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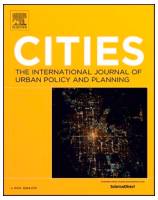

Intentions to use ride-sourcing services in Vietnam: What happens after three months without COVID-19 infections?

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ABSTRACT

The COVID-19 pandemic has brought new risks and stress for paid transport users worldwide. COVID-19 has changed mobility dynamics worldwide, including low- and middle-income countries (e.g., Vietnam). The present study aims to provide an in-depth understanding of ride-sourcing passengers' behavioural intentions when COVID-19 pandemic management successfully prevented community transmission by extending the TPB with two constructs: perceived virus infection risk and problem-focused coping. Using self-administered questionnaires, data were collected from ride-sourcing customers in Ho Chi Minh City (Vietnam). A total of 540 responses were used for validating the proposed theorethical model. The structural equation model results indicate that problem-focused coping is a multi-faceted construct with two dimensions: problem-solving and self-protection. Also, problem-focused coping has the highest total effect on the intention to use ride-sourcing services following a period of COVID-19 suppression (3 months without identified cases). The findings also reveal that attitude partially mediates the link between problem-focused coping and behavioural intention. The results of this study could be used to develop strategies to promote ride-sourcing services in the aftermath of the COVID-19 pandemic.

1. Introduction

The transport sector has been one of the forerunners of the sharing economy (SE) revolution with the massive success of Uber in 2011 (Martin, 2016). Since then, new technology-enabled forms of on-demand mobility have emerged. Ride-sourcing is a typical example of this trend by offering a relatively similar service to traditional taxis enhanced by a booking app that supports pick up, routing, and pricing (Gilibert et al., 2019). Ride-sourcing services are commercially and internationally operated by Transportation Network Companies (TNCs), such as Uber, Cabify, Ola, Didi, Chuxing, and Lyft. Many terminologies are used interchangeably to talk about ride-sourcing such as app-based ride services, on-demand ride services, ride-hailing or ride-booking services (Tirachini, 2020). However, ride-sourcing is not necessarily a shared service in that most ride-sharing trips convey one passenger or take one booking (Henao & Marshall, 2019). Although ride-sourcing services bring fewer benefits than shared services in terms of sustainability (Tirachini, 2020), it has attained considerable popularity as it has more benefits than traditional taxi services (Nguyen-Phuoc et al., 2021c). Thus, the arrival of ride-sourcing services has contributed to the rapid growth of transport-for-hire services in big cities in over 66 countries (Contreras & Paz, 2018). Up to now, most of the understanding on the use of ride-sourcing services is from high-income countries (e.g., U.S.) and China (Acheampong et al., 2020; Akbari

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et al., 2020; Contreras & Paz, 2018; Gilibert et al., 2019; Guo et al., 2020; Henao & Marshall, 2019; Xiong et al., 2021). However, little is known about the use of or the intention to use ride-sourcing services in low- and middle-income countries (LMICs) (Javaid et al., 2019; Nguyen-Phuoc et al., 2021c). This may originate from the fact that ride-sourcing in LMICs has fallen behind in quality and service availability compared to high-income countries (Tirachini, 2020).

In Vietnam, ride-sourcing services have played an essential role in the transport system. They are considered to be unofficial public transport (PT) due to the lack of actual PT infrastructure and delays with current plans to build more PT infrastructure (Nguyen-Phuoc et al., 2020; Nguyen-Phuoc et al., 2021d; Pham et al., 2021). Although rapid mass transit (e.i., metro systems) projects were approved over ten years ago, there were no operating metro lines in Vietnam at the time of this study. Alternatively, Vietnam's first bus rapid transit corridor has been officially operating in Hanoi. However, its ridership is below the transport authorities' expectations (Nguyen et al., 2019). The limited financial resources, lack of integrated land-use strategies, and discrepancies in views between the national and local transportation agencies are also significant barriers to building more PT infrastructure (Nguyen-Phuoc et al., 2021b). All of this creates a heavy burden to the transport system (e.g., traffic congestion and pollution) because of private vehicles (Huynh, 2020). As such, ride-sourcing has become a common transport mode for low- and middle-income users since it was first launched in Vietnam. Currently, Singapore-based Grab dominates the Vietnamese ride-sourcing market.

The unprecedented spread of COVID-19, together with the broad implementation of non-pharmaceutical interventions (e.g., lockdowns and social distancing), has resulted in important changes in travel behaviour (De Vos, 2020). Many recent studies report reductions in travelling due to the substantial adoption of teleworking (Belzunegui-Eraso & Erro-Garcés, 2020; Molloy et al., 2021; Nguyen & Armoogum, 2021). In scenarios where travel is needed, it is widely accepted that the perceived risk of virus infection determines mobility decisions/intentions (Beck et al., 2020; Nguyen, 2021) and the choice of transport mode (Musselwhite et al., 2020). A public transport vehicle is usually associated with a high perception of infection risk because PT vehicles are enclosed spaces with a crowd of passengers, which is an ideal environment for human-to-human transmission of COVID-19. As a result, numerous passengers have given up this transport mode (Tirachini & Cats, 2020). Alternatively, ride-sourcing services do not share the same passenger crowding concerns (i.e., it is usually a driver and a passenger possibly with a passenger's acquaintance). However, this vehicle could represent a risk if the the driver or previous passengers were infected with COVID-19. Nonetheless, the perceived risk of infection when using ride-sourcing services could still be lower than that of public transport, especially when considering passengers' self-protection measures (e.g., wearing a face mask).

The Cognitive Activation Theory of Stress (CATS) emphasises that the ability to cope with a problem (e.g., a disease) and protect oneself from it may lead to the activation or deactivation of an activity (e.g., travelling for tourism) (Fisher et al., 2018; Homburg & Stolberg, 2006). Arguably, the profile of users of ride-sourcing services during the COVID-19 pandemic has changed worldwide due to physical distancing and other health measures (Awad-Núñez et al., 2021; Dzisi et al., 2021; Luan et al., 2021; Morshed et al., 2021). However, there is no research on what factors influence intention to use such services during this pandemic, particularly in jurisdictions that have experienced economic reactivation due to successful COVID-19 management. Motivated by the research gaps highlighted, the present study examines factors associated with the intention to use ride-sourcing services during the COVID-19 pandemic by proposing an extension of the Theory of Planned Behaviour (TPB) and using data from a low income country. The TPB explains that intentions are predicted by attitude, subjective norms, and perceived behavioural control (Ajzen, 1985). In the context of the ride-sourcing services, the TPB has been adapted and extended to consider the intention to use app-based travel modes (Fu, 2021; Wang et al., 2020). The current investigation considers the issues mentioned above by extending the TPB with two new constructs: including *problem-focused coping* measured by two second-order constructs (i.e., *problem-solving* and *self-protection*) and *perceived infection risk*. The research context is Ho Chi Minh, Vietnam, a typical megacity in a LMIC (Huynh, 2020), with rapid growth in the ride-sourcing market (Nguyen-Phuoc et al., 2021c).

