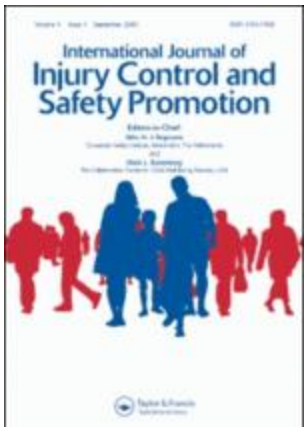

Cost analysis of road traffic crashes in China

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Cost analysis of road traffic crashes in China

Fatalities and injuries resulting from road traffic crashes is always a serious problem. The overall economic losses caused by road traffic crashes are beyond imagination. Including the economic cost of property damage, productivity loss, medical cost, travel delay time cost, legal cost and insurance cost, the total economic cost of traffic crashes in China in 2017 is calculated as 490.1 billion yuan (72.6 billion USD 2017), which is equivalent to 0.60% of the GDP. The cost of productivity loss accounts for the highest proportion of total economic cost, which is 72%. The second is the travel delay cost, accounting for 12%. insurance cost, property damage cost and medical cost are followed. The more serious the injury, the higher the unit economic cost. The unit cost of a crash that caused only property damage is 11,274 yuan. The unit cost of a minor injured crash is 20,223 yuan. The highest unit economic cost is the unit cost of a fatal crash, which is 3,181,394 yuan. This study would provide key insights into the cost-benefit analysis China-related road safety policy.

Keywords: traffic crashes; cost analysis; fatalities and injuries

Introduction

Deaths and injuries resulting from road traffic crashes is always a serious problem. The number of road traffic deaths continues to climb, reaching 1.35 million in 2016 (WHO, 2018). In 2010, there were 32,999 people killed, 3.9 million were injured, and 24 million vehicles were damaged in motor vehicle crashes in the United States (NHTSA, 2015). There was a total of 160,597 casualties of all severities in road traffic crashes in Great Britain that were reported by the police in 2018 (Department of Transport, 2019). And a total of 8.419 million traffic crashes were reported in China in 2017. There were 203,049 accidents involving fatalities and severe injuries, resulting in 63,729 fatalities and 209,654 severe injuries. There were 8.216 million road traffic accidents that caused only car damage or minor injuries, resulting in a slight injury to 1.465 million people (The Ministry of Public Security, 2018).

The overall economic losses caused by road traffic crashes are beyond imagination. Elvik compiled estimates of the total costs of road traffic crashes for 12 countries including UK, Sweden and Germany. These results indicated that road crashes costs amount for 1% to 2% of the gross national product (Elvik, 2010). Wijinen analyzed the national cost of road crashes of 10 high income countries and 7 low and middle income countries indicating that costs are 2.7% of Gross Domestic Product (GDP) on average in high income countries and 2.2% of GDP in low and middle income countries (Wijnen, Stipdonk, 2016). The economic costs of road crashes in USA totaled $242 billion in 2010. The $242 billion cost of vehicle crashes represents 1.6% of the $14.96 trillion real U.S in 2010 (NHTSA, 2015). The evaluation of road crashed cost for India accounts for 0.65% of the GDP in 1999 (Mohan, 2002). The annual cost of road traffic crashes injury in Australia was approximately 17 billion US dollar in 2003, which is approximately 2.3% of the GDP (Connelly, Supangan, 2006) . The total economic cost of road traffic crashes represents a remediable drain on the limited resources of the country.

In 2017, there are 230 million vehicles and 330 million drivers obtained licenses in China (NBSC, 2019). China represents a huge and underserved market for injury control policy and programming. It is self-evident that successful injury control in China will have a significant effect on global totals (Sutter, 2003). However, there is a lack of the research on economic costs of traffic crashes injury in China.

With the aim for filling such a gap, the comprehensive economic cost of road traffic crashes in China in 2017 was evaluated. Considering China's medical, legal, transportation and economy, various types of economic losses related to traffic crashes are calculated.

This paper is organized as follows. The next section describes the method in the study. Following that, all required data and processing details are given. Te subsequent section shows the result and cost components. Te final section provides the discussion and conclusive remarks.

Method

This section describes the method in this paper. The model consists of two parts: crashes incidence and economic costs, as shown in Fig.1. First, the basic crashes incidence data are classified into fatal crashes, severe injured crashes, and simple crashes. And the simple crashes include minor crashes and only property damage crashes. Economic costs are classified into object related cost, human-related cost and other costs. In terms of object related costs, property damage is considered, which representing the value of the damaged vehicle, carry-on property, on-board cargo, infrastructure or other damaged objects. In terms of human-related costs, productivity loss, medical costs and travel delay costs are considered. The productivity loss represents the lost life value of the casualties. Medical costs represent registration fees, medical expenses, treatment fees, surgery fees, inspection fees, hospitalization fees, etc. Travel delay costs represent the value of travel delay time in traffic congestion caused by traffic crashes. In terms of other costs, legal costs and insurance costs are considered. Legal costs represent the lawyer fees and court costs associated with civil and criminal litigation resulting from traffic crashes. Insurance costs represent the operating expenses of insurance companies such as employee wages and administrative office expenses.

