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A comparison of characteristics between food delivery riders with and without traffic crash experience during delivery in Malaysia

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ABSTRACT

The rapid development of e-commerce and the spread of the COVID-19 virus created many new jobs opportunity including food delivery riders known as P-Hailing riders. The number of food delivery riders has increased drastically, especially in Malaysia. Consequently, the number of food delivery riders involved in traffic crashes also increased. This study aimed to examine the characteristics of food delivery riders involved in traffic crashes during delivery and to compare with the characteristics of food delivery riders without any traffic crash history. This paper explores and compares general characteristics, previous experience of working and receiving traffic tickets, and knowledge of road safety. Due to unavailable official records about the number of active food delivery riders in Malaysia, this study focuses on riders who registered as members of the Malaysian P-Hailing Association, PENGHANTAR. A total of 225 food delivery riders participated in the online survey conducted through Google Form. Categorical data analysis techniques were used to examine the different characteristics of food delivery riders with and without traffic crash experiences. Results show that the odds ratio of young and full-time riders are respectively about 2.05 times and 1.79 times higher than being involved in traffic crashes. Other factors that increase the odds of being involved in traffic crashes include having more than two years of experience in delivery, an average distance travelled of >100 km a day, working previously in the food and grocery sector, and without working experience. The findings from this study will help related agencies to design and develop awareness programs targeting this group of riders.

1. Introduction

The rapid development of electronic commerce (e-commerce) has changed traditional business models around the world. In 2016, e-commerce generated approximately US$400 billion in the United States, EUR 601 billion in Europe, and US$11 billion in South Asia (Nair, 2017). In Malaysia, there have been upward trends in the e-commerce industry in recent years. For example, in 2017, the e-commerce business value was US$3.6 billion and rose to US$8 billion in 2019 (Morgan, 2020). Among the biggest growth areas in the e-commerce industry is food delivery services. It is projected that by the year 2022, the food delivery business will grow to annual revenue of US$956 million, which is one of the fastest-growing sectors in the food market (Milo, 2018). In early 2020, the world was shocked by the pandemic COVID-19. The Malaysian government has introduced a different approach to combating this pandemic to reduce the number of infected people. For example, during the Movement Control Order (MCO), customers were not allowed to dine in at the restaurants, while during the Conditional Movement Control Order (CMCO) and Recovery Movement Control Order (RMCO), restaurants needed to reduce their seating capacity to maintain social distancing between tables. As an alternative, customers and restaurants are moving to online and delivery services to buy or sell food. Many companies offer food delivery services in Malaysia, including FoodPanda, DeliverEat, Ubar Eats, Grab Food, Lalamove, Honestbee, and Running Man Delivery. These companies have appointed local riders to deliver food and parcels. For example, Foodpanda has 30,000 riders working for them around the country (Murugiah, 2021). This scenario created a new job opportunity, and most were food delivery riders, also known as P-Hailing riders in Malaysia. To support the development of the food delivery business, it is important to understand the risk factors

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associated with this job.

The trend of traffic crashes involving food delivery riders has also increased recently worldwide. For example, there are 76 fatal crashes in Shanghai, China involving delivery riders in the first 6 months of 2017 and nearly-one delivery rider died from a traffic crash every 2.5 days (Daily, 2017). In Malaysia, although there is not a specific breakdown for food delivery riders, 66% of the people killed in traffic crashes in Malaysia are motorcyclists (Dave, 2020). Based on three months of crash statistics recorded by the Malaysian Institute of Road Safety Research (MIROS), there are 4 fatalities, 55 serious injuries, and 73 slight injuries were reported from two food delivery services companies, Foodpanda and GrabFood (Tamrin, 2020). The Social Security Organisation (SOCSO) reported there were >150 road traffic crashes involving food delivery riders that happens between March and June 2020 (Bernama, 2021). Additionally, there is often news about crashes involving this group of riders. To avoid the increasing number of fatalities in Malaysia, this issue must be well understood before a targeted countermeasure can be proposed. Intensive study is the only way to understand this issue. However, the research related to the safety of food delivery riders is very limited in Malaysia.

