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Travel satisfaction and travel well-being: Which is more related to travel choice behaviour in the post COVID-19 pandemic? Evidence from public transport travellers in Xi’an, China

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ABSTRACT

The spread of Coronavirus Disease 2019 (COVID-19) has decreased the willingness to choose public transport where travellers are more likely to be infected due to intensive passenger flow, in which case it is hard to attract passenger volume if the subjective well-being of travellers is not improved. However, the traditional measurement of travel evaluation may be not applicable to the context of the pandemic and it is necessary to analyse the changes in the internal mechanisms of travel well-being to avoid the loss of passengers. Based on structural equation modelling, this paper explored the internal relationship between the constructs of travel well-being and emphasised the significance of taking psychological factors into consideration in the post COVID-19 pandemic. The results show that travel satisfaction with the anti-pandemic related service quality of public transport is related to overall travel well-being, which can be used as a key part of well-being measurement scale design in the future. The results also indicate that, due to negative mood on the affective level induced by COVID-19, travel satisfaction on the cognitive level is not directly but indirectly related to travel choice behaviour through overall travel well-being. Compared to travel satisfaction, travel well-being is more extensive and covers travel satisfaction to some extent. Therefore, instead of studying travel satisfaction simply, taking travel well-being as the dependent variable to identify shortages existing in public transport will provide a more accurate perspective for policymakers in the post COVID-19 pandemic.

1. Introduction

Public transport acts as a significant role in the efficient operation of modern cities (Dong et al., 2021), but the spread of Coronavirus Disease 2019 (COVID-19 for short) has exerted a great influence on public transport travel behaviour (Chen et al., 2022; Luan et al., 2021; Przybylowski et al., 2021). Especially during the lockdown of some cities with the severe pandemic, public transport was suspended. Public transport usage is on a declining trend due to COVID-19 (de Haas et al., 2020; Eisenmann et al., 2021; Brough et al., 2021), which is a serious issue associated with the development of sustainable urban strategies (Chen et al., 2022). Currently, although the pandemic has been under control to some extent, its impact will last for a long time (Van Wee and Witlox, 2021). Travel satisfaction will be influenced by COVID-19 (Dong et al., 2021; Khaddar and Fatmi, 2021; Nilashi et al., 2022), and reduced travel mobility may

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also have a negative impact on individuals’ well-being (Pan and He, 2022). Furthermore, the decrease of travel well-being of public transport travellers may lead to the loss of public transport passenger flow. Travellers are afraid of being infected on public transport where travellers may access a vast volume of people, and show more willingness to use private transport (Chen et al., 2022; Meena, 2020; Eisenmann et al., 2021). Therefore, attracting more traffic volume for public transport by improving users’ travel well-being is crucial to achieving sustainable urban transport development in the post COVID-19 pandemic.

Most studies have indicated that travel well-being or travel satisfaction with taking public transport is lower than that with choosing active modes (Friman et al., 2017a; Zhu and Fan, 2018a; Lades et al., 2020; Handy and Thigpen, 2019; Smith, 2013). For example, a study shows that the subjective well-being of walking and bicycling commuters is significantly higher than that of public transport commuters (Smith, 2013). Especially, in the context of the pandemic, the travel well-being of public transport travellers, which was already poor before COVID-19 outbreak, may be even lower due to travellers’ negative attitudes towards public transport induced by COVID-19. The decrease of travel well-being is not beneficial for the physical and mental health of travellers. Some researchers also mentioned that well-being related to transport should become a target for policy makers (de Oña et al., 2016). Travel well-being of public transport under the influence of COVID-19 requires more attention from public transport managers.

