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

Xiuquan Shi1,2, Miao Qi1, Xiuli Hu1, Guojia Qi1 and Ping Yuan1

1Department of Epidemiology and Health Statistics, School of Public Health, Zunyi Medical University, Zunyi, Guizhou, China and 2Center for Injury Research and Policy and Center for Pediatric Trauma Research, The Research Institute at Nationwide Children’s Hospital, The Ohio State University College of Medicine, Columbus, Ohio, USA

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+ in recent years. Commercial courier businesses have become a new dynamic part of 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. 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.4 Data also show that the growth rate of Chinese express delivery companies is 4 times that of the GDP growth rate.

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 the number will exceed 300 million in the near future.5 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.6 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 2.7 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.8

A study in the United States in 2019 revealed the relationship between freight vehicles and road traffic safety in the era of e-commerce.9 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.1,2,10

References

1. Shi X, Qi M, Hu X, Qi G, Yuan P. Epidemiological characteristics, risk factors, and preventive measures of occupational injuries among commercial couriers in China before and during the COVID-19 pandemic. Disaster Med Public Health Prep. 2022. doi: https://doi.org/10.1017/dmp.2022.86.

2. Commercial Couriers in China

3. Keywords: commercial couriers; COVID-19 pandemic; epidemiological characteristics; occupational injuries

4. Corresponding author:
Xiuquan Shi,
Email: xqshi@zmu.edu.cn.

© The Author(s), 2022. Published by Cambridge University Press on behalf of Society for Disaster Medicine and Public Health, Inc.
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%. The study showed 46.85% of couriers worked 8–10 hours a day. Nearly 20% of couriers worked for more than 12 hours a day. Nearly 20% of couriers worked for more than 12 hours a day. About 60% of couriers had 2 days off or less each month. About 60% of couriers worked for more than 12 hours. About 60% of couriers had 2 days off or less each month.

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. 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. The majority are under 40 years old, and more than half have worked for less than 3 years.

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. 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. 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.

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.

In this high-risk occupation, about 33% of couriers and food delivery riders have been injured in their work. 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.

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.

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.

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.

**Epidemiological Characteristics of Occupational Injury Among Commercial Couriers**

**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. 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. 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...
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. 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. Byun et al. found that, although total injury rate decreased, young food delivery riders commonly violated traffic laws and had serious injuries.

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.

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. 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.

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.

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. 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.

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.20

**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.11 Newly manufactured electric vehicles are configured to meet national standards (speed ≤ 25 km/h, weight ≤ 55 kg, motor power ≤ 400 W, and battery voltage ≤ 48 V), and electric delivery vehicles that exceed those standards should be removed from production.13 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.13

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.13

**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.

**Funding statement.** This project was funded by the National Natural Science Foundation of China (No.82060602, PI: Xiuquan Shi).

**Conflict(s) of interest.** The authors report no conflicts of interest in this work.

**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.

**References**

1. Hao YL. A study on the difficulties and countermeasures of work-related injury protection of new forms of business employees. *J China Univ Labor Relat*. 2018;32(6):98-107. In Chinese with English abstract.

2. Huang LP, Hao ZX. Investigation report on occupational injury protection of employees in new business forms—a case study of express employees in Beijing. *Labor Protect*. 2020;3:85-88. In Chinese.

3. China Express Development Index Report in 2019. State Post Bureau. Updated March 27, 2020. Accessed September 6, 2021. [http://spb.gov.cn/xw/dtxx_15079/202003/202003327_2068989.html](http://spb.gov.cn/xw/dtxx_15079/202003/202003327_2068989.html)

4. China Express Development Index Report in March 2018. State Post Bureau. Updated April 13, 2018. Accessed September 6, 2021. [http://spbj.spb.gov.cn/xydtt_5428/201804/t20180413_1540134.html](http://spbj.spb.gov.cn/xydtt_5428/201804/t20180413_1540134.html)