The present study addresses gaps in the literature on the intention to use ride-sourcing services in several ways. First, this is one of the first studies modeling the intention of using ride-sourcing services in a LMIC during the COVID-19 pandemic. The second is the theoretical contributions regarding the extension of TPB and new influential factors on the intention. Specifically, the study will examine the importance of problem-focused coping and perceived risk on the intention to use ride-sourcing services following a period of COVID-19 infection suppression. Based on the findings, policy implications have been proposed to develop ride-sourcing services sustainably considering the impacts of a pandemic in LMICs. The remainder of the paper is organised as follows. Sections 2 and 3 present the foundational background and the hypotheses development of the proposed model. These sections are followed by the methodology (Section 4), which details the questionnaire design, data collection, and analysis. Then, the results will be described in Section 5. The paper concludes with theoretical and practical implications in Section 6 and future research in Section 7.

2. Foundational theories

2.1. Travel intentions in the context of the COVID-19 outbreak

At the beginning of 2020, the world witnessed turmoil caused by the COVID-19 pandemic. COVID-19 can result in severe physical and mental health issues (e.g., anxiety, stress and depression) (Polizzi et al., 2020). It has been considered an unprecedented global disaster because of its widespread and harmful effects on both economy and society (Naumov et al., 2021). Various measures were implemented in many countries to control the spread of the virus, e.g., mobility and travel restrictions, physical distancing, self-isolation, and quarantine (Kucharski et al., 2020; Wells et al., 2020). Meanwhile, these measures have also had significant impacts on travel behaviour. With the delays experienced with the COVID-19 vaccine rollout, many individuals may experience fear, anxiety, and stress while travelling (Abdullah et al., 2020; Huang et al., 2020a). Nonetheless, mobility remains a basic need for most individuals as it is necessary to access services and work (Abdullah et al., 2020; Bae & Chang, 2021). As such, in the context of a pandemic, the perception of infection risk, the perception of safety, and self-protective actions to cope with COVID-19 play an increasingly important role in maintaining daily life, including travelling and working. These factors are essential for public transport users due to the high possibility of COVID-19 infection inside a closed environment such as buses, stations, etc. (Abdullah et al., 2021). COVID-19 is an airborne virus, meaning you don't have to be very close to a positive case to contract it. Recent research suggests that public transport remains a necessity even during the pandemic in LMICs due to high travel demand, but the use of public transport could potentially accelerate community transmission of COVID-19 (Abdullah et al., 2021; Musselwhite et al., 2020). Thus, adherence to infection prevention measures while using PT is vital during the COVID-19 pandemic (Budd & Ison, 2020).

The COVID-19 pandemic has changed perceptions, preferences, and intentions related to travel (Su et al., 2021b). The influence of pandemics on travel intention has also been widely explored in many studies (Bae & Chang, 2021; Floyd et al., 2000; Lee et al., 2012). In particular, researchers have discussed various influential factors that impact travel decision making and behavioural intention during a pandemic, e.g., perceived risk (Huang et al., 2020a), perceived severity of the disease (Li et al., 2020), and the prevention behaviour of travellers (Hartjes et al.,

2009). The intention to use PT during a pandemic while adhering to safety instructions has also been of interest. Some of the key variables to consider are attitudes, awareness, responsibility, and difficulty (Abdullah et al., 2021). During a pandemic, issues related to perceived safety, perceived risk, and personal protection are always the top priorities of travellers when making travel decisions and will influence their intentions to choose public transport (Abdullah et al., 2021).

A vital scenario to consider is when the virus has been successfully suppressed in a jurisdiction for a significant period. In such circumstances, whether people feel safe and confident to travel using a particular mode and what affects their attitudes and travel intentions are critical to understanding the cognitive and affective process of behaviours during a period of infection suppression. We theorised that in a pandemic, potential travellers would have knowledge about the virus and then consider health risks before their trips, which might be more important than other kinds of risks when travelling (e.g., traffic safety and security). Accordingly, it is needed to define the impact of the health risk coping process on the attitude and travelling intentions. More information about these propositions is presented in the below discussion (Section 2.3) of health risk perception in travel decision-making and the foundational theory of Cognitive Activation Theory of Stress (CATS) (Lazarus Richard, 1991).

2.2. The Theory of planned behaviour

The Theory of Planned Behaviour (TPB) originated from the Theory of Reasoned Action (TRA), in which the behavioural intention was determined by attitude and subjective norm (Ajzen, 1985). Based on TRA, Ajzen (1985) developed the TPB by adding perceived behavioural control as another determinant of behavioural intention to deal with the lack of non-volitional factors in TRA. Therefore, the behavioural intention could be predicted by attitude, subjective norm, and perceived behavioural control in the TPB. The attitude was defined as a "person's degree of favourableness or favourableness with respect to a psychological object" (Ajzen & Fishbein, 2000). Attitude is usually developed by behavioural beliefs central to consumer decision-making theory. Subjective norm refers to the perception of social pressure to encourage or discourage someone in making a specific action (Ajzen, 1985). According to Hsu and Huang (2012), perceived behavioural control refers to a perceived ability to perform a particular behaviour.

A literature review showed that the TPB had been widely utilised in different areas (e.g., e-commerce, psychology, education, medicine, tourism, and transport). Moreover, the TPB has been extended by adding other constructs to enhance its explanatory power to predict an individual's behavioural intention in various specific contexts (Chen, 2016; Fu, 2021; Kim et al., 2018). Notably, multiple studies have applied the TPB and its extended versions to predict and explain diverse behaviours in the transport context. For example, Heath and Gifford (2002) identified predictive factors that explain the behavioural intention of using public transport in Canada, including original constructs from the TPB and other constructs such as social norms, moral norms, and environmental concerns. The studies conducted by Haldar and Goel (2019) and Septiani et al. (2017) provided further insight into predicting behavioural intentions to use ride-sourcing services by integrating the TPB and Technology Acceptance Model (TAM). Studies on the behavioural intention of using ride-sharing applications were also conducted in many LMICs (i.e., Malaysia (Choong & Goh, 2021), Bangladesh (Karim et al., 2020), Iran (Akbari et al., 2020), and Hong Kong (Lee et al., 2018)) by considering various additional influential constructs as part of the TPB such as perceived usefulness, perceived ease of use, safety risk, perceived trust or perceived usability.