Previous studies identified many risk factors associated with traffic crashes involving food delivery riders. A study conducted in the Republic of Korea analysed the data of motorcycle crashes of 1,310 food delivery workers that have been approved as on-duty industrial crashes since 2015 (Byun et al., 2017). They found that 99.2% of crash-involved food delivery riders were males and 82.6% had less than six months of work experience. Another study also conducted in the Republic of Korea analysed the traffic crashes involving 671 motorcycle curriers and found 50.6% were aged less than 40 years, 49.2% ran a small business of less than five employees, and 47.2% had work experience of less than six months (Shin et al., 2019). Further study by (Byun et al., 2020) about the effect of age and violations on occupational accidents among 1,317 injured motorcyclists performing food delivery in the Republic of Korea. Among injured riders, 67.4% were temporary workers, 76.1% worked in small companies with fewer than five employees, 58.7% in the night time, and 51.5% had work experience of less than one month. They also found that the violation rate decreased with age. A study in two cities in China; Shanghai, and Nanjing found less rest, higher frequency of engaging in risky riding behaviours, and completing more daily orders significantly associated to crash involvement among delivery workers (Zheng et al., 2019). Tran et al. (2022) conducted a study in Ho Chi Minh City, Vietnam found many delivery riders adopt risky riding behaviours due to job pressure, long working hours and financial commitment. It is crucial to know the association between the characteristics of food delivery riders and traffic crash experiences before further action can be taken. However, the amount of evidence available to explain road traffic crashes involving food delivery riders is relatively scarce in Malaysia.

The economic downturn due to the pandemic of COVID-19 has led some people to lose their jobs. As an alternative, they become food delivery riders to earn a living. Food delivery riders earn money based on the number of deliveries that have been made. They will earn more money if they make more deliveries. As for food delivery, they also got pressure from customers about the duration of delivery of food (The-STAR, 2021). Many food delivery riders violate a traffic law to get a high income and avoid complaints from customers. Based on previous research, about two-thirds of the delivery riders disobeyed traffic rules and about one-third committed a serious safety violations including holding their phones in their hands while riding, running red lights, making illegal U-turns, and riding in the wrong direction (Dave, 2020). Among the factors associated with traffic violation behaviours among motorcycle curriers were a small business of less than 5 employees (13.9%), with work experience of less than 6 months (13.9%), on cloudy or clear days (12.4%), at an intersection (29.8%), in the type of “crash with a vehicle” (31.2%), or a deadly traffic crash (35.7%) (Shin et al., 2019). Papakostopoulos et al. (Papakostopoulos and Nathanael, 2021) investigated the intricate interrelationship of occupational factors underlying the risky driving behaviour of food delivery riders in Athens, Greece, with a focus on two serious offenses: red-light running and helmet non-use. They discovered that common health and safety precautions had an impact on serious traffic offenses; instead, they found a relationship between young age and both offenses. However, various work circumstances such as less working experience, use of a personal vehicle on the job, and hourly payment were associated with red-light running behaviours, while intense work pace, high tip income per day, and low concern about vehicle condition were associated with helmet non-use. In Malaysia, (Kulanthayan et al., 2012) conducted a study to determine the factors that influence non-standard safety helmet use by food delivery workers. They found that 55.3% of fast-food delivery workers use non-standard helmets. A study conducted by the Malaysian Institute of Road Safety Research (MIROS) discovered 70% of food delivery riders have broken the traffic regulations during delivery (Supramani, 2021). In addition, this study also reveals that few of traffic violation including stopping within yellow box (57%), red-light running (16%), mobile phone use during riding (15%), riding in opposite direction (7%) and performing illegal U-turns (5%). Although there is some research about food delivery riders, much more remains to be known about factors associated with crash occurrence among this group of riders.

Therefore, the objectives of this study were to examine the characteristics of food delivery riders involved in traffic crashes during delivery and to compare with the characteristics of food delivery riders without any crash experience. It should be noted that the study focus on food delivery riders only includes those who deliver food using motorcycles. Compared to other motorcycle riders, food delivery riders more frequent disobey traffic rules due to time commitment in delivery (Dave, 2020). In addition, the increasing number of motorcycle riders embarked in the food delivery industry during the pandemic has raised serious concerns among the safety actors as registered number of traffic violations and crashes. Three aspects analysed in this study include general characteristics of riders, previous experience in previous jobs and receiving traffic tickets, and knowledge of road safety. The scope of this study is limited to the riders who registered with the Malaysian P-Hailing Association, PENGHANTAR. The findings from this study could provide a proper road safety awareness program targeting this group of riders. In addition, findings from this study are also necessary for researchers to further analyse the identified factors associated with food delivery riders.