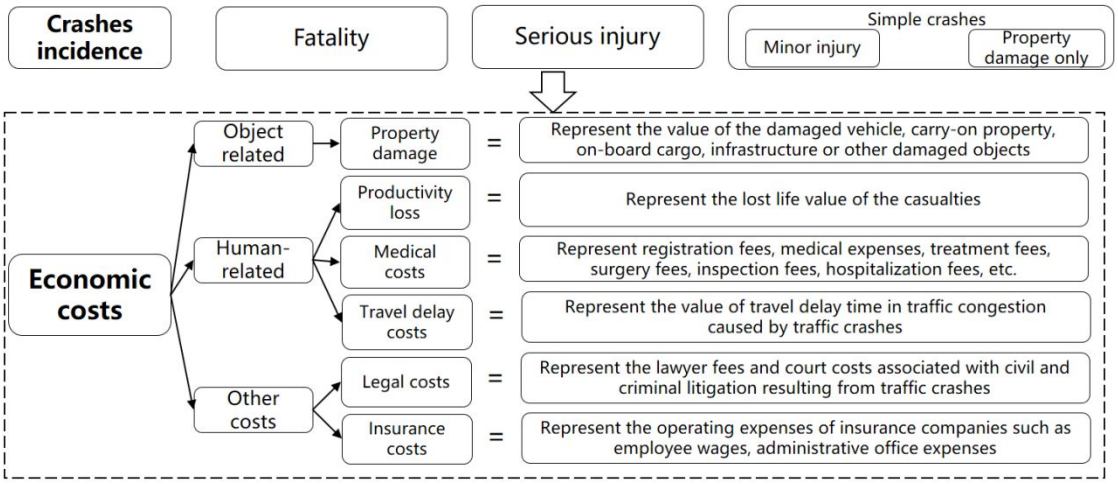

Figure 1. Evaluation model of economic cost of road traffic crashes in China

The total economic cost of road traffic accidents in China in 2017 can be obtained by Eq.(1). The corresponding calculation sub-method for the cost of each type was described in the next section.

$$EC = PD + PL + MC + TDC + LC + IC \quad (1)$$

Where EC means total economic cost of traffic crashes in China; PD means the cost of property damage; PL means the cost of productivity loss; MC means medical costs; TDC means travel delay time cost; LC means legal costs; IC means insurance costs.

Data

This section describes the data used in this study. In section 3.1, a brief description of crashes incidence is given. Following that, the data used in calculating economic cost of property damage, productivity loss, medical cost, travel delay time, legal cost and insurance cost are discussed.

Crashes incidence

The data reported by the police is the main source of crashes data in global road safety studies. They are comprehensive, accurate and reliable, and comparable (Loo, Tsui, 2007). In this study, road traffic crashes data reported by the police is publicly obtained from the 'Annual Report on Road Traffic Accidents of the People's Republic of China (2017)', which is published by the Ministry of Public Security of China (The Ministry of Public Security, 2018).

In order to be combined with the method in this paper, the data is presented in two dimensions: the number of casualties and crashes. The casualties were classified as minor injuries, severe injuries and fatality depending on the severity of the injury. The number of minor injuries, severe injuries and fatalities were 1465527, 209654, 63772, respectively, which was caused by road traffic crashes in 2017 in China. And the distribution of agricultural and non-agricultural population among the number of severe injuries and fatalities was sorted out, as shown in Tab.1 (The Ministry of Public Security, 2018). The proportion of the agricultural population in the number of minor injuries is assumed to be the average of the proportion of fatalities and severe injuries.

Table 1. The distribution of injured people with different injury severity

Casualty	Type	Number of People	Proportion
Minor injury	Agriculture	1264603	86.3%
	Non-agriculture	200924	13.7%
Severe injury	Agriculture	184011	87.7%
	Non-agriculture	25643	12.23%
Fatality	Agriculture	54085	84.81%
	Non-agriculture	9687	15.19%

In terms of the number of crashes, a total of 8.419 million crashes occurred in China in 2017, of which 203,049 were severe injuries and fatalities. One death per fatal crashes was assumed. The incidents of 203,049 were classified as 139,277 severe

crashes and 63,772 fatal crashes. And the proportion of severe crashes and fatal crashes occurring in urban roads and highways was sorted out, as shown in Tab.2 (The Ministry of Public Security, 2018). 67.01% of fatal crashes occurred on highways, while 32.99% occurred in urban roads. 54.80% of severe injured crashes occurred on the highway, while 45.20% occurred in urban roads. Obviously, simple accidents (minor injured or only property damage crashes) occurred more in urban roads because of the lower driving speed. Therefore, the proportion of simple crashes that occurred on urban roads is assumed to be 67.01%.