Before the pandemic, most studies about travel evaluation of public transport are focused on the dimension of cognition, the impacts of mood or other psychological factors on travel choice behaviour are seldom discussed. There are more studies about the improvement of public transport service from the perspective of travel satisfaction (Zhang et al., 2016; Wong et al., 2017; Abenoza et al., 2017; Zhang et al., 2019; Ngatia et al., 2010), and researchers can also obtain policy implication based on the results of travel satisfaction studies. However, under the influence of COVID-19, are policy recommendations based on travel satisfaction regardless of mood really reasonable? Travel mode switching was found to be correlated with user satisfaction indeed (Abou-Zeid et al., 2012), and satisfaction with public transport services has a positive impact on the intention to continue to adopt public transport (Lai and Chen, 2011). From this perspective, not only improving travel satisfaction is helpful for attracting traffic volume, but also measuring current travel satisfaction can be applied in predicting usage behaviour in the future. Differently, since COVID break, the pandemic has induced the negative mood of travellers (Meena, 2020; Dong et al., 2021; Chen et al., 2022; Zheng et al., 2021) and reduced happiness (Yıldırım and Güler, 2020). Does simply enhancing travel satisfaction really mean that more traffic volume will be attracted? Subjective well-being extensively expresses individuals’ cognitive and affective evaluations (Zhu and Fan, 2018b; Chen et al., 2019). Will well-being incorporating travel satisfaction and mood be more related to switching intention and become a better perspective for predicting choice behaviour? In the post COVID-19 pandemic, travel satisfaction, mood, and overall travel well-being are all possible to be related or not related to travel choice behaviour, directly or indirectly. Meanwhile, these constructs may influence each other. Therefore, this paper aims to explore whether the impacts of mood or other psychological factors are non-negligible, and to compare the relative importance of travel satisfaction and travel well-being when they are related to travel behavioural intention, thus understanding the internal mechanisms in the formation of travel well-being in the post COVID-19 pandemic.

The paper is organised as follows. Previous relevant studies about travel well-being are summarised in Section 2. The hypotheses and the conceptual model are put forward in Section 3. Data collection and the characteristics of the sample are described in Section 4. The final model results are discussed in Section 5. Finally, the findings are summarised and interpreted in conclusions, along with policy implications.

2. Literature review

2.1. Theoretical structure of travel well-being

Travel satisfaction can be understood as travellers’ cognitive evaluation of the quality of travel (Mokhtarian and Pindyala, 2018; Gao et al., 2017a), while subjective well-being is a relatively complex concept covering many aspects (Diener, 1984). Some studies have summarised the concept of subjective well-being into different views, i.e., “hedonic” vs “eudaimonic”, “cognitive” vs “affective”. Eudaimonic well-being is concerned with the cognitive dimension, about how one evaluates life considering life goals, life meaning, self-growth, and self-actualization (De Vos et al., 2013; Gao et al., 2017b; Singleton, 2019). Hedonic well-being is concerned with the affective dimension, about one’s feelings about life and experiences of positive and negative mood (Chen et al., 2019; Son and Wilson,
In the domain of transport, travel well-being is defined as the subjective well-being during travel, including not only the travellers’ cognitive judgements but also their affective feelings during the travel (Zhu and Fan, 2018b; Chen et al., 2019). Compared with travel satisfaction, the definition of travel well-being is more extensive, in which travel satisfaction is included in the cognitive level as one of the dimensions, and emotion is included in the affective level as another dimension (Zhu and Fan, 2018b; Chen et al., 2019; De Vos et al., 2015). Based on existing literature, the theoretical framework of travel well-being was drawn as Fig. 2-1.

2.2. Measurement of travel well-being

2.2.1. Cognitive dimension

For the measurement of travel-related subjective well-being, Satisfaction with Travel Scale (STS) developed by Ettema et al. (2011) has become a commonly used scale (Zhu and Fan, 2018b), which is a nine-item measure of multiple dimensions of well-being. Although this scale literally appears to be about measuring satisfaction, it is believed to include both cognitive and affective dimensions of well-being (Zhu and Fan, 2018b). However, in terms of cognitive dimension alone, Bergstad et al. (2011) proposed another five-item STS which only contains the cognitive relationship related to daily travel satisfaction rather than satisfaction with specific travel modes. Besides, there are also some researchers who used travel satisfaction ratings to simply divide travel satisfaction into three levels from 0 (dissatisfied) to 2 (very satisfied) without the description of measurement items (Khaddar and Fatmi, 2021). Rather than directly asking about the cognitive evaluation, some researchers measured satisfaction with mode-specific attributes including congestion, accessibility, reliability of public transport and so on (Lai and Chen, 2011). In addition to travel-specific scales, some researchers in the field of transport also chose to adopt or adapt some general scales for measuring customer satisfaction to measure transport-related satisfaction, such as the Service Quality Index (SQI) adopted by Marcucci and Gatta (2007); Customer Satisfaction Index (CSI) adopted by Poliaková (2010), Nurmahdi (2019); the Heterogeneous Customer Satisfaction Index (HCSI) adapted by Eboli and Mazzulla (2009) based on CSI; Passenger Satisfaction Index (PSI) adopted by Zhang et al. (2019) based on American Customer Satisfaction Index (ACSI) (Fornell et al., 1996); and etc.

2.2.2. Affective dimension

In terms of the application of mood scales in the field of transport, commonly used scales include Swedish Core Emotion Scale (SCAS) adopted by Ettema et al. (2011), Eriksson et al. (2013), Chen et al. (2019); Emotional Well-being (EWB) adopted by Friman et al. (2017a); Positive and Negative Affect Schedule (PANAS) adopted by Vella-Brodrick and Stanley (2013); travel enjoyment ratings adopted by Paez and Whalen (2010); happiness ratings adopted by Lancée et al. (2017); Travel Mood Scale (TMS) adopted by Glasgow et al. (2018); happy, sad, fatigue, stress, and pain ratings & a combined total affect score adopted by Morris and Guerra (2015); and etc. Compared to other measurement scales, SCAS designed by Västfjäll et al. (2002) behaves more suitable especially in the context of Chinese because it includes more vivid and fruitful vocabularies for measuring mood. SCAS consists of two orthogonal affect dimensions, valence (happy-sad, satisfied-dissatisfied, joyful-depressed) and activation (active-passive, awake-sleepy, peppy-dull), and scores on each dimension vary from −4 to 4 (Zhu and Fan, 2018b; Eriksson et al., 2013).

Since COVID break, some studies are related to travellers’ satisfaction under the influence of COVID-19 (Khaddar and Fatmi, 2021; Dong et al., 2021; Istijanto, 2021; Nilashi et al., 2022). Although these researchers did not directly use “well-being” as the keyword in their research, these studies on travellers’ satisfaction can be seen as an exploration of the cognitive dimension of travel well-being in the post-COVID-19 pandemic. Some studies have shown that COVID-19 breeds negative emotions among public transport travellers (Meena, 2020; Dong et al., 2021; Chen et al., 2022), or taken psychological factors into the research framework of travel behaviour (Liu et al., 2022), but these researchers did not continue with an in-depth discussion about subjective well-being. In the context of COVID-19 pandemic, studies that consider both the cognitive dimension and affective dimensions, valence (happy-sad, satisfied-dissatisfied, joyful-depressed) and activation (active-passive, awake-sleepy, peppy-dull), and etc. Since COVID break, some studies are related to travellers’ satisfaction under the influence of COVID-19 (Khaddar and Fatmi, 2021; Dong et al., 2021; Istijanto, 2021; Nilashi et al., 2022). Although these researchers did not directly use “well-being” as the keyword in their research, these studies on travellers’ satisfaction can be seen as an exploration of the cognitive dimension of travel well-being in the post-COVID-19 pandemic. Some studies have shown that COVID-19 breeds negative emotions among public transport travellers (Meena, 2020; Dong et al., 2021; Chen et al., 2022), or taken psychological factors into the research framework of travel behaviour (Liu et al., 2022), but these researchers did not continue with an in-depth discussion about subjective well-being. In the context of COVID-19 pandemic, studies that consider both the cognitive dimension and affective dimensions (activating, deactivating, awake-sleepy, peppy-dull), and etc. Since COVID break, some studies are related to travellers’ satisfaction under the influence of COVID-19 (Khaddar and Fatmi, 2021; Dong et al., 2021; Istijanto, 2021; Nilashi et al., 2022). Although these researchers did not directly use “well-being” as the keyword in their research, these studies on travellers’ satisfaction can be seen as an exploration of the cognitive dimension of travel well-being in the post-COVID-19 pandemic. Some studies have shown that COVID-19 breeds negative emotions among public transport travellers (Meena, 2020; Dong et al., 2021; Chen et al., 2022), or taken psychological factors into the research framework of travel behaviour (Liu et al., 2022), but these researchers did not continue with an in-depth discussion about subjective well-being. In the context of COVID-19 pandemic, studies that consider both the cognitive dimension and affective dimensions (activating, deactivating, awake-sleepy, peppy-dull), and etc.

2.3. Common research methods

Regression analysis, which can show the significant relationship and the influence strength of multiple independent variables on a dependent variable (Cheng, 2001), is a common research method in travel behaviour analysis. In recent studies of travel well-being or satisfaction, Ordered Logistic Regression has been used by researchers (Zhu and Fan, 2018a; Khaddar and Fatmi, 2021). In addition, as an extension of the standard linear regression model, Optimal Scale Model in which categorical variables are quantified according to different values and can be converted into continuous type for statistical analysis, is also helpful identifying and analysing the relative importance of factors affecting travel well-being (Chen et al., 2019). In addition to regression models, Structural Equation Modelling (SEM), behaves as an extension of the regression model (Cheng, 2001), whose advantage lies in dealing with many dependent variables at the same time, especially when the relationship between variables is indirect. SEM has been widely used in the domain of travel behaviour (Lai and Chen, 2011; Dong et al., 2021; Gao et al., 2017b; Nilashi et al., 2022; Zhang et al., 2019; Singleton, 2019). For example, in a recent study, some researchers adopted SEM to study travel satisfaction of public transport travellers in the post-COVID-19 pandemic (Dong et al., 2021).

Factor analysis is also a common multivariate statistical analysis method, which can be divided into two types: Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). EFA is used to explore the classification of factors, and CFA is used to verify the corresponding relationship between factors and measurement items. For example, some researchers adopted EFA to identify key factors affecting travel well-being.
components in the attributes of Iranian bus services (Esmailpour et al., 2020). Besides, some other researchers from the UK adopted CFA to check whether the hypothesised constructs of travel satisfaction and life satisfaction fits the data, and to understand how observed variables and latent variables interact with each other (Pineda and Lira, 2019).

For studying travel well-being or travel satisfaction of public transport travellers, common research methods or models are concluded in the following Table 2.2. This table mainly shows some application practices of regression, SEM, factor analysis, and these methods are related to the following methodology section (some other research methods are just listed in this table but will not be discussed detailedly).

When the impact of multiple independent variables on travel well-being is analysed, the regression model is convenient for researchers to identify the key influencing factors that lead to changes in well-being, but it is not as good as SEM when explaining the internal influencing mechanisms between different factors and distinguishing direct correlation from indirect correlation. Besides, factor analysis is suitable for simplifying the analysis, which is usually not used singly but combined with regression analysis or SEM. In short, SEM is more extensive, and to some extent covers regression, factor analysis and other methods to scientifically analyse the role of variables on the whole and the relationship between single indicators (Cheng, 2001).

3. Hypotheses and conceptual model

In this study, eight hypotheses (from H1 to H8) are put forward. H1, H2, and H3 are put forward based on existing literature, but will be applied to new data collected after COVID outbreak, which can be regarded as an update of the original research in a new context. H4, H5, and H6 consider the relationship between psychological distance to COVID-19 and travel behaviour. In the domain of public transport, psychological distance to COVID-19 was only considered in one study about travel satisfaction (Dong et al., 2021), but its relationship with overall travel well-being remains to be further verified.

The key hypotheses of this study are H7 and H8. In terms of correlation with switching intention, no researchers have yet compared the relative importance of travel satisfaction and travel well-being since COVID break. In the absence of the impact of COVID-19, travel satisfaction was believed to be correlated with travel choice (Abou-Zeid et al., 2012; Lai and Chen, 2011). However, when travellers consider infection risk, public transport use will face a huge shock (Luan et al., 2021). Emotional or other psychological factors are likely to severely restrict travel choices. Travel well-being extends to include the cognitive dimension and the affective dimension. Whether overall travel well-being is more related to switching intention is the core part of the conceptual model. If travel well-being is found to be more correlated with travel choice, this finding could lead to new insights towards promoting public transport usage in the post COVID-19 pandemic.

3.1. The relationship between mood and overall travel well-being

In the early 1990 s, current mood was proved to have significant effects on current subjective well-being (Yardley and Rice, 1991).

| Author (Year) | Sample Size (Source) | Some of Main Influencing Factors | Research Methods |
|--------------|----------------------|----------------------------------|-----------------|
| Chen et al. (2019) | 6719 (American Time Use Survey well-being module data) | Degree of rest; Interaction with other travellers | Optimal Scale Regression Model; Factor Analysis; Analytic Hierarchy Cluster Analysis; Decision Tree |
| de Ota et al. (2016) | 3664 (Face to face survey) | Transit service quality attributes | |
| de Ota et al. (2021) | 2531 (Online survey) | Frequency; Punctuality; Intermodality; Cost; Cleanliness | Ordered Logistic Regression Model |
| Dong et al. (2021) | 665 (Online questionnaire) | Psychological distance to COVID-19; Perceived safety; Anxiety | SEM |
| Fan et al. (2021) | 1080 (Web-based survey) | Residential environment; Optimism; Daily happiness | Multiple Regression Model |
| Handy and Thigpen (2019) | 4412 (UC Davis Campus Travel Survey) | Location; Commute mode; Student versus employee status; Gender | Bayesian Linear Regression Model |
| Khaddar and Fatmi (2021) | 226 (Web-based survey) | Daily activity engagement; Sociodemographic attributes | Ordered Logistic Regression Model |
| Kim et al. (2020) | 91,721 (Smart card data) | Opportunity to travel; Satisfaction for leisure trips | Regression Model |
| Lai and Chen (2011) | 763 (On-site survey) | Public transit service quality; Perceived value | SEM |
| Pineda and Lira (2019) | 217 (Web-based survey) | Waiting time; Station design; Safety; Inter-modality | CFA |
| Sukhov et al. (2021) | 353 (Face-to-face survey) | Public transport service quality attributes | fuzzy set Qualitative Comparative Analysis |
| Zhang et al. (2019) | 5294 (Roadside field survey questionnaire) | Perceived quality; Passenger expectations; Passenger loyalty; Passenger complaint; Comfort; Operational service; Reliability | SEM; Partial Least Squares |
| Zhu and Fan (2018a) | 13,532 (Publicly available data from American Time Use Survey) | Trip mode; Duration; Purpose; Companionship | Ordered Logistic Regression Model |
The relationship between mood and travel well-being has also attracted the attention of researchers in the field of transportation in recent years. Some researchers have found that self-reported optimistic mood has a large positive effect on travel well-being (Fan et al., 2021). Some researchers who developed mood scales also found a strong correlation between the Travel Mood Scale they designed and STS, suggesting that mood scale and well-being scale measure similar constructs (Glasgow et al., 2018). From some research results, mood is indeed associated with well-being, but it is not quite clear whether mood directly affects travel well-being or indirectly affects travel well-being through mediating factors, which will be verified in this study. Therefore, this study initially assumed that mood is positively related to travel well-being, which means positive mood is helpful for improving overall travel well-being.

**Hypothesis 1.** Mood is positively related to overall travel well-being (H1).

### 3.2. The relationship between travel satisfaction and overall travel well-being

There are a lot of studies on the impact of travel satisfaction on travel well-being. For example, some researchers have found a significant link between commute satisfaction and overall travel well-being (Olsson et al., 2013). Some researchers have drawn the conclusion that daily travel satisfaction will directly influence well-being (Friman et al., 2017a), while some other researchers found that the effect of satisfaction with daily travel on well-being is both direct and indirect (Bergstad et al., 2011). In recent years, another study shows that daily travel has less impact on travel well-being than other areas such as work, health and interpersonal relationships (Gao et al., 2017b). Despite not totally consistent conclusions drawn by these researchers, the existing literature has confirmed that travel satisfaction is related to travel well-being. In this study, we assumed that satisfaction with anti-pandemic related attributes during travel is positively related to overall travel well-being and the impact is direct.

**Hypothesis 2.** Travel satisfaction is positively related to overall travel well-being (H2).

### 3.3. The relationship between mood and travel satisfaction

Travel satisfaction ratings are not only affected by travel attributes, but also may be affected by travellers’ mood and other factors (Ettema et al., 2017). Although travel satisfaction and mood are distinct constructs, there is a link between the two (Glasgow et al., 2018). Mood affects user satisfaction (Homburg et al., 2006), and there is no exception in the travel domain as some researchers have found that travellers’ affective state acts as an important role in influencing the reported travel satisfaction (Friman et al., 2017b; Gao et al., 2017a; Le and Carrel, 2021; Woodcock et al., 2014). For example, the positive effect of mood on travel satisfaction was found in a sample of travellers in San Francisco (Le and Carrel, 2021). Therefore, this study assumed that mood is positively related to travel satisfaction, so as to explore the relationship between travellers’ satisfaction on the cognitive level and mood on the affective level.

**Hypothesis 3.** Mood is positively related to travel satisfaction (H3).

### 3.4. The relationship between psychological distance to COVID-19 and mood (or overall travel well-being)

In the literature about public transport services under the influence of pandemic, there emerges an interesting influencing factor, psychological distance to COVID-19 (Dong et al., 2021). Based on Construal Level Theory (CLT) which explains how individuals’ behaviour is influenced by psychological perception (Trope et al., 2007), psychological distance refers to the subjective distance between the self and other people, objects or events (Wang et al., 2019; Baltatescu, 2014). Psychological distance is helpful for regulating individuals’ mood in the face of social events (Dong et al., 2021; Moran and Eyal, 2022; Kivetz and Kivetz, 2006). Negative mood brought by the pandemic may be more likely to be experienced by travellers with smaller psychological distance to COVID-19 (e.g., when there are news reports of COVID-positive patients infecting others on public transport, those reports may have a noticeable impact on the travel experience for passengers who are psychologically close to the event) (Dong et al., 2021). Endangering events may cause changes of mood that may ultimately negatively affect the overall travel well-being. Psychological distance also provides an explanation and link for assessing subjective well-being (Baltatescu, 2014). Therefore, this paper assumed that positive mood may emerge and overall travel well-being may be improved when public transport travellers keep away from the COVID-19 pandemic psychologically.

**Hypothesis 4.** Psychological distance to COVID-19 pandemic is positively related to mood (H4).

**Hypothesis 5.** Psychological distance to COVID-19 pandemic is positively related to overall travel well-being (H5).

### 3.5. The relationship between travel satisfaction and psychological distance to COVID-19

In addition, cognitive evaluation may be also related to psychological distance to COVID-19. Believing that an event is near or far away can change not only the affective response but also cognitive evaluation (Williams and Bargh, 2008; Dong et al., 2021; Lee et al., 2021). If anti-pandemic measures on public transport are relatively desirable and satisfying, it may increase travellers’ perceived psychological distance to COVID-19. Being psychologically distant also results in a relatively more abstract understanding of experienced events and affects individuals’ evaluation (Kim and Jin, 2020; Dong et al., 2021; Lee et al., 2021). Therefore, this study also assumed that psychological distance to COVID-19 is positively related to satisfaction of public transport travellers with anti-pandemic related service quality during travel. However, at present, only a few researchers have explored the relationship between travel satisfaction and psychological distance under the influence of COVID-19 (Dong et al., 2021), and this hypothesis needs to be further verified in this study.

**Hypothesis 6.** Psychological distance to COVID-19 is positively related to travel satisfaction (H6).
3.6. The relationship between overall travel well-being (or travel satisfaction) and switching intention

The research on travel well-being is helpful for improving the travel experience of urban public transport users (Shao et al., 2019), but the relationship between travel well-being and travel choice needs to be further explored. It is difficult to attract more passenger flow simply by educating travellers about the environmental friendliness and sustainability of public transport, so attracting more users relies on improving travel satisfaction or well-being. For example, higher satisfaction enhances loyalty and promotes usage behaviour (Olsen, 2007). Combined with the impact of COVID-19, we assumed that higher satisfaction with anti-pandemic related attributes during travel is helpful for reducing switching intention.

Despite this, COVID concerns may cast a shadow over perceptions of travel satisfaction, so whether the promotion of user satisfaction can really attract more passenger flow in post COVID-19 pandemic remains to be verified. Switching behaviour was found to be related to travel satisfaction (Abou-Zeid et al., 2012), but this conclusion may not be fully established in the post COVID-19 pandemic because negative mood such as fear and anxiety occurs among travellers (Dong et al., 2021; Meena, 2020; Chen et al., 2022). In travel choices, in addition to travel satisfaction, health and well-being may be considered due to exposure to transmissible diseases. The choice of a positive experience will increase one’s chance to choose the same choice in the future decision-making process (De Vos, 2019), but how to know that travellers experience a positive trip? Is it reflected by travel satisfaction or well-being? The concept of travel well-being extensively covers travel satisfaction and mood, so whether travel well-being is a better perspective also remains to be checked. As far as travel satisfaction and travel well-being, which is more related to travel choice will also be discussed in this paper.

**Hypothesis 7.** Overall travel well-being is negatively related to the switching intention of public transport travellers to other travel modes (H7).

**Hypothesis 8.** Travel satisfaction is negatively related to the switching intention of public transport travellers to other travel modes (H8).

Combined with the hypothesis put forward, the conceptual model was proposed as Fig. 3-1.

4. Data collection

In travel surveys, travel well-being can be measured based on self-reports of respondents (Chen et al., 2019). Therefore, this study designed a questionnaire of public transport travel well-being to collect the data.

4.1. Investigation scheme design

Taking Xi’an, a major city in China, as an example, this study aims to explore the internal influencing mechanisms of travel-related subjective well-being of public transport travellers in the post COVID-19 pandemic, because Xi’an’s public transport system is relatively developed and similar to that of major cities in other countries, which can provide experience for cities similar to Xi’an. The questionnaire mainly includes the following contents (see Table 4-1).

4.1.1. Mood

SCAS was adopted to measure mood during travel. Respondents were required to record three rating scales ranging from negative to positive (sad-happy, dissatisfied-satisfied, depressed-joyful) and three rating scales ranging from deactivated to activated (passive-active, sleepy-awake, dull-peppy) (Eriksson et al., 2013; Västfjäll et al., 2002). Considering that satisfaction will be measured as cognitive level, we deleted the “dissatisfied-satisfied”.

![Fig. 3-1. Conceptