# Preliminary Modelling of Accident and Near Miss Risk Factors Among Gig Delivery Workers in Malaysia

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**Abstract:**
This study explores the risk factors of accidents and near misses among gig delivery motorcyclists in Klang Valley, Malaysia. Using a customized questionnaire, this cross-sectional study collected 235 responses through closed Facebook groups. Sociotechnical aspects such as Rider Behaviour (RB), Rider Safety Awareness (RA), Work Conditions (WC), Environmental Factors (EF), Motorcycle Design and Safety (MDS), and Platform Safety Management (PSM) have been evaluated using an initial 74-item questionnaire. The Partial Least Squares Structural Equation Modelling (PLS-SEM) was utilized resulting a final model with 56 items. The study outcomes have good validity and reliability with Cronbach's alpha between 0.67 and 0.95, Average Variance Extracted (AVE) > 0.50, and Composite Reliability (CR) > 0.80. Path analysis identified WC ($\beta$ = -0.337, $p$ < 0.001) and ORU ($\beta$ = 0.198, $p$ = 0.003) as critical predictors for accident. MDS ($\beta$ = 0.177, $p$ = 0.026), EF ($\beta$ = 0.175, $p$ = 0.009), and PSM ($\beta$ = -0.207, $p$ = 0.001) were significant predictors of near misses. By combining Sociotechnical System Theory and Multiple Causation Theory, the findings showed the complex relationship of various factors in gig delivery workers' safety. Immediate reforms in platform policies, better road infrastructure, improved motorcycle safety design, and enhancing road users' safety awareness are much needed. This research contributes to the limited literature on gig worker safety in Malaysia and provides a foundation for future studies and policy recommendations.

**Keywords:** SEM modelling; Accident; Near miss; Risk factors; Gig delivery workers

## 1. INTRODUCTION

In recent years, delivery services for food, drinks, groceries, parcels, and other essential goods have become an integral part of our society's activities. Since the COVID-19 pandemic, gig delivery services have become a popular type of business worldwide and continue to thrive along with technological advancements. Further growth necessitates critical scrutiny of the human factors and ergonomic (HFE) risks faced by workers. The gig delivery workers have their unique occupational risk factors, which may impact on their health and safety. Their tight schedule to complete delivery exacerbates speeding and risky riding behaviours among them (1, 2). The risky riding behaviour was more common among those who perform gig work as their main income (2, 3). The long working hours and insufficient rest also elevate the risk of road accidents (1, 4). External factors such as poor road conditions and traffic jams increase the likelihood of accidents among the gig delivery workers (5), while nighttime deliveries reduce their on-the-road visibility and enhance fatigue among them (6). In terms of worker's characteristics, inexperienced novice riders (6), inadequate training, and poor response towards near misses (1, 7, 8), speeding, phone use, and ignoring traffic signals (1, 5) were significant accident contributors. Gig delivery tasks were controlled by algorithm management with lack of human interaction. This situation increases ego-depletion, deters workers 'safety performance (9) and incentivizes risky behaviours such as speeding during harsh weather to maximize earnings (10, 11). Existing studies often focus on those riding e-bikes (12), bicycles (13), or mixed types of gig motorcyclists (5). Our research focused on gig delivery riders who use their own motorcycles for delivery tasks since Malaysia is notable for its high rate of motorcycle usage, driven by economic factors and urban congestion (14).

Few studies on gig delivery workers have been conducted in Malaysia mostly during COVID-19 pandemic. Hang Tuah *et al.* (15) reported that slippery roads, red-light running and speeding were prominent accident contributing factors while the delivery time frame did not significantly impact the gig delivery workers in Shah Alam. Rusli *et al.* (16) found that young, full-time riders who travel long distances (> 100km) are more prone to traffic accidents. Shah Zulkefly (17) interviewed 15 gig riders for their study on the occupational safety and health (OSH) issues faced by P-hailing riders in Malaysia, without further details on their qualitative analysis, or sample population distribution. The research by Ghani *et al.* (18) was

conducted in Kuala Lumpur which described cell phone use while travelling on highways as a major accident-causing factor among gig delivery workers.