Table 2. The distribution of crashes at different locations

Type of Crashes	Location	Number of Crashes	Proportion
Simple crashes	Highway	2710601	32.99%
	Urban road	5505830	67.01%
Severe injured crashes	Highway	76324	54.80%
	Urban road	62953	45.20%
Fatal crashes	Highway	42732	67.01%
	Urban road	21040	32.99%

Property damage

The property damage represents the value of the damaged vehicle, carry-on property, on-board cargo, infrastructure or other damaged objects. Among them, infrastructure generally refers to road safety facilities and other facilities on and near the road, such as electricity, water conservancy facilities, houses, trees and flowers. Data on property damage are obtained from the 'Annual Report on Road Traffic Accidents of the People's Republic of China (2017)'. 203 thousand severe injured and fatal crashes caused property damage of 1.2 billion yuan. 82.16 million simple crashes caused property damage of 18.9 billion yuan. In 2017, China's road traffic crashes caused a total of 20.1 billion yuan of property damage. Considering that the equivalent of 100 dollars US is 675.18 yuan RMB in 2017 (National Bureau of Statistics of China, 2019), the property damage of traffic crashes is 2.98 billion dollars in China in 2017.

Productivity loss

Premature death caused by traffic crashes causes the social productivity of the dead to disappear. Injuries caused by road traffic crashes cause social productivity to be discounted or even lost. These are the economic costs of traffic crashes. According to the relevant laws of China, the current death compensation for road traffic crashes is only 20 times the expected annual income of casualties. Compensation for different disability caused by crashes also has a fixed multiple relationship with wages (Chen, 2004). The effectiveness of this type of assessment is questioned by many studies (Qin, Li, and Liu, 2013).

The value of a statistical life (VSL) is used to quantify the loss of productivity in fatality in this study. McMahon suggested that VSL is 70 times of GDP per capita in iRAP project, while the value of a statistical injury (VSI) is expressed as 25% of VSL (McMahon K, 2008). But it turns out that the difference between agricultural and non-agricultural people is very large, and this detail is not reflected in McMahon's study. Qin, Li, and Liu(2013) estimated the value of a statistical life (VSL) in China using the hedonic wage mode and explored the difference between the agriculture and non-agriculture people based on the data in 2006. Their result was adopted in this study after considering the consumer price index during 2006-2017 from National Bureau of Statistics of China.The VSL of agriculture was 1.85 million RMB in 2006 and 2.51 million RMB in 2017 (371.5 thousand US dollar 2017). And the VSL of non-agriculture was 3.95 million RMB in 2006 and 5.34 million RMB in 2017 (791.3 thousand US dollar 2017).

The value of a statistical injury (VSI) is expressed as a fraction of VSL (Kuang, Zhao, Hao, and Liu, 2019). An average ratio of different injury severity levels is calculated, according to the official guidance of U.S. Department of Transportation

(DOT US, 2016).The ratio is defined as cost factor in this study.The cost factor of minor injury is 0.003. And the cost factor of severe injury is calculated as 0.253.

Th productivity loss caused by traffic crashes in China in 2017 could be calculated by Eq.(2).

$$PL = \sum_{i=1}^{3} (VSL_a * N_{a,i} * CF_i + VSL_{na} * N_{na,i} * CF_i) \quad (2)$$

Where PL is productivity loss; VSL_a means the VSL of agricultural population; $N_{a,i}$ means the number of agricultural people with an injury degree of i; CF_i means the cost factor of injury degree of i; VSL_{na} means the VSL of non-agricultural population; $N_{na,i}$ means the number of non-agricultural people with an injury degree of i; i indicates the degree of injury, 1 for minor injuries, 2 for severe injuries and 3 for death.

Medical cost

Medical costs are closely related to the severity of the injury. Data on various medical cost in 2017 comes from the China Health Statistical Yearbook(2018), which is published by the National Health Council of China (NHCC). People who are minor injured need only go to the clinic to do some checks. The average medical expenses for outpatients in 2017 was 257 yuan (NHCC, 2018). Severe injured people need to be hospitalized and treated. The average medical expenses for inpatients in 2017 was 9735.4 yuan, which covers hospitalization, treatment, surgery, and inspection fees. Approximately 84.3% of people with severe injuries are intracranial injuries. The average medical cost of intracranial injury was slightly higher than that of the average inpatient, which was 12,361 yuan. The fatality should also be sent to the hospital for

rescue. Funeral is arranged after confirmation of death. Due to the lack of rescue cost data, the rescue cost is assumed to be the same as the average medical expenses for inpatients. The funeral of death was included in the medical cost. The funeral cost are stipulated by the national law as half of the average annual salary of employed persons, which is 37,159 yuan in 2017. The total medical cost of traffic crashes in 2017 was calculated as 5.872 billion RMB (869.7 million USD 2017) based on the data in Table 3.

