Journal of Hunan University

(Natural Sciences)

Vol. 51 No. 11

November 2024

Available online at

http://jonuns.com/index.php/journal/index

Open Access Article

https://doi.org/10.55463/issn.1674-2974.51.11.4

Red-Light Running's Intention Behavior through P-Hailing Riders' Demographic Factors

Nor Syaziana Mohd Radzi[1], Muhamad Nazri Borhan[1,2]*, Ahmad Nazrul Hakimi Ibrahim[1,2]

([1] Department of Civil Engineering, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Malaysia

[2] Smart and Sustainable Township Research Centre, Faculty of Engineering & Built Environment, Universiti Kebangsaan Malaysia, Bangi, 43600, Selangor, Malaysia)

* Corresponding author: mnazri_borhan@ukm.edu.my

Article History:

Received: September 18, 2024
Revised: October 16, 2024
Accepted: October 24, 2024
Published: November 30, 2024

Abstract: Delivery riders, known as p-hailing riders in Malaysia, have become an important part of the country's expanding e-commerce industry. However, this booming industry has also introduced significant challenges in traffic safety, particularly in red light running (RLR). Delivery riders, who often navigate under mixed traffic conditions, have been linked to this risky behavior. This study aimed to explore the demographic factors influencing red-light running (RLR) behavior among p-hailing riders, with the goal of identifying safety and socioeconomic challenges specific to the demographic. By linking these insights to broader Sustainable Development Goals (SDGs), this study seeks to inform policy recommendations and targeted interventions for improving rider safety and working conditions. The research was conducted through a survey in Selangor, collecting 453 responses, of which 401 were valid after exclusion. The findings reveal that most riders are young and inexperienced males with lower incomes and education levels. Economic pressures and long working hours increase the vulnerability of certain demographics to risky behaviors, such as RLR, posing safety challenges. This study has two primary goals: first, to analyze the demographic and socioeconomic factors that contribute to RLR

Copyright: © 2024 by the authors. Licensee JHU
This article is an open-access article distributed under the terms and conditions of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0)

among p-hailing riders, and second, to propose actionable recommendations for enhancing rider safety and well-being. The research aligns with SDG 3 (Good Health and Well-being) by advocating for safety measures to reduce accidents, and SDG 8 (Decent Work and Economic Growth) by highlighting the need for improved working conditions. Additionally, it supports Sustainable Cities and Communities (SDG 11) by promoting safer urban environments and Quality Education (SDG 4) through calls for educational initiatives to raise awareness of safer road practices. The novelty of this study' lies in combining demographic analysis with SDG-aligned safety and socioeconomic insights into Malaysia's growing p-hailing industry. It bridges gaps in the understanding of economic pressure, traffic behavior, and urban safety. These findings promote sustainable and safe e-Commerce delivery practices.

Keywords: P-hailing riders; behavior; red-light running; demographic factors

通过网约车乘客的人口统计学因素了解闯红灯行为的意向

摘要：送货骑手在马来西亚被称为网约车骑手，已成为该国不断扩张的电子商务行业的重要组成部分。然而，这个蓬勃发展的行业也带来了交通安全方面的重大挑战，尤其是闯红灯（RLR）。送货骑手经常在混合交通条件下行驶，与这种危险行为有关。这项研究旨在探索影响网约车骑手闯红灯（RLR）行为的人口因素，目的是确定特定于该人群的安全和社会经济挑战。通过将这些见解与更广泛的可持续发展目标（SDG）联系起来，本研究旨在为改善骑手安全和工作条件提供政策建议和有针对性的干预措施。这项研究是在雪兰莪州通过一项调查进行的，收集了 453 份回复，其中 401 份在排除后有效。研究结果显示，大多数骑手都是年轻且缺乏经验的男性，收入和教育水平较低。经济压力和长时间工作增加了某些人群对闯红灯（RLR）等危险行为的脆弱性，带来了安全挑战。本研究有两个主要目标：首先，分析影响网约车乘客 RLR 的人口和社会经济因素；其次，提出可行的建议，以提高乘客的安全和福祉。该研究通过倡导减少事故的安全措施，符合可持续发展目标 3（良好的健康和福祉），通过强调改善工作条件的必要性，符合可持续发展目标 8（体面工作和经济增长）。此外，它通过呼吁教育举措来提高人们对更安全的道路实践的认识，促进可持续城市和社区（可持续发展目标 11）和优质教育（可持续发展目标 4）。本研究的新颖之处在于将人口分析与与可持续发展目标一致的安全和社会经济洞察相结合，以研究马来西亚不断发展的网约车行业。它弥合了对经济压力、交通行为和城市安全的理解差距。这些发现促进了可持续和安全的电子商务交付实践。

关键词：网约车乘客；行为；闯红灯；人口因素

1. Introduction

The rapid rise in e-commerce and growing consumer demand for faster deliveries has given birth to new delivery models. These models often rely on networks of independent drivers to meet delivery needs [1]. However, this booming industry has introduced significant challenges, particularly with regard to traffic safety. The increase in the number of riders increases the number of road crashes involving p-hailing riders [2]. P-hailing riders, who often navigate mixed traffic conditions, have been associated with risky behaviors, one of the most concerning ones being red-light running (RLR). Research has shown that RLR is a frequent issue, particularly in busy urban and suburban areas. For instance, a 2017 report on traffic safety by the AAA Foundation found that in the United States, RLR was responsible for 28% of fatal crashes at intersections with traffic signals [3]. This statistic highlights how dangerous and widespread the problem is. Several studies have attempted to identify the causes behind this behavior among delivery riders, pointing to factors such as working conditions, job-related stress, and individual characteristics. While previous research has examined these aspects, there is still a gap in understanding how demographic factors, such as age, gender, and experience, influence RLR tendencies among delivery riders [4]-[5].

RLR is a hazardous traffic violation and it is important to understand how common it is among delivery riders. Engaging in RLR significantly increases the chance of accidents, leading to injuries and even fatalities [5]-[7]. Studying this behavior among delivery riders is a necessary first step toward improving their overall safety. Previous research suggests that several factors, such as demographic characteristics, perceptions of safety, and environmental conditions, play a role in influence RLR behaviors [8]-[10]. Delivery riders tend to run red lights more frequently than regular e-bike riders,

making it even more important to understand the reasons behind this behavior [11]-[12]. Some of the factors contributing to RLR include individual characteristics, intersection design, and traffic environment [9], [12]. Researchers have also used the Theory to analyze the intentions and psychological factors that drive these actions [9]. The pressure of time constraints and high demand for deliveries often push riders to take risks [13]. To address this issue, interventions should be tailored to specific demographic groups, as age and sex have been shown to affect RLR behavior [11]. Tackling this challenge requires a broad approach involving government regulations, stronger police enforcement, and private sector efforts to enhance road safety for delivery riders [5].