In exploring the theoretical frameworks for the safety and health of gig delivery workers, Nguyen-Phuoc *et al*. (19, 20) and Nilsen and Kongsvik (21) employed the Job Demands-Resources Model. Their research indicates that personal demands, job resources, and job burnout shape the risky behaviours of the workers. Nilsen and Kongsvik (21) further emphasize that the balance between job demands and resources significantly impact health, safety, and well-being in platform-mediated employment. Bonardi *et al*. (22) utilized the Safety Climate Model to assess the effects of rider safety performance, knowledge, and motivation. They also emphasized the importance of management values, effective safety communication, and high-quality safety equipment in creating a positive safety climate. Laskaris *et al*. (3) investigate the impact of job dependence on injury and assault among food delivery gig workers by using the Job Dependence Model. Their work highlights the vulnerability of fully dependent workers to the negative consequences of working conditions managed algorithmically by platforms.

Our research aims to address existing gaps by developing a customized occupational safety questionnaire specifically for gig delivery riders after the COVID-19 pandemic. We employed Partial Least Squares structural equation modelling (PLS SEM) to investigate the intricate relationships between various occupational risk factors and incidents of accidents or near misses. This study examined the predictors of accidents and near misses which has never been studied in gig delivery safety research, especially within Malaysia's sociotechnical context. Additionally, our study integrates the Sociotechnical System Theory with the Multiple Causation Theory as the theoretical framework.

## 2. METHODOLOGY

This cross-sectional study was targeting Klang Valley's gig delivery riders. Participation in this study was voluntary, and participants were rewarded with RM5 through their chosen e-payment medium after completing the online questionnaire. The questionnaires comprised of nine sections (74 items) and were adopted or adapted from previous research. The Motorcycle Rider Behaviour Questionnaire (MRBQ) by Elliot *et al*. (23), was adopted in its Malay-translated version provided by the Malaysian Institute of Road Safety Research (MIROS). The Occupational Health and Safety Vulnerability Questionnaire (24) was adapted after translation and back-translation into Malay, with items rephrased to suit gig delivery work situation. Items not derived from validated questionnaires were newly developed in Malay by referring to previous studies by Christie and Ward (1, 25), Nguyen-Phuoc *et al*. (19), Hagan *et al*. (26), and Ngoc *et al*. (20). The questionnaire responses were measured by Likert Scale from 1 to 7 (Strongly disagree to Strongly agree). For constructs related to rider behaviour, work conditions and interactions with other road users, a scale of 1 to 7 was used ranging from Not Applicable, Rarely, Very Rarely, Sometimes, Often, Very Often, Almost Always. The questionnaire has undergone two stages of face and content validation. First, four experts in the field of occupational and road safety from the Malaysian Institute of Road Safety (MIROS), Department of Occupational Safety and Health (DOSH), National Institute of Occupational Safety and Health (NIOSH) and Universiti Teknologi MARA (UiTM) reviewed the questionnaire. Subsequently, the face and content validation were assessed through pretesting the questionnaire with 10 gig delivery riders. Pretesting was essential to ensure the questionnaire understandable and practical. Before this pilot study, we calculated the sample size using G*Power software (version 3.1.9.7) developed by Faul *et al*. (27). Based on a calculation with an effect size of 0.15, an 0.05 α err probability and Power (1-β err probability) was set to 0.95 and seven predictors (number of constructs), the minimum sample size obtained was 153 participants.