Table 3. The medical cost of traffic crashes in 2017 in China

	Minor injury	Severe injury		Fatality	
Type of cost	Outpatients cost	Intracranial injury cost	Other severe injury	Rescue cost	Funeral cost
Number of people	1,465,527	176,627	33,018	63,772	
Per capita cost	257	12361	9735	9,735	37,159
Total medical cost	5.872 billion RMB				

Travel delay time cost

The travel delay cost of traffic crashes is determined by the time for cleaning the crash scene, average traffic volume and average wage. The crash scene handing time of each crash type in China was calculated by Wang, Li, and Guo(2018) based on the historic data and the k-Nearest Neighbor algorithm model, as shown in Table 4. In order to get the average handing time of crashes in China, the distribution of various types of crashes has also been sorted out (The Ministry of Public Security, 2018). Based on the above two sets of data, the average handing time of each crash in China in 2007 is calculated to be 64.34 minutes (1.07 hour).

Table 4. The average handing time of different types of crashes

Type of crash	Rear-end	Sideswipe	Included pedestrian or bike	Rollover	Others
Handing time(min)	28.77	32.24	54.71	87.22	71.50
distribution of types	7.62%	1.55%	22.94%	2.79%	65.10%
Average handing time (min)			64.34		

A model introduced by Koster and Rietveld (2011) and developed by Bardal and Jørgensen (2017) was used to get the average delay time loss caused by crashes, as shown in Eq.(3).

$$ATL = \frac{1}{2}HT(1-\frac{CAP_{crash}}{F}) \quad (3)$$

Where ATL_s means the average time loss per road user; CAP_{crash} means the capacity of the road after the crash; F means the flow of vehicles.

The Eq.(3) shows that the average time loss per road user increases with HT and decreases when the rate of the CAP_{crash} to F. It is assumed that the fatal crash has a great impact on capacity, resulting in the road capacity to be 0. The severe injured crash causes the road capacity to be 1/2 of the flow of vehicles. And the simple crash only has a weak impact on the capacity, resulting in a road capacity to be 3/4 of the flow of vehicles. So, the average time loss per road user is calculated to be $\frac{1}{2}HT$ for fatal crashes, $\frac{1}{4}HT$ for severe injured crashes and $\frac{1}{8}HT$ for simple crashes.

Traffic flow volume is also a key influence factor. The traffic volume of highways is generally higher than that of urban roads. The annual average daily traffic volume (AADT) on urban roads in Shanghai is 68797 vehicles (Sun, Li, and Li, 2016). However, Shanghai is one of the best cities in economic development, and its traffic

flow will be higher than the national average. In order to obtain the AADT of China's urban roads, it is calculated to be 33028 vehicles based on Shanghai's GDP and national GDP in 2017 (National Bureau of Statistics of China, 2019). On the other hand, the AADT of China's highway is considered to be 74129, which is obtained from the AADT of the G42 highway in China (Ding, Zhang, and Zhou, 2019). And, the annual average hourly traffic volume (AAHT) of highway and urban road is calculated based on the AADT.

The total travel delay cost of traffic crashes could be calculated by Eq.(4).

$$\mathrm{TDC} = AW * \sum_{s=1}^{3} (\mathrm{AAHT_u} * ATL_s * N_{u,s} + AAHT_h * ATL_s * N_{h,s}) \quad (4)$$

Where TDC means the travel delay cost; AW means average wage of employed persons; $\mathrm{AAHT_u}$ means annual average hourly traffic volume of urban roads; ATC_s means the average time loss caused by a crash of severity s; $N_{u,s}$ means the number of crashes of severity s occurred on the urban road; $\mathrm{AAHT_h}$ means annual average hourly traffic volume of highway; $N_{h,s}$ means the number of crashes of severity s occurred on the highway.

The average wage per hour of employed persons is obtained based on the yearly wage of employed persons from the National Bureau of Statistics of China. It is assumed that the working time is 8 hours per day. The result of total travel delay cost in China in 2017 is 58.78 billion RMB, as shown in Table 5.

Table 5. The delay time and cost of crashes at different severity

Type of Crashes	Location	AAHT	Number of Crashes	Average time loss per car(h)	Average wage(RMB/h)	Total delay cost(billion RMB)

Simple crashes	Highway	3088.7	2710601	0.13		
	Urban road	1376.2	5505830			
Severe injured crashes	Highway	3088.7	76324	0.27	25.45	58.78
	Urban road	1376.2	62953			
Fatal crashes	Highway	3088.7	42732	0.54		
	Urban road	1376.2	21040			

Legal cost

After a crash occurs, the casualty and the perpetrator may be controversial due to the compensation problem. When the parties are unable to handle the dispute, they will withdraw the lawsuit from the court to defend their rights. This type of traffic crash case is called a civil case of in China. Violation of traffic management regulations, resulting in a major accident, causing serious injury, death or serious loss of public and private property is be recognized as crime of causing traffic casualties and crime of dangerous driving. These are called criminal cases in China. Whether it is a civil dispute or a criminal case, the court needs to deal with it, and the lawyer needs work with it. The legal costs of traffic crashes include litigation costs and attorney fees in both civil and criminal cases.