Research on RLR behavior among delivery riders shows that several demographic and job-related factors influence this risky behavior. Demographic characteristics play a significant role in understanding the RLR across different groups of road users. For instance, factors such as age and gender have been found to be important predictors, with younger individuals being more likely to run red lights [14]-[15]. Studies have consistently shown that young and male, in particular, are more prone to this behavior [11], [16]. In addition to age and gender, marital status and occupation also influence RLR behavior [8], [17]. Environmental factors also play a role; elements such as group size, parked vehicles, and heavy traffic contribute to the RLR tendency [10], [14]. Other studies have found that things such as a rider’s position at the intersection, the number of other cyclists around, and the behavior of those cyclists can also impact RLR tendencies [11], [18].

Job conditions, such as limited experience, being paid by the hour, and the fast pace of delivery work, contribute to RLR behavior [16], [19]. Factors such as the time of day, design of intersections, and how traffic signals are set up also influence the RLR [17], [20]. According to [9], psychological factors, including riders’’ attitudes and conformity tendencies, are strong predictors of intention to run red lights. The Theory of Planned Behavior has been used in psychological research to understand RLR, showing that attitudes, subjective norms, and perceived behavior help to understand RLR intentions [9]. A clear understanding of these demographic and contextual factors is critical for designing effective interventions to reduce RLR and improve road safety. These insights are essential for creating targeted strategies to help reduce RLR behavior among delivery riders.

Many studies have highlighted how demographic factors influence various traffic behaviors, including RLR [4], [5], [21]. In the case of delivery riders, understanding how individual characteristics contribute to this behavior can provide valuable insights for developing safety interventions [5]. This study takes a comprehensive approach to the relationship between demographic factors and RLR behavior among delivery riders. While previous research has examined how work conditions and job pressures lead to unsafe riding, the role of personal characteristics and work burnout is less clear and inconsistent across studies.

Therefore, this study offers fresh insights into how demographic factors affect RLR behavior, specifically focusing on delivery riders in Selangor, Malaysia. The contributions of this study are as follows: First, it assesses the range of demographic factors used in prior research on RLR among delivery riders (or p-hailing riders, as they are known in Malaysia) and compares them with the findings from this study. Second, it identified the most influential demographic factors based on the study’s data and previous findings. Finally, the discussion offers practical recommendations and strategies based on the results of this’ study. These findings are expected to help future researchers to plan their studies more effectively, particularly when designing surveys. Early preparation is important to avoid wasting time and improve the overall quality of research.

2. Method

Designing a questionnaire is key for comprehensive analysis in any research study. To ensure that the questionnaire was of high quality and provided accurate results, both preliminary and formal analyses were conducted. The process flow in Figure 1 outlines the systematic methodology used to develop, distribute, and analyze a demographic survey aimed at understanding RLR behavior among p-hailing riders in Malaysia. The workflow begins with documentation, where critical elements, such as the sampling plan, data analysis, and survey design, are prepared to ensure a robust and reliable study. Subsequently, a questionnaire was developed and designed by combining appropriate questions. The design underwent a pilot test involving 50 respondents to identify potential weaknesses and to refine the instrument for clarity and effectiveness. The sample size for this pilot test was chosen based on similar studies, which used sample sizes of 54 samples [22], 50 samples [23]-[24], and 30 samples [9], [25]-[26]. The goal of the preliminary study was to gather feedback on the content of the questionnaire and ensure that all questions were clear and easy to understand. After reviewing the feedback, the questionnaire was carefully revised and refined to produce the final version for the formal study.

Survey distribution was conducted using both manual and online formats to maximize reach and participation. As shown in the figure, a total of 453 responses were collected, of which 401 were confirmed

for analysis after excluding incomplete or inconsistent data. This feedback is then subjected to a structured process of data analysis and evaluation, in which statistical techniques and analytical methods are used to obtain the findings.

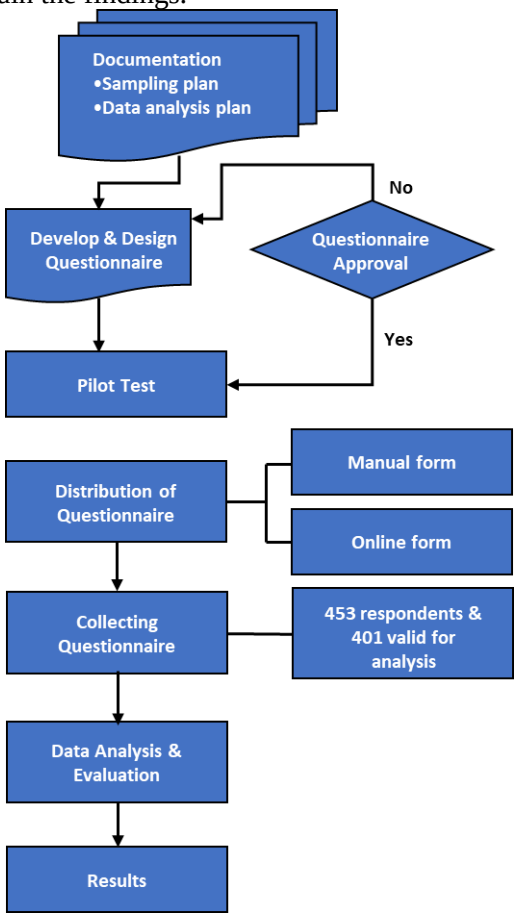

Figure 1. Research methodology flowchart (Source: developed by the authors)

The findings were synthesized into actionable results, forming the basis for targeted interventions and recommendations. This clear, step-by-step process demonstrates the study's commitment to methodological rigor and reliability, ensuring the validity and applicability of the conclusions drawn from the research.

3. Demographic Analysis

Demographic factors play an important role in traffic safety research, and this study specifically examines how these factors relate to RLR behavior among p-hailing (delivery) riders. Data were collected through a questionnaire completed by 453 p-hailing riders who had experience in delivering food in Selangor, Malaysia. After filtering out some responses, 401 questionnaires were deemed valid for analysis. Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 26. This section starts by explaining how the data were collected and then compares the findings with those from previous studies, which are shown in Tables 1 and 2. The demographic variables included in this study were gender, age, marital status, educational level, monthly income, type of work, working hours, work experience, and history of road accidents. A summary of respondents' demographic information is presented in Table 1.

