

## Report from the Field

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# Epidemiological Characteristics, Risk Factors, and Preventive Measures of Occupational Injuries Among Commercial Couriers in China Before and During the COVID-19 Pandemic

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## Abstract

In this study, we focus on the significant upward trend of occupational accidental traffic injuries in commercial couriers during the coronavirus disease (COVID-19) pandemic. This review comments on the characteristics of occupational accidental injuries of commercial couriers in China and then discusses the reasons of the high incidence rate and associated risk factors. Various potential protective measures were also explored to prevent and control the occupational injuries in this vulnerable worker group.

## Commercial Couriers in China

New types of employment have emerged with the rapid development of the Internet<sup>+</sup> in recent years. Commercial courier businesses have become a new dynamic part China's economic growth. According to the national statistics, new industries, new business forms, and new developing models increased the gross domestic product (GDP) in China by approximately 15.3% in 2016.<sup>1,2</sup> Among them, the express delivery business has developed very rapidly in the last decade, with both business volume and number of employees growing rapidly in China.<sup>3</sup> Data also show that the growth rate of Chinese express delivery companies is 4 times that of the GDP growth rate.<sup>4</sup>

Similar to the express delivery business, the food delivery business has had an explosion of growth. By June 2018, food delivery customers had reached 150 million in China, that is, about 10% of the Chinese people. The newest data show that number will exceed 300 million in the near future.<sup>5</sup> The great demand for food delivery has also attracted a large number of couriers, nearly 10 million workers. According to data from the State Post Bureau of China, as of November 16, 2020, the annual volume of express deliveries in China exceeded 70 billion for the first time.<sup>6</sup> The express delivery business has developed very rapidly, and both business volume and number of employees have grown rapidly in China in the last decade (Table 1, Figure 1).

With the rapid development of these new industries, the number of employees, mainly couriers, has also increased quickly. In this paper, we narrowed the definition of commercial couriers to only those using electrically powered scooters as their vehicle, and we excluded peddle bike riders and truck/lorry drivers.

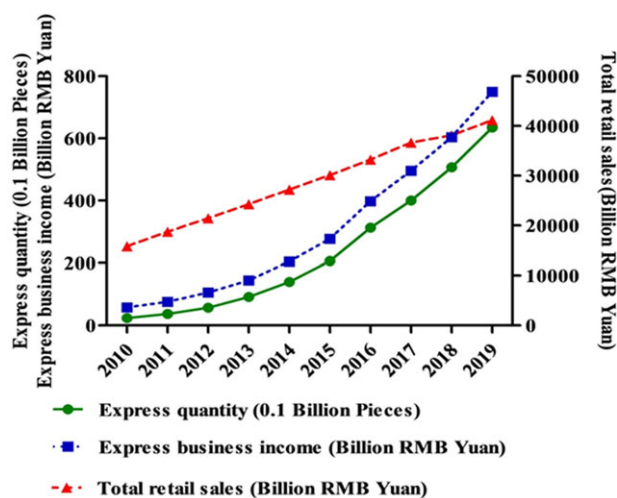
Currently, there is still a lack of an accurate number estimating total Chinese couriers nationwide. The estimated numbers of couriers in different time periods are shown in Table 2.<sup>7</sup>

On June 9, 2020, a report analysis showed that the number of delivery workers continued to grow during the COVID-19 pandemic. At present, the total number of couriers, including part-time workers, in China, is as high as 10 million, and it is far more than any other country around the world.<sup>8</sup>

A study in the United States in 2019 revealed the relationship between freight vehicles and road traffic safety in the era of e-commerce.<sup>9</sup> The growing population of couriers has brought convenience to consumers and developed this new industry. These couriers mainly include food and express commercial delivery workers who ride electric motorcycles, electric bikes, and motorcycles. However, the rise of the delivery industry has also resulted in a high incidence of traffic accident injuries. Occupation risk categories for couriers rank workers into 4 or 5 categories. Level 5 is the highest risk level. Their risk is much higher than that of other occupations, and protection from occupational injury among employees is also urgently needed.<sup>1,2,10</sup>

