the constructing and maintaining the safe of roads and streets. Developing school bus should be a key target for the local government in order to decrease the traffic jam and road injury mortality of children.

Drowning was the second leading cause of injury mortality after the traffic. It was priority reason that most water area where children enjoyed to play did not have warning sign and isolation fencing. Additionally, there were above 80% children could not swim in coast cities in the eastern China [28], such as Tianjin .Swimming training should be popularized in schools, even kindergartens. Indeed, the warning sign and isolation fencing must be set alongshore regions. The parents and teachers should raise the children awareness of injury prevention. The third leading cause of injury mortality was poisoning that child contacted toxic gas from burning coal, ate pesticide by accident and overuse medicines. In rural area, a lot of families burned coal for warm in winter when carbon monoxide induced from the unburned coal, also, some farmers used to put pesticide in the home so that a child ate or contacted it accidently. The limitation of our study is that lack related data form a special survey. However, the education of poisoning prevention should be emphasized at rural areas.

Also, it is a huge challenge to create a perfect system of trauma or emergency aid and rehabilitation care in Tianjin. Improving the organization and planning of trauma care services is an affordable and sustainable way to decrease injury death. This would involve improving services in health care facilities and capacity of ambulance transportation. Meanwhile, the education of injury prevention should developed in schools, even the parents. The children who have lessons of safety knowledge are easy to avoid injury or to take self help with unsafe situation [28]. So, the Tianjin Education Committee required that all the element secondary and high schools open the lesson of injury prevention and have window displaying of safety common sense in order to promote the awareness and behavior as well as the injury. And, the professionals go to these schools give the specific lectures of injury prevention. It is important for Tianjin to implement diversity methods to develop health promotion of injury prevention so that the burden of children injury will be decreased by improving legislation, education and action. We carried out road safety promoting program in children since 2007 with the support of Safe Kids and Global Road Safety Program. We apply the analysis result of surveillance data into health education.

In conclusion, the injury is the first leading cause of death in children under 19 year old in Tianjin. The disparity gap was between the urban/ rural, sex and age groups. The positive effects were observed with the integrated methods of injury prevention that are safety education, risk warning, regulation enforcement and facility installation. Hence, it is unquestionable that the injury death or incidence are preventable, the more methods tried and the more efforts paid, the more lives would be saved.

"What is already known on this topic"

Answer: The injury related death was the first leading cause of childhood mortality from 1999–2006.
"What this study adds"

Answer: We add 5 years' data from 2007-2011 and focused on injury death of children only. Age group interval was divided more elaborate, that is 0-,1-,5-,10-,15-(years), instead of 0-4,5-14(years).Children Injury mortality proportion of 5 leading causes of death (traffic, drowning, poisoning, suicide, assault) was analyzed by genders and urban /rural areas.

Acknowledgement

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