Table 1. Demographic descriptive data (Source: developed by the authors)

Variables	Category	Frequency	(%)
Gender	Male	367	91.5
	Female	34	8.5
Age	16 - 20	56	14.0
	21 - 25	150	37.4
	26 - 30	81	20.2
	31 - 35	53	13.2
	36 - 40	31	7.7
	41 +	30	7.5
Marital status	Unmarried	245	61.1
	Married	156	38.9
Education level	Secondary school	122	30.4
	Certificates, diplomas & matriculation	143	35.7
	Bachelor's degree	128	31.9
	Master's degree	8	2.0
Monthly income	< RM 2,000	146	36.4
	RM 2,001 - RM 4,000	197	49.1
	RM 4,001 - RM 6,000	52	13.0
	> RM 6,001	6	1.5
Type of work	Full-time	150	37.4
	Part-time	251	62.6
Working hours per day (h)	< 3	55	13.7
	3 - 6	145	36.2
	6 - 9	114	28.4
	> 9	87	21.7
Work experience	< 1 year	100	24.9
	1 - 2 years	145	36.2
	2 - 3 years	91	22.7
	> 3 years	65	16.2
Accident history	Yes	226	56.4
	No	175	43.6

3.1. Demographic Descriptive Data of this Study

This section provides an overview of the respondents' demographic data. The results show that the vast majority of p-hailing riders are male, with 91.5% (367 respondents), and only 8.5% (34 respondents) being female. This indicates that men

dominate the delivery rider workforce. Regarding age, 37.4% (150 respondents) were between 21 and 25 years, while 20.2% (81 respondents) were between 26 and 30 years. The smallest group of respondents (7.5%) was those aged 41 years and above. This suggests that most p-hailing riders in this study were between the ages of 20 and 30 years. In terms of marital status, the majority of riders (61.1%, 245 respondents) were single, while 38.9% (156 respondents) were married. The education levels of the respondents were fairly balanced across different categories. Secondary school graduates made up 30.4% (122 respondents), while those with certificates, diplomas, or matriculation were slightly higher at 35.7% (143 respondents), and 31.9% (128 respondents) held a bachelor's degree. Respondents with certificates, diplomas, and matriculation qualifications constituted the largest educational group in this study.

In terms of monthly income, 36.4% (146 respondents) earned less than RM 2,000 per month, while 32.7% (131 respondents) earned RM 2,001 or RM 3,000. Only a small proportion (1.5%) reported earning more than RM 6,001 per month. Most respondents, 62.6% (251 riders), worked part-time and the remaining 37.4% (150 riders) worked full-time, suggesting that many riders have multiple jobs to supplement their income. The data also show that most riders work between 3 and 9 hours a day. Specifically, 36.2% (145 respondents) worked 3–6 hours daily, and 28.4% (114 respondents) worked 6–9 hours. A smaller percentage, 21.7% (87 respondents), worked more than nine hours a day, while 13.7% (55 respondents) worked less than three hours a day. In terms of experience, 36.2% (145 respondents) had been working as p-hailing riders for one to two years, and 24.9% (100 respondents) had less than one year of experience. In addition, 56.4% (226 respondents) were involved in road accidents, whereas 43.6% did not experience any traffic accidents.

3.2. Demographic Data of the Previous Studies

Table 2 provides an overview of various studies that focus on demographic factors, sampling methods, and key findings regarding RLR behavior among delivery riders in different contexts. These studies highlight significant safety trends and concerns in the delivery rider industry. The studies conducted between 2019 and 2023 vary in their sample sizes and methodologies, providing valuable insights into how demographic factors relate to RLR behavior. By examining these demographic details and the key findings in the table, this study builds a strong foundation for understanding the characteristics and behaviors of delivery riders. Such insights are essential for developing targeted interventions and for emphasizing the importance of safety regulations in this industry.

Table 2 shows that age and gender are consistently the most commonly studied factors when examining human behavior, particularly in traffic safety research, which often examines traffic violations and accidents. Across all studies summarized in the table, men overwhelmingly dominated the delivery rider workforce. For instance, according to [19], 93.5% of their sample was male, and only 6.5% was female. Similar findings were reported by [9], who noted that over 90% of delivery riders were male. This trend is consistent with other studies, such as those by [16] and [27], who also found that most delivery riders were male. Regarding age, studies have shown that delivery riders tend to be young adults. For example, [16] focused on riders aged 18 to 24 years, while [9] reported that their sample mainly consisted of individuals aged 18 to 30 years. This demographic pattern suggests that the delivery industry attracts younger men, which may contribute to the higher risk profile of this occupation, as younger individuals are often more prone to engaging in risky behaviors.

Education level is another important factor linked to risky behavior, as highlighted in several previous studies. Although the educational levels of delivery riders vary, there is a clear trend toward lower educational attainment within this group. For example, as found in [19], only 8.5% of delivery riders in their study had a college degree, whereas the majority had finished junior high school (53.2%) or high school (30.5%). Similar results were found in [27], revealing that most delivery riders had completed junior or senior secondary education. Similarly, as reported in [9], a majority of their respondents had a low level of education, with only 21.5% holding a primary or bachelor's degree. These findings suggest that the delivery rider profession tends to attract individuals with fewer educational opportunities who may see it as one of the few viable job options. However, this lower level of education may also impact riders' understanding of and adherence to traffic rules and safety practices, potentially leading to a higher risk of accidents and unsafe behaviors, such as RLR.

Another important factor to consider is the delivery rider's work experience and employment pattern. Previous studies have shown that many delivery drivers have relatively little work experience, typically less than three years. For instance, according to [16], most riders had fewer than two years of experience. Similarly, as reported in [19], nearly 67% of delivery riders in their study had less than three years of experience, while as found in [27], their respondents generally had between one and three years of experience. [9] revealed an even lower level of experience, with 38.6% of riders having less than six months of work experience. This lack of experience is often linked to the fact that many riders work part-time.

According to [19], 58.3% of their participants were part-time riders, whereas [9] found that 62.3% of their respondents worked full-time. Reliance on a temporary workforce for delivery services can hinder the development of expertise and safe-riding habits. Part-time delivery riders or those with limited experience may not receive adequate training or gain sufficient exposure to manage the risks involved in delivery riding. This can increase risky behaviors and potentially cause more accidents on the road.

Another critical factor to consider is the working hours and income levels of the delivery riders. Most riders worked for more than six hours a day [27]. Similarly, as reported in [19], their respondents worked an average of 9.1 hours daily, with 78% having fewer than one rest day per week. As also found in [9], delivery riders typically worked over nine hours per day, and there were notable income differences based on their experience levels. In terms of income level, [9] reported that 38.6% of riders earned less than 4,000 yuan per month, whereas only 7% earned more than 8,000 yuan. According to [27], most riders earned between 4,000 yuan and 6,000 yuan per month. These findings paint a picture of long working hours and relatively low wages for delivery riders, which can be unfair. Demanding work schedules and low pay are likely to contribute to high stress levels and lead to risky behaviors such as RLR.