**Table 1.** Characteristics related to express delivery in China from 2010 to 2019

Year	Express quantity (10 <sup>4</sup> pieces)	Express business income (10 <sup>4</sup> RMB Yuan)	Total retail sales of social consumer goods (Billion RMB Yuan)
2010	233 891.99	5 746 029.84	15 800.80
2011	367 311.08	7 579 878.21	18 720.58
2012	568 547.99	10 553 324.22	21 443.27
2013	918 674.89	14 416 815.26	24 284.28
2014	1 395 925.30	20 453 586.23	27 189.61
2015	2 066 636.84	27 696 465.85	30 093.08
2016	3 128 315.11	39 743 601.32	33 231.63
2017	4 005 591.91	49 571 088.76	36 626.16
2018	5 071 042.80	60 384 253.78	38 098.69
2019	6 352 290.97	74 980 000.00	41 164.90
Total	24 108 228.88	311 125 043.47	286 653.00

**Figure 1.** The tendency of express delivery related indicators in China from 2010 to 2019.

### Epidemiological Characteristics of Occupational Injury Among Commercial Couriers

Several studies have reported on the characteristics of the courier occupation. A monographic study reported that, in Beijing, there were 463 service sectors engaged in the courier occupation in 2019, and it showed that the proportion of male employees was as high as 96%.<sup>2</sup> The study showed 46.85% of couriers worked 8–10 hours a day, and 33.69% of couriers worked 10–12 hours a day. Nearly 20% of couriers worked for more than 12 hours. About 60% of couriers had 2 days off or less each month.<sup>6</sup>

The education level of couriers is generally low, and nearly 80% are from rural areas. More critically, 59.01% of couriers felt pressure from their work.<sup>2,6</sup> At present, couriers face 3 problems: The first one is lack of professional dignity, the second is that the regulatory standards for the use of express vehicles such as electric motorcycles has not been issued yet, and the third is that the income of couriers needs to be improved.<sup>6</sup> The majority are under 40 years old, and more than half have worked for less than 3 years.<sup>7</sup>

Unfortunately, we found that occupational injuries had proliferated over recent years. At present, the salary of couriers is closely related to how many pieces the courier can deliver. Electric motorcycles and electric bicycles are the most important vehicles for e-commerce and are used by almost 100% of couriers.<sup>11</sup>

Electric motorcycles and electric bicycles are important vehicles because of their ability to avoid congested traffic delays and for their ease when parking on narrow streets. Moreover, electric motorcycles and electric bicycles are more economic than oil burning motorcycles. Until recently driver's licenses were not mandatory for driving them in China. A study investigates the characteristics of crashes and traffic signal violations caused by motorcycle couriers in Korea.<sup>12</sup> Of the 671 injured couriers, 67.5% of motorcycle crashes were described as “rider overturned alone,” 73.5% of crashes were in the daytime, and 77.2% occurred on cloudy or clear days.<sup>12</sup>

A report of electric bicycle accidents in China showed that there was a total of 56 200 road traffic accidents caused by electric bicycles throughout the country from 2013 to 2017, and the number of accidents and deaths caused by electric bicycles has increased year by year.<sup>13</sup>

In this high-risk occupation, about 33% of couriers and food delivery riders have been injured in their work.<sup>2</sup> Among them, 78% were injured in traffic accidents, 14% had suffered other accidental injuries, 17% had suffered heat stroke, and 20% were injured by other people.<sup>2</sup>

In the first half of 2017, according to data released by Nanjing city, China, there were, on average, 18 traffic accidents related to couriers every day and a total of 3200 accidents. During the same period in the Shanghai Municipality, there were 76 traffic accidents in the food delivery industry, with 1 death every 2.5 days, and more than 15% of people had experienced traffic accidents.<sup>1,5</sup>