China Justice big data service platform(CJBDS) is established by the Supreme People's Court of China. In 2017, the number of civil cases arising from road traffic accidents in China reached 336,647. And there were 159,598 criminal cases including crimes of causing traffic casualties and crimes of dangerous driving (CJBDS, 2019).

In Beijing, China, there are two ways to charge for attorney fees in civil cases. The first way to charge is 3,000-10,000 yuan per case. Another way to charge is to charge a certain percentage of the bid amount. The ratio of 100,000 or less is 10% and the ratio of 100,000 to 1 million is 6% (BMCDR, 2010). There is little difference between regions in China. In this study, the attorney fee for civil case is considered to be the average of 3000 and 10000, which is 6500 yuan. The court litigation fee in civil

case is also charged in proportion to the bid amount (SPCC, 2010). This ratio is basically a quarter of the attorney fee. Therefore, the court litigation fee for civil case is assumed to be 1,625 yuan. The attorney fees for criminal cases are charged according to the progress of the case. In the reconnaissance phase, the fee is 2000-10000, the fee for review and prosecution is 2000-10000, and the fee for the first trial is 4000-30000 (BMCDR, 2010). Take the average fee of the three processes to get the attorney fee for each criminal case, which is 29000 yuan. The court don't charge litigation fees for criminal cases. But the operation of the court still has costs. Therefore, the operating cost of the courts in each criminal case is 1,625 yuan, which is the same as the litigation in civil cases.

The total legal cost of Chinese traffic crashes in 2017 was calculated to be 7.62 billion yuan by Eq.(4).

$$LC = \sum_{t=1}^{2} (N_t * (C_{t,court} + C_{t,lawyer})) \quad (4)$$

Where LC means the legal cost; N_t means the number of cases of type t; $C_{t,court}$ means the cost of Court litigation; $C_{t,lawyer}$ means the fee paid to the lawyer; t means the type of cases, 1 represents the civil case, 2 represents the criminal case.

Insurance cost

Compulsory traffic crashes liability insurance for vehicles is a compulsory insurance system stipulated by the state law (The State Council, 2012). The insurance company compensates for the economic losses caused by traffic crashes of the insured motor vehicles and reduces the economic burden of the person who is responsible for the crash. China Banking and Insurance Regulatory Commission (CBIRC) is the official regulatory body of China's insurance industry. The CBIRC summarized all the data of

compulsory traffic crash insurance in 2017. The insurance companies covered 234 million vehicles. In 2017, the total insurance cost of traffic crashes is 46.2 billion yuan in 2017, representing the operating expenses of compulsory traffic crash insurance such as employee wages and administrative office expenses (CBIRC, 2018).

Result & discussion

This section presents the result of this study. Section 4.1 shows the total economic cost and its composition of traffic crashes in China in 2017. After that, Section 4.2 discusses the unit economic cost of traffic crash at different severity.

Total economic cost of crashes

Including the economic cost of property damage, productivity loss, medical cost, travel delay time cost, legal cost and insurance cost, the total economic cost of traffic crashes in China in 2017 is calculated as 490.1 billion yuan (72.6 billion USD 2017), which is equivalent to 0.60% of the GDP. From the perspective of different cost categories, the cost of productivity loss accounts for the highest proportion of total economic cost, which is 72%, reaching 351.7 billion yuan. The second is the travel delay cost, accounting for 12% of the total economic cost, reaching 58.8 billion yuan. The third is insurance cost, accounting for 9% of total economic cost, reaching 46.2 billion yuan, as shown in Fig. 2.

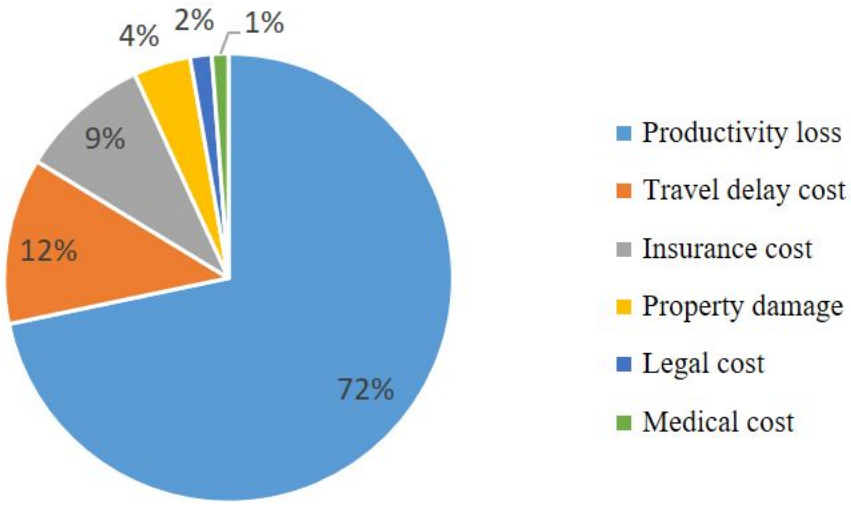

Figure 2. The proportion of different cost to total economic cost of traffic crashes in China in 2017

The cost of travel delay is so high that it cannot be ignored in assessment of the national economic cost of crashes. The cost of travel delay is closely related to the country's economic development. The traffic volume of expressways and urban highways is high in economically developed countries. At the same time, hourly wages of employed people would be higher.