These descriptive results also highlight safety concerns for delivery riders, particularly regarding RLR behavior. According to [12] and [18], younger male delivery riders are more likely to engage in RLR. Specifically, as noted in [12], male e-cyclists were more prone to this behavior than females. Another study emphasized that delivery riders using e-bikes had a higher chance of RLR [18]. These findings suggest that demographic factors, such as age and gender, significantly influence delivery riders' safety behavior, with younger and less experienced riders being at a higher risk of engaging in these dangerous practices.

The demographic trends and descriptive results presented in this study emphasize the need for targeted interventions to improve the safety of delivery riders, particularly those who are younger and have less experience. The fact that the majority of these riders were young men with limited education and work experience suggests that this group could benefit from focused training programs aimed at improving riding safety and compliance with traffic regulations. Additionally, the rise in incidents of RLR and other risky behaviors points to the need for stricter enforcement of traffic laws and the design of safer delivery systems to alleviate the work pressures faced by riders. To address these issues effectively, it is important to examine delivery riders' intentions and perceptions from multiple perspectives, including their demographic background. As noted in [27], understanding the intentions and behavior of delivery riders is essential for developing effective security measures. Future research should continue to explore the factors behind unsafe riding practices, paying special attention to demographic elements such as age, gender, and education level to better understand how these factors influence riders' actions and road safety.

Table 2. Demographic data of the previous study of RLR among delivery rider (Source: developed by the authors)

Author	Sample Size	Sampling Method	Demographic Factors	Descriptive Results	Findings
[19]	824	Cross-sectional study with self-administered questionnaires	Gender, age, educational level, type of work, work experience, working hours per day,	• 93.5% male, 6.5% female. • Average age: 31.5 years. • Education: • 8.5% had college degrees. • 53.2% completed junior high. • 30.5% completed senior high. • 7.8% stopped at elementary school. • 58.3% worked as part-time delivery riders. • 67% had less	Younger riders experience higher time pressure; less experienced riders engage in risky behaviors.

				than 3 years of experience. • Average workday: 9.1 hours (Standard deviation: 1.22 hours). • 78% had fewer than one rest day weekly.	
[9]	228 complete questionnaires	Random selection of delivery riders for presurvey and survey	Gender, age, work experience, educational background, type of work, working hours per day, marital status, and income	• Over 90% were male, primarily aged 18-30 years. • Education: 21.6% had junior or undergraduate degrees. • 62.3% were full-time. • Half worked more than 9 hours daily. • 38.6% had less than 6 months of experience. • 13.6% had over 2 years of experience. • Income: • 38.6% earned below 4000 yuan/month. • 7% earned over 8000 yuan/month.	Novice riders were unsure about running red lights, while experienced riders were more likely to do so, with age and work experience influencing red-light running intentions.
[12]	3335 e-bike riders in Xi'an, China	Video recording technology for street crossing behavior	Gender, age	• DEB riders were more likely to run red lights than OEB riders • Male e-bike riders are more likely to run red lights than females. • Females are 21% less likely to engage in RLR. • Age also influences RLR behavior: • Younger riders in both groups, more likely RLR than older riders. • Older riders have a 27.4%	DEB riders run more red lights than OEB riders. Younger riders run red lights more than older riders. Male e-bike riders have higher red-light running rates than females.

				(OEB) and 24% (DEB) lower likelihood of RLR. • 91.1% of younger riders, more inclined to RLR than older riders. • 8.9% of younger riders have a lower probability of RLR.	
[18]	4,180 e-bike riders	Video-based observation without external interventions	Age, gender, and e-bike type	• Younger riders are more likely to RLR compared to older riders. • Male e-bike riders have higher RLR rates than females. • Delivery e-bikes increase the likelihood of RLR: • 34% higher for waiting and running red lights. • 65% higher for running red lights immediately. • Delivery e-bike riders have higher probabilities of RLR than other e-bike riders.	Gender and age majorly affect red-light compliance among e-bike riders, with older riders being more cautious. Young riders, especially during noon or due to poor waiting positions, are more likely to run red lights.
[16]	434 food delivery riders	Non-probability consecutive sampling in Athens	Gender, age, riding experience, work experience, involvement in accidents	• All respondents were male, aged 18-24. • Riding experience: less than 5 years. • Work experience: less than 2 years. • Most had previous serious accidents. • Used personal vehicles for work. • Paid hourly. • Work mileage: over 250	High-risk delivery riders are commonly young, reflecting research identifying age as a critical risk factor.

				km/week. • Low concern for wayfinding.	
[27]	612 instant delivery service riders	Structured questionnaire survey in Hangzhou, Xi'an, and Aral	Age, gender, education, experience, part-time status, driver's license, past violations, accidents	• Most participants were male (86.9%). • A significant portion were young adults (particularly aged 26-30). • 40.4% were non-married. • Education: Senior high school (51.5%) was the most common education level. • Income: • Most earned between 4000-8000 yuan/month. • Experience: • Most had 1-3 years of delivery experience. • Usually worked over 6 hours/day.	Understanding the intentions of instant delivery service riders is important, but future studies should also explore their behaviors. The study's predominantly male sample reflects the demographics of China's delivery riders accurately.

Notes: Red-light running = RLR

Table 2 provides a comprehensive overview of the demographic characteristics and behaviors related to RLR among delivery riders, drawing on findings from previous studies. The consistent findings of a young, male-dominated workforce coupled with the challenges of low education levels, limited work experience, and demanding work schedules highlight the vulnerabilities faced by these riders. These factors contribute to the prevalence of RLR risk behaviors, emphasizing the need for targeted safety interventions and further research to address the specific challenges faced by delivery riders. The insights from these studies are valuable for guiding future research and shaping policies aimed at improving the safety and overall well-being of delivery riders.

4. Results and Discussion

Table 1 illustrates the demographic profile of the p-hailing riders, offering valuable insights into the risk behaviors observed within this group.