5. The High Incidence of Takeaway Food Delivery Traffic Accidents: The Accident Rate of Couriers Is Astonishing as They Are Catching Up with the Time. China Central Television (CCTV) network. Updated September 14, 2017. Accessed September 6, 2021. [http://news.cctv.com/2017/09/14/ ARTIuEAEaln7x2f5J5/2ZH32LE170914.shtml](http://news.cctv.com/2017/09/14/ARTIuEAEaln7x2f5J5/2ZH32LE170914.shtml)

6. The Express Delivery in China Exceeded 70 Billion for the First Time. State Post Bureau of China. Updated November 16, 2020. Accessed November 3, 2021. [https://view.inews.qq.com/a/20201117A0C7T200](https://view.inews.qq.com/a/20201117A0C7T200)

7. Research Report on National Socialized e-Commerce Logistics Practitioners. Beijing Jiaotong University, Alibaba Research Institute, Cainiao Network. Updated October 29, 2016. Accessed September 6, 2021. [http://www.199t.com/archives/530975.html](http://www.199t.com/archives/530975.html)

8. Analysis Report on China’s Express Industry Market Outlook and Future Investment Strategy in 2020-2025. Academia Sinica Industry Research Institute. Updated June 9, 2020. Accessed September 6, 2021. [http://it.chinainm.info/news/20200609/101407363.html](http://it.chinainm.info/news/20200609/101407363.html)

9. McDonald N, Yuan Q, Naumann R. Urban freight and road safety in the era of e-commerce. *Traffic Inf Prev*. 2019;20(7):764-770.

10. Lin Y, Li XH, Li YR. Empirical research on employment and overwork situation of couriers—based on the investigation of 1214 couriers in Beijing. *China Circ Econ.* 2018;32(8):79-88. In Chinese with English abstract.

11. Zeng MG, Lin H, Lin Q. Study on speed limit strategy of electric tricycle for express special based on multi-game model. *Chin J Manag Sci*. 2016;24(Special Issue):122-127. In Chinese with English abstract.

12. Shin DS, Byun JH, Jeong BY. Crashes and traffic signal violations caused by commercial motorcycle couriers. *Saf Health Work*. 2019;10:213-218.

13. Jiao X. The traffic management bureau of the ministry of public security has established five innovative mechanisms, to strengthen the governance of illegal electric bicycles in the food delivery industry. *Automob Saf*. 2018;4(5):44-45. In Chinese.

14. Soares DF, Mathias TA, da Silva DW, et al. Motorcycle couriers: characteristics of traffic accidents in southern Brazil. *Revista Brasileira de Epidemiologia*. 2011;14(3):435-444.

15. Silva DW, Andrade SM, Paula Soares DFP, et al. Factors associated with road accidents among Brazilian motorcycle couriers. *Sci World J*. 2012;2012:e605480.

16. Yu Y, Peng JJ, Li QF, et al. Helmet wearing among e-bikers in Shanghai: on-site observational study. *Shanghai J Prev Med*. 2018;30(9):730-734. In Chinese with English abstract.

17. Global Status Report on Road Safety 2015 [M]. World Health Organization, 2015. Updated December 7, 2018. Accessed September 6, 2021. [https://www.who.int/violence_injury_prevention/road_safety_status/2015/en/](https://www.who.int/violence_injury_prevention/road_safety_status/2015/en/)

18. Lu SC. Traffic bad habits often lead to accidents, set a “slow down button” for couriers. *People’s Traffic*. 2018;6:20-22. In Chinese.

19. Byun JH, Park MH, Jeong BY. Effects of age and violations on occupational accidents among motorcyclists performing food delivery. *Work*. 2020;65(1):53-61.

20. Sun LL, Liu D, Chen T, et al. Road traffic safety: an analysis of the cross-effects of economic, road and population factors. *Chin J Traumatol*. 2019;22:290-295.