Letter to the Editor

Pedestrian Mortality between 2006 and 2010 in China: Findings from Non-police Reported Data*

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Pedestrian safety in China is an important but largely neglected issue, in part due to the substantial under-reporting within police data. In this study we aimed to examine changes in pedestrian fatality between 2006 and 2010 in China using non-police reported data. A multi-year study was conducted based on the mortality data during 2006-2010 from the Disease Surveillance Points (DSP) data in China. Between 2006 and 2010, the crude pedestrian mortality increased from 7.0 to 10.5 per 100 000 populations. Annual pedestrian mortality from DSP data was 13 times in 2006 and 55 times in 2010 mortality for pedestrians and passengers from police-reported data in the corresponding years. After controlling for sex, age, and urban/rural, the mortality increased by 44% from 2006 to 2010 (adjusted mortality rate ratio (MRR)=1.11, 95% CI 1.10-1.12). The problem of pedestrian deaths is much more serious in China than that officially reported by the police. Significant and urgent efforts are needed to save lives of pedestrian in China.

As the largest developing country, China suffers serious road traffic injuries. However, road traffic deaths in general were found to be seriously underreported by the most cited data source-police data[1]. The police-reported pedestrian mortality rates are particularly questionable because pedestrians' injuries and deaths are often incompletely or inconsistently recorded in police reports[2]. In China, pedestrians merely accounted for 26% of road traffic deaths[3], far lower than the average 45% in low-income countries[4]. Although non-police data like health data were suggested to be used in order to improve estimation of road traffic injuries[1], no study has yet used other data sources in China to estimate pedestrian mortality.

As seriously underreported statistics may mislead the policy-making for pedestrian safety promotion, we attempted to reassess the magnitude of the problem using non-police data. Chinese government founded the Disease Surveillance Points system (DSP) in 1978 and expanded it to include death certificate data in 2004[5], offering an alternative way of examining pedestrian mortality. To provide the base for the Global Burden of Disease study and the policy-making for road traffic safety of China, we used the DSP data to estimate pedestrian mortality from 2006 to 2010.

Mortality data came from the DSP system that was established in 1978 and expanded to be nationally representative in 1989. Substantial adjustments were made to the DSP system to further raise the national representativeness between 2005 and 2006[5]. Currently, 73 million population of 161 surveillance points (6% of the total population) are included by the DSP[5]. Data after 2002 were coded using the 10th International Classification of Diseases (ICD-10). The DSP data were adjusted using compartment adjustment method and propensity score method[6]. The police-reported road traffic mortality rates were included as contrast and were obtained from the online China Statistical Yearbook (http://www.stats. gov.cn/tjsj/ndsj/).

Deaths from road traffic pedestrians and pedal cyclists were identified using the external cause of injury mortality matrix for ICD-10[7]. We used Poisson regression to examine the changes in pedestrian mortality rate by adjusting for sex, age, and urban/rural location. Spearman correlation analysis was performed to examine the relationship between pedestrian mortality and per capita gross domestic product (GDP) (Chinese Yuan), and number of civil vehicles (10 000 units).

In the study time period, there were 31 917 pedestrians dying from road traffic crashes in the national disease surveillance points of China (Table 1). Males had higher pedestrian mortality than females (12.5 *vs.* 4.6 per 100 000 population). Rural residents were more likely to die as pedestrians than

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urban residents (unadjusted mortality rate ratio: 1.32, 95% CI 1.23-1.35). The elderly aged 60 years and older had the highest pedestrian mortality (19.1 per 100 000 population).

Between 2006 and 2010, pedestrian mortality rates from DSP data were 13-55 times the mortality for pedestrians and passengers from police-reported data (Figure 1). According to DSP data, the crude pedestrian mortality increased from 7.0 to 10.5 per 100 000 population; whereas the police-reported mortality for pedestrians and passengers decreased from 0.5 to 0.2 per 100 000 population.

Based on DSP data, the annual pedestrian mortality increased by 11% (adjusted MRR: 1.11, 95% CI 1.10-1.12) after adjusting for sex, urban/rural location, and age (Table 2). The analysis for police-reported data was not performed due to the lack of information of covariates. When adjusting age, place and year, males were 2.55 times females dying as pedestrians in a crash. Rural pedestrians had higher risk of dying in a crash than urban pedestrians (adjusted MRR: 1.42, 95% CI 1.39-1.46). The impact of age based on adjusted rates was similar to those based on unadjusted rates.

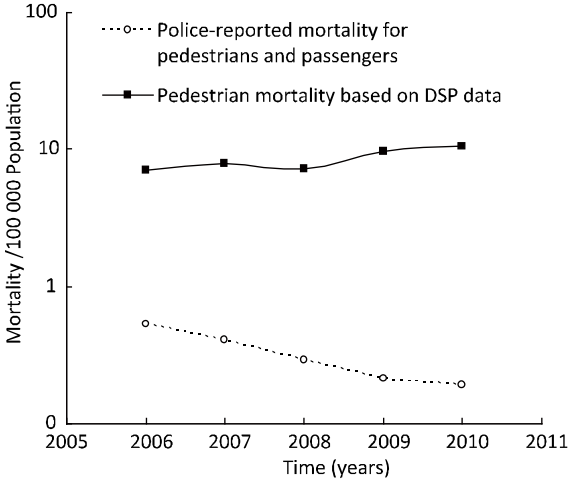

Figure 1. Comparisons for crude pedestrian mortality /100 000 population between police-reported data and DSP data (2006-2010, China). The mortality rates of pedestrians and passengers were combined in police statistics. The 'passenger' here excludes motor vehicle related passengers.