4.1. Age and Gender

The data reveal that 91.5% of delivery riders are male, which aligns with previous studies that show that the industry is overwhelmingly male-dominated in various regions [9], [19]. The significant gender imbalance in this industry raises critical questions about recruitment practices and cultural perceptions, which may actively discourage female participation. The fact that the workforce is predominantly male could result in safety policies being tailored more toward male riders, potentially overlooking the specific needs and safety concerns of female riders. The table also shows that a majority of riders, around 57.6%, fall between the ages of 21 and 30, indicating a heavy reliance on young adults in the industry. This result suggests that the industry heavily depends on young adults, who might be more inclined towards risky behavior, such as RLR [12]. Younger riders, while physically suited to handle the job's demands, may be more likely to exhibit unsafe behaviors, such as speeding or ignoring traffic rules, which increases their chances of accidents [12]. Research has consistently shown that younger males are especially prone to risky behaviors, which is concerning in jobs where time pressure is a constant challenge [27]. The dominance of this demographic group is troubling, as studies suggest that younger male riders are more likely to engage in

unsafe practices, such as RLR, owing to both inexperience and a predisposition toward risk-taking [18].

4.2. Educational Background

Educational background is another key demographic factor that should be considered. The data show that most riders had completed secondary education or held certificates, diplomas, or other non-degree qualifications (66.5%). In contrast, only 31.9% of riders have a bachelor's degree and only 2.0% have a master's degree. The low percentage of highly educated individuals may reflect the perception that delivery does not require advanced education, making it a more accessible option for those with limited opportunities for higher education. This educational profile may also influence how well riders understand and follow safety protocols and traffic laws, potentially increasing the risk of accidents [9]. Individuals with lower levels of education may be drawn to work because of the limited availability of higher-paying job options. This finding suggests a possible link between education level and the types of employment available within this sector. Moreover, the limited educational qualifications of many riders could have long-term consequences for their career prospects, possibly trapping them in low-paying, low-skill jobs and perpetuating a cycle of economic hardships.

4.3. Type of Work and Work Experience

The data on employment status showed that a significant number of riders (62.6%) were engaged in part-time work. This trend aligns with the broader shift toward gig economy jobs, where roles such as delivery services are appealing to individuals looking for flexible work schedules or additional income [27]. However, the prevalence of part-time work raises concerns regarding riders' familiarity with safety protocols. Part-time workers may not receive the same level of training or gain the same amount of experience as their full-time counterparts, potentially leaving them less equipped to handle job risks of the job [16]. Many part-time riders, who might balance multiple jobs or other responsibilities, could also be more distracted or less familiar with specific routes and safety measures, increasing their risk of accidents. Additionally, the relatively short tenure of many riders—24.9% with less than a year of experience and 36.2% with only one to two years—further highlights the safety risks associated with inexperience. These factors highlight the importance of implementing comprehensive training and safety programs, specifically for this group of workers.

4.4. Income Level and Working Duration

Income levels among riders are also a cause for concern, with a substantial number earning less than RM 4,000 per month and 36.4% earning less than RM 2,000. This reflects the precarious nature of gig economy work, where earnings are inconsistent and directly tied to the hours worked. Riders facing financial pressure may feel compelled to work longer hours or take on riskier deliveries in an attempt to boost their income, which in turn increases the risk of accidents [16]. The fact that 34.8% of riders work between 6 and 9 hours a day suggests that many are subject to significant time pressures, which can lead to unsafe behaviors on the road. Similar trends were observed by [9], who found that less experienced riders and those under financial strain are more likely to engage in risky behaviors, often due to time constraints. This link between economic pressure and unsafe practices highlights the need for interventions that target both rider behavior and the underlying socio-economic challenges contributing to these risks.

4.5. Accident History

An analysis of accident history revealed that 56.4% of delivery riders have been involved in accidents, underscoring the significant risks associated with this line of work. This high accident rate reflects the broader trend of risky behaviors among delivery riders and suggests that current safety measures do not adequately address the dangers they face. The clear connection between long working hours and accident history aligns with the findings of [27], who observed that extended work periods contribute to fatigue, which in turn increases the risk of accidents. Moreover, the link between certain demographic factors, such as younger age, part-time employment, and lower income, and higher accident rates indicates the need to reassess safety protocols and introduce more rigorous training and support systems for riders [9]. To mitigate these risks, the industry must implement policies that not only enhance safety measures but also improve working conditions. This includes ensuring more stable incomes and guaranteeing that all riders have access to vital safety training, regardless of their employment status.

The comparative analysis of this study with previous research highlights the consistency in the findings regarding the influence of demographic factors, work conditions, and experience on delivery riders' safety behaviors. As emphasized in [18], factors such as age and the type of e-bike used significantly affect adherence to traffic laws, with younger riders and those using delivery-specific e-bikes being more likely to engage in RLR. These findings highlight the need for tailored interventions that address these specific factors, potentially through technology-driven solutions such as speed regulators on e-bikes and automated reminders to follow traffic rules. Although

the impact of education on safety behavior is less prominent, it remains relevant. Riders with only secondary education or less (66.1%) might lack formal safety training that could reduce risky behaviors. According to [9], lower levels of education are associated with a higher likelihood of taking risks. Incorporating basic traffic safety education into the onboarding process for delivery riders can bridge this gap and enhance road safety for both the riders and the public.

5. Conclusion

The findings highlight the need for targeted interventions to enhance the safety of p-hailing riders. The demographic patterns observed, particularly the dominance of young, inexperienced male riders who tend to have lower incomes and limited educational backgrounds, make this group especially prone to risky behaviors such as RLR. Economic pressures and long working hours further exacerbate these behaviors, creating significant challenges for maintaining safe practices. Income and employment status also significantly influence p-hailing rider behavior and safety outcomes. The prevalence of p-hailing riders working part-time or earning low income indicates a need for improved financial stability and more secure employment opportunities within the industry.

The study suggests that specific interventions, such as more comprehensive safety training, stricter traffic law enforcement, and educational programs, could help reduce accident rates and improve the safety of p-hailing riders. This emphasizes the importance of training programs that teach safe riding techniques and traffic law compliance, particularly for new or inexperienced riders. Additionally, there is an urgent need for stronger safety measures, including the stricter enforcement of existing traffic regulations, better rider education, and safer working conditions. Addressing these issues could foster a safer and more sustainable delivery industry. Policymakers and industry leaders should consider making safety training mandatory, and offering incentives for full-time employment to create a more stable and skilled workforce. Such measures could help mitigate the risks linked to inexperience and part-time work, ultimately leading to improved safety outcomes. Furthermore, regulating working hours through policy changes could reduce fatigue, which is a common contributor to accidents associated with long shifts.

In conclusion, the analysis identified that demographic factors play an important role in addressing safety issues faced by p-hailing riders. The proposed interventions were designed to address the unique challenges of this workforce by prioritizing safety, improving working conditions, and lowering accident rates. This strategic approach aims to improve the well-being of p-hailing riders' and support the continued growth and success of the delivery services industry.