2.3. Extending the TPB with the cognitive activation theory of stress (CATS)

The Cognitive Activation Theory of Stress (CATS) was developed by Lazarus (1991) to explain the causal link between health and external and internal events for humans. Such events were identified as stressful life events (Brown et al., 1991) that enabled people to find ways to deal with situations (Ursin & Eriksen, 2004). The theory also explained that stress triggered a person's cognitive processes, causing physiological outcomes (Reme et al., 2008). Given that the COVID-19 pandemic can be considered a stressful event, the CATS might be a suitable psychological theory in this research context. Accordingly, the level of travellers' perceived health risk could activate coping behaviour, which will affect behavioural intention. Hence, we added perceived risk of virus infection and problem-focused coping into the TPB model.

Given the centrality of the problem-focused coping construct in the CATS (Lazarus, 1991), it was selected as an outcome of health-related risk perception in this study. According to Folkman (1997), coping is the ability to create and maintain psychological health despite living in a problematic condition. Thus, it was associated with better psychological adjustment outcomes (Smith et al., 1997). Coping was influenced by individual appraisals of threats and pre-designed coping options (Ryan & Carr, 2010). It was also considered a process that reduced uncertainty and complexity (Lantermann, 1983). In the literature, problem-focused coping can be understood from two perspectives. The first one is problem-solving strategies, defined as the individuals' ability to seek and process problem-related information (Grunig, 2006; Grunig & Grunig, 2008). In complex situations such as the COVID-19 pandemic, a significant amount of information sharing and well-developed information appraisal skills are required. According to Miller et al. (1989), problem-solving strategies help to make situations more predictable, making travellers' choices more explicit. The second one is self-protection strategies which help travellers protect themselves or their health (Homburg & Stolberg, 2006). As such, problem-focused coping could be considered as a hierarchical-order construct including two dimensions: problem-solving and self-protection. However, existing measurements of problem-focused coping have not yet adequately captured the multidimensionality of this construct (DeFranco & Morosan, 2017). As a result, the present study empirically tests the second-order measurement model of problem-focused coping intention. Then, it investigates its role in forming usage intention among ride-sourcing passengers during COVID-19.

3. Hypothesis development

3.1. Problem-focused coping

In the present study, problem-focused coping is formed by two dimensions: problem-solving and self-protection. Problem-solving strategies are crucial in shaping positive attitudes and behavioural intentions towards travelling during a pandemic (Miller et al., 1989). Self-protection intentions have been explored in the field of public health as well as environmental behaviours (Cho et al., 2013; Wang et al., 2019). In tourism research, self-protection intentions have also received significant attention. Studies focusing on tourists' intentions to adopt precautionary actions in different travelling contexts have been carried out, e.g., during the pandemic (Su et al., 2021b; Zheng et al., 2021), in crowded areas (Lu & Wei, 2019), in a national park (Samdin, 2021). Thus, problem-focused coping is an essential factor that impacts people's attitudes and behavioural intentions in an uncertain condition. From the above discussion, problem-focused coping is hypothesised to influence passengers' attitudes and behavioural intention to use ride-sourcing services following a period of COVID-19 infection suppression as follows:

H1. : Problem-focused coping has a direct influence on attitudes towards ride-sourcing services following a period of COVID-19 suppression.

H2. : Problem-focused coping has a direct influence on behavioural intention to use ride-sourcing services following a period of COVID-19

suppression.

3.2. Perceived virus infection risk

The perceived virus infection risk refers to the "identification of health-related problems varying from infectious viral diseases to global pandemics". It is considered a significant risk in a health-related crisis (Jonas et al., 2011; Peattie et al., 2005). According to Rosenstock (1974), people with elevated perceived health risk tend to engage in health-protective behaviours to deal with the risk. Additionally, previous studies have indicated that perceived risk directly affects attitude and behavioural intention (Ajzen, 1985; Quintal et al., 2010). These relationships have been investigated in various disciplines such as e-commerce (Belkhamza & Wafa, 1970), banking (Fadare, 2015), marketing (Bhukya & Singh, 2015), tourism (Jonas et al., 2011), and transport (Oviedo-Trespalacios et al., 2020; Oviedo-Trespalacios et al., 2021; Wan et al., 2016). Notably, in the context of transport, a number of empirical studies have confirmed the impact of perceived risk on travellers' attitudes and behavioural intentions to use ride-sourcing services and ride-sharing services (Nguyen-Phuoc et al., 2021a; Wan et al., 2016; Wang et al., 2020). For example, Wan et al. (2016) confirmed the direct effect of perceived risk on customers' intentions to use Uber services in tourism destinations. A negative relationship between perceived risk and a consumer's intention to use a ride-sharing service was also found in the study of Wang et al. (2020). In the context of a pandemic, perceived infection risk is considered a unique element that might impact the traveler's problem-focused coping, attitudes, and behavioural intention to use ride-sourcing services. Therefore, based on the literature, the present study proposes the following hypotheses:

H3. : Perceived virus infection risk has a direct influence on problem-focused coping in using ride-sourcing services following a period of COVID-19 suppression.

H4. : Perceived virus infection risk has a direct influence on attitudes towards ride-sourcing services following a period of COVID-19 suppression.

H5. : Perceived virus infection risk has a direct influence on behavioural intention to use ride-sourcing services following a period of COVID-19 suppression.

3.3. Subjective norms, attitude, and perceived behavioural control

According to the TPB, subjective norms, attitude, and perceived behavioural control directly and positively influence behavioural intention (Ajzen, 1985). These relationships are confirmed in many prior studies with different contexts. In the transport context, various studies have indicated that attitude, subjective norms, and perceived behavioural control are key factors influencing passengers' intentions towards public transport (Zailani et al., 2016) or ride-sourcing services (Choong & Goh, 2021; Weng et al., 2017). This study will test the effects of the original TPB constructs on passengers' intention to use ride-sourcing services after the COVID-19 pandemic. As such, the following hypotheses were proposed:

H6. : Subjective norms have a direct influence on behavioural intention to use ride-sourcing services following a period of COVID-19 suppression.