The study model was developed based on combination of two theories namely Sociotechnical System Theory and Multiple Causation Theory. Sociotechnical system theory views an accident as complex interactions between social (organizational and human) and technical (equipment and processes) elements within a system. The Multiple Causation Theory suggests that accidents result from combination of interrelated factors rather than a single cause (28). Combining both theories enables holistic and multilayered understanding of how accident occurs in complex systems. The Partial Least Squares Structural Equation Modelling (PLS SEM) was utilized to investigate the occupational risk factors of gig riders and how they may affect their involvement in accidents or near misses. Hair *et al*. (29) recommended PLS SEM when studying a theoretical framework with a predictive lens, specifically for complicated structural model with multiple constructs, indicators, and model relationships. SmartPLS version 3.2.9 was used to test the Cronbach alpha and Composite Reliability (CR) was observed for the reliability testing. As for the construct validity, convergent and discriminant validity was calculated. Average Variance Extracted (AVE) was assessed. The Fornell and Larcker's criterion and cross loadings were included in discriminant validity testing. In addition, bootstrapping with 5000 samples was used to test significant relationship between constructs.

The online questionnaire was circulated across six Facebook groups of gig delivery workers in Klang Valley, Malaysia during the third quarter of 2024. The researcher requested permission from the group administrators to join and posted invitations for study participation. The participants accessed the questionnaire through a provided Microsoft Form's link. A total of 235 responses were collected with only one response being discarded due to repeated answering, leaving 234 responses used for analysis. There were no items non-responses, as the system required participants to answer all questions.

## 3. RESULTS AND DISCUSSION

Table 1 shows the characteristics of respondents in this research where more than 90% of them were under 40 years old. Most respondents have completed their tertiary studies (STPM and above, 63.1%), worked in Kuala Lumpur area (35.9%), had riding experience of more than six years (74.3%) and held B2 license which is for motorcycle with less than 250cc capacity (90.6%). Most gig riders reported monthly income of less than RM1500 which was lower than current National

Table 1. Characteristics of respondents.

| Demographics | n | % | Working history | n | % |
|---|---|---|---|---|---|
| Age (years) | | | Employment status | | |
| 17-20 | 7 | 3.0 | Full-time | 80 | 34.2 |
| 21-30 | 103 | 44.0 | Part-time | 154 | 65.8 |
| 31-40 | 101 | 43.2 | Work experience as gig rider (years) | | |
| 41-50 | 22 | 9.4 | <1 | 39 | 16.7 |
| >50 | 1 | 0.4 | 1-2 | 74 | 31.6 |
| Level of education | | | 3-4 | 70 | 29.9 |
| PMR/PT3 | 6 | 2.6 | >4 | 51 | 21.8 |
| SPM | 78 | 33.3 | Number of platform provider/s attached to | | |
| STPM | 8 | 1.7 | 1 | 119 | 50.9 |
| Skilled certificates | 28 | 12 | 2 | 74 | 31.6 |
| Diploma | 60 | 25.6 | 3 | 28 | 12.0 |
| Bachelor's degree | 50 | 21.4 | >3 | 13 | 5.6 |
| Master's degree | 8 | 3.4 | Daily working hours (hr) | | |
| Location | | | <4 | 35 | 15.0 |
| Kuala Lumpur | 84 | 35.9 | 4-6 | 86 | 36.8 |
| Gombak | 11 | 4.7 | 7-9 | 55 | 23.5 |
| Petaling | 57 | 24.4 | 10-12 | 38 | 16.2 |
| Klang | 30 | 12.8 | >12 | 20 | 8.5 |
| Hulu Langat | 18 | 7.7 | Daily working distance (km) | | |
| Hulu Selangor | 2 | 0.9 | <30 | 20 | 8.5 |
| Kuala Langat | 1 | 0.4 | 31-40 | 18 | 7.7 |
| Sabak Bernam | 1 | 0.4 | 41-50 | 26 | 11.1 |
| Kuala Selangor | 4 | 1.7 | 51-60 | 30 | 12.8 |
| Sepang | 15 | 6.4 | 61-70 | 18 | 7.7 |
| Putrajaya | 11 | 4.7 | >70 | 122 | 52.1 |
| Riding experience (years) | | | Experience crash during working as gig rider in last 12 months | | |
| < 1 | 2 | 0.9 | 0 | 151 | 64.5 |
| 1-5 | 22 | 9.4 | 1-2 | 73 | 31.2 |
| 6-10 | 71 | 30.3 | 3-4 | 9 | 3.8 |
| 11-15 | 55 | 23.5 | >10 | 1 | 0.4 |
| 16-20 | 48 | 20.5 | Experience near miss during working as gig rider in last 12 months | | |
| > 20 | 36 | 15.4 | 0 | 39 | 16.7 |
| License class | | | 1 -2 | 73 | 31.2 |
| B (> 500 cc) | 13 | 5.6 | 3-4 | 55 | 23.5 |
| B1 (< 500 cc) | 6 | 2.6 | 5-6 | 28 | 12.0 |
| B2 (<250 cc) | 212 | 90.6 | 7-8 | 10 | 4.3 |
| P | 3 | 1.3 | 9-10 | 4 | 1.7 |
| Income as gig rider (RM) | | | | | |
| >1500 | 83 | 35.5 | | | |
| <1500 | 151 | 64.5 | | | |