5.1. Research Contribution

This study contributes significantly to the understanding of the interaction between socioeconomic pressure and traffic safety among p-hailing riders. By examining demographic factors such as age, income level, and education, this study highlights the elements that influence risky behavior, such as red-light running. It is important to investigate these socioeconomic factors and safety challenges, especially as they impact the growing workforce in today's rapidly growing e-commerce sector. This study is aligned with various Sustainable Development Goals (SDGs), including SDG 3 (Good Health and Well-Being), SDG 4 (Quality Education), SDG 8 (Decent Work and Economic Growth), and SDG 11 (Sustainable Cities and Communities). This alignment emphasizes relevance to society by offering actionable insights for policymakers, urban planners, and industry stakeholders.

These findings support several targeted interventions to address this challenge comprehensively. For example, increased safety training programs and stricter enforcement of traffic laws are essential to reduce accident rates and promote safer road behavior. Simultaneously, addressing the economic pressures faced by p-hailing riders requires a regulatory framework to ensure fair earnings, limit excessive working hours, and provide financial assistance programs. Educational initiatives such as awareness campaigns can further instill a culture of road safety while fostering personal responsibility among riders. In addition, technological solutions such as traffic-safety-oriented navigation tools can complement efforts to create a holistic strategy for rider well-being.

By addressing these issues through a multifaceted approach and perspective, this study not only addresses safety concerns for p-hailing riders, but also contributes to the broader objective of sustainable urban development. The recommendations aim to balance the needs of riders, employers, and the wider community by ensuring that the growth of the delivery service industry is equitable and sustainable. These findings can be the basis for future research and policy formulation in Malaysia as well as in other countries that experience the same trend.

5.2. Limitations and Future Development

Although this study provides valuable insights into the demographic factors influencing safety behavior among p-hailing riders, several limitations should be acknowledged. First, the cross-sectional design of the

study captures data at only one point in time, which limits our understanding of how these behaviors might change over time. Longitudinal studies would be more effective in understanding how these behaviors evolve over time, particularly as p-hailing riders gain more experience or as working conditions in the gig economy change. Another limitation is the potential for self-reporting bias, particularly regarding work hours and accident history. P-hailing riders may not always report risky behaviors accurately, or they may perceive themselves as following safety protocols more diligently than they actually do. This could result in underreporting of unsafe practices. Future studies would benefit from incorporating more objective data to better understand rider behavior.

Additionally, the focus on a specific geographic region limits the generalizability of these findings. Riders in other regions may encounter different challenges, with their behaviors shaped by factors such as local traffic patterns, cultural attitudes toward safety, and the level of law enforcement in their area. Conducting comparative studies across various regions or countries would help to identify both universal and region-specific risk factors. Finally, future research should also investigate the role of technological interventions, such as apps that monitor rider behavior in real time and provide alerts when unsafe actions are detected. These technologies could play an important role in reducing accidents and enhancing rider safety, particularly when combined with the demographic and socioeconomic insights from this study.

Declarations

Author Contributions

Conceptualization, N.S.M.R.; methodology, M.N.B.; validation, A.N.H.I.; formal analysis, A.N.H.I.; investigation, A.N.H.I.; resources, N.S.M.R.; data curation, M.N.B.; writing—original draft preparation, all authors contributed equally; writing—review and editing, N.S.M.R.; visualization, M.N.B.; supervision, N.S.M.R.; project administration, M.N.B. All authors have read and agreed to the published version of the manuscript.

Data Availability Statement

The data presented in this study are openly available in Scopus.

Funding

Funding information is not available.

Acknowledgements

The authors thank the Universiti Kebangsaan Malaysia, and this work was funded by a GUP-2023-030 research grant from Universiti Kebangsaan Malaysia.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Conflicts of Interest

The authors declare that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

References

[1] SAMPAIO A., SAVELSBERGH M., VEELENTURF L. P., & VAN WOENSEL T. Delivery systems with crowd-sourced drivers: A pickup and delivery problem with transfers. *Networks*, 2020, 76(2): 232–255. https://doi.org/10.1002/net.21963

[2] SUBRAMANIAM S., ZULAIKHA H., ZIN M., SHANG J., & HAKIMI A. N. Factors Influencing Risky Riding Behaviors among P-Hailing Riders in Malaysia. *Journal of Hunan University Natural Sciences*, 2023, 50(11). https://doi.org/10.55463/issn.1674-2974.50.11.10

[3] ZHANG G., TAN Y., ZHONG Q., & HU R. Analysis of Traffic Crashes Caused by Motorcyclists Running Red Lights in Guangdong Province of China. *International Journal of Environmental Research and Public Health*, 2021, 18(2): 553. https://doi.org/10.3390/ijerph18020553

[4] LUU L., VAN MINH C. C., & LONG N. X. The development of safe riding guidelines for young riders – A case study of Phu Yen, Vietnam. *IATSS Research*, 2021, 45(2): 226–233. https://doi.org/10.1016/j.iatssr.2020.11.001

[5] NGUYEN-PHUOC D. Q., NGUYEN L. N. T., SU D. N., NGUYEN M. H., & OVIEDO-TRESPALACIOS O. Deadly meals: The influence of personal and job factors on burnout and risky riding behaviors of food delivery motorcyclists. *Safety Science*, 2023, 159. https://doi.org/10.1016/j.ssci.2022.106007

[6] GHAHREMANNEZHAD H., SHI H., & LIU C. Real-Time Accident Detection in Traffic Surveillance Using Deep Learning. *Proceedings IEEE of the International Conference on Imaging Systems and Techniques*, 2022. https://doi.org/10.1109/IST55454.2022.9827736

[7] UKENNA S. I., & AYODELE A. A. Applying the Extended Theory of Planned Behavior to Predict Sustainable Street Food Patronage in a Developing Economy. *Journal of Food Products Marketing*, 2019, 25(4): 404–434. https://doi.org/10.1080/10454446.2019.1572561

[8] ESMAELI S., AGHABAYK K., & BATES L. Willingness and intention to run a red light among motorcyclists. *Journal of Safety Research*, 2022, 83: 66–78. https://doi.org/10.1016/j.jsr.2022.08.005

[9] SHEN X., ZHANG F., LV H., WEI S., & SUN Z. The Application and Extension of The Theory of Planned Behavior to An Analysis of Delivery Riders' Red-Light Running Behavior in China. *Accident Analysis & Prevention*, 2020, 144: 105640.

