Deadly meals

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Quy Nguyen-Phuoc, Duy; Ngoc Thi Nguyen, Ly; Ngoc Su, Diep; Nguyen, Minh Hieu; Oviedo-Trespalacios, Oscar

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Deadly meals: The influence of personal and job factors on burnout and risky riding behaviours of food delivery motorcyclists

Duy Quy Nguyen-Phuoc [a,*], Ly Ngoc Thi Nguyen [b], Diep Ngoc Su [b,c], Minh Hieu Nguyen [d], Oscar Oviedo-Trespalacios [e]

[a] Faculty of Road and Bridge Engineering, The University of Danang - University of Science and Technology, 54 Nguyen Luong Bang Street, Lien Chieu District, Danang City, Viet Nam
[b] Faculty of Tourism, The University of Danang - University of Economics, 71 Ngu Hanh Son, Danang City, Viet Nam
[c] The University of Danang - Advanced Institute of Science and Technology, 41 Le Duan, Danang City, Viet Nam
[d] Faculty of Transport - Economics, University of Transport and Communications, No. 3 Cau Giay Street, Dong Da District, Hanoi, Viet Nam
[e] Delft University of Technology, Faculty of Technology, Policy and Management, Section of Safety and Security Science, Jaffalaan 5, 2628 BX Delft, The Netherlands

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ABSTRACT

Food delivery riders are overrepresented in road crashes. Arguably, the increased risk experienced by food delivery riders is linked to the working conditions offered by the "gig economy". Research is needed to fully understand the safety-related issues this vulnerable group of road users face daily and identify opportunities for counter measures. In this investigation, we proposed a new theoretical model to explain the risky behaviour of food delivery motorcyclists based on the well-established Job Demands-Resources (JD-R) model. Following the JD-R, we considered the impact of job demands (job aspects that require sustained effort) and job resources (job aspects that help achieve work-related goals, reduce job demands and stimulate personal development) on the risky riding behaviours of food delivery motorcyclists. The JD-R model was also extended with three constructs, including personal demands, personal resources, and perceived safety risk to explore the role of individuals' within-person aspects. The developed model was tested using data collected from 554 food delivery riders in the two biggest cities in Vietnam. The results showed that job burnout, job resources, and personal demands directly impact risky riding behaviours, in which job burnout was the most significant predictor. Constructs such as job demands, personal resources, and perceived safety risk were not significant predictors of risky riding behaviours. This research shows that organisation-level factors could be modified to prevent risky riding behaviour. The gig economy industry can do much more to improve the safety of delivery riders.

1. Introduction

The online food delivery industry has boomed in recent years (Statista Reports, 2018). Many 'gig economy' food delivery services have launched and become increasingly popular, e.g., Uber Eats in the United States and Grab Food in South Asia. During the COVID-19 pandemic, there has been a significant rise in the demand for online food delivery services (Ali et al., 2021). Thanks to technological developments in telecommunication and geo-localisation, customers can order food via online platforms and have their food delivered to any location within the shortest time possible (Su et al., 2022). However, delivery riders employed by these services - gig workers - have faced several challenges (e.g., poor working conditions, lack of regulation, and absence of job security), affecting their health and safety (Mehta, 2020, Nguyen-Phuoc et al., 2022). For example, over 3,000 delivery-related crashes were reported in Nanjing (China) in the first half of 2017 (Shepherd, 2017), while more than 150 motorcycle-related crashes involving delivery riders occurred between March through June 2020 in Malaysia (Bernama, 2021). Due to these issues, the sustainability of the online food delivery model is questionable. Indeed, it can be argued that food delivery organisations have not aligned their practices with the UN's Sustainable Development Goals (United Nations, 2015), which clearly highlight the role of fair work and health outcomes to guarantee a better future for all humanity. According to the US Occupational Safety and

* Corresponding author.
E-mail addresses: npqduy@dut.udn.vn (D. Quy Nguyen-Phuoc), lyntn@due.udn.vn (L. Ngoc Thi Nguyen), diepsn@due.udn.vn (D. Ngoc Su), hieunm@utc.edu.vn (M.H. Nguyen), O.OviedoTrespalacios@tudelft.nl (O. Oviedo-Trespalacios).

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Health Administration (2016), organisations cannot achieve sustainable development goals without protecting the safety, health, and welfare of their most vital resource: employees. The private sector needs to consider a broader view of sustainability that accounts for better work conditions and health outcomes of employees.

Risky riding behaviours contribute to the high prevalence of severe crashes among food delivery riders. Therefore, important scientific efforts have been directed to look at factors determining risky riding behaviours among delivery riders (Dablanc et al., 2017; Oviedo-Trespalacios et al., 2022; Papakostopoulos and Nathanael, 2021; Qin et al., 2021; Tran et al., 2022; Zhang et al., 2020). Generally, these studies have concentrated on the impact of different working environments and factors (e.g., prolonged working hours, temporal pressure, lack of rest, shortage of organisational support, and riding on congested and mixed roads) on unsafe riding behaviours. Yet, knowledge of the role of personal characteristics of riders (e.g., demands, resources, and perception of risk) and job burnout in risky riding behaviours is a largely unexplored area of research. Previous research has also overlooked the perceived demands that delivery riders experience as part of their jobs. As such, there is a need to develop a comprehensive model to examine the effects of these variables on the intention to engage in risky riding behaviours. The findings can support the development of safety policies protecting delivery riders and other road users. This will help to meet global sustainability goals of the transport system and the gig economy industry.

The Job Demands-Resources (JD-R) model introduced by Demerouti et al. (2001) explains that working conditions, which an individual perceives as job demands (JD) and job resources (JR), can result in burnout and other health issues. Burnout is a health impairment process wherein challenging tasks exhaust employees' resources, leading to the depletion of energy and health problems (Bakker et al., 2003). In the workplace, employees experience a wide range of JD, such as exposure to hazards and cognitively and physically demanding tasks. However, the workplace also creates opportunities for employees' learning, development, and achievement of goals through JR, such as a positive working climate, co-worker support, and job autonomy (Crawford et al., 2010). JR help employees satisfy their needs and protect themselves from the burden of some working conditions. The opposite contributions of JD and JR to burnout have been consistently demonstrated by several earlier studies (Bakker et al., 2003, Demerouti et al., 2001, Nahrgang et al., 2011, Nguyen-Phuoc et al., 2022). While the JD-R model is well-established and useful, the JD-R also has a shortcoming. One key issue is that the JD-R relies on job characteristics and overlooks the role of personal traits, which also influence risky behaviours (Oviedo-Trespalacios et al., 2017). Therefore, Demerouti and Bakker (2011) highlight that extending JD-R models using resources and demands of individuals to consider additional constructs is necessary. To the best of our knowledge, very few studies have utilised the JD-R to investigate risky riding behaviours among on-demand food delivery riders. However, past studies have confirmed that job design influences employee performance while on the road (Costantini et al., 2022), suggesting that the JD-R can be an effective framework to explore determinants of risky riding behaviours among food delivery workers.

To address these research gaps, the present investigation proposes an extension of the JD-R model to examine factors associated with risky riding behaviours (self-reported risky riding behaviours) among delivery riders. Besides the traditional constructs included in the JD-R model (i.e., JD, JR, and job burnout), three new constructs (i.e., personal demands, personal resources, and perceived safety risk) are utilised to investigate risky riding behaviours. The present investigation was conducted in Hanoi and Ho Chi Minh City – the two largest cities of Vietnam and typical megacities in the Global South. Both have seen a boom in delivery services such as GrabFood, Now's, and Beamin (VietnamCredit, 2020).

2. Theoretical background

According to Rothengatter (1997), the behaviour of a road user is determined by performance, attitude, motivation, personality and many other factors. Several previous scholars have attempted to develop models and theories that encompass several, if not all, of these factors. From a traffic psychology perspective, Fuller (2000) presented the Task-Capability Interface (TCI) model, where driving task difficulty dominates drivers' behaviour. The TCI model claims that the difficulty of driving task arises out of the dynamic interaction between driving task demand and driver capability. The driving task is considered within the driver's control when the capability exceeds the demands. Alternatively, the loss of control, the precursor to road crashes, occurs when task demand exceeds driver capability. In the TCI model, task demand is a function of the environmental conditions, vehicle characteristics, speed, and position of the vehicle with respect to other road users; while driver capability is assumed to be limited by constitutional traits (e.g., knowledge and skills obtained through education or training) and biological capabilities (e.g., reaction time and visual acuity). The TCI has been widely used as a framework to explain behavioural changes of road users in previous research (Ortiz-Peregrina et al., 2020, Onate-Vega et al., 2020, Hinton et al., 2022, Oviedo-Trespalacios et al., 2019). Unfortunately, the TCI only provide real-time explanations of behaviour as both driving demands and capability can vary during the driving task (Onate-Vega et al., 2020). As such, the TCI is not useful for exploring more stable patterns of behaviours. Additionally, the TCI model does not provide specific guidance on operationalising work-related factors that impact the behaviour of road users. As such, the present research proposed a theoretical framework to explain stable behaviour patterns and consider work-related factors.