Minimum Wage. We did not ask for the respondents' gender as this job is male dominated in Malaysia as well as in other countries. Moreover, research by Cox *et al.* (30) did not show any significant differences in road incident involvement between male or female gig workers. In terms of the respondents' working history, 65.4% of them were part-timers and mostly have worked as gig delivery riders for more than one year. Notably, gig riders who were attached to more than one platform (49.2%) were slightly equal to those who with only one company (50.9%). Since most respondents were part timers, the highest daily working hours were 4 to 6 hours (36.8%). Surprisingly, most of the gig riders had a long daily working journey of more than 70 km (52.1%). About 64% of respondents reported no crash involvement while working but the majority had experienced more than once near miss during the past 12 months (83.3%).

## 3.1 Model Reliability, Validity and Fitness

Based on the Initial Model in Table 2, the internal consistency of most constructs had Cronbach's alpha of more than 0.80 which is considered very good. Only Near misses (NMSS) Cronbach's alpha slightly below 0.70 which is considered acceptable in exploratory research (31). As for the Average Variance Extracted (AVE), most constructs showed > 0.80 except for Rider Behaviour (RB) and Work Conditions (WC). Additionally, the Composite Reliability (CR) of all constructs were all very good, exceeding 0.80. The outer loadings of all items were analyzed. Any items with factor loadings below 0.70 will be removed provided that the item deletions can elevate the values of AVE and CR (31). Table 2 also shows the number of items in the initial and final models after deletion of items with low outer loadings. The AVE values for RB and WC were increased after performing items deletion. In the Final Model, 74 items were reduced to 56. The final instrument with only 56 items will be utilized for the main data collection.

Table 2. Reliability and convergent validity: Comparison of the initial and final structural models.

| Constructs | Number of items | | Cronbach's alpha > 0.60 to 0.95 | | Average Variance Extracted (AVE) >0.50 | | Composite Reliability (CR) >0.80 | |
|---|---|---|---|---|---|---|---|---|
| | Initial model | Final model | Initial model | Final model | Initial model | Final model | Initial model | Final model |
| ACC | 4 | 4 | 0.920 | 0.920 | 0.807 | 0.806 | 0.943 | 0.943 |
| NMSS | 3 | 3 | 0.668 | 0.668 | 0.601 | 0.602 | 0.817 | 0.818 |
| SA | 7 | 7 | 0.942 | 0.942 | 0.735 | 0.735 | 0.951 | 0.951 |
| RB | 13 | 6 | 0.888 | 0.830 | 0.399 | 0.538 | 0.893 | 0.875 |
| WC | 9 | 6 | 0.821 | 0.850 | 0.427 | 0.571 | 0.861 | 0.889 |
| EF | 12 | 9 | 0.918 | 0.915 | 0.530 | 0.597 | 0.930 | 0.930 |
| PSM | 9 | 9 | 0.939 | 0.939 | 0.670 | 0.671 | 0.948 | 0.948 |
| ORU | 7 | 4 | 0.844 | 0.873 | 0.512 | 0.720 | 0.876 | 0.911 |
| MDS | 10 | 8 | 0.932 | 0.949 | 0.614 | 0.743 | 0.936 | 0.958 |