A study from Brazil found that 39.6% of motorcycle couriers reported more than 1 traffic accident in the previous 12 months. Significant differences were observed in climatic conditions, time of the day, prehospital care, and hospital admission rate. The study revealed the susceptibility of motorcycle couriers to traffic accidents and suggested the need for measures to effectively intervene and specific prevention policies.<sup>14</sup>

Another study on 740 motorcycle couriers in southern Brazil found that the characteristics associated with accidents were young driver age, the use of cell phones while driving, and speeding. The study revealed the need to adopt wide-ranging strategies to reduce accidents, including better work conditions for motorcyclists.<sup>15</sup>

### Risk Factors of Occupational Injury Among Commercial Couriers

In the present study, the risk factors of occupational injury for couriers were summarized and reported in 2 categories: objective conditions and subjective reasons.

The first aspect was objective conditions. This includes inadequate protective equipment, overwork, and stress. A survey on 463 couriers found that their protective equipment was very simple. Only 71% of couriers were equipped with helmets, and 47% carried out regular maintenance on their electric vehicles. Moreover, couriers were responsible for providing protective equipment for themselves.<sup>2</sup> For a common occupational safety risk such as traffic accidents, e-commerce platform/companies are not taking responsibility for driver protective equipment and vehicle maintenance.<sup>2</sup> The quality of various electric motorcycles/bicycles varies, and the laws and regulations for businesses and workers using these vehicles are new and imperfect.

A study showed that couriers had a heavy work burden and showed an overall trend of overwork. Long work hours and competitive pressure among drivers were important factors influencing

**Table 2.** Number of delivery employees in different periods

Time	Number of delivery employees	Reference or data source	Information authority level*
Year 2010	Reach to 0.60 million	<a href="http://www.hdtawl.cn/a/news/17.html">http://www.hdtawl.cn/a/news/17.html</a> and Ref. 9	Semi-official
At the end of 2012	About 0.90 million	<a href="https://zhidao.baidu.com/question/84755815.html">https://zhidao.baidu.com/question/84755815.html</a>	Non-official
At the beginning of 2016	About 1.183 million	Ref. 4	Semi-official
Year 2017	About 2.295 million	Ref. 4	Semi-official
At the beginning of 2016	Reach to 2.033 million	Ref. 9	Semi-official
August 9, 2018	Increased 50% from 2016 to 2018, and beyond 3.00 million	People's Daily Online. <a href="http://finance.people.com.cn/n1/2018/0809/c1004-30219620.html">http://finance.people.com.cn/n1/2018/0809/c1004-30219620.html</a>	Official
At the end of 2019	Beyond 3.20 million	<a href="http://news.gao7.com/article/961906-20200114-1">http://news.gao7.com/article/961906-20200114-1</a>	Non-official

\*Official: data source from government, such as "People's Daily Online"; semi-official: data partly from the government; non-official: data only from society organizations.

couriers.<sup>10</sup> Under heavy stress, accidents and injuries are more likely to occur.

This study's second aspect is subjective reasons. The present study defined these to mainly include reasons such as "not insisting on wearing a helmet," "weak safety awareness," and "bad traffic habits." According to a report in Shanghai, total electric bicycle traffic casualties increased from 13.8% to 20.5% from 2008 to 2013, of which traumatic brain injury accounted for 68.9% of the injuries. The use of safety helmets has been proven to be one of the most effective interventions for road safety. Correct use of helmets can reduce 72% of serious injuries and approximately 40% of deaths.<sup>16,17</sup> However, there are couriers who choose not to wear a helmet when they are working.

On the other hand, weak safety awareness and bad traffic habits were found to be an important risk factor of courier injury. The most common traffic habits of couriers were to exceed the speed limit, drive through crosswalks, and to drive using a mobile phone in 1 hand. Other habits included riding an electric bicycle retrograde to traffic flow, running a red light, and riding in the motor vehicle lane.<sup>18</sup> Byun et al. found that, although total injury rate decreased, young food delivery riders commonly violated traffic laws and had serious injuries.<sup>19</sup>

### Preventive Measures to Control Occupational Injuries Among Couriers

Based on the analyses of the above risk factors, there are 7 preventive measures we identified to help control occupational injuries among commercial couriers in China. Among these measures, the first 4 are measures that require action by the courier, while the last 3 measures are government actions.