2. Methods
2.1 Materials and data collection
A questionnaire has been developed to obtain information from food delivery riders to achieve the objectives of this study. The questionnaire consists of three sections including general characteristics (i.e., gender, age, job status, experience in delivery works, average monthly income, average daily working hours, and average daily distance travelled), previous experience (i.e., the previous job and received traffic ticket), and knowledge in road safety (i.e., frequency of motorcycle servicing, basic knowledge about safety as a food delivery rider and behaviour of holding the mobile phone while riding). In addition, the participants also need to state their experience being involved in traffic crashes during delivery.

This research has used an online survey to obtain feedback from food delivery riders. Due to unavailable official information about the numbers of active food delivery riders in Malaysia, this study used the number of members registered with the Malaysian P-Hailing Association, PENGHANTAR as a study population. Based on the record from PENGHANTAR, the number of registered members reached approximately 4,000 riders in December 2020. This study followed Hair et al. (Hair et al., 2018) to determine the appropriate sample size. As the ideal sample-to-variable ratio for observational research, they suggest 15:1 to
20:1. If we use the lower ratio of 20:1, with 11 variables in this study, 220 samples or observations are necessary. The link to the survey was distributed among the PENGHANTAR members using the official communication platform, Facebook “Persatuan Penghantar P-Hailing Malaysia”. The online survey was available for five months and was accessible from 1st December 2020 until 30th April 2021. Riders who completed the survey received a voucher worth RM10. During online surveying, about 6% (240) of the registered food delivery riders voluntarily participated in this study which is more than the minimum sample size.

2.2. Data analysis

This study applied disaggregate-analysis techniques to examine the different characteristics of riders with and without traffic crash experiences. A series of chi-square tests in the form of contingency tables with a 5% level of confidence was formed to compare the statistical differences between with and without crash experience across the range of explanatory variables. We also calculate the odds ratio to measure the effect of size and strength of the relationship between pairs of categorical variables. The selection of this technique is due to the capability to elucidate underlying trends and patterns. This is very important for us as the first step to comprehending the safety scenario for riders of food delivery services. This technique has been used widely in road safety research. For example, Rusli et al. (2015) applied this technique to compare the characteristics of road traffic crashes along rural mountainous roads and non-mountainous roads. Another study in the US used this technique in their data analysis to evaluate the safety edge treatment for pavement edge drop-offs on two-lane rural roads (Lyon et al., 2018).

3. Results and discussion

A total of 240 riders participated in this survey. However, after the data cleaning process, the final participant is 225. Out of these, 93 riders (41%) have been involved in traffic crashes during deliveries. This finding shows that more than one-quarter of the food delivery riders were involved in traffic crashes out of the total respondents in this study. This finding explains the increasing trend in road traffic crashes reported nationwide (Tamrin, 2020; Bernama, 2021). Furthermore, forty-one riders (18%) reported being involved in at least one traffic crash, 25 riders (11%) were involved in two traffic crashes, and 27 riders (12%) claimed that they had been involved in more than three traffic crashes. Due to less feedback from the female riders (3%), gender was dropped from the discussion list. Further discussions were held based on the differences in general characteristics, previous experience in previous jobs and receiving traffic crashes, and knowledge in road safety among delivery riders with and without traffic crash history. As mentioned before, this study will only discuss the variables with a p-value less than 0.05. P-value more than 0.05 implies that no effect has been observed.

3.1. General characteristics

Table 1 represents a univariate analysis comparing the general characteristics of food delivery riders with and without traffic crash experience. The age of riders was divided into two categories: young riders (Kulanthayan et al., 2012) and middle-aged riders (Zhang et al., 2020). About 65% of riders who experienced being involved in traffic crashes were young riders. Compared to middle-aged riders, young riders were slightly overrepresented in involved traffic crashes, with the corresponding odds about 2.05 times (95% CI 0.82–1.19) higher compared to not involved in traffic crashes (p less than 0.01). This finding is in line with a study in the Republic of Korea (Byun et al., 2020). They found more than half of the injured riders were young riders (less than 29 years old). They also found that 16% of them violated traffic rules and regulations. This group of riders are inexperienced, lack proper riding skills and are risk-taker (Haworth and Rowden, 2010). A study in Greece also revealed age is a critical risk factor and found young riders are the common dominators of red-light running and helmet non-use among food delivery riders (Papakostopoulos and Nathanale, 2021).