The present research primarily used the Job Demands-Resources (JD-R) model proposed by Demerouti et al. (2001) which focuses on the effect of work characteristics on an individual's behaviour. The JD-R suggests that work characteristics can be conceptualised as job demands and job resources. Demerouti et al. (2001) describe job demands as the physical, psychological, social, and organisational strain associated with a job that consumes physiological and psychological resources in completing tasks within the job. Specifically, exposure to a risky working environment leads to physical fatigue, limitations of cognitive processing capacity, and negative emotions, thus encouraging employees to finish work quickly and increasing risk of accidents and injuries. While job demands predispose employees to work stress and adverse outcomes, job resources act as a catalyst for positive exchanges between them and their organisation, such as outstanding performance (Bakker and Demerouti, 2007a, Bakker et al., 2004). Under demanding working conditions, employees with high levels of resources are likely to have more capacity to deal with these demands.

According to the conservation of resources theory (COR), an individuals continuously distribute available resources across domains and can be influenced by the environments in which they operate (Hobfoll, 1989). As such, besides job demands and job resources (original constructs in the JD-R model), personal resources may play a key role in the development of job burnout, affecting employees' job performance. Personal resources are aspects of the self that are generally linked to resiliency and refer to individuals' sense of their ability to control and impact their environment successfully (Hobfoll et al., 2003). This study considers four dimensions: self-efficacy, hope, resilience, and optimism to form personal resources. Additionally, Chen and Fellenz (2020) defined personal demand as tangible, social, psychological or symbolic factors that attract individual attention and require physical, cognitive or emotional effort to prevent them from interfering with valued activities or with the personal resources necessary to pursue such activities. Such personal demands may stem from internal sources or from a particular domain in which an individual operates. As such, in the present study, the impacts of job demands and resources as well as personal demands and resources on job burnout and risky riding

behaviours among on-demand food delivery riders are examined.

Perceived safety risk can be defined as the individual's assessment concerning the likelihood of undesired consequences occurring (i.e., injuries, accidents, diseases), and the level of perceived risk can be different depending on the type of risk. As front-line personnel in the organisation, employees are directly exposed to workplace risks, injuries, and accidents. If they perceive their work to be at a high level of risk, they are likely to behave safely to avoid risks to their own safety (Didla et al., 2009). If they do not behave safely, they increase their likelihood of suffering workplace injuries and accidents (Christian et al., 2009). Many studies have confirmed the positive relationship between risk perception and safety behaviour (Hallett et al., 2011; Nguyen-Phuoc et al., 2020d; Oviedo-Trespalacios et al., 2018, 2019, 2020a). However, the current findings concerning the impact of risk perception on safety behaviour are still contradictory. On the other hand, the risk perception of injuries or accidents may induce strain (i.e., anxiety, distress, and tension), which in turn reduces job performance (Nielsen et al., 2011, Falco et al., 2021). Therefore, it is necessary to study the interrelationships among perceived safety risk, job burnout, and risky riding behaviours in the study context. Identifying the relative influence of various factors that affect risky riding behaviours and the correlations among them can help to determine which factors should be prioritised when designing and implementing safety management policies. Fig. 1 represents the theoretical research framework of the study.

3. Hypothesis development

3.1. Job demands

While job demands are not necessarily problematic if properly designed, job demands can cause major job burnout when the individual involved with the job does not get appropriate recovery after investing their personal resources (e.g., personal time, effort, mental fortitude) (Bakker and Demerouti, 2007b). The combination of high job demand, job strain, and low job control (an individual's control over their tasks within the job) can cause major job strain and consequently job burnout (Karasek, 1998, Bakker and Demerouti, 2007b). Furthermore, an increase in job demands can result in higher job burnout. This can impair the performance of employees, making them more prone to occupational injuries (Snyder et al., 2008). As such, employees with a high job demand are less likely to comply with safety regulations and more likely to experience higher risk of an accident. Studies in road user behaviour confirm that more demands are positively associated with higher perceived risk.

Within the transport field, job demands along with job strain are associated with health issues among urban bus drivers (Albright et al., 1992). The stress and fatigue derived from job demands are often connected to job dissatisfaction (De Croon et al., 2002), safety issues, and accidents and injuries during work (Useche et al., 2017b, Aronsson and

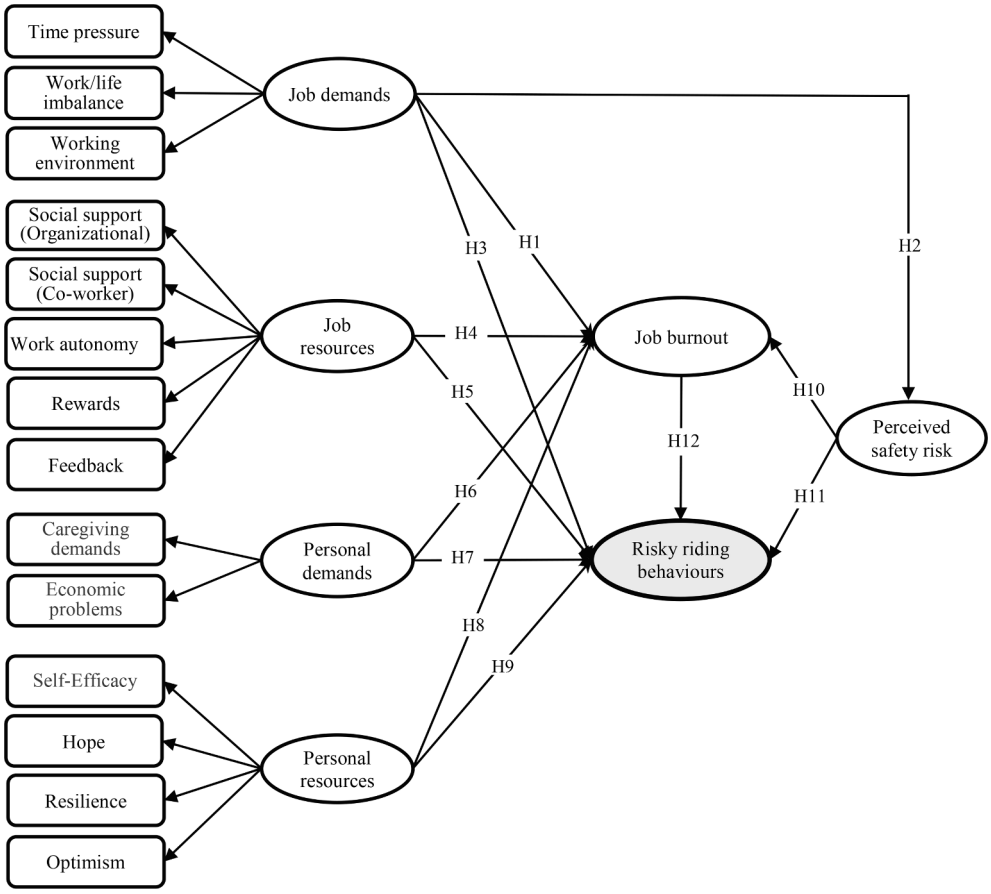

Fig. 1. Proposed conceptual model.

Rissler, 1998). In the case of professional drivers, excessive job strain is shown to significantly compromise their safety as it is the most influential factor for on-road crashes (Useche et al., 2018, Nguyen-Phuoc et al., 2019, Nguyen-Phuoc et al., 2020a). Indeed, bus drivers experiencing high job strain caused by high job demand are found to be involved in significantly more crashes than those without high job strain (Useche et al., 2017a).

Therefore, the following hypotheses are proposed as follows.