#### Improve Company Orientations

Every courier must have a strict and professional orientation before starting the job, including lectures on wearing the safety equipment and obeying traffic rules. The company trainer and the local traffic management department must regularly educate couriers on traffic safety rules. It is necessary to establish consequences for violators. Each courier must sign a traffic safety commitment letter before starting the job. Moreover, for high-risk delivery persons who have multiple traffic violations and accidents, they must study traffic safety laws and regulations again, watch traffic accident videos,

and practice as a director of traffic to improve their traffic safety awareness.<sup>13</sup>

#### Wearing a Helmet Is Mandatory

A study in Shanghai showed that the helmet-wearing rates of couriers were 34.14% and 10.18% in food delivery persons and express delivery persons, respectively, with more helmets worn in winter than in summer.<sup>16,17</sup> Although their correct wearing rate is relatively high compared to that of the general public in China, it is far below the helmet wearing rate of other countries with helmet laws. It is urgent to enact legislation related to helmets, and specific occupations must be forced to wear helmets when working. In this way, we can effectively reduce the road traffic injuries and deaths induced by electric bicycles.<sup>16,17</sup>

#### Health Education and Avoiding Driving with Fatigue

The couriers' health needs to be emphasized. The government and companies should guide couriers to pay more attention to their own health related to work duties. Couriers commonly disregard their own health and often drive with fatigue for the immediate economic benefits.<sup>9</sup>

#### Establish a License Credit System

A database of drivers, each with credits reflecting their traffic violations, should be used by all online ordering platforms and companies. All couriers in the database without sufficient credits should not be hired.<sup>18</sup> A credit disciplinary mechanism where delivery companies and police report monthly traffic violations and accidents for each courier needs to be established. By introducing driver license credits for couriers, couriers would see consequences for multiple serious traffic violations and traffic accidents, and delivery companies could fire them and even prohibit them from driving.<sup>13</sup>

#### Improve Management of Transportation Resources

Although it is believed that the increase in traffic investments as GDP increases can significantly reduce the number of road traffic casualties in China, there are still problems in road design, distribution of road resources, and traffic management in China.

Therefore, better management of transportation resources can improve road traffic safety.<sup>20</sup>

### Speed Limits for Electric Vehicles

Generally speaking, if the driving speed of electric vehicles does not exceed 30 km/h, the probability of accidents is very low. Even if accidents occur, they involve mostly minor collisions or scratches, which are not likely to cause serious injuries. Therefore, a specific speed limit for electric vehicles is very necessary.<sup>11</sup> Newly manufactured electric vehicles are configured to meet national standards (speed  $\leq$  25 km/h, weight  $\leq$  55 kg, motor power  $\leq$  400 W, and battery voltage  $\leq$  48 V), and electric delivery vehicles that exceed those standards should be removed from production.<sup>13</sup> It is worth noting that the delivery time limit for couriers must be extended accordingly.

### Delivery Vehicles Must Be Licensed

The government should require delivery companies to implement clear record systems that pair employees with the license plate of their vehicle. By this means, it would be easy to trace and identify the courier when they break the rules, and suspend their driver license. Enterprises or companies should be required to use standard delivery vehicles and register them in advance.<sup>13</sup>

It is necessary to establish a searchable database for delivery vehicle traffic violations. It is also essential to require the food delivery and commercial express companies to establish a public traffic violation reporting platform or phone hotline, and encourage the public to report traffic violations of couriers.<sup>13</sup>

### Conclusion

In summary, this study highlights the characteristics of occupational accidental injuries in the commercial courier businesses in China, discussing reasons for the high accident rate and related risk factors. Finally, various potential protective measures are also explored to prevent and control the occupational injuries of courier drivers.

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**Ethical standards.** This study did not involve the collection of human participants or animal samples directly, and the study used only available data to do retrospective analyses. So formal consent was not required and IRB approval could be exempted.

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