https://doi.org/10.1016/j.aap.2020.105640
[10] ZHU D., SZE N. N., & FENG Z. The trade-off between safety and time in the red-light running behaviors of pedestrians: A random regret minimization approach. *Accident Analysis and Prevention*, 2021, 158: 106214. https://doi.org/10.1016/j.aap.2021.106214
[11] GAO X., ZHAO J., & GAO H. Red-Light Running Behavior of Delivery-Service E-Cyclists Based on Survival Analysis. *Traffic Injury Prevention*, 2020, 21(8): 558–562. https://doi.org/10.1080/15389588.2020.1819989
[12] ZHANG F., JI Y., LV H., & MA X. Analysis of Factors Influencing Delivery E-Bikes' Red-Light Running Behavior: A Correlated Mixed Binary Logit Approach. *Accident Analysis and Prevention*, 2012, 152: 105977. https://doi.org/10.1016/j.aap.2021.105977
[13] MALIK M., RUSLI R., NUSA F. N. M., & ADINEGORO Y. Risky Behaviors among Delivery Riders at Signalized Intersections in Malaysia. *Journal of the Malaysian Institute of Planners*, 2023, 21(4): 73–85. https://doi.org/10.21837/pm.v21i28.1317
[14] DOMMES A., GRANIÉ M.-A., CLOUTIER M.-S., COQUELET C., & HUGUENIN-RICHARD F. Red light violations by adult pedestrians and other safety-related behaviors at signalized crosswalks. *Accident Analysis and Prevention*, 2915, 80: 67–75. https://doi.org/10.1016/j.aap.2015.04.002
[15] FRABONI F., MARÍN PUCHADES V., DE ANGELIS M., PIETRANTONI L., & PRATI G. Red-Light Running Behavior of Cyclists in Italy: An Observational Study. *Accident Analysis and Prevention*, 2018, 120: 219–232. https://doi.org/10.1016/j.aap.2018.08.013
[16] PAPAKOSTOPOULOS V., & NATHANAEL D. The Complex Interrelationship of Work-Related Factors Underlying Risky Driving Behavior of Food Delivery Riders in Athens, Greece. *Safety and Health at Work*, 2021, 12(2): 147–153. https://doi.org/10.1016/j.shaw.2020.10.006
[17] JENSUPAKARN A., & KANITPONG K. Influences of Motorcycle Rider and Driver Characteristics and Road Environment on Red Light Running Behavior at Signalized Intersections. *Accident Analysis & Prevention*, 2018, 113: 317–324. https://doi.org/10.1016/j.aap.2018.02.007
[18] ZHANG F., KUAI C., LV H., & LI W. Investigating Different Types of Red-Light Running Behaviors Among Urban E-Bike Rider Mixed Groups. *Journal of Advanced Transportation*, 2021, 2021: 1–9. https://doi.org/10.1155/2021/1977388
[19] ZHENG Y., MA Y., GUO L., CHENG J., & ZHANG Y. Crash Involvement and Risky Riding Behaviors among Delivery Riders in China: The Role of Working Conditions. *Transportation Research Record: Journal of the Transportation Research Board*, 2019, 2673(4): 1011–1022. https://doi.org/10.1177/0361198119841028
[20] ZHANG W., WANG K., WANG L., FENG Z., & DU Y. Exploring factors affecting pedestrians' red-light running behaviors at intersections in China. *Accident Analysis and Prevention*, 2016, 96: 71–78. https://doi.org/10.1016/j.aap.2016.07.038
[21] ZHENG H. Customer Preferences on Delivery based on Data Analysis. *Proceedings of the 2022 7th International Conference on Financial Innovation and Economic Development*, 2022, 648: 1306–1311. https://doi.org/10.2991/aebmr.k.220307.215
[22] TANG T., GUO Y., ZHOU X., LABI S., & ZHU S. Understanding Electric Bike Riders' Intention to Violate Traffic Rules and Accident Proneness in China. *Travel Behaviour and Society*, 2021, 23: 25–38. https://doi.org/10.1016/j.tbs.2020.10.010
[23] BORHAN M. N., IBRAHIM A. N. H., & MISKEEN M. A. A. Extending the theory of planned behaviour to predict the intention to take the new high-speed rail for intercity travel in Libya: Assessment of the influence of novelty seeking, trust and external influence. *Transportation Research Part A*, 2019, 130: 373–384. https://doi.org/10.1016/j.tra.2019.09.058
[24] TANG T., WANG H., ZHOU X., & GONG H. Understanding Electric Bikers' Red-Light Running Behavior: Predictive Utility of Theory of Planned Behavior Vs Prototype Willingness Model. *Journal of Advanced Transportation*, 2020, 2020: 1–13. https://doi.org/10.1155/2020/7097302
[25] BORHAN M. N., YAZID M. RAZUHANAFI M., & IBRAHIM A. N. H. The relationship between the demographic, personal, and social factors of Malaysian motorcyclists and risk-taking behavior at signalized intersections. *Accident Analysis & Prevention*, 2018, 121: 94-100. https://doi.org/10.1016/j.aap.2018.09.004
[26] SATIENNAM W., SATIENNAM T., TRIYABUTRA T., & RUJOPAKARN W. Red Light Running by Young Motorcyclists: Factors and Beliefs Influencing Intentions and Behavior. *Transportation Research Part F: Traffic Psychology and Behaviour*, 2018, 55: 234–245. https://doi.org/10.1016/j.trf.2018.03.007
[27] YE F., & CHENG W. Exploring Factors That Influence Instant Delivery Service Riders' Red Light Running Behaviour – Development and Validation of a Questionnaire Based on the Theoretical Domains Framework. *Promet - Traffic and Transportation*, 2023, 35(6): 855–870. https://doi.org/10.7307/ptt.v35i6.393

参考文:

[1] SAMPAIO A.、SAVELSBERGH M.、VEELENTURF L. P. 和 VAN WOENSEL T. 众包司机配送系统：带转接的取送问题。网络，2020，76(2)：232–255。https://doi.org/10.1002/net.21963
[2] SUBRAMANIAM S.、ZULAIKHA H.、ZIN M.、SHANG J. 和 HAKIMI A. N. 影响马来西亚网约车乘客危险乘车行为的因素。湖南大学自然科学学报，2023，50(11)。 https://doi.org/10.55463/issn.1674-2974.50.11.10
[3] ZHANG G.、TAN Y.、ZHONG Q. 和 HU R. 中国广东省摩托车闯红灯交通事故分析。国际环境研究与公共健康杂志，2021，18(2): 553。https://doi.org/10.3390/ijerph18020553
[4] LUU L.、VAN MINH C. C. 和 LONG N. X. 为年轻骑手制定安全骑行指南——以越南富安省为例。IATSS 研究，2021，45(2): 226–233。https://doi.org/10.1016/j.iatssr.2020.11.001
[5] NGUYEN-PHUOC D. Q.、NGUYEN L. N. T.、SU D. N.、NGUYEN M. H. 和 OVIEDO-TRESPALACIOS O. 致命餐食：个人和工作因素对送餐摩托车手倦怠和危险骑行行为的影响。安全科学，2023，159。https://doi.org/10.1016/j.ssci.2022.106007