H7. : Attitude has a direct influence on behavioural intention to use ride-sourcing services following a period of COVID-19 suppression.

H8. : Perceived behavioural control has a direct influence on behavioural intention to use ride-sourcing services following a period of COVID-19 suppression.

Finally, a research model that integrated the original TPB constructs (e.i., subjective norms, attitude and perceived behavioural control) with problem-focused coping and perceived virus infection risk was proposed, as shown in Fig. 1. The two additional constructs are hypothesised to impact attitude and behavioural intention directly. In the developed model, problem-focused coping is operationalised as a formative second-order construct formed by the two dimensions of first-order constructs: problem-solving and self-protection.

4. Methodology

4.1. Survey design

A questionnaire was designed to collect the data following the proposed hypotheses. The questionnaire encompassed three sections. The first part introduced participants to the scope and objectives of this study. The second section contained 31 attitudinal statements used to measure the seven constructs. Particularly, 18 items were adapted from Lee et al. (2012) to measure attitude (ATT), subjective norms (SNO), perceived behavioural control (PBC), and behavioural intention (BIN) to use ride-sourcing services after the pandemic compared to before the pandemic. Perceived virus infection risk (PVI) was obtained through 3 statements adapted from Dolnicar (2005). Six and four items introduced in Homburg and Stolberg (2006) and Régner et al. (2018) were used to measure problem-solving (PRS) and self-protection (SEP), respectively. Participants were asked to provide their responses to the items based on a 7-point Likert scale ('strongly disagree' - 'strongly agree'). The third and final part of the questionnaire requested the respondents' socio-demographic information (i.e., gender, age, education level, occupation, and monthly income).

The authors originally designed the questionnaire in English before translating it into Vietnamese. Five transport experts reviewed the translation to ensure its quality. Any notes and discrepancies in the feedback were carefully addressed. The improved questionnaire was subsequently pilot tested by 50 undergraduate students at a university in Da Nang. Some minor wording errors were reported and corrected to produce the final version.

4.2. Data collection

Face-to-face-based recruitment was implemented to undertake self-administered surveys from 12 July to 24 July 2020. Ho Chi Minh, the largest city in Vietnam, was chosen as a research context for this study. On 24 July 2020, Vietnam marked more than three months without any identified community transmission (Nong et al., 2021). During the survey, ten research officers were divided into two groups to seek potential candidates at places with high demand for taxis and ride-sourcing services, such as shopping centres, hospitals, and airports. Surveyors randomly approached people to introduce the survey's objectives before inviting them to participate in it. Respondents received a 20,000 VND-prepaid mobile card (about one USD) as an incentive for their participation. Of 562 questionnaires distributed, 540 were eligible for further analyses, leading the valid response rate to reach a relatively high level of 96.1%. Twenty-two responses were excluded due to several reasons such as outlier values, pattern answers, overly fast responses, or missing data in some critical variables.

According to Hair et al. (2011) and Goodhue et al. (2012), data for a PLS-SEM model should be at least five to ten times the number of items questioned to make sure that the PLS-SEM test, which was a statistical test's probability of avoiding type II errors or false negatives, achieved an acceptable level of power (usually 0.8). With a 31-item questionnaire, the minimum sample size of this study per the rule mentioned above is 310. With 540 responses collected, the sample was more than adequate for this study. Table 1 provides information about the means (*M*), standard deviation (*SD*), excess kurtosis, and skewness of constructs' measurement items. The obtained data were confirmed to have normal distributions since all items' skewness, and kurtosis values were in the

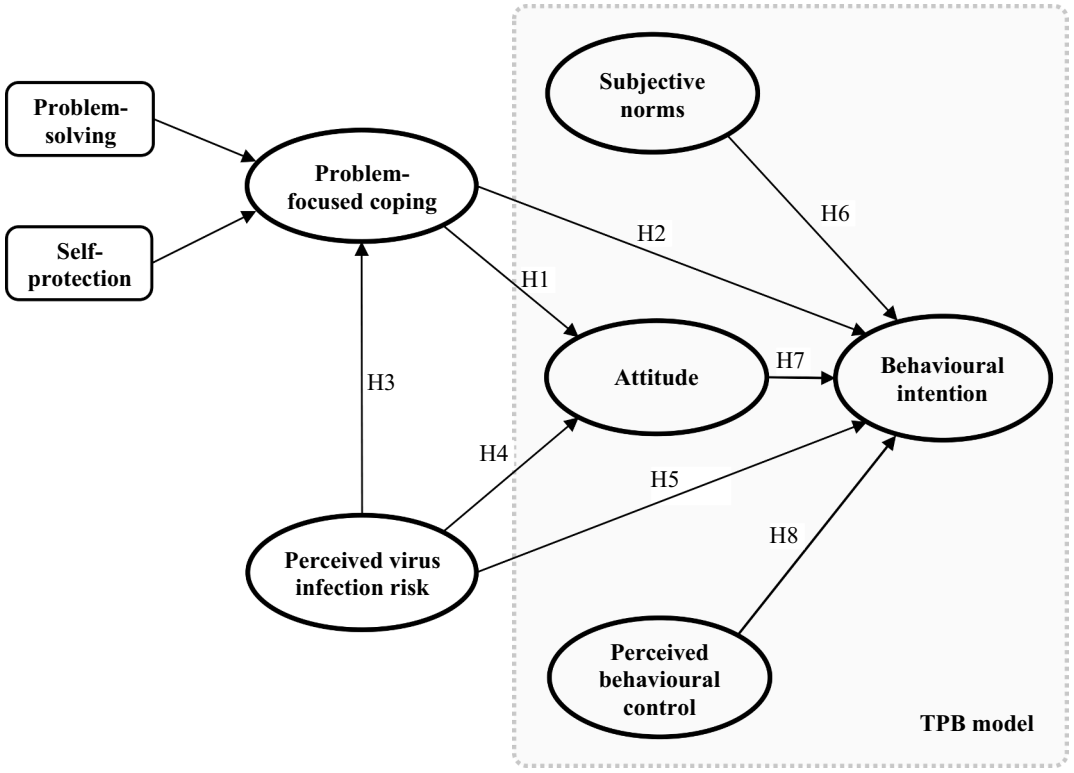

Fig. 1. Developed conceptual model.

normal range (±2) recommended by George and Mallery (2010).