H1: Job demands are positively associated with job burnout
H2: Job demands are positively associated with perceived safety risk
H3: Job demands are positively associated with risky riding behaviours

3.2. Job resources

Schaufeli and Taris (2014) (p.56) defined job resources as "positively valued physical, psychological, social, or organisational aspects of the job that are functional in achieving work goals, reducing job demands, or stimulating personal growth and development". In other words, job resources refer to components of a particular job that have enabling or positive effects on professional development, work engagement, and organisational commitment (Demerouti et al., 2001, Demerouti and Bakker, 2011). Particularly, job resources can be categorised into three different levels: group, leader, and organisational (Day and Nielsen, 2017). According to Day and Nielsen (2017), group-level resources describe resources that stem from interpersonal relationships such as support or knowledge exchanged among co-workers. Leader-level resources refer to the resources coming from the relationship between a leader, coordinator, or supervisor with the workers, such as rewards, feedback, and work autonomy. Organisational-level resources are derived from the design, standard, procedure, management, or organisation of the work which offer workers benefits such as skill refinement or development opportunities. Job resources, in general, have an important role in reducing job stress and burnout (Demerouti et al., 2001, Bakker and Demerouti, 2007b).

In the transport sector, job resources can increase drivers' motivation and engagement and, therefore, prevent drivers' job burnout, especially in situations with high job demands (Buitendach et al., 2016). Additionally, social support such as increasing decision latitude or job control as a part of job resources, is found to have a significant positive effect on minimising the risk of crashes and improving safety among bus drivers (Cendales-Ayala et al., 2017). In a study on the working conditions of professional drivers, Useche et al. (2018) also noted that drivers with less social support tend to have a higher rate of traffic infringements and traffic crashes.

Therefore, the following hypotheses regarding the influence of job resources on job burnout and risky riding behaviours are proposed for validation:

H4: Job resources are negatively associated with job burnout
H5: Job resources are negatively associated with risky riding behaviours

3.3. Personal demands

Personal demands are "tangible social, psychological, or symbolic factors that attract individual attention and that require physical, cognitive, or emotional effort to prevent them from interfering with valued activities or with the personal resources required to pursue such activities" (Chen and Fellenz, 2020). In other words, when individuals experience increased personal demands, they are likely to become less engaged in work. Salmela-Aro and Upadyaya (2018) examined the relationship between personal demands (e.g., taking care of dependents and economic problems) and job burnout in three phases of a career. They found that caregiving demands were associated with work burnout in the late-career stage, while economic problems were associated with burnout in the early career stage. In another study conducted by LePine et al. (2005), the positive relationship between health impairments and personal demands was also confirmed. In the context of delivery services, delivery riders facing significant personal demands might lose their motivation and could stop focusing on their safety performance. Additionally, riders facing economic issues are likely to respond to economic needs and deprioritise their safety (even unintentionally) to increase their earnings. This might motivate them to engage in risky riding behaviours such as red-light running or speeding (Oviedo-Trespalacios et al., 2022). In the present study, the effects of personal demand on job burnout as well as risky riding behaviours will be assessed. Hence, the hypotheses are proposed as follows:

H6: Personal demands are positively associated with job burnout
H7: Personal demands are positively associated with risky riding behaviours

3.4. Personal resources

Personal resources are defined by Xanthopoulou et al. (2007) as a construct encompassing positive self-evaluations which create a sense of control over the surrounding environment for an individual. Personal resources, including self-efficacy, hope, resilience, or optimism, play an essential role in forming high work engagement among workers and reducing the strain of job burnout (Salmela-Aro, 2009, Bakker and Demerouti, 2008, Salmela-Aro and Upadyaya, 2018). Throughout all stages of an individual career, the positive effect that personal resources have on preventing work stress, limiting job burnout, and improving work dedication remains constant (Salmela-Aro and Upadyaya, 2018, Christian et al., 2011). Lack of personal resources may increase burnout symptoms (Hakanen et al., 2006). Thus, we propose the following hypotheses:

H8: Personal resources are negatively associated with job burnout
H9: Personal resources are negatively associated with risky riding behaviours

3.5. Perceived safety risk

The concept of perceived risk was introduced by Bauer (1960) and defined as "a combination of uncertainty plus seriousness of outcome involved". Perceived risk can be further categorised into two components: the uncertainty or probability of an undesired outcome, and the losses, which describe the severity of the consequences (Cox and Rich, 1964). Within the delivery rider line of work, the risks associated with the business have mostly or fully been off-loaded onto the riders, who are treated as "self-employed contractors" instead of an employee for a platform (Gregory, 2021, De Stefano, 2015). This constant awareness of risk can influence job strain. Additionally, road safety is another type of risk that concerns the safety of the workers (Gregory, 2021). Delivery riders have a higher probability of crashes and injury due to the absence of appropriate safety equipment and/or training (Christie and Ward, 2018) combined with work stress (on-time delivery and pressure to take more orders) (Moore and Newsome, 2018). Previous research has reported that delivery riders are often prone to take risks such as riding during dangerous weather conditions or going over the speed limit to meet their job's demands (Gregory, 2021). Many past studies have confirmed the negative relationship between perceived risk and risky behaviours on the road (Smith, 2016, Nguyen-Phuoc et al., 2020d, Oviedo-Trespalacios et al., 2021, Nguyen-Phuoc et al., 2020b).

In the present study, the impact of perceived safety risk on job burnout and risky riding behaviours will be examined in the context of on-demand food delivery services. As such, the hypotheses are proposed as follows:

H10: Perceived safety risk is positively associated with job burnout

Table 1
Measurement items and their Excess Kurtosis and Skewness value.

Constructs	Dimensions	Measurement items		Supporting literature	Excess Kurtosis	Skewness
Job demands (JDE)	***Time pressure (TIP)***	TIP1	I am always in a hurry to fulfil the assignment on time	Demerouti et al. (2001), Zheng et al. (2019)	−0.047	−0.759
		TIP2	I often think about the penalty for late delivery		−0.238	−0.737
		TIP3	I often worry about late delivery while working because of the time limit for each order		0.029	−0.827
		TIP4	I try to complete the number of orders as many as possible to increase my wage		1.142	−1.207
	Work/life imbalance (WLI)	WLI1	Personal life suffers because of work	Hayman (2005)	−0.880	−0.303
		WLI2	Job makes personal life difficult		−1.013	−0.193
		WLI3	Neglect personal needs because of work		−0.996	−0.202
		WLI4	Put personal life on hold for work		−1.046	−0.188
	Working environment (WEN)	WEN1	Delivery riders have to ride motorcycles in adverse road conditions (e.g., poor road surfaces), which increases the risk of accident	Demerouti et al. (2001)	0.698	−1.093
		WEN2	Delivery riders work in all weather, even in bad weather conditions		0.491	−1.040
		WEN3	Delivery riders work in a pressured working environment as they are required to deliver to the right place, sometimes in the dark within a set time frame*		0.415	−0.876
Job resources (JRE)	***Social support (Organizational Level) (SSO)***	SSO1	The delivery firms are willing to invest money and effort to improve safety for riders.	Cheung et al. (2021)	−0.913	−0.200
		SSO2	The delivery firms seem to care about my safety.		−0.875	−0.209
	Social support (Co-worker level) (SSW)	SSW1	Delivery riders who I know expect me to behave safely.	Cheung et al. (2021)	0.021	−0.641
		SSW2	Delivery riders who I know emphasise working safety and make sure to do the same.		0.299	−0.816
		SSW3	Delivery riders who I know remind me to follow safety regulations.		0.396	−0.835
	Work autonomy (WAU)	WAU1	I am allowed to decide how to go about getting my job done.	Breaugh (1999)	0.305	−0.922
		WAU2	I can decide myself how to perform my work		0.189	−0.874
		WAU3	I am free to choose the methods to use in carrying out my work.		0.364	−0.941
	Rewards (REW)	REW1	My performance is rewarded properly	Demerouti et al. (2001), Radic et al. (2020)	−0.035	−0.710
		REW2	I receive the recognition I deserve for my work		−0.128	−0.681
	Feedback (FDB)	FDB1	I get enough feedback about the quality of my performance	Demerouti et al. (2001)	0.226	−0.792
		FDB2	I always receive feedback about my performance from the customers		0.287	−0.850
Personal demands (PED)	***Caregiving demands (CAD)***	CAD1	If you have dependents, e.g., small children, elderly relatives, close persons who depend on you in other ways, how demanding do you feel the situation is for you?	Salmela-Aro and Upadyaya (2018) 1 = not at all demanding; 7 = very demanding	−0.747	−0.460
		CAD2	Most of my earnings will be used for my dependents		−0.891	−0.278
	Economic problems (EPR)	EPR1	How good is your and your family's economic situation, taking into account total family income and debts	Salmela-Aro and Upadyaya (2018) 1 = very good economic situation;7 = very poor economic situation	−0.720	−0.218
		EPR2	If I need money, my family will support me		−0.594	−0.370
		EPR3	I always have enough money in savings to cover when unexpected things come up		−0.649	−0.413
Personal resources (PER)	***Self-efficacy (SEE)***	SEE1	I feel confident analysing a long-term problem to find a solution.	Cheung et al. (2021)	−0.095	−0.511
		SEE2	I feel confident contributing to discussions about the company's strategy.		−0.435	−0.382
		SEE3	I feel confident helping to set targets/goals in my work area.		−0.385	−0.431
		SEE4	I feel confident contacting people outside the company (e.g., suppliers, customers) to discuss problems		−0.324	−0.446
	Hope (HOP)	HOP1	There are lots of ways around any problem.	Cheung et al. (2021)	0.024	−0.757
		HOP2	Right now, I see myself as being pretty successful at work.		−0.277	−0.591
		HOP3	I can think of many ways to reach my current work goals.		0.025	−0.772
		HOP4	At this time, I am meeting the work goals that I have set for myself.		−0.154	−0.614