Table 1. Mortality/100 000 Population from Pedestrians during 2006-2010 in China

Variables	Population	Number of Deaths	Mortality	95% CI of MRR†
All deaths	377 085 758	31 917	8.5	
Gender				
Male	184 564 439	23 034	12.5	2.49 (2.43, 2.55)**
Female	192 521 318	8 883	4.6	Reference
Urban/rural				
Urban	136 137 929	9 568	7.0	Reference
Rural	240 947 828	22 350	9.3	1.32 (1.29, 1.35)**
Age groups				
0-4 years	21 289 382	788	3.7	Reference
5-14 years	50 131 778	1 158	2.3	0.62 (0.57, 0.68)**
15-24 years	61 469 042	3 190	5.2	1.40 (1.29, 1.51)**
25-59 years	198 221 568	18 004	9.1	2.44 (2.27, 2.62)**
60 years and over	45 973 989	8 777	19.1	5.13 (4.77, 5.52)**

Note. †: Unadjusted mortality rate ratio. **: $P<0.01$.

Table 2. Poisson Regression Results for Pedestrian Mortality/100 000 Population (China, 2006-2010)

Variables	MRR†	Std. Err.	*Z*	*P*	95% CI of MRR†	
Male (female=ref.)	2.55	0.03	74.77	<0.001**	2.48	2.61
Rural (urban=ref.)	1.42	0.17	28.67	<0.001**	1.39	1.46
Age 5-14 years (0-4 years=ref.)	0.64	0.03	9.80	<0.001**	0.58	0.70
Age 15-24 years (0-4 years=ref.)	1.43	0.06	8.92	<0.001**	1.32	1.54
Age 25-59 years (0-4 years=ref.)	2.56	0.09	25.93	<0.001**	2.39	2.75
Age 60+ (0-4 years=ref.)	5.52	0.20	46.02	<0.001**	5.13	5.94
Year	1.11	0.004	25.21	<0.001**	1.10	1.12

Note. Model fit: LR χ^2=13356.52, $P<0.001$, Pseudo R^2=0.827. †: Adjusted mortality rate ratio. **: $P<0.01$.

Spearman correlation analysis indicated that the overall pedestrian mortality was highly correlated with per capita GDP, number of civil vehicles, respectively, with r_s of 0.90 and 0.90 (P<0.05).

It is the first study to estimate the national pedestrian mortality of China using non-police data. Our findings revealed that police-reported pedestrian mortality rates were merely 2%-8% of those based on DSP data during 2006-2010. In contrast to police-reported downward trend, DSP data displayed a growing trend of pedestrian mortality between 2006 and 2010.

Large gaps between DSP data and police data in pedestrian mortality may reflect the combined effects of inconsistent definition of road traffic death and potentially undercounting within police data. So far, the traffic police still adopt the definition of deaths within 7 days of crash[3], while DSP data do not specify a time limit of road traffic deaths, indicating that deaths out of 7 days of crashes are also counted as road traffic deaths in DSP data. The study by Hu et al. indicated that police data may seriously underestimate road traffic mortality compared with vital registration data of the Ministry of Health of China[1].

Our findings emphasize the severity and growing threat of fatal pedestrian injuries that has not been previously reported. The increasing pedestrian mortality may primarily be the effects of rapidly growing economy and motorization. According to China Statistics Yearbook 2012[8], per capita GDP increased from 16 500 in 2006 to 30 015 Yuan in 2010; the number of civil vehicles more than doubled, rising from 37 to 78 million. The results indicate that China should not be complacent for 'decrease in police-reported pedestrian death rate'. Instead, more efforts are needed to curb the rising pedestrian deaths. First, a long-term, multi-department, and multi-discipline national development agenda for road traffic safety should be established as soon as possible. Although China has initiated the national action plan as the Global Plan for the Decade of Action for Road Safety 2011-2020 suggested[9], almost all activities are limited within the road traffic police department. The lack of multi-department and multi-discipline national development agenda may limit the implementation of global action plan. Second, priorities should be built for pedestrian injury prevention. Environmental and engineering measures like sidewalks, safe islands, cross bridges or tunnels that have been proved much more effective than interventions to change personal behaviors in developed countries[10], need to be introduced to and promoted in China. Third, a data-sharing mechanism should be built among multi-department to use non-police data like DSP to improve data quality of road traffic injuries.

This study has serveral limitations. First, the lack of covariate information such as alcohol use, driving speed, characteristics of crash location and motor vehicles, and personal walking behaviors, prevent us from determining factors that contribute to the recent increase in pedestrian mortality. Second, the unavailability of non-fatal pedestrian injury data restricts the implication of our findings to some degree. Finally, since DSP data rely on the quality of data reporting system in hospitals, it may suffer from incompleteness and/or coding errors, which could lead to both underreported pedestrian fatality in general and underreporting bias between regions (for example, pedestrian fatality may be more likely to be underreported or miscoded in the rural areas).

To conclude, recent under-reported and rising pedestrian mortality merits attention of researchers and policy-makers. Improving pedestrians' safety should be a priority of road traffic injury prevention in China.

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