4.3. Data analysis

Data were analysed using Partial Least Squares – Structural Equation Modeling (PLS-SEM), which has been developed recently (Khan et al., 2019) but demonstrated as an effective and popular alternative to SEM for transport-specific research (Friman et al., 2020; Nguyen-Phuoc et al., 2021c; Rehman Khan & Yu, 2021; Su et al., 2021a). The PLS-SEM approach was appropriate for the present study. This method can consider both direct and indirect causal relationships across constructs in the proposed conceptual structure, requiring a (relatively) small sample size. SmartPLS 3.0 was used to estimate the parameters of the adopted model.

Researchers have created more sophisticated PLS-SEM models with second-order constructs (reflective or formative measurement models). Most studies in transport have focused on second-order constructs with a reflective measurement. There has been limited research and practical examples of estimating formative second-order constructs. In the current paper, the problem-focused coping construct was funnelled into a formative second-order construct. This model makes the path model more parsimonious and allows researchers to enhance the content comprised by a specific construct (Cong, 2016).

5. Results

5.1. Descriptive statistics

Table 2 shows that the sample was generally balanced in gender with a slightly higher share of females (51.3%). The average age of respondents was approximately 33 years old (M = 32.9, SD = 12.0). Regarding the education-based distribution, nearly three-fourths of respondents (75.7%) had a university degree, 12.6% had a college, and 11.7% had a high school. Respondents working full time (38.2%) and or studying/students (34.4%) were the dominant groups in the sample when considering occupation. Regarding income, the lowest income earners (<5 million VND, 37.8%) were almost three times more prevalent than the highest income earners (≥15 million VND, 13.5%).

5.2. First-order measurement model assessment

The first-order measurement model was initially evaluated by testing the reliability and validity of the constructs. Particularly, internal consistency among the components was tested based on Cronbach's alpha (CA) value, while convergence validity was assessed using factor loadings, composite reliability (CR), and average variance extracted (AVE). The results from Table 3 indicated that all first-order constructs were reliable and valid as the loading factor of each measurement item, the CA, CR, and AVE values of each construct were above the recommended cut-off values of 0.7, 0.7, 0.7, 0.5, respectively (Fornell & Larcker, 1981; Nunnally & Bernstein, 1994).

Secondly, the measurement model was evaluated by examining the discriminant validity of each construct. This study used two discriminant validity methods: Fornell-Larcker Criterion and Heterotrait-Monotrait Ratio (HTMT). The Fornell-Larcker Criterion method compared the square root of the average variance extracted (AVE) with the correlation of latent variables. A latent variable should explain better the variance of its indicator rather than the variance of other latent variables. The results in Table 4 stated that all first-order constructs in the developed model had adequate discriminant validity as the square root of the AVE of each latent variable was higher than its correlations with other latent constructs (Fornell & Larcker, 1981).

On the other hand, Henseler et al. (2015, p. 117) proposed the superior performance of the HTMT method using Monte Carlo simulation. They found that HTMT achieved higher specificity and sensitivity rates (97% to 99%) than the Fornell-Lacker (20.82%). HTMT values closed to 1 indicated a lack of discriminant validity. Using the HTMT method, the discriminant validity was also achieved as all of the HTMT values were below the 0.85 benchmark suggested by previous scholars (Table 5).

Table 1
Measurement scales.

Code	Measurement scales	M	SD	Excess Kurtosis	Skewness
Problem-Solving (PRS)					
PRS1	It is important for me to talk to others about COVID-19	4.911	1.311	0.380	−0.780
PRS2	I try to be informed about how COVID-19 can be prevented	5.180	1.177	0.841	−0.934
PRS3	I make sure I obtain more exact information about COVID-19	5.196	1.128	0.361	−0.617
PRS4	I take the opportunity to talk to others about COVID-19	5.100	1.265	1.115	−0.937
PRS5	I am learning more about ways to prevent COVID-19 (e.g., wearing masks, using hand sanitisers)	5.398	1.092	0.662	−0.745
PRS6	I will read and check precautions about COVID-19	5.476	1.017	0.663	−0.739
Self-Protection (SEP)					
SEP1	I will be more careful than usual while travelling	5.469	1.074	1.038	−0.854
SEP2	I will refrain from touching my eyes, nose, and mouth while travelling.	5.515	1.037	0.745	−0.814
SEP3	Due to COVID-19, I will limit contacts with drivers while travelling	5.422	1.125	0.539	−0.783
SEP4	I will take preventative measures against COVID-19 (e.g., wearing masks, using hand sanitisers) while travelling	5.539	1.068	0.230	−0.673
Perceived Virus Infection Risk (PVI)					
PVI1	I might be exposed to the risk of COVID-19 when I use ride-sourcing services	4.956	1.410	0.140	−0.705
PVI2	I might become infected with COVID-19 when I use ride-sourcing services	4.978	1.428	0.027	−0.661
PVI3	I might become infected with COVID-19 if the cars have carried infected passengers	5.089	1.378	0.021	−0.667
Subjective Norms (SNO)					
SNO1	Most people who are important to me think it is okay for me to travel by ride-sourcing services	4.870	1.199	0.208	−0.556
SNO2	Most people who are important to me support that I travel by ride-sourcing services	4.924	1.142	0.238	−0.510
SNO3	Most people who are important to me agree with me about travelling by ride-sourcing services	5.033	1.118	0.378	−0.456
SNO4	Most people who are important to me recommend travelling by ride-sourcing services	4.970	1.159	0.485	−0.529
Attitude (ATT)					
ATT1	I think that travelling by ride-sourcing services is positive.	5.104	1.077	0.734	−0.671
ATT2	I think that travelling by ride-sourcing services is useful.	5.176	1.028	0.608	−0.707
ATT3	I think that travelling by ride-sourcing services is valuable.	5.157	1.085	−0.136	−0.464
ATT4	I think that travelling by ride-sourcing services is desirable.	5.124	1.136	0.985	−0.694
ATT5	I think that travelling by ride-sourcing services is wise.	5.109	1.113	0.687	−0.662
ATT6	I think that travelling by ride-sourcing services is enjoyable	5.224	1.078	0.349	−0.499
ATT7	I think that travelling by ride-sourcing services is delightful.	5.189	1.136	0.593	−0.619
Perceived Behavioural Control (PBC)					
PBC1	Whether or not I travel by ride-sourcing services is entirely up to me	5.374	1.157	1.819	−1.067
PBC2	I am capable of travelling by ride-sourcing services	5.431	1.055	0.262	−0.703
PBC3	I am confident that if I want, I can travel by ride-sourcing services	5.413	1.108	0.477	−0.770
PBC4	I have enough resources (money) to travel by ride-sourcing services	5.369	1.175	0.659	−0.863
Behavioural Intention (BIN)					
BIN1	I am likely to continue travelling by ride-sourcing services as frequently as before the pandemic	5.107	1.125	0.785	−0.627
BIN2	I intend to continue travelling by ride-sourcing services as frequently as before the pandemic	5.076	1.104	0.612	−0.598
BIN3	I will continue travelling by ride-sourcing services as frequently as before the pandemic	5.131	1.145	0.665	−0.631

Table 2
Sample profile.