Table 1

| Variable | Rider with crash experience (%) | Rider without crash experience (%) | OR (95% CI) | p-value |
|----------|---------------------------------|-----------------------------------|-------------|---------|
| Age      |                                 |                                   |             |         |
| 25-49 years old* | 33(35.5) | 70(53.0) | 1.00 | – |
| 16–29 years old | 60(64.5) | 62(47.0) | 2.05 | (1.19–3.54) |
|          |                                 |                                   | 6.77, p less than 0.01 |         |
| Job Status |                                 |                                   |             |         |
| Part-time* | 32(34.4) | 64(48.5) | 1.00 | – |
| Full-time | 61(65.6) | 68(51.5) | 1.79 | (1.04–3.10) |
|          |                                 |                                   | 4.42, p < 0.04 |         |
| Delivery Experience | less than 2 years* | 66(71.0) | 11(86.4) | 1.00 | – |
|          | ≥ 2 years | 27(29.0) | 18(13.6) | 2.59 | (1.32–5.05) |
|          |                                 |                                   | 8.08, p less than 0.01 |         |
| Average Monthly Income | <RM1000* | 28(30.1) | 52(39.4) | 1.00 | – |
|          | RM1000–RM2000 | 33(35.5) | 48(36.4) | 1.27 | (0.67–2.42) |
|          | RM2000–RM3000 | 22(23.7) | 24(18.2) | 1.70 | (0.81–3.56) |
|          | >RM3000 | 10(10.8) | 8(6.1) | 2.32 | (0.82–6.55) |
|          |                                 |                                   | 2.62, p < 0.11 |         |
| Average Daily Working Hours | less than 8 h* | 45(48.4) | 74(56.1) | 1.00 | – |
|          | 8–12 h | 35(37.6) | 46(34.8) | 1.25 | (0.70–2.22) |
|          | >12 h | 13(14.0) | 12(9.1) | 1.78 | (0.75–4.24) |
|          |                                 |                                   | 1.73, p < 0.19 |         |
| Average Daily Distance Traveled | less than 100 km* | 32(34.4) | 64(48.5) | 1.00 | – |
|          | ≥ 100 km | 61(65.6) | 68(51.5) | 1.79 | (1.04–3.10) |
|          |                                 |                                   | 4.42, p < 0.04 |         |

*reference category.
the increased period of working as a food delivery rider, the exposure to the crash also increases. Further research is needed to identify this contradictory finding. Fig. 2 presents the percentage of riders by delivery experience for riders with and without traffic crash experience.

Riders in the food delivery industry are mostly paid based on the number of deliveries. An increased number of deliveries will increase the income of the riders. Most of the food delivery companies in Malaysia do not have the maximum number of working hours for their riders in a day. Findings from this study reveal that about 11% of the respondents work >12 h per day. Nevertheless, it was found that there was no significant difference in average monthly income between riders with and without crash experience (p > 0.05). This study also found daily working hours spent by food delivery riders are not statistically different between riders with and without traffic crash experience (p > 0.05). However, daily distance travelled of 200 km and more, compared to less than 200 km, increases the likelihood of being involved in traffic crashes by as much as 1.79 times (95%CI 1.04–3.10) (p = 0.04). This is due to the exposure factors of riders on the road. The majority of road safety studies discovered that increasing distance travelled is positively associated with the occurrence of a crash. For example, a study among motorcycle taxis in Vietnam found high daily travel distances were associated with crash occurrences (Nguyen-Phuoc et al., 2019). In Malaysia, distance travelled is among the factors identified as influencing crash occurrence among commuter workers by motorcycle (Oxley et al., 2013). Fig. 3 shows the percentage of riders by average daily distance travelled for riders with and without traffic crash experience.

#### 3.2. Previous experience in job and receiving traffic ticket

Table 2 presents the distribution of riders with and without traffic crash experience across previous job sectors and experienced received traffic tickets or fines. As mentioned before, the food delivery sector has been increasing recently due to the growth of e-commerce. This sector became more popular when the COVID-19 Pandemic spread around the world, forcing many sectors to shut down including restaurants. In this study, the previous job was categorized into seven categories based on the feedback from respondents. Among them, riders who did not have any previous working experience were overrepresented in the crash, representing about 22% of all riders who have experience in traffic crashes. Compared to riders from the transportation sector, riders with no previous working experience were about 3.50 times (95%CI 1.22–10.04) more likely to be involved traffic crashes (p = 0.02). This study used the transportation sector as a reference because it is similar to food delivery services.