From the perspective of the severity of the crash, the economic cost related to fatal crashes accounts for the highest proportion of total economic cost, which is 41%. The second highest is related to severe injured crashes, accounting for 37%. And the cost related to minor injured crashes accounts for 16%, while property damage only crashes only accounting for 6%, as shown in Fig. 3.

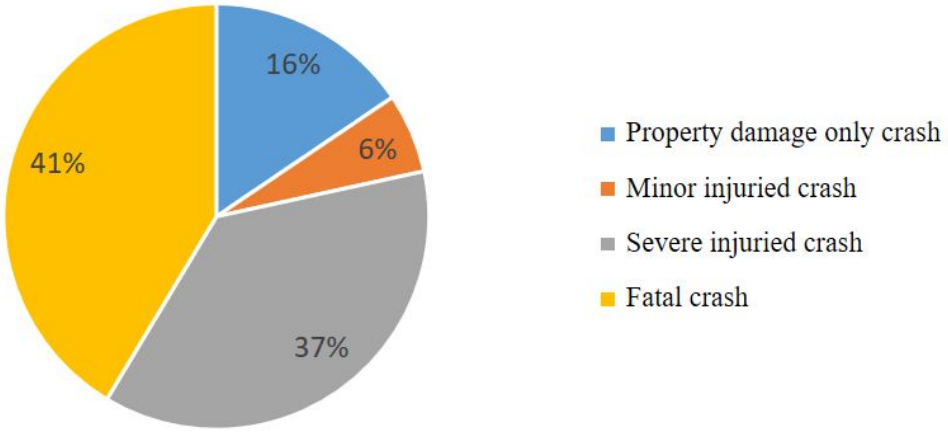

Figure 3. economic costs of traffic crash at different severity in China in 2017

Unit economic cost of the crash

Fig. 4 exhibits the unit economic cost of traffic crash at different severity in China in 2017. The more serious the injury, the higher the unit economic cost. The unit cost of a crash that caused only property damage is 11,274 yuan. The unit cost of a minor injured crash is 20,223 yuan. The unit cost of a severe injured crash is 865,544 yuan. The highest unit cost is the unit cost of a fatal crash, which is 3,181,394 yuan.

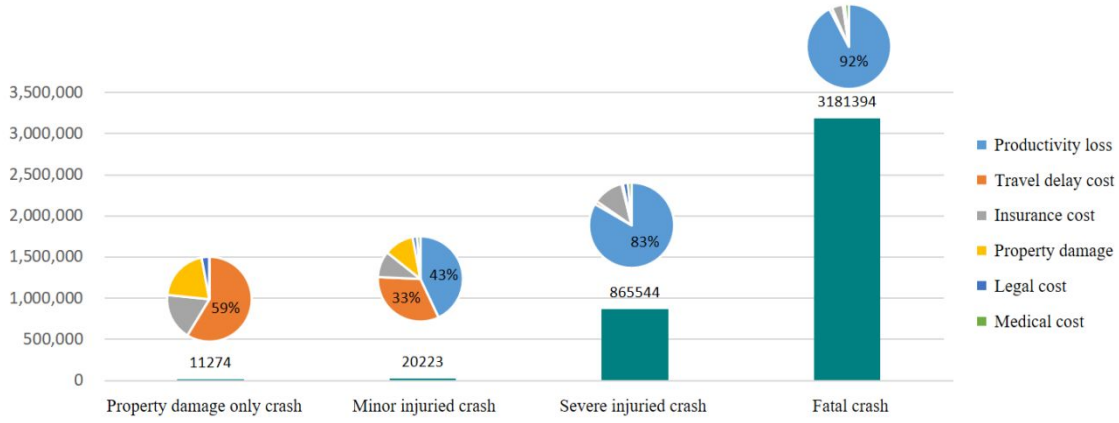

Figure 4. The unit economic cost of traffic crash at different severity in China in 2017

From the perspective of the composition of unit cost, the lower the severity of injury, the higher the proportion of the travel delay cost to unit cost, as shown in Fig.4. Especially in the crash that caused only property damage, the travel delay cost accounts

for 59% of the unit cost. The proportion of travel delay costs of minor injured crash is 33%, while it is only 1% for fatal crashes. The higher the severity of injury, the higher the proportion of the cost of productivity loss to unit cost. The proportion of the cost of productivity loss to the unit cost of minor injured crashes is 43%. The cost of productivity loss in severe injured crashes accounts for 83%, while it is highest in fatal crashes, reaching 92%.