Abbreviations: ACC- accident, NMSS- near miss, SA- Rider's safety awareness, RB- rider's behaviour, WC- Rider's work conditions, EF- Road and environmental factors, PSM- Platform provider's safety management, ORU- Interaction with other road users, MDS- Motorcycle design/safety

All constructs have shown good discriminant validity with Fornell-Larcker criterion of more than 0.70. For this study, the final model demonstrated SRMR of 0.059 and an NFI 0.750 which are adequate to indicate the recommended Model Fitness by Hair *et al.* (29).

## 3.2 Significant Testing

For significant testing, bootstrapping with 5000 samples was conducted as recommended by Hair et. al (31). Table 3 showed path coefficients for the relationship between sociotechnical factors and accidents or near misses. The path analysis revealed clear divergence in the predictors of accidents and near misses, emphasizing the complexity of risk in this sociotechnical system. Accidents were primarily influenced by immediate work context and human interaction, specifically the Work Conditions (WC) and Interactions with Other Road Users (ORU). In addition, near misses were primarily driven by factors related to equipment, environment and organizational systems, specifically the Motorcycle Design and Safety (MDS), Environmental Factors (EF) and Platform Safety Management (PSM). This distinction suggests that accidents may result from acute pressures and social dynamics during work execution. However, near misses often serve as precursors due to inadequate equipment, poor surroundings and systemic safety malfunctions by the platform providers.

In this study, Work Conditions (WC) of the gig riders significantly impacted their involvement in accidents or near misses. This is consistent with Christie and Ward (1, 25) findings where work conditions were highly significant in gig delivery workers' accidents in the UK. In addition, Nilsen and Kongsvik (21) reported that the physical environment, safety risks, performance expectations, and job satisfaction of delivery workers are all crucial factors impacting their performance and overall well-being. Since gig riders were also motorcyclists which categorized as vulnerable road users, their interactions with Other Road Users (ORU) significantly affected their road safety. Wang and Churchill (11) found that heavy traffic, busy intersections, and large crowds create risky conditions for delivery workers. Tram tracks and traffic conditions increase the chance of collision and road rage incidents among them. Moreover, the increased number of pedestrians and dense traffic during peak hours increases the risk of accidents for platform delivery riders (13). Both WC and ORU represent the social and work-organizational components of the gig delivery complex system.

In terms of near misses, the Motorcycle Design and Safety (MDS), Environmental Factors (EF) and Platform Safety Management (PSM) highly influenced by this situation. For MDS, our findings further support the notion that gig delivery workers are more likely to be involved in accidents due to motorcycle's inherent instability and lack of safety features (20).

Table 3. Path coefficients of the variables.