The government servants and the professional sector represent the second largest group of food delivery riders (19%) followed by the food and groceries sector with about 15%. Compared to the transportation sector, the odds of food delivery riders previously from the food and grocery sector were about 3.39 times (95%CI 1.16–9.91) higher to...
Previous Job Experience and Receiving Traffic Ticket.

| Variable                  | Rider with crash experience (%) | Rider without crash experience (%) | OR (95% CI) | χ², p-value |
|---------------------------|---------------------------------|-----------------------------------|-------------|-------------|
| Previous Job Business     | 12(12.9)                        | 16(12.1)                          | 0.49 (0.17 – 1.37) | 1.88, 0.17 |
| Factory                   | 16(17.2)                        | 23(17.4)                          | 1.74 (0.62 – 4.92) | 1.10, 0.29 |
| Food & Groceries          | 19(20.4)                        | 14(10.6)                          | 3.39 (1.16 – 9.91) | 5.15, 0.02 |
| Government Servant        | 9(9.7)                          | 33(25.0)                          | 0.68 (0.23 – 2.05) | 0.47, 0.49 |
| Professionals Services    | 8(8.6)                          | 11(8.3)                           | 1.82 (0.53 – 6.19) | 0.92, 0.34 |
| Not Working               | 21(22.6)                        | 15(11.4)                          | 3.50 (1.22 – 10.04) | 5.63, 0.02 |
| Transportation* Repeated Traffic Ticket | 8(8.6) | 20(15.2) | 1.00 – | – |
| No*                       | 64(68.8)                        | 104(78.8)                         | 1.00 – | – |
| Yes                       | 29(31.2)                        | 28(21.2)                          | 1.68 (0.92 – 3.08) | 2.87, 0.09 |

*reference category.

3.3. Knowledge in road safety

Three factors were examined to identify the relationship between knowledge of road safety and involvement in traffic crash, including the frequency of servicing motorcycles, basic knowledge about safety as food delivery riders, and mobile phone use during riding. Based on the distribution of riders with and without traffic crash experience in Table 3, the same observation for frequency motorcycle servicing was observed. Most riders with and without traffic crash experience prefer to service their motorcycle on a daily basis with about 41% and 42%, respectively. The odds ratio analysis confirms that there are no significant differences between these groups (p > 0.05). Referring to the basic knowledge about safety as a food delivery rider, the same observation was also found. There is no specific course that needs to be attended by the food delivery riders when first joining this job (p > 0.05). However, 70% of riders with crash experience and 79% of riders without crash experience reported having basic traffic safety knowledge.

The use of the mobile phone during riding shows the same proportion between riders with and without traffic crash experience about 25% and 24%, respectively. Analysis of the odds ratio shows there are no significant differences between both groups with regards to the holding mobile phone (p > 0.05). Although previous research has found that mobile phones increase the likelihood of being involved in a crash, the mobile phone is important for food delivery riders because it provides navigation to the delivery address. A study in China confirms that 96.3% out of 315 respondents among food deliverymen used mobile phone while riding (Zhang et al., 2020). There were about 21% of all courier and take-out food delivery riders by electric bike in China using a mobile phone (Wang et al., 2021). Oviedo-Trespalacios et al. (2022) found cyclists delivering food used handheld mobile phones differently depending on the time of day. The focus of this study is only on riders who hold their phones while riding. Further studies need to be conducted to confirm the use of the mobile phone (text, wayfinding, phone, and use of the application) during riding among food delivery riders.

4. Conclusion

This study applied the disaggregated-analysis technique to examine the characteristics of riders with and without traffic crash experiences. An online survey was conducted among the food delivery riders who registered as members of PENGHANTAR, the Malaysian P-Hailing Association. Based on participants feedback, several explanatory variables were tested in this study including age, job status, experience in delivery, monthly income, daily working hours, and daily delivery distance. In addition, previous working experience and history of receiving traffic tickets (p = 0.02). The explanation might be due to riders formerly from the food and grocery sectors needing to learn new skills as riders compared to their previous jobs, which were mostly involved in restaurants and shops. Other work sectors such as business, factories, government servants and professionals, and services were found to be not significantly different between riders with and without traffic crash experience (p > 0.05). Fig. 4 shows the percentage of riders by previous job for riders with and without traffic crash experience.