Comparison between countries

Acceptable estimates of road accident costs have been found for the following countries: US(NHTSA, 2015); Australia(Connelly L B, Supangan R, 2006); UK(Kilbey P, Wilson D, Beg O, et al. 2013); India(Mohan D, 2002); Bangladesh(Government of the People's Republic of Bangladesh, 1998). In general, the total economic cost of traffic crashes is equivalent to 0.5%-3.6% of the country's GDP, while the number is 0.6% for China. The reason for the relatively low proportion is that the per capita GDP is relatively small, and the unit cost caused by the Chinese crash is far lower than that of the United States, Australia, and the United Kingdom. At the same time, the total GDP value is relatively large. From the perspective of composition, the cost of productivity and life value loss accounts for more than 60% of the total economic cost of traffic crashes in each country. The average cost of travel delay of countries accounts for about 10%, which cannot be ignored in the economic cost assessment of crashes, and some results of assessment in some countries do not take into account the travel delay caused by crashes.

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Supplemental Materials

The data used to support the findings of this study are available from the corresponding author upon request.

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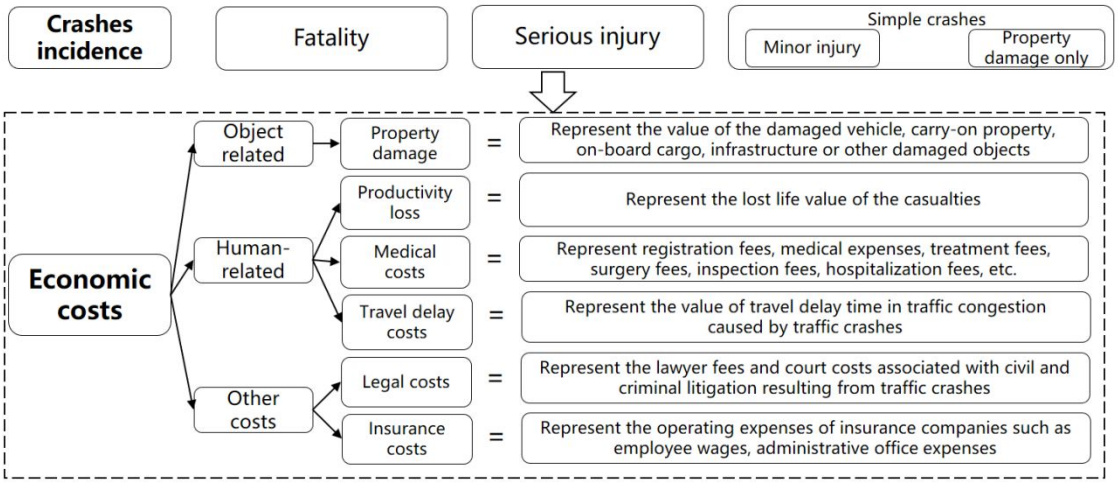

Figure 1. Evaluation model of economic cost of road traffic crashes in China

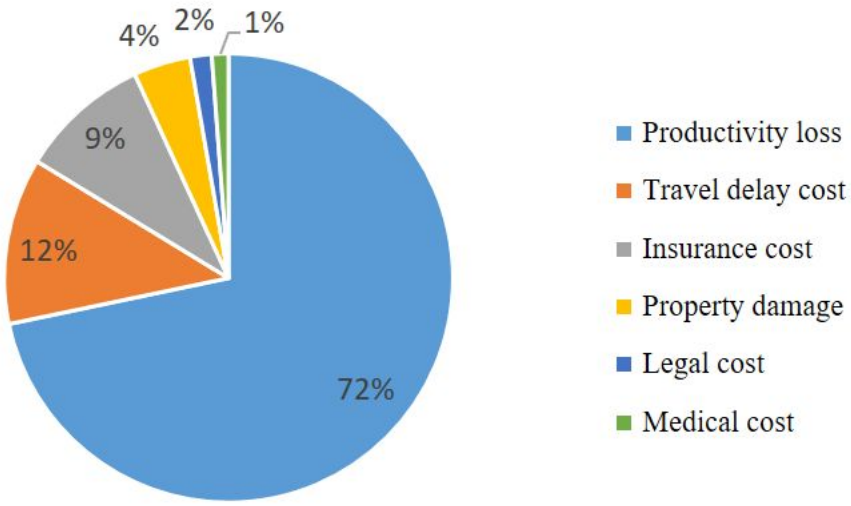

Figure 2. The proportion of different cost to total economic cost of traffic crashes in China in 2017