Characteristics	n	%		n	%
Gender			***Occupation***		
Female	277	51.3	Full-time employee	206	38.2
Male	263	48.7	Part-time employee	93	17.2
Age			Student	186	34.4
Mean (Standard Deviation)	32.9 (12.0)		Retired	18	3.3
Level of education			Other	37	6.9
High school	63	11.7	***Monthly income (VND)***		
College	68	12.6	<5 million	204	37.8
University and above	409	75.7	5–10 million	133	24.6
			10–15 million	130	24.1
			≥15 million	73	13.5

Note: 1 USD = 23,000 VND.

5.3. The assessment of second-order measurement model

The second-order construct, problem-focused coping (PFC), was formed from two first-order constructs, including problem-solving (PRS) and self-protection (SEP). Table 6 showed that all attributes of the higher-order construct have the value of variance inflation factor (VIF) were under the cut-off value of 5.0. According to Hair et al. (2010), the results indicated no multicollinearity problem among sub-constructs.

Table 3
First-order model evaluation.

Constructs	Items	Loadings	CA	CR	AVE
Problem-focused coping 1: Problem-Solving (PRS)			0.851	0.893	0.627
	PRS1	–			
	PRS2	0.757			
	PRS3	0.813			
	PRS4	0.752			
	PRS5	0.845			
	PRS6	0.787			
Problem-focused coping 2: Self-Protection (SEP)			0.874	0.914	0.727
	SEP1	0.814			
	SEP2	0.887			
	SEP3	0.845			
	SEP4	0.863			
Perceived Virus Infection Risk (PVI)			0.928	0.954	0.875
	PVI1	0.933			
	PVI2	0.957			
	PVI3	0.915			
Subjective Norms (SNO)			0.891	0.924	0.754
	SNO1	0.844			
	SNO2	0.901			
	SNO3	0.870			
	SNO4	0.856			
Attitude (ATT)			0.897	0.919	0.620
	ATT1	0.764			
	ATT2	0.823			
	ATT3	0.822			
	ATT4	0.787			
	ATT5	0.795			
	ATT6	0.796			
	ATT7	0.718			
Perceived Behavioural Control (PBC)			0.861	0.906	0.708
	PBC1	0.702			
	PBC2	0.889			
	PBC3	0.900			
	PBC4	0.861			
Behavioural Intention (BIN)			0.891	0.932	0.820
	BIN1	0.891			
	BIN2	0.938			
	BIN3	0.887			

They supported the formative nature of PFC, confirming the satisfactory reliability for the second-order measurement model. PRS had a greater influence on PFC than SEP with the outer weight of 0.687 ($t = 10.434$) compared to 0.399 ($t = 5.352$).

5.4. Structural model and test of hypotheses

Before testing the hypotheses, the structural model was evaluated using bootstrapping (5000 iterations). This procedure can be applied to measure the model's fitness and assess the significance of indicators and coefficient paths (Chin et al., 2008). The PLS-SEM model fit is typically evaluated using standard root mean square residual (SRMR) and the Normed Fit Index (NFI). In the present study, the SRMR value (0.055) was below the 0.08 benchmark suggested by Sinkovics et al. (2016) and the NFI value (0.824) was higher than the 0.80 benchmark proposed by Hu and Bentler (1998), indicating the good model fit.

The value of R^2 of each endogenous construct was adopted to assess the predictive accuracy and represent the degree of variance (Hair et al., 2019). R^2 values of ATT, PFC and BIN were 23.8%, 20.6% and 31.7%, respectively. Approximately 32% of BI variance can be described by SNO, PFC, ATT, PVI and PBC. Additionally, the value of Q^2, which was determined via the blindfolding procedure, was used to check predictive relevance. The findings showed that Q^2 of ATT, PFC and BIN were 0.137, 0.167 and 0.241, respectively. The positive values of Q^2 (>0) indicated that the predictive prevalence of all endogenous variables in the developed model was appropriate (Henseler et al., 2009).

Fig. 2 illustrated the direct relationships among constructs in the hypothesised model. All three original TPB constructs, including SNO, ATT and PBC were found to have a significant direct effect on BIN (H6, H7, H8), in which ATT had the highest impact ($ß_{ATT→BIN} = 0.269$, $t = 5.434$, $p \leq 0.001$). The results showed that the second-order construct PFC was successfully formed by the two first-order constructs, PRS ($δ_{PRS→PFC} = 0.687$, $t = 10.434$, $p \leq 0.001$) and SEP ($δ_{SEP→PFC} = 0.399$, $t = 5.352$, $p \leq 0.001$). PFC was also found to have a positive and significant effect on both ATT (H1: $ß_{PFC→ATT} = 0.487$, $t = 11.550$, $p \leq 0.001$) and BIN (H2: $ß_{PFC→BIN} = 0.149$, $t = 3.210$, $p \leq 0.001$). In contrast, PVI did not have a significant direct effect on both ATT and BIN (H4, H5); however, PVI positively influenced PFC (H3: $ß_{PVI→PFC} = 0.454$, $t = 11.941$, $p \leq 0.001$).

The indirect and total impacts of constructs on BIN were also shown in Table 7. The indirect impact between PFC and BIN via ATT was confirmed with $ß'_{PFC→BIN} = 0.131$, $t = 4.979$, $p \leq 0.001$. Similarly, PVI was found to indirectly effect BIN via PFC and ATT ($β'_{PVI→BIN} = 0.127$, $t = 4.913$, $p \leq 0.001$). Among five constructs influencing BIN, PFC and ATT had the strongest total impacts on BIN with $λ_{PFC→BIN} = 0.279$, $t = 5.817$, $p \leq 0.001$ and $λ_{ATT→BIN} = 0.269$, $t = 5.434$, $p \leq 0.023$, respectively. They were followed by SNO and PBC. The total impact of PVI on BIN was the lowest ($λ_{PVI→BIN} = 0.096$, $t = 2.271$, $p \leq 0.023$).