Another variable found with no significant difference between riders with and without traffic crash experience is experienced received a traffic ticket (p > 0.05). About 30% of riders with traffic crash experience got traffic tickets due to traffic violence compared to about 21% of riders without traffic crash experience. Nevertheless, in Brazil, drivers having a history of traffic tickets are associated with crash involvement (Rios et al., 2020). According to a study conducted in Massachusetts, the United States, traffic tickets significantly reduce traffic crashes and non-fatal injuries (Luca, 2015).
Riders without traffic crash experience

| Percentage of riders |
|----------------------|
| 12.00                |
| 14.00                |
| 16.00                |

Interestingly, although the number of riders holding the mobile phone during riding was higher, there were no significant differences between riders with and without crash experience.

Table 3
Knowledge in Road Safety.

| Variable                           | Rider with crash experience (%) | Rider without crash experience (%) | OR (95% CI) | χ2, p-value |
|------------------------------------|---------------------------------|-----------------------------------|-------------|-------------|
| Servicing                          |                                 |                                   |             |             |
| Motorcycle                         |                                 |                                   |             |             |
| Everyday*                          | 39(41.9)                        | 56(42.4)                          | 1.00        | –           |
| Three times a week                 | 17(18.3)                        | 20(15.2)                          | 1.22        | 0.26, p     |
| Two times a week                   | 24(25.8)                        | 33(25.0)                          | 1.04        | 0.02, p     |
| One a month or more                | 13(14.0)                        | 23(17.4)                          | 0.81        | 0.27, p     |
| Basic knowledge about Safety of Food Delivery Rider | | | | |
| No*                                | 28(30.1)                        | 28(21.2)                          | 1.00        | –           |
| Yes                                | 65(69.9)                        | 104(78.8)                         | 0.63        | 2.31, p     |
| Hold Mobile Phone when Riding      |                                 |                                   |             |             |
| No*                                | 70(75.3)                        | 100(75.8)                         | 1.00        | –           |
| Yes                                | 23(24.7)                        | 32(24.2)                          | 1.03        | 0.01, p     |

*reference category.

Fig. 4. Percentage of Riders by Previous Job for Riders With and Without Traffic Crash Experience.

Although this study has some limitations, it does identify some basic characteristics between riders with and without crash experience as food delivery riders. Based on the findings from this study, it is important to introduce a short course for new food delivery riders to increase their understanding of safe riding, especially for those riders without working experience or who have previously worked in other sectors. In addition, regular safety campaigns should be provided to increase awareness of road safety among full-time, experienced and riders with higher daily travelled distances. (Wang et al., 2021) also suggested that distribution companies create a safety campaign as one strategy to lower the risk of crashes among delivery riders in Shanghai, China. This current study also discovered a relationship between young riders and crash experiences. Implementing a demerit point system for young delivery riders or perhaps setting an age restriction should be considered, as suggested by (Papakostopoulos and Nathanael, 2021).

Alternative, a record from SOCSO could be used as a data source in future research. Second, data for this study was obtained on a self-reported online questionnaire distributed through social media to the PENGHANTAR association members only. Third, this study’s focus on mobile phone usage as a whole ignores the impact of specific mobile phone uses, such as texting, calling, location-based services, and delivery apps. Future research should include these observations in order to get an in-depth understanding of the distraction of food delivery riders during riding. In addition, advanced analysis techniques such as the development of binary logistic regression should be considered in future research to examine the relevant variables discovered in this study using data from the SOCSO.

The results show that young, full-time, experienced, and those who travel equal to or >100 km daily are more likely to be involved in road traffic crashes. Riders who previously did not work or worked in the food and grocery sector are more likely to be involved in traffic crashes. This study also confirms that the frequency of servicing motorcycles and having basic knowledge about the safety of food delivery is not significantly different between riders with and without crash experience. Interestingly, although the number of riders holding the mobile phone during riding was higher, there were no significant differences between both categories of riders (with or without crash experience).