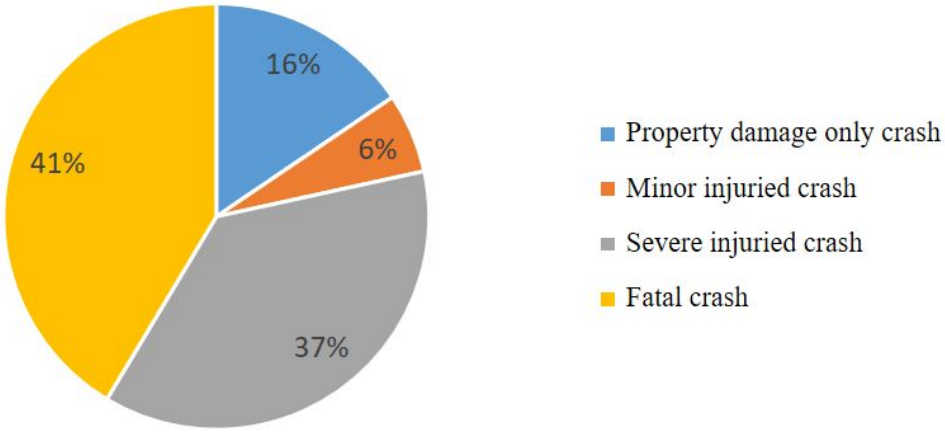

Figure 3. economic costs of traffic crash at different severity in China in 2017

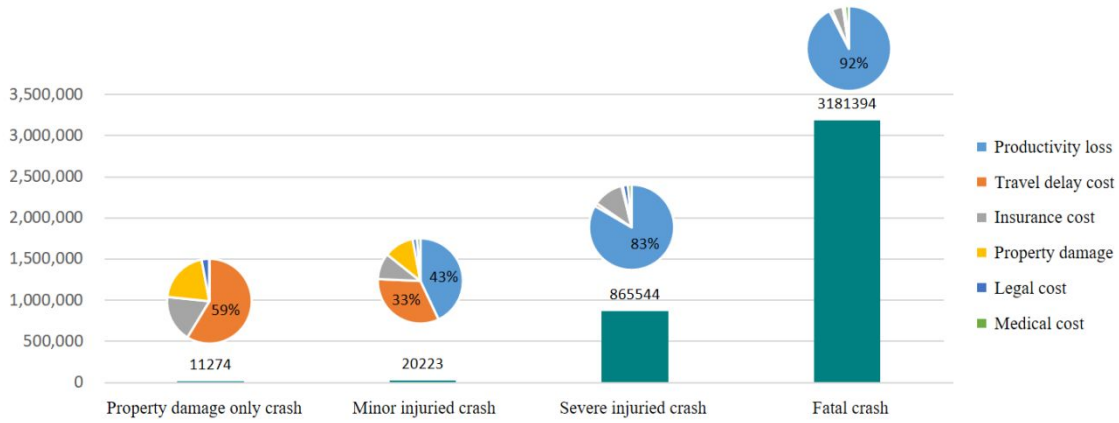

Figure 4. The unit economic cost of traffic crash at different severity in China in 2017

Table 1. The distribution of injured people with different injury severity

Casualty	Type	Number of People	Proportion
Minor injury	Agriculture	1264603	86.3%
	Non-agriculture	200924	13.7%
Severe injury	Agriculture	184011	87.7%
	Non-agriculture	25643	12.23%
Fatality	Agriculture	54085	84.81%
	Non-agriculture	9687	15.19%

Table 2. The distribution of crashes at different locations

Type of Crashes	Location	Number of Crashes	Proportion
Simple crashes	Highway	2710601	32.99%
	Urban road	5505830	67.01%
Severe injured crashes	Highway	76324	54.80%
	Urban road	62953	45.20%
Fatal crashes	Highway	42732	67.01%
	Urban road	21040	32.99%

Table 3. The medical cost of traffic crashes in 2017 in China

	Minor injury	Severe injury		Fatality	
Type of cost	Outpatients cost	Intracranial injury cost	Other severe injury	Rescue cost	Funeral cost
Number of people	1,465,527	176,627	33,018	63,772	
Per capita cost	257	12361	9735	9,735	37,159
Total medical cost	5.872 billion RMB				

Table 4. The average handing time of different types of crashes

Type of crash	Rear-end	Sideswipe	Included pedestrian or bike	Rollover	Others
Handing time(min)	28.77	32.24	54.71	87.22	71.50
distribution of types	7.62%	1.55%	22.94%	2.79%	65.10%
Average handing time (min)			64.34		

Table 5. The delay time and cost of crashes at different severity

Type of Crashes	Location	AAHT	Number of Crashes	Average time loss per car(h)	Average wage(RMB/h)	Total delay cost(billion RMB)
Simple crashes	Highway	3088.7	2710601	0.13	25.45	58.78
	Urban road	1376.2	5505830			
Severe injured crashes	Highway	3088.7	76324	0.27		
	Urban road	1376.2	62953			
Fatal crashes	Highway	3088.7	42732	0.54		
	Urban road	1376.2	21040			