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

Constructs	ATT	BIN	PBC	PRS	PVI	SEP	SNO
ATT							
BIN	0.548						
PBC	0.611	0.457					
PRS	0.566	0.454	0.577				
PVI	0.244	0.186	0.293	0.452			
SEP	0.431	0.382	0.528	0.766	0.488		
SNO	0.543	0.466	0.427	0.459	0.230	0.342	

Table 6
Second-order model assessment.

Higher-order construct	Outer Weights	SD	t	p	VIF
Problem-focused coping (PFC)					
Problem-Solving (PRS)	0.687	0.066	10.434	<0.001	1.828
Self-Protection (SEP)	0.399	0.074	5.352	<0.001	1.828

Table 4
Fornell-Larcker Criterion of the first-order constructs.

Constructs	AVE	PRS	SEP	PVI	SNO	ATT	PBC	BIN
PRS	0.627	0.792						
SEP	0.727	0.670	0.853					
PVI	0.875	0.404	0.440	0.935				
SNO	0.754	0.398	0.303	0.210	0.868			
ATT	0.620	0.491	0.383	0.223	0.485	0.787		
PBC	0.708	0.494	0.464	0.270	0.366	0.536	0.842	
BIN	0.820	0.394	0.340	0.170	0.417	0.493	0.408	0.906

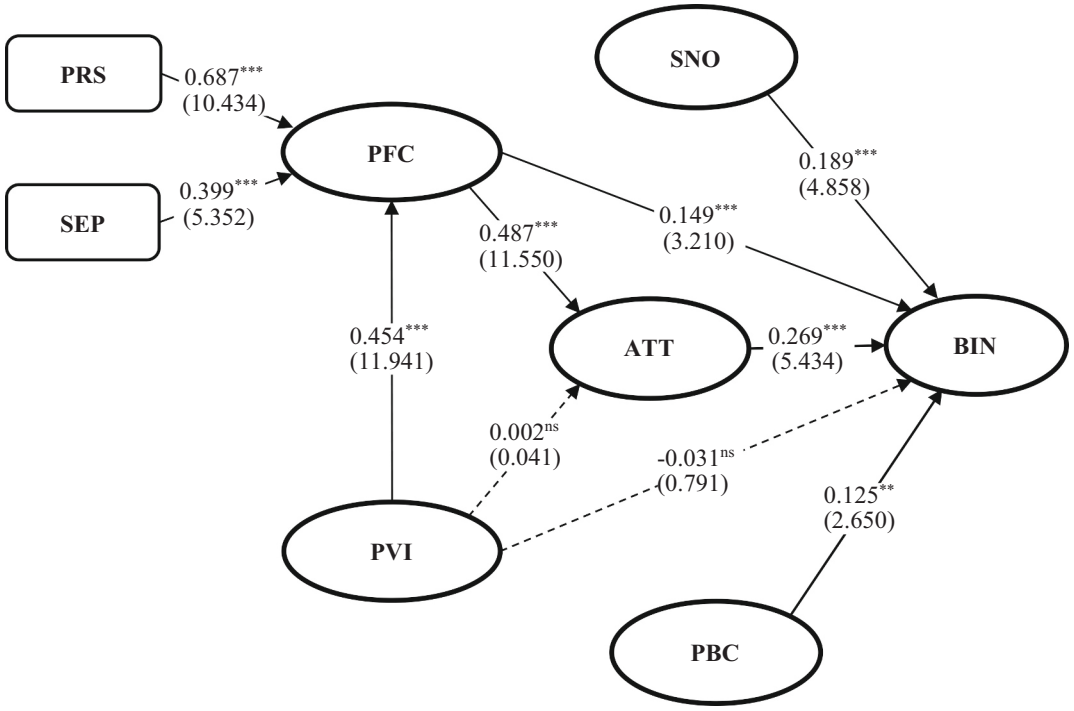

Fig. 2. Relationships among proposed model's constructs.

Table 7
Decomposition of direct, indirect and total effects.

Relationships	Direct effects		Indirect effects		Total effects	
	ß	t	ß'	t	λ	t
PFC → ATT	0.487***	11.550			0.487***	11.550
PFC → BIN	0.148***	3.206	0.131***	4.979	0.279***	5.817
PVI → PFC	0.454***	11.941			0.454***	11.941
PVI → ATT	0.002ns	0.041	0.221***	8.026	0.223***	5.309
PVI → BIN	-0.031ns	0.791	0.127***	4.913	0.096**	2.271
SNO → BIN	0.189***	4.858			0.189***	4.858
ATT → BIN	0.269***	5.434			0.269***	5.434
PBC → BIN	0.125***	2.650			0.125***	2.650

Notes: ns non-significant.
*** $p < 0.01$.
** $p < 0.05$.

6. Discussion

6.1. Theoretical implications

Several theoretical implications could be inferred from the findings. First, the findings of this study confirmed the utility of TPB as a theoretical framework when assessing the behavioural intention of PT passengers following a period of COVID-19 suppression. All three original TPB constructs (i.e., attitudes, subjective norms, and perceived behavioural control) directly and positively influenced passengers' behavioural intention as hypothesised. Attitude had a more considerable impact on the intention to use ride-sourcing than subjective norms and perceived behavioural control. The role of attitude as the strongest predictor of behavioural intention was in line with most past studies in the transport context, which indicated that increasing the attitude of travellers towards public transport would significantly increase their intention to use PT (Heath & Gifford, 2002; Li et al., 2015). However, there have also been several studies that found that attitude had the weakest effect among the primary TPB constructs (Juschten et al., 2019; Wang et al., 2016) or a non-significant impact on behavioural intention (Dirgahayani & Sutanto, 2020; Juschten et al., 2019). In addition, the positive effects of subjective norms and perceived behavioural control on intention were also confirmed to be statistically significant in this study. This was consistent with the main assumptions of Ajzen's TPB (Ajzen, 1985). However, the links between subjective norms, perceived behavioural control, and behaviour intention were sometimes not well established in previous studies, particularly in Western contexts (Sparks, 2007). This could be due to the difference in culture among countries. For example, Asian countries tend to be more collectivistic. People from collectivistic cultures could be more influenced by social norms than people from individualistic cultures.