There are some limitations to this study. First, the number of populations cannot be identified due to unavailable official records about traffic tickets were also tested. Lastly, knowledge of the riders toward road safety was also tested including the frequency of motorcycle servicing, basic knowledge about the safety of food delivery, and holding mobile phones while riding.

Implementing a demerit point system for young delivery riders or perhaps setting an age restriction should be considered, as suggested by (Papakostopoulos and Nathanael, 2021). It should be noted that the respondents in this study are PENGHANTAR members and all suggestions are primarily appropriate for PENGHANTAR use. However, other relevant authorities or service providers also can consider these findings where suitable.
Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Self-Employment Social Security Act 2017 (Act 780) (2017). https://www.pegkos.gov.my/images/enq/akta_dan_penuntutn/Act780-AssentMarch2020.pdf. 2017.
Ashkrof, P., de Almeida Correia, G.H., Cats, O., van Arem, B., 2020. Understanding ride-interests or personal relationships that could have appeared to influence the work reported in this paper.

Bernama, 2021. Socso: Over 150 accidents involving delivery riders from March to June last year. Bernama.
Byun, J.H., Jeong, B.Y., Park, M.H., 2017. Characteristics of motorcycle crashes of food delivery workers. J. Ergon. Soc. Korea 36 (2), 157–168.
Byun, J.H., Park, M.H., Jeong, B.Y., 2020. Effects of age and violations on occupational accidents among motorcyclists performing food delivery. Work. 65 (1), 53–61.

Legal Daily. Frequent Accident Involvement of Delivery Rider, Traffic Management Departments Start to Take Actions. [Internet]. 2017 [cited 2021 Apr 4]. Available from: http://www.legaldaily.com/legal/2017-09/15/c_1121666204.htm.

Dave G. Malaysian Road Safety Institute Pushes For Better Training Of Food Delivery Riders. Voice of America (VOA) [Internet]. 2020 Sep 16; Available from: https://www.voanews.com/economy-business/malaysian-road-safety-institute-pushes-better-training-food-delivery-riders.

Dave G. Malaysian Road Safety Institute Pushes For Better Training Of Food Delivery Riders. 2020 Sep 16; Available from: https://www.voanews.com/a/economy-business/malaysian-road-safety-institute-pushes-better-training-food-delivery-riders/6195935.html.

Employment Act 1995 (Act 265) (1995). https://jtksm.mohr.gov.my/images/kluster-wa/rmawart/akta-borang/akta-peraturan/akta_kerja1995_bi.pdf.

Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E., 2018. Multivariate Data Analysis, 8th ed. Cengage Learning, United Kingdom.

Haworth, N, Rowden P. Challenges in improving the safety of learner motorcyclists. In: Proceedings of the 20th Canadian Multidisciplinary Road Safety Conference. Canadian Association of Road Safety Professionals; 2016. p. 1–16.
Kulanthanay, S., See, L.G., Kaviyarasu, Y., Afiah, M.Z.N., 2012. Prevalence and determinants of non-standard motorcycle safety helmets amongst food delivery workers in Selangor and Kuala Lumpur. Injury. 43 (5), 653–659.
Luca, D.L., 2015. Do traffic tickets reduce motor vehicle crashes? Evidence from a natural experiment. J. Policy Anal. Manag. 34 (1), 85–106.

Lyons, C., Persaud, B., Donnell, E., 2018. Safety evaluation of the SafetyEdge treatment for pavement edge drop-offs on two-lane rural roads. Transp. Res. Rec. 2672 (30), 1–6.

M B. Demanding customers force us to break traffic rules, say riders. TheStar [Internet]. 2021 Mar; Available from: https://www.thestar.com.my/metro/metro-news/2021/03/23/demanding-customers-force-us-to-break-traffic-rules-say-riders.

Manan, M.M.A., Virheholi, A., 2012. Motorcycle fatalities in Malaysia. IATSS Res. 36 (1), 30–39.

EC Milo. The food delivery battle has just begun in Malaysia [Internet]. 2018. Available from: https://www.ecominder.my/2018/02/food-delivery-companies-malaysia.html?m=1&fbclid=IwAR2gZv4y69B8R8jIGeCUmFUKSPvF9SO-URWaOG-Me5JB5fbjZ9Oz2ZkUA.

J.P.Morgan. 2020 E-commerce Payments Trends Report: Malaysia [Internet]. J.P. Morgan. 2020 [cited 2021 Apr 2]. Available from: https://www.jpmorgan.com/merchant-services/insights/reports/malaysia-2020#---text---Malaysia’s e-commerce market is,9 percent in 2019 alone.