[6] GHAHREMANNEZHAD H.、SHI H. 和 LIU C. 使用深度学习进行交通监控中的实时事故检测。 IEEE 国际成像系统和技术会议论文集，2022。https://doi.org/10.1109/IST55454.2022.9827736
[7] UKENNA S. I. 和 AYODELE A. A. 应用扩展计划行为理论预测发展中经济体的可持续街头食品赞助。食品营销杂志，2019，25(4)：404–434。https://doi.org/10.1080/10454446.2019.1572561
[8] ESMAELI S.、AGHABAYK K. 和 BATES L. 摩托车手闯红灯的意愿和意图。安全研究杂志，2022，83：66–78。 https://doi.org/10.1016/j.jsr.2022.08.005
[9] SHEN X., ZHANG F., LV H., WEI S., 和 SUN Z.。计划行为理论在中国外卖骑手闯红灯行为分析中的应用与扩展。事故分析与预防，2020，144：105640。https://doi.org/10.1016/j.aap.2020.105640
[10] ZHU D., SZE N. N., 和 FENG Z.。行人闯红灯行为中安全与时间的权衡：一种随机遗憾最小化方法。事故分析与预防，2021，158：106214。https://doi.org/10.1016/j.aap.2021.106214
[11] GAO X., ZHAO J., 和 GAO H. 基于生存分析的外卖电动自行车驾驶员闯红灯行为。 交通伤害预防，2020，21(8)：558–562。https://doi.org/10.1080/15389588.2020.1819989
[12] ZHANG F., JI Y., LV H., 和 MA X. 影响外卖电动自行车闯红灯行为的因素分析：相关混合二元 Logit 方法。事故分析与预防，2012，152：105977。https://doi.org/10.1016/j.aap.2021.105977
[13] MALIK M.、RUSLI R.、NUSA F. N. M. 和 ADINEGORO Y. 马来西亚信号交叉口送货骑手的危险行为。马来西亚规划师协会杂志，2023，21(4)：73–85。https://doi.org/10.21837/pm.v21i28.1317
[14] DOMMES A.、GRANIÉ M.-A.、CLOUTIER M.-S.、COQUELET C. 和 HUGUENIN-RICHARD F. 成年行人在信号人行横道上的闯红灯行为和其他安全相关行为。事故分析与预防，2915，80：67–75。https://doi.org/10.1016/j.aap.2015.04.002
[15] FRABONI F.、MARÍN PUCHADES V.、DE ANGELIS M.、PIETRANTONI L. 和 PRATI G. 意大利自行车骑手闯红灯行为：一项观察性研究。事故分析与预防，2018，120：219–232。https://doi.org/10.1016/j.aap.2018.08.013
[16] PAPAKOSTOPOULOS V. 和 NATHANAEL D. 希腊雅典外卖骑手危险驾驶行为背后的工作相关因素的复杂相互关系。工作安全与健康，2021，12(2)：147–153。https://doi.org/10.1016/j.shaw.2020.10.006
[17] JENSUPAKARN A. 和 KANITPONG K. 摩托车骑手和驾驶员特征以及道路环境对信号交叉口闯红灯行为的影响。事故分析与预防，2018，113：317–324。https://doi.org/10.1016/j.aap.2018.02.007
[18] ZHANG F., KUAI C., LV H., 和 LI W. 调查城市电动自行车骑手混合群体中不同类型的闯红灯行为。先进交通杂志，2021，2021：1-9。https://doi.org/10.1155/2021/1977388
[19] ZHENG Y., MA Y., GUO L., CHENG J., 和 ZHANG Y. 中国外卖骑手的碰撞事故和危险骑行行为：工作条件的作用。交通研究记录：交通研究委员会杂志，2019 年，2673(4)：1011-1022。https://doi.org/10.1177/0361198119841028
[20] ZHANG W., WANG K., WANG L., FENG Z., 和 DU Y. 探索影响中国路口行人闯红灯行为的因素。事故分析与预防，2016，96：71-78。https://doi.org/10.1016/j.aap.2016.07.038
[21] ZHENG H. 基于数据分析的顾客配送偏好。2022 年第七届金融创新与经济发展国际会议论文集，2022，648：1306-1311。 https://doi.org/10.2991/aebmr.k.220307.215
[22] TANG T.、GUO Y.、ZHOU X.、LABI S. 和 ZHU S. 了解中国电动自行车骑手违反交通规则的意图和事故倾向。出行行为与社会，2021，23：25–38。https://doi.org/10.1016/j.tbs.2020.10.010
[23] BORHAN M. N.、IBRAHIM A. N. H. 和 MISKEEN M. A. A. 扩展计划行为理论以预测利比亚乘坐新高铁进行城际旅行的意图：评估新颖性寻求、信任和外部影响的影响。交通研究 A 部分，2019，130：373–384。https://doi.org/10.1016/j.tra.2019.09.058
[24] TANG T.、WANG H.、ZHOU X. 和 GONG H. 理解电动自行车骑手闯红灯行为：计划行为理论与原型意愿模型的预测效用。先进交通杂志，2020，2020：1-13。https://doi.org/10.1155/2020/7097302
[25] BORHAN M. N.、YAZID M. RAZUHANAFI M. 和 IBRAHIM A. N. H. 马来西亚摩托车手的人口统计、个人和社会因素与信号交叉口冒险行为之间的关系。事故分析与预防，2018，121：94-100。https://doi.org/10.1016/j.aap.2018.09.004
[26] SATIENNAM W.、SATIENNAM T.、TRIYABUTRA T. 和 RUJOPAKARN W. 年轻摩托车手闯红灯：影响意图和行为的因素和信念。交通研究 F 部分：交通心理学和行为，2018，55：234-245。https://doi.org/10.1016/j.trf.2018.03.007
[27] YE F. 和 CHENG W. 探索影响即时配送服务骑手闯红灯行为的因素——基于理论领域框架的问卷开发和验证。Promet - 交通和运输，2023，35(6)：855-870。https://doi.org/10.7307/ptt.v35i6.393

Disclaimer/Publisher's Note:
The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of Journal of Hunan University (Natural Sciences) and/or the editor(s). Journal of Hunan University (Natural Sciences) and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.