| | β | Sample Mean | Standard Deviation | t - values | p - values |
|---|---|---|---|---|---|
| PSM -> ACC | 0.005 | 0.001 | 0.074 | 0.070 | 0.472 |
| EF -> ACC | -0.027 | -0.023 | 0.077 | 0.344 | 0.365 |
| SA -> ACC | 0.030 | 0.029 | 0.081 | 0.375 | 0.354 |
| WC -> NMSS | 0.063 | 0.053 | 0.085 | 0.743 | 0.229 |
| RB -> ACC | -0.068 | -0.075 | 0.083 | 0.814 | 0.208 |
| SA -> NMSS | -0.091 | -0.093 | 0.074 | 1.220 | 0.111 |
| RB -> NMSS | 0.087 | 0.101 | 0.071 | 1.232 | 0.109 |
| MDS -> ACC | 0.126 | 0.124 | 0.093 | 1.356 | 0.088 |
| ORU -> NMSS | 0.102 | 0.100 | 0.068 | 1.490 | 0.068 |
| MDS -> NMSS | 0.177 | 0.189 | 0.091 | 1.948 | 0.026* |
| EF -> NMSS | 0.175 | 0.182 | 0.075 | 2.351 | 0.009* |
| ORU -> ACC | 0.198 | 0.201 | 0.072 | 2.761 | 0.003* |
| PSM -> NMSS | -0.207 | -0.212 | 0.064 | 3.209 | 0.001* |
| WC -> ACC | -0.337 | -0.340 | 0.080 | 4.188 | 0.000* |

*: Significant $p<0.05$

Our findings on environmental factors are consistent with previous studies in which poor road surface or markings (32), night or low lighting (33) and weather conditions (34) were strongly related to accident occurrence. For MDS and EF, they represent the technical and environmental components of the system. Meanwhile, PSM strongly influenced gig delivery riders' safety and health. PSM and near misses highlights a critical organizational and algorithmic failure within the sociotechnical system. Due to economic incentives and time pressures introduced by platform providers, delivery workers are often involved in risky riding behavior (10). Gig platforms often provide insufficient assistance with safety training, protective gear, and health precautions, leaving employees to manage risks on their own (35, 36).

## 4. CONCLUSION

This study analyzed occupational risk factors influencing accidents and near misses among gig delivery motorcycle riders in Malaysia after COVID-19 pandemic, using a customized questionnaire. We identified significant accident predictors, Work Conditions ($\beta$ = -0.337, $p$ < 0.001) and Interactions with Other Road Users ($\beta$ = 0.198, $p$ = 0.003). Near misses were associated with Motorcycle Design and Safety ($\beta$ = 0.177, $p$ = 0.026), Environmental Factors ($\beta$ = 0.175, $p$ = 0.009), and inadequate Platform Safety Management ($\beta$= -0.207, $p$ = 0.001). These findings align with prior international research while addressing gaps in the Malaysian context. Our theoretical framework applies Sociotechnical System Theory and Multiple Causation Theory to provide a holistic view of gig delivery risks. Practical implications include the need for platform providers to implement robust safety protocols, policymakers to enhance infrastructure and regulations, and road users to improve their road safety awareness. Future research should employ the 56 items from this study with broader geographic samples to further authenticate these findings. This pilot study has used PLS SEM to refine our model. For future research, we recommend using Covariance-Based Structural Equation Modelling (CB-SEM) for rigorous theory testing and confirmatory analysis. Addressing these factors can help stakeholders mitigate risks while improving gig delivery workers' safety and well-being. This supports sustainable growth in this rapidly expanding sector.

## AUTHORSHIP CONTRIBUTION STATEMENT

Syiikhah Abd Rahman: writing - original draft, formal analysis. Rozlina Md Sirat: writing – review & editing, project administration. Jafri Mohd Rohani: conceptualization, supervision, writing – review & editing. Mohd Firdaus Mohd Taib: writing – review & editing, project administration. Wong Kuan Yew: writing – review & editing. Mohamed Zul Fadhli Khairuddin: writing – review & editing

## DATA AVAILABILITY

Data is available on request.

## DECLARATION OF COMPETING INTEREST

There is no conflict of interest regarding this research.

## DECLARATION OF GENERATIVE AI

We would like to acknowledge the use of DeepSeek and Scopus AI to assist in the writing of this paper, specifically for identifying relevant literature, language editing and references checking. The AI-generated parts of the journal were

extensively reviewed, refined and revised to ensure compliance with the percentage of AI- contents as required by the general academic guidelines of less than 20%.

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