(*continued on next page*)

Table 1 (*continued*)

Constructs	Dimensions	Measurement items		Supporting literature	Excess Kurtosis	Skewness
	Resilience (RES)	RES1	When I have a setback at work, I can recover from it and move on.	Cheung et al. (2021)	0.204	−0.807
		RES2	I usually manage difficulties one way or another at work.		−0.046	−0.715
		RES3	I usually take stressful things at work in stride.		0.156	−0.799
		RES4	I can get through difficult times at work because I have experienced difficulty before.		0.522	−0.901
		RES5	I feel I can handle many things at a time at this job.		0.212	−0.676
	Optimism (OPT)	OPT1	When things are uncertain for me at work, I usually expect the best.	Cheung et al. (2021)	0.095	−0.771
		OPT2	If something can go wrong for me work-wise, it will be better later on.		0.112	−0.788
		OPT3	I always look on the bright side of things regarding my job.		0.365	−0.853
Job burnout (JBO)		JBO1	I feel burned out from my work.	Chang et al. (2009), Gounaris et al. (2007)	−0.649	−0.096
		JBO2	I feel emotionally drained from my work.		−0.645	0.150
		JBO3	I feel fatigued when I get up in the morning and have to face another day on the job.		−0.764	0.051
		JBO4	I feel frustrated by my job.		−0.750	0.057
Perceived safety risk (PSR)		PSR1	I might be at risk of having some kind of accident on roads	Gregory (2020)	0.491	−0.939
		PSR2	I am at greater risk of accidents as I exposed to roads more time than other people		0.172	−0.833
		PSR3	I worry about being injured as I work with different road and weather conditions		0.388	−0.903
Risky riding behaviours (RRB)		RRB1	How often do you drive on the pavement when caught in a traffic jam?		−0.779	0.285
		RRB2	How often do you drive above the speed limit in order not to be late for an appointment?		−0.662	0.199
		RRB3	How often do you neglect to turn the signal when making a turn during work time?		−0.158	0.582
		RRB4	How often do you use your mobile phone while riding during work time?		−0.649	0.150
		RRB5	How often do you run red lights during work time?		−0.143	0.702
		RRB6	How often do you ride against the direction of traffic during work time?		−0.110	0.722

H11: Perceived safety risk is negatively associated with risky riding behaviours

3.6. Job burnout

Job burnout is a psychological syndrome consisting of three distinct elements: emotional exhaustion, cynicism, and low professional efficacy (Demerouti et al., 2001, Maslach et al., 2001). Emotional exhaustion can be considered the primary dimension of burnout (Halbesleben and Bowler, 2007) which refers to the feeling of being overextended, overstretched, or overwhelmed at work (Maslach et al., 2001). Cynicism refers to detachment or indifference to the work, while low professional efficacy describes the work's common professional standard or quality.

Job burnout in professional driving (bus drivers) is heavily correlated with health problems and risky driving behaviours (Chen and Kao, 2013). Similarly, a study on the crash involvement of transport drivers in Taiwan by Chung and Wu (2013) confirms the direct positive influence of burnout on crash occurrence. Job burnout is also linked to increased occupational incidents among professional drivers (Useche et al., 2018). Therefore, the following hypothesis on the relationship between job burnout and risky riding behaviours is proposed for testing.

H12: Job burnout is positively associated with risky riding behaviours

4. Methodology

4.1. Survey

To collect data to test the proposed model developed in Section 2, the authors carefully searched for the relevant literature to design a three-part questionnaire. In the first part, the study was introduced to respondents (e.g., the aim and objectives of the survey, the rights to be part of this study). The second part included a host of attitudinal questions requiring the respondents to show their level of (dis-)agreement through a 7-point Likert scale. Three dimensions were taken into account to measure job demands, including time pressure, work/life imbalance, and working environment (Table 1). Such dimensions were measured through four, four, and three items, respectively, which were referenced by Demerouti et al. (2001), Hayman (2005) and Zheng et al. (2019). Based on Breaugh (1999), Cheung et al. (2021), Demerouti et al. (2001) and Radic et al. (2020), the measurement of job resources was undertaken via five dimensions, including social support at the organisational level (two items), social support at the co-worker level (three items), work autonomy (three items), rewards (two items), and feedback (two items). Two items involving caregiving demands and two ones involving economic problems adapted from Salmela-Aro and Upadyaya (2018) were used to evaluate personal demands. Meanwhile, four dimensions (i.e., self-efficacy, hope, resilience, and optimism) introduced by Cheung et al. (2021) were utilised to assess personal resources. Perceived safety risk was measured through three items adopted by Gregory (2021). Four items were modified from Chang et al. (2009) and Gounaris et al. (2007) to measure job burnout. Finally, six statements concerning the frequency of performing risky driving behaviours were adopted by the authors to measure the risky riding behaviours construct. The questionnaire closed with questions about riders' socio-demographic characteristics (e.g., age, gender, education, income).

Before the questionnaire was used to collect data, it was created in English and then translated into the local language (Vietnamese) to

Table 2
Demographic information (n = 554).

Variables	*n*	%	Variables	*n*	%
Age			*Education level*		
Mean (SD)	25.66 (5.54)		High school	96	17.3
Gender			College	205	37.0
Female	64	11.6	University	182	32.9
Male	490	88.4	Above university	31	5.6
Married status			Other	40	7.2
Married	147	26.5	*Income from delivery jobs (million VND per month)*		
Unmarried	407	73.5	Mean (SD)	8.58 (4.48)	
Job type			*Total family income (million VND per month)*		
Part-time	304	54.9	Mean (SD)	27.32 (12.50)	
Full-time	250	45.1	*Migrant status*		
			Migrant	311	56.1
			Non-migrant	243	43.9

Note: 1 USD = 23,000 VND; SD = Standard Deviation.

request comments from international transport researchers. After carefully addressing matters raised by the experts, the authors employed the questionnaire to conduct some tests with delivery riders to detect potential issues with the survey. Results of pilot surveys confirmed the properties of the questionnaire. Hair et al. (2006) proposed the critical values of skewness and kurtosis are ± 2.58 at the significance level of 1%. The skewness values (ranged from −1.207 to 0.722) and excess kurtosis values (ranged from −1.046 to 1.142) of all the measurement items are in the normal range, indicating the normal data distribution.

4.2. Data collection

A cross-sectional survey with the target population, food delivery riders, was used to collect data for the current study. The survey was carried out on weekdays and weekends between 10 April 2021 and 9 May 2021 when COVID-19 was controlled successfully in both Hanoi and Ho Chi Minh city. Face-to-face interviews were inappropriate for this study because they were time-consuming and inconvenient due to the use of face masks during the survey process. Therefore, each participant was asked to complete the form individually. To seek respondents, surveyors (trained students) travelled to public places (e.g., parks, lakes, and shopping malls) where the riders usually gathered to wait for food delivery orders. When finding potential participants, a surveyor approached the individual, introduced the study, and invited them to participate in the survey. If a delivery rider agreed to complete the survey, they would receive a paper questionnaire together with a pen. To mitigate the threat of common method bias, the surveyors needed to inform the respondents that their responses were anonymous and there were no right or wrong answers. Once completing the form, a respondent would receive a voucher valued at 30,000VND (≈1.5 USD), while the surveyor also received 20,000VND (≈1 USD). At the end of the survey, over 600 forms were distributed. After removing incomplete and unreliable responses, the final sample of 554 was used for the analysis.