Second, using a two-stage hierarchical method in the PLS-SEM approach demonstrated that problem-focused coping is a multi-faceted construct with two dimensions: problem-solving and self-protection. The present study built from previous research by Lee et al. (2012), which considered problem-focused coping only as personal protective measures (self-protection). In the current research, as the global pandemic could cause stress among travellers, problem-solving was empirically tested as another factor influencing travellers' intention. The results showed that problem-focused coping had both direct and indirect effects (via attitude) on behavioural intention to use ride-sourcing services. Finally, our findings revealed that attitude partially mediated the

causal link between problem-focused coping and behavioural intention.

Third, the present study considered the relevance of perceived virus infection risk with problem-focused coping, attitude, and behavioural intention to use ride-sourcing services. Perceived virus infection risk was a significant determinant of problem-focused coping. This finding extended the results from Lee et al.'s (2012) study, which uncovered the direct influence of knowledge about a disease on the intervention behaviour. This relationship was confirmed in the ride-sourcing service context, contributing to understanding how travellers' perceived virus infection risk and problem-focused coping affect attitudes and behavioural intention. While perceived virus infection risk directly influenced problem-focused coping, the links between this construct and attitude and behavioural intention were not confirmed. Problem-focused coping was found to play a fully mediating role in the relationship between perceived virus infection risk perception and behavioural intention. A passenger with a high level of perceived viral infection risk could increase their problem-focused coping, leading to an increase in the intention to use ride-sourcing services.

6.2. Practical implications

The findings of this study describe ride-sourcing ridership after COVID-19 infection suppression. As many countries have experienced and will experience periods of COVID-19 infection suppression, the results of this study could have global relevance. According to our findings, travellers' attitude towards ride-sourcing services was positively influenced by problem-focused coping. If travellers have a high level of problem-focused coping, they would form a more positive attitude towards ride-sourcing services, increasing travellers' intention to use ride-sourcing services. As such, campaigns improving problem-solving strategies and encouraging self-protection through health promotion and education efforts are needed (Shen et al., 2020). Many respondents in this study were university students (34.4%) and university educated (75.7%). University student support services could have played a role in the development of problem-focused coping in this cohort of participants (Julal, 2013). Overall, this study shows the need for reliable, accessible and convenient psychosocial support during the COVID-19 pandemic to promote self-protection (Bull et al., 2016).

Problem-focused coping has been shown to improve with cognitive behavioural therapy (Nam et al., 2013) and mindfulness training (de Vibe et al., 2018). When combined with a distraction (e.g., hobbies, entertainment), problem-focused coping in a high job stress environment leads to better work performance and lower stress responses among blue-collar workers (Shimazu & Schaufeli, 2007). This means that the use of mindfulness training, cognitive behavioural therapy, or even intentional distractions could yield improvements in problem-focused coping. In addition, information about COVID-19 and safety guidelines should be better provided to travellers while making choices through online (e.g., platforms, social networks) or offline communication channels (e.g., flyers, posters).

Subjective norms were found to influence ride-sourcing travellers' behavioural intention significantly. In Vietnam, many aspects of daily life are relatively dominated by collectivism, and social pressure plays a critical role in road users' behaviour (Lin et al., 2020). Relatives' or friends' assessments of ride-sourcing usage during the COVID-19 pandemic have significantly affected the ride-sourcing users' intentions. Therefore, ride-sourcing firms should pay more attention to building public confidence in using ride-sourcing services. For instance, they should apply strict measures to ensure their drivers and passengers follow the safety guidelines (e.g., passengers must sit in the back and drivers have to wear a mask).

Lastly, our findings indicated that passengers' perceived behavioural control was an essential construct in the proposed model. If ride-sourcing services were easily accessible to passengers, they would have more usage intention towards the services. For example, this study revealed that most potential ride-sourcing customers were low- and medium-income users, so competitive prices could significantly influence passengers' decision-making. If the service was more affordable, the intention to use ride-sourcing services would increase.

7. Conclusion

The present paper aimed to understand ride-sourcing passengers' intention to use ride-sourcing services during the COVID-19 pandemic by incorporating two psychological constructs - problem-focused coping and perceived virus infection risk – into the Theory of Planned Behaviour (TPB) model. The survey data was collected in Ho Chi Minh, Vietnam using paper-based questionnaires. The empirical results revealed that the extended TPB model successfully explained the behavioural intention to use ride-sourcing services during the COVID-19 pandemic. Our results also indicated that problem-focused coping was the most significant construct in generating passengers behavioural intentions towards ride-sourcing services. Thus, our findings highlighted the importance of understanding the impact of protective measures against COVID-19, filling a gap in the existing literature on ride-sourcing passenger behaviour. From a managerial perspective, our results can be used by ride-sourcing service providers to develop efficient marketing strategies to enhance the intentions to use the services during the COVID-19 pandemic.

The current study has some limitations that are needed to be considered in later research. Firstly, data collection was conducted in Ho Chi Minh (Vietnam), when COVID-19 infections were well controlled (no new cases in the community were detected during the preceding three months). Further research should be carried out in other nations with different cultures (e.g., western countries), at other pandemic stages, or after the COVID-19 pandemic has ended globally. Secondly, the TPB was extended by incorporating two factors: problem-focused coping and perceived virus infection risk. It is unclear if the results from this research would be maintained in other transport & health contexts. Additionally, other factors that might influence passengers' intentions in the post-pandemic (e.g., personality, trust in media or culture) should be investigated in future studies to extend further the model presented in this research. Fourthly, the added factors were adapted from tourism studies. Measurement scales of these factors should be further developed and validated in the context of transport in future research. Fifthly, the present research relies on self-reported data, which do not necessarily describe the participants' actual behaviour. Further external validation is needed to determine the predictive capability of the extended TPB model developed in this research. Finally, COVID-19 infection can be more severe given an individual comorbidities (Rod et al., 2020). Therefore, it is likely that the behaviour varies according to the health of the individuals and their close ones. Further work needs to consider passengers' differences in transport choices in the COVID-19 pandemic.

CRediT authorship contribution statement

Duy Quy Nguyen-Phuoc: Conceptualization, Methodology, Formal analysis, Data curation, Writing – original draft. **Oscar Oviedo-Trespalacios:** Formal analysis, Writing – original draft, Writing – review & editing. **Hieu Minh Nguyen:** Data curation, Writing – original draft. **My Thanh Tran Dinh:** Writing – original draft, Formal analysis. **Diep Ngoc Su:** Conceptualization, Writing – original draft.

Declaration of competing interest

Authors state no conflict of interest.

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