Muriah S. Big data has trimmed 50% off delivery time for foodpanda delivery riders. theedgemarkets.com [Internet]. 2021; Available from: https://www.theedgemarkets.com/article/big-data-has-trimmed-50-delivery-time-foodpanda-delivery-riders.

Nair, K.S., 2017. Impact of E-Commerce on Global Business And Opportunities -A Conceptual Study. Dubai Int. J. Adv. Eng. Manag. Res. 2 (2).

Nguyen-Phuc, D.Q., Nguyen, H.A., De Grayter, C., Su, D.N., Nguyen, V.H., 2019. Exploring the prevalence and factors associated with self-reported traffic crashes among app-based motorcycle taxis in Vietnam. Transp. Policy 81, 68–74.

Oviedo-Trespalacios, Oscar, Rubie, E., & Haworth, N., 2022. Risky business: Comparing the riding behaviours of food delivery and private bicycle riders. Accident Analysis & Prevention 177, 106820. https://doi.org/10.1016/j.aap.2022.106820. Submitted for publication.

Oxley, J., Yuen, J., Ravi, M.D., Hoareau, E., Mohammed, M.A.A., Bakar, H., et al., 2013. Commuter motorcycle crashes in Malaysia: An understanding of contributing factors. Ann. Adv. Automot. Med. 57, 45.
Papakostopoulos, V., Nathanael, D., 2021. The Complex Interrelationship of Work-Related Factors Underlying Risky Driving Behavior of Food Delivery Riders in Athens, Greece. Available from: Sal Health Work [Internet]. 12 (2), 147–153. https://www.sciencedirect.com/science/article/pii/S2093791120303486.

Rios, P.A.A., Mota, E.L.A., Ferreira, L.N., Cardoso, J.P., Ribeiro, V.M., de Souza, B.S., 2020. Factors associated with traffic accidents among drivers: findings from a population-based study. Cien Saude Colet. 25, 943–955.

Rusti, R., Haque, M.M., King, M., Voon, W.S., 2015. A Comparison of Road Traffic Crashes along Mountainous and Non-Mountainous Roads in Sabah, Malaysia. The 2015 Australasian Road Safety Conference. Australasian College of Road Safety Inc. (ACRS), Australia.

Shin, D.S., Byun, J.H., Jeong, B.Y., 2019. Crashes and traffic signal violations caused by commercial motorcycle couriers. Saf Health Work. 10 (2), 213–218.
Supramani, S., 2021. 70% of p-hailing riders disobey traffic rules while on delivery runs: Miras. The Sun Daily.

Tarmi N. Agensi keselamatan akan bincang kadar kemalangan penghantar makanan. https://www.freemalaysiatoday.com/ [Internet]. 2020; Available from: https://www.freemalaysiatoday.com/category/bahasa/2020/07/19/agensi-keselamatan-akan-bincang-kadar-kemalangan-penghantar-makanan/.

Tran, N.A.T., Nguyen, H.L.A., Nguyen, T.B.H., Nguyen, Q.H., Huyhn, T.N.L., Pojani, D., et al., 2022. Health and safety risks faced by delivery riders during the Covid-19 pandemic. J. Transp. Heal. 25, 101343.

Wang, X., Chen, J., Quddus, M., Zhou, W., Shen, M., 2021. Influence of familiarity with traffic regulations on delivery riders’ e-bike crashes and helmet use: Two mediator ordered logit models. Accid. Anal. Prev. 159, 106277.

Wang, Z., Nitzel, R.I., Zheng, W., Wang, D., Xue, X., Jiang, G., 2021. Road safety situation of electric bike riders: A cross-sectional study in courier and take-out food delivery population. Traffic Inf. Prev. 22 (7), 564–569.

Zhang, Y., Huang, Y., Wang, Y., Casey, T.W., 2020. Who uses a mobile phone while driving for food delivery? The role of personality, risk perception, and driving self-efficacy. J. Safety Res. 73, 69–80.

Zhang, Y., Ma, Y., Guo, L., Cheng, J., Zhang, Y., 2019. Crash involvement and risky riding behaviors among delivery riders in China: the role of working conditions. Transp. Res. Rec. 2673 (4), 1011–1022.