4.3. Data analysis

Partial Least Squares Structural Equation Modelling (PLS-SEM), a rapidly emerging version of structural equation modelling, was used for this study because of the advantages of PLS-SEM. First, PLS-SEM does not require data with normal distributions or a large sample size to generate reliable estimations of models (Hair et al., 2016). Moreover, PLS-SEM is demonstrated to perform well when analysing the extensions of theories (do Valle and Assaker, 2016), particularly in safety research (Safitri et al., 2020, Nguyen-Phuoc et al., 2020b). Different to covariance-based SEM, PLS-SEM does not fit a common factor model to the data, it rather fits a composite model by maximising the amount of variance explained. PLS-SEM comprises two sub-models: the measurement model and the structural equation model. The measurement models represent the relationships between the observed data and the latent constructs. The structural model represents the relationships between the latent constructs. In this study, SmartPLS 3.0 was used to assess the measurement and structural equation models established based on the conceptual framework proposed in Section 2.

The statistical analysis associated with the PLS-SEM approach involved two main stages, including:

- Evaluation of the measurement model (i.e., first-order and second-order model) via three criteria:
  - Internal consistency reliability (Outer Loadings, Cronbach's Alpha, Composite Reliability)
  - Convergent validity (Average Variance Extracted)
  - Discriminant validity (Fornell-Larcker criterion & Heterotrait-Monotrait Ratio)
- Evaluation of the structural equation model via three criteria:
  - Model fit
  - Predictive relevance
  - Relationships between latent variables

5. Results

5.1. Descriptive statistics

Table 2 details the demographic information of survey respondents. The majority of respondents were male (88.4%) and 11.6% were female. The respondents' mean age was relatively low at 25.66 years old, with a standard deviation of 5.54 years. Over a quarter of respondents were married (26.5%), and nearly 55% considered food delivery a part-time job. Regarding education, around 70% of survey participants had received a college or university degree. They also reported that delivery jobs helped them earn approximately 8.6 million VND per month, while the average total family monthly income was around 27.3 million VND per month. Over 56% of respondents were migrants from rural areas or small towns.

5.2. Measurement model

5.2.1. First-order measurement model evaluation

The PLS-SEM analysis examined the measurement model for proposed first-order constructs. As suggested by Hair et al. (2017), Cronbach's alpha (CA) and composite reliability (CR) scores were used to evaluate the reliability of the outer model. The figures for these two evaluative measures for each of the modelled constructs were presented in Table 3 and were all higher than the cut-off value of 0.7, indicating satisfactory internal consistency reliability (Nunnally and Bernstein, 1994). Subsequently, the outer loading of each indicator was estimated to assess its quality in reflecting the respective construct. The test resulted in removing TIP4, RES4, RES5, RRB1 and RRB4 from the theorised scales of time pressure, resilience, and risky riding behaviours, respectively, with their outer loadings being under the threshold value of 0.7 (Henseler et al., 2009). The indicator RRB2 was kept in the outer model since its loading (0.680) was close to the threshold and removing it did not increase the AVE value of the risky riding behaviours construct. In addition, the average variance extracted (AVE) scores of the eighteen factors ranged from 0.605 to 0.894, which are well above the suggested point of 0.5 (Fornell and Larcker, 1981), demonstrating adequate convergent validity of the measurement model.

Regarding discriminant validity, the long-established Fornell-Larcker criterion requires the square root of each factor's AVE value to be the highest in comparison with its correlation coefficients with other latent variables in the model. All constructs met this requirement as seen in bold diagonal scores in Table 4. Additionally, this study used Heterotrait-Monotrait Ratio (HTMT) to examine the similarity among proposed latent variables (Henseler et al., 2015). The HTMT statistics showed in Table 5 were all far below the threshold of 0.85, confirming

Table 3
First-order model evaluation.

Constructs	Items	*M*	*SD*	Loadings	*CA*	*CR*	*AVE*
Job demands' dimension 1: Time pressure (TIP)					0.890	0.932	0.820
	TIP1	4.792	1.574	0.889			
	TIP2	4.780	1.567	0.923			
	TIP3	4.883	1.518	0.904			
	TIP4	5.390	1.454	–			
Job demands' dimension 2: Work/life imbalance (WLI)					0.898	0.928	0.765
	WLI1	4.211	1.597	0.844			
	WLI2	4.152	1.649	0.898			
	WLI3	4.217	1.654	0.904			
	WLI4	4.236	1.721	0.850			
Job demands' dimension 3: Working environment (WEN)					0.808	0.887	0.723
	WEN1	5.267	1.487	0.816			
	WEN2	5.137	1.533	0.894			
	WEN3	5.114	1.426	0.840			
Job resources' dimension 1: Social support (Organizational Level) (SSO)					0.896	0.937	0.883
	SSO1	4.088	1.605	0.990			
	SSO2	4.105	1.617	0.886			
Job resources' dimension 2: Social support (Co-worker level) (SSW)					0.830	0.895	0.740
	SSW1	5.032	1.327	0.903			
	SSW2	4.989	1.391	0.908			
	SSW3	4.971	1.389	0.762			
Job resources' dimension 3: Work autonomy (WAU)					0.875	0.923	0.800
	WAU1	5.125	1.478	0.881			
	WAU2	4.940	1.493	0.914			
	WAU3	4.968	1.491	0.887			
Job resources' dimension 4: Rewards (REW)					0.882	0.944	0.894
	REW1	4.940	1.513	0.938			
	REW2	4.968	1.562	0.953			
Job resources' dimension 5: Feedback (FDB)					0.854	0.932	0.872
	FDB1	5.060	1.469	0.926			
	FDB2	5.049	1.500	0.942			
Personal demands' dimension 1: Caregiving demands (CAD)					0.869	0.938	0.882
	CAD1	4.500	1.674	0.922			
	CAD2	4.296	1.596	0.956			
Personal demands' dimension 2: Economic problems (EPR)					0.852	0.902	0.754
	EPR1	4.278	1.420	0.827			
	EPR2	4.412	1.396	0.835			
	EPR3	4.542	1.414	0.939			
Personal resources' dimension 1: Self-Efficacy (SEE)					0.851	0.899	0.690
	SEE1	4.847	1.287	0.848			
	SEE2	4.708	1.344	0.879			
	SEE3	4.744	1.320	0.835			
	SEE4	4.704	1.384	0.756			
Personal resources' dimension 2: Hope (HOP)					0.844	0.893	0.677
	HOP1	5.020	1.392	0.803			
	HOP2	4.699	1.427	0.793			
	HOP3	4.951	1.384	0.910			
	HOP4	4.747	1.391	0.777			
Personal resources' dimension 3: Resilience (RES)					0.830	0.892	0.736
	RES1	5.014	1.413	0.905			
	RES2	4.975	1.427	0.933			
	RES3	4.901	1.383	0.720			
	RES4	4.917	1.410	–			
	RES5	4.843	1.396	–			
Personal resources' dimension 4: Optimism (OPT)					0.851	0.905	0.762
	OPT1	4.984	1.422	0.786			
	OPT2	5.103	1.368	0.909			
	OPT3	5.128	1.373	0.917			
Job burnout (JBO)					0.876	0.914	0.727
	JBO1	4.036	1.477	0.820			
	JBO2	3.801	1.451	0.889			
	JBO3	3.926	1.515	0.840			
	JBO4	3.718	1.575	0.861			
Perceived safety risk (PSR)					0.885	0.929	0.814
	PSR1	5.282	1.429	0.899			
	PSR2	5.213	1.464	0.935			
	PSR3	5.181	1.472	0.870			
Risky riding behaviours (RRB)					0.786	0.859	0.605
	RRB1	3.489	1.620	–			
	RRB2	3.372	1.455	0.680			
	RRB3	2.800	1.425	0.760			
	RRB4	3.884	1.513	–			
	RRB5	2.668	1.398	0.827			
	RRB6	2.659	1.416	0.835			

Note: *M* = Mean; *SD* = Standard Deviation; *CA* = Cronbach's Alpha; *CR* = Composite Reliability; *AVE* = Average Variance Extracted.

Table 4
Fornell-Larcker criterion of the first-order factor model.

	CAD	EPR	FDB	HOP	JBO	OPT	RES	REW	RRB	PSR	SEE	SSW	SSO	TIP	WAU	WLI	WEN
CAD	**0.94**																
EPR	0.24	**0.87**															
FDB	0.18	0.18	**0.93**														
HOP	0.25	0.33	0.29	**0.82**													
JBO	0.04	−0.09	−0.08	−0.14	**0.85**												
OPT	0.21	0.31	0.32	0.41	−0.02	**0.87**											
RES	0.25	0.34	0.32	0.50	−0.16	0.41	**0.86**										
REW	0.13	0.24	0.60	0.20	−0.13	0.32	0.29	**0.95**									
RRB	0.05	0.02	−0.16	−0.10	0.18	−0.08	−0.10	−0.14	**0.78**								
PSR	0.30	0.21	0.40	0.38	−0.08	0.39	0.39	0.32	−0.11	**0.90**							
SEE	0.19	0.40	0.23	0.48	−0.11	0.46	0.47	0.24	0.05	0.25	**0.83**						
SSW	0.19	0.25	0.37	0.34	−0.12	0.33	0.37	0.35	−0.09	0.39	0.30	**0.86**					
SSO	0.15	0.04	0.04	0.15	0.01	0.03	0.02	0.04	−0.06	−0.08	0.14	0.19	**0.94**				
TIP	0.30	0.22	0.13	0.25	0.16	0.26	0.16	0.07	0.01	0.30	0.19	0.16	0.09	**0.91**			
WAU	0.27	0.27	0.41	0.37	−0.05	0.41	0.40	0.41	−0.04	0.46	0.34	0.43	−0.05	0.23	**0.89**		
WLI	0.10	−0.04	−0.11	−0.02	0.31	0.00	−0.12	−0.13	0.03	−0.10	0.07	−0.09	0.16	0.26	−0.12	**0.87**	
WEN	0.34	0.14	0.29	0.21	0.20	0.30	0.25	0.22	−0.09	0.34	0.24	0.26	0.14	0.35	0.28	0.26	**0.85**

Table 5
Heterotrait-Monotrait Ratio (HTMT) of the first-order factor model.

	CAD	EPR	FDB	HOP	JBO	OPT	RES	REW	RRB	PSR	SEE	SSW	SSO	TIP	WAU	WLI	WEN
CAD																	
EPR	0.30																
FDB	0.21	0.21															
HOP	0.29	0.38	0.35														
JBO	0.07	0.09	0.09	0.14													
OPT	0.24	0.36	0.38	0.47	0.05												
RES	0.29	0.43	0.38	0.58	0.17	0.49											
REW	0.16	0.27	0.69	0.23	0.14	0.36	0.34										
RRB	0.12	0.08	0.20	0.13	0.21	0.12	0.12	0.17									
PSR	0.34	0.24	0.46	0.43	0.10	0.44	0.45	0.36	0.13								
SEE	0.23	0.45	0.26	0.57	0.13	0.54	0.56	0.28	0.11	0.28							
SSW	0.22	0.31	0.45	0.40	0.13	0.40	0.44	0.42	0.10	0.44	0.34						
SSO	0.18	0.05	0.05	0.20	0.05	0.05	0.07	0.04	0.08	0.08	0.18	0.23					
TIP	0.34	0.26	0.15	0.30	0.18	0.30	0.21	0.08	0.05	0.34	0.22	0.19	0.10				
WAU	0.31	0.32	0.47	0.43	0.06	0.47	0.48	0.47	0.05	0.51	0.39	0.51	0.05	0.26			
WLI	0.10	0.05	0.13	0.07	0.34	0.04	0.14	0.14	0.07	0.11	0.09	0.11	0.15	0.29	0.13		
WEN	0.40	0.19	0.35	0.26	0.23	0.37	0.30	0.26	0.12	0.40	0.29	0.32	0.13	0.41	0.33	0.31	

Table 6
Assessment of the second-order measurement model.

Second-order / First-order constructs	***VIF***	**Outer Loadings**	***SD***	***t-value***	***p-value***
Job demands (JDE)					
Time pressure (TIP)	1.179	0.780	0.043	17.959	<0.001
Work/life imbalance (WLI)	1.112	0.451	0.152	2.958	0.003
Working environment (WEN)	1.181	0.843	0.039	21.568	<0.001
Job resources (JRE)					
Social support (Co-worker level) (SSW)	1.317	0.692	0.082	8.439	<0.001
Work autonomy (WAU)	1.392	0.625	0.099	6.343	<0.001
Rewards (REW)	1.669	0.833	0.047	17.751	<0.001
Feedback (FDB)	1.679	0.831	0.047	17.589	<0.001
Personal resources (PER)					
Self-efficacy (SEE)	1.533	0.693	0.115	6.048	<0.001
Hope (HOP)	1.526	0.832	0.078	10.610	<0.001
Resilience (RES)	1.524	0.852	0.074	11.501	<0.001
Optimism (OPT)	1.391	0.621	0.110	5.623	<0.001

Notes: *VIF* = Variance Inflation Factor; *SD* = Standard Deviation.

that the discriminant validity of the measurement model was established (Henseler et al., 2015). Taken together, the reliability and validity of the measurement model was statistically verified.

5.2.2. Second-order measurement model evaluation

The analysis in this study treated job demands, job resources, personal demands, and personal resources as reflective second-order constructs, hence we proceeded with the assessment of the higher-order measurement model by estimating the outer loadings of the lower-order variables and their variance inflation factor (VIF) (Duarte and Amaro, 2018). Due to the insignificant loading value of social support (organisational level) (job resources' dimension 1) and caregiving demands (personal demands' dimension 1), these two dimensions were removed from the measurement model. As such, personal demands included only one dimension, economic problems. As seen in Table 6, all remaining first-order dimensions significantly reflected their corresponding second-order constructs, with VIF values being far under the critical point of 5.0, outer loadings exceeding 0.1 (Lohmöller, 2013) and significant *t*-values at a 0.1% significance level (Hair et al., 2017). Therefore, these three constructs had sufficient quality to be processed in the next step of structural model evaluation.

Additionally, a Pearson correlation analysis was also performed to identify the significant correlations among the latent variables. Table A1 showed that all correlations were lower than the prior defined threshold of 0.7, confirming that there was no interdependency between latent variables (Nettleton, 2014).

5.3. Structural equation model

5.3.1. Model fit

In this study, the standard root mean square residual (SRMR) was

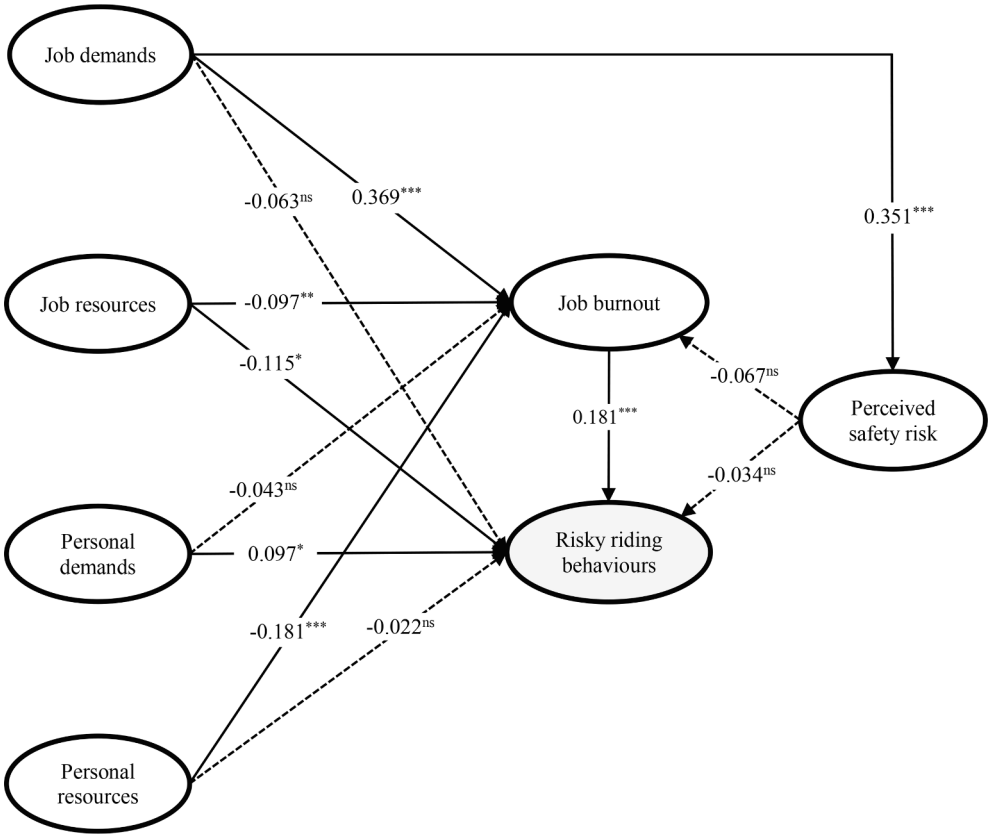

Fig. 2. Model results.

Table 7
Results of direct effects among constructs.

Path Relation (Hypothesis)	Path Coefficient (ß)	*SD*	*t-value*	*p-value*	Result
H1: JDE → JBO	0.369^{***}	0.061	6.018	<0.001	Supported
H2: JDE → PSR	0.351^{***}	0.060	5.868	<0.001	Supported
H3: JDE → RRB	-0.063^{ns}	0.057	1.113	0.266	**Rejected**
H4: JRE → JBO	-0.097^{**}	0.049	1.988	0.047	Supported
H5: JRE → RRB	−0.115*	0.067	1.724	0.085	Supported
H6: PED → JBO	-0.043^{ns}	0.047	0.913	0.361	**Rejected**
H7: PED → RRB	0.097*	0.052	1.881	0.060	Supported
H8: PER → JBO	-0.181^{***}	0.053	3.412	0.001	Supported
H9: PER → RRB	-0.022^{ns}	0.082	0.264	0.792	**Rejected**
H10: PSR → JBO	-0.067^{ns}	0.050	1.347	0.178	**Rejected**
H11: PSR → RRB	-0.034^{ns}	0.060	0.563	0.573	**Rejected**
H12: JBO → RRB	0.181^{***}	0.048	3.800	<0.001	Supported

Notes: ^{ns} non-significant, $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$, *SD* = Standard Deviation

Table 8
Results of indirect effects between each construct.

Indirect Effect	Path Coefficient	*SD*	*t-value*	*p-value*
JDE → JBO → RRB	0.067^{***}	0.022	3.023	0.003
JRE → JBO → RRB	−0.018*	0.010	1.702	0.089
PED → JBO → RRB	-0.008^{ns}	0.009	0.870	0.384
PER → JBO → RRB	-0.033^{***}	0.013	2.565	0.010
PSR → JBO → RRB	-0.012^{ns}	0.010	1.243	0.214
JDE → PSR → JBO → RRB	-0.004^{ns}	0.004	1.166	0.244
JDE → PSR → RRB	-0.012^{ns}	0.022	0.543	0.587

Notes: ^{ns} non-significant, $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.1$, *SD* = Standard Deviation

Table 9
Results of total effects.

Total Effect	Path Coefficient	*SD*	*t-value*	*p-value*
JDE → RRB	-0.012^{ns}	0.057	0.217	0.828
JRE → RRB	-0.133^{**}	0.065	2.033	0.042
PED → RRB	0.089*	0.052	1.720	0.085
PER → RRB	-0.054^{ns}	0.081	0.670	0.503
PSR → RRB	-0.046^{ns}	0.061	0.751	0.453
JBO → RRB	0.181^{***}	0.048	3.800	<0.001

Notes: ^{ns} non-significant, $^{***}p < 0.001$, $^{**}p < 0.05$, $^{*}p < 0.1$, *SD* = Standard Deviation

estimated to test the PLS-SEM model fit. The value of this index was 0.046 which is less than the threshold of 0.08 (Henseler et al., 2016), indicating that the proposed structural model fits the empirical data well.

5.3.2. *Predictive relevance evaluation*

In PLS-SEM, the predictive accuracy of the structural model (inner model) could be examined through the predictive relevance (Q^2) (Geisser, 1974, Hair et al., 2017). The blindfolding procedure in PLS-SEM was conducted to test the predictive relevance of the structural model. As a guideline, Q^2 values should be larger than zero for a specific endogenous construct to indicate the predictive accuracy of the PLS-path model for that construct. Accordingly, the statistics for Q^2 values of three endogenous constructs (PSR, JBO and RRB) were 0.154, 0.111 and 0.051, respectively, indicating small predictive relevance of the path model (Henseler et al., 2009).

5.3.3. *Relationships*

The proposed hypotheses were tested through a bootstrapping procedure with 554 cases and 5,000 resamples in PLS-SEM. As seen in Fig. 2

Table A1
The Pearson correlation coefficient among latent variables.

	TIP	WLI	WEN	SSO	SSW	WAU	REW	FDB	CAD	EPR	SEE	HOP	RES	OPT	JBO	PSR	RRB
TIP	1	0.259**	0.349**	0.085*	0.165**	0.227**	0.07	0.131**	0.295**	0.229**	0.193**	0.257**	0.177**	0.263**	0.159**	0.302**	0.01
WLI	0.259**	1	0.264**	0.134**	-0.092*	-0.117**	-0.125**	-0.112**	0.089*	−0.03	0.08	0.00	-0.118**	0.00	0.306**	-0.093*	0.04
WEN	0.349**	0.264**	1	0.112**	0.259**	0.275**	0.215**	0.292**	0.335**	0.160**	0.240**	0.209**	0.242**	0.308**	0.197**	0.333**	−0.08
SSO	0.085*	0.134**	0.112**	1	0.198**	−0.05	0.04	0.04	0.157**	0.04	0.157**	0.170**	0.05	0.04	0.00	−0.07	−0.04
SSW	0.165**	-0.092*	0.259**	0.198**	1	0.434**	0.358**	0.381**	0.190**	0.258**	0.283**	0.330**	0.368**	0.333**	-0.107*	0.379**	-0.085*
WAU	0.227**	-0.117**	0.275**	−0.05	0.434**	1	0.411**	0.402**	0.271**	0.278**	0.335**	0.365**	0.412**	0.404**	−0.05	0.452**	−0.03
REW	0.07	-0.125**	0.215**	0.04	0.358**	0.411**	1	0.601**	0.136**	0.233**	0.241**	0.197**	0.292**	0.308**	-0.124**	0.317**	-0.138**
FDB	0.131**	-0.112**	0.292**	0.04	0.381**	0.402**	0.601**	1	0.183**	0.179**	0.224**	0.295**	0.320**	0.327**	−0.08	0.399**	-0.167**
CAD	0.295**	0.089*	0.335**	0.157**	0.190**	0.271**	0.136**	0.183**	1	0.257**	0.196**	0.246**	0.248**	0.206**	0.04	0.300**	0.07
EPR	0.229**	−0.03	0.160**	0.04	0.258**	0.278**	0.233**	0.179**	0.257**	1	0.382**	0.325**	0.363**	0.307**	−0.08	0.207**	0.04
SEE	0.193**	0.08	0.240**	0.157**	0.283**	0.335**	0.241**	0.224**	0.196**	0.382**	1	0.483**	0.472**	0.457**	-0.109*	0.242**	0.06
HOP	0.257**	0.00	0.209**	0.170**	0.330**	0.365**	0.197**	0.295**	0.246**	0.325**	0.483**	1	0.483**	0.397**	-0.125**	0.367**	−0.08
RES	0.177**	-0.118**	0.242**	0.05	0.368**	0.412**	0.292**	0.320**	0.248**	0.363**	0.472**	0.483**	1	0.407**	-0.146**	0.382**	−0.07
OPT	0.263**	0.00	0.308**	0.04	0.333**	0.404**	0.308**	0.327**	0.206**	0.307**	0.457**	0.397**	0.407**	1	−0.01	0.381**	−0.07
JBO	0.159**	0.306**	0.197**	0.00	-0.107*	−0.05	-0.124**	−0.08	0.04	−0.08	-0.109*	-0.125**	-0.146**	−0.01	1	−0.07	0.172**
PSR	0.302**	-0.093*	0.333**	−0.07	0.379**	0.452**	0.317**	0.399**	0.300**	0.207**	0.242**	0.367**	0.382**	0.381**	−0.07	1	-0.102*
RRB	0.01	0.04	−0.08	−0.04	-0.085*	−0.03	-0.138**	-0.167**	0.07	0.04	0.06	−0.08	−0.07	−0.07	0.172**	-0.102*	1

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

and Table 7, seven out of 12 hypothesised path relationships were supported while the other five were rejected by comparing their empirical *t*-values with critical values at the corresponding significance level suggested by Hair et al. (2017). Regarding the hypothesised linkages to risky riding behaviours, job burnout and personal demands had significant positive impacts on its construct ($\beta_{JBO\rightarrow RRB} = 0.181$, $t = 3.800$, $p < 0.001$ and $\beta_{PED\rightarrow RRB} = 0.097$, $t = 1.881$, $p = 0.060$, respectively) while there was a negative effect of job resources on risky riding behaviours of food delivery riders ($\beta_{JRE\rightarrow RRB} = -0.115$, $t = 1.724$, $p < 0.085$). Job demands, personal resources, and perceived safety risk were found not to be direct predictors of risky riding behaviours. With respect to the positive direct linkages from proposed independent variables to job burnout, job demands served as the most influential factor in predicting job burnout with $\beta_{JDE\rightarrow JBO} = 0.369$, $t = 6.018$, $p < 0.001$. In contrast, in addition to the statistically supported negative effect of job resources, personal resources was the most powerful factor in reducing job burnout ($\beta_{PER\rightarrow JBO} = -0.181$, $t = 3.412$, $p = 0.001$). In the present study, personal demands and perceived safety risk failed to predict job burnout.

The mediating effects and total effects of the structural model were examined. Particularly, as job demands and personal resources were found to have no significant direct effects on risky riding behaviours, the causal paths from these two constructs to risky riding behaviours were fully mediated by job burnout, with path coefficients being 0.067 ($p = 0.003$) and -0.033 ($p = 0.010$), respectively. Moreover, the mediating effect of job burnout in the relationship between job resources and risky riding behaviours was partial ($\beta = -0.018$, $t = 1.702$, $p = 0.089$). A point that should be paid attention to here is that there was no mediation between personal demands and risky riding behaviours, making personal demands the only rider construct affecting risky riding behaviours without association with job burnout (Table 8).

The total effects of all constructs on risky riding behaviours were examined in this study (Table 9). The results signified the utmost importance of job burnout in predicting the safety behaviours of delivery riders ($\beta = 0.181$, $t = 3.800$, $p < 0.001$). The findings of total effects also provided support for the influence of job resources and personal demands on risky riding behaviours with $\beta = -0.131$ at $p = 0.042$ and $\beta = 0.089$ at $p = 0.085$. The total impacts of job demand, personal resources, and perceived risk on risky riding behaviours were not found to be significant.

6. Discussion

6.1. Theoretical implications

The present investigation examined factors contributing to food delivery riders' safety and risky riding behaviours. We adapted and extended the JD-R model to study risky riding behaviours, which resulted in three key theoretical contributions. First, burnout, a highly undesirable health condition, was the most significant predictor of risky riding behaviours among food delivery motorcyclists. This finding distinguishes the present investigation from previous research that has been primarily focused on examining associations between workers' fatigue and stress and involvement in either general or specific risky behaviours/events (Zheng et al., 2019, Liang et al., 2021, Papakostopoulos and Nathanael, 2021, Qin et al., 2021, Rusli et al., 2020, Nahrgang et al., 2011). In other words, this research considers burnout and risk-taking behaviour on the roads as outcomes of job-related factors, which have never been empirically tested. We also want to highlight that this is the first time that this type of framework has been used in a low- and middle-income country which further highlights the importance of these findings as road safety research is still scarce in these jurisdictions (Haghani et al., 2022)

Second, the present study sheds light on mechanisms associated with burnout by extending the JD-R model with personal demands and resources as well as perceived safety risks. Generally, the findings were

consistent with previous research using the JD-R model, as job demands served as the most influential predictor of job burnout (Cheung et al., 2021, Nahrgang et al., 2011, Salmela-Aro and Upadyaya, 2018). Additionally, the alleviating impact of job resources on job burnout was also demonstrated (Cheung et al., 2021, Bakker and Demerouti, 2014). The results showed that personal resources are a significant buffer against the negative association between job demands and job burnout. A noteworthy contribution of the present study is to incorporate perceived safety risk into the JD-R model to investigate job burnout and risky riding behaviours. This is the first time that perceived safety risk was investigated in the context of riding for work whilst considering organisational influences, as previous research has mainly studied one of these sets of variables at a time (Nahrgang et al., 2011, Yang et al., 2020, Nielsen et al., 2011). Another significant contribution of the current research is that job burnout also appeared to influence risky riding behaviours.

Third, the findings showed that personal demands are not associated with job burnout among food delivery riders, which is inconsistent with prior research (Salmela-Aro and Upadyaya, 2018). A possible explanation of this result is that the strong influence of job demands and the mitigating effect of food delivery riders' personal and job resources reduces the scope for the influence of personal demands on job burnout. Importantly, personal demands positively affected risky riding behaviours, meaning that food delivery riders experiencing personal hardships are likelier to engage in risky riding behaviours. These results provide new insights into the impact of personal demands on job burnout and road safety in the delivery industry.

6.2. Practical implications

The present investigation has practical implications that must be considered to increase safety among this vulnerable group of road users. The findings provide a guide to reducing or preventing job burnout and risky riding behaviours. From the perspective of food delivery service providers, the pressure of job demands can be diminished by developing employee/partner-centred delivery systems (e.g., improving navigation, upgrading safety alerts, minimising touchpoints while riding and communicating with customers, notifying of unexpected incidents, road and weather conditions, financially supporting vehicle maintenance) to provide a more stable and safer working environment. These organisations should not prioritise financial gains over the working conditions of their riders. This issue is also a threat to sustainability as per the UN Sustainable Development Goals (United Nations, 2015). Food delivery riders' working conditions and health outcomes need to be improved as part of sustainability efforts. All transport and gig economy stakeholders must commit to protecting riders from road trauma. As described in the present research, optimising the job demands and capabilities of riders will provide strategies to increase the sustainability of the food delivery business. This is a good starting point for future risk management initiatives in the food delivery industry.

At a more operational level, as time will always be a critical operational factor in the delivery industry (Papakostopoulos and Nathanael, 2021), it is important to improve job and personal resources to create buffers against the impact of increased job demands. The industry needs to optimise the delivery time promised to clients to promote a more transparent interaction between riders and customers, especially in cases where the delay is out of the rider's control (NSW Government, 2021). The industry should start implementing time margins to allow riders some time affordances so they do not feel the pressure to ride in a risky way because of the need to meet the customers' expectations. Additionally, increasing job resources involves empowering riders by allowing them to take personal initiatives to fulfil their work efficiently as long as they comply with the company's regulations and traffic safety laws. Food delivery services should also consider offering rewards for well-performed deliveries that also discourages risky riding behaviours and incentivises safe riding. Previous research has demonstrated that more organisational involvement and controls can improve road user behaviours even in stressful situations (Rosenbloom, 2022).

Delivery services should also consider the role of job and personal resources of the delivery riders in the mitigation of job and personal demands. The social work-related relationships of riders and their social support at the organisational level are unlikely to act as a statistically significant job resource that helps mitigate job burnout among food delivery riders. Significantly, social support from co-workers can be improved by supporting riders associations or unions, which can also create opportunities to improve safety culture and developing behavioural change programs based on peer influence (Beck and Watters, 2016). Moreover, Mérida-López and Extremera (2017) suggested that personal resources (i.e., emotional intelligence) may be enhanced to reduce burnout through educational interventions.

6.3. Limitations and future research

The present study has several limitations that must be considered in future research. Firstly, this current study is cross-sectional, so a longitudinal study is encouraged to examine the possible causality and bi-directionality of relationships. This is needed particularly during the COVID-19 pandemic, which has occurred in many waves. Secondly, although several precautionary measures have been undertaken to reduce the threat of common method bias, using multiple data collection methods is recommended for future studies to improve data quality. For example, several participants might not feel comfortable providing open and honest feedback on safety-related questions. Online surveys can mitigate this type of bias as they provide respondent anonymity. Thirdly, the moderating effects of respondents' characteristics (e.g., gender, age, educational level) on the relationships between risky riding behaviours and its influencing factors are not investigated in this current study. Future research needs to be conducted to address this limitation. Finally, PLS-SEM assumes that the data stems from a single homogeneous population. Unobserved heterogeneity, if existing in the data, is likely to produce misleading results. In future studies, advanced SEM models (e.g., likelihood-based models) can be used to identify whether unobserved heterogeneity significantly affects structural model relationships (Afghari et al., 2021). The present study used well-established and consistent analytical tools with previous work to develop theoretical and behavioural frameworks.

7. Conclusion

The present investigation provides an in-depth understanding of risky riding behaviours among food delivery riders. Notably, the theoretical framework used in the present study (i.e., JD-R model) demonstrated a helpful tool to explain burnout and risky riding behaviours. The key finding is that working conditions influence the behaviour of food delivery riders. As such, the delivery industry and regulators have responsibility for the poor safety outcomes of this highly vulnerable group of road users. This paper adds to the growing evidence of the need for more action in the private sector and work systems to increase road safety (Nguyen-Phuoc et al., 2020c, Oviedo-Trespalacios et al., 2020b, Hasan et al., 2022). We also demonstrated that personal resources and perceptions of risk influence risky riding behaviours, which is useful for developing better countermeasures. The present research confirms that an important step to increase road safety is to address organisational influences on food delivery riders' behaviour and improve the quality of life of these workers.

CRediT authorship contribution statement

Duy Quy Nguyen-Phuoc: Writing – review & editing, Methodology, Investigation, Conceptualization. **Ly Ngoc Thi Nguyen:** Writing – original draft. **Diep Ngoc Su:** Writing – original draft, Methodology. **Minh Hieu Nguyen:** Writing – original draft. **Oscar Oviedo-**

Trespalacios: Methodology, Conceptualization, Writing – review & editing.

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.

Data availability

Data will be made available on request.

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Appendix A

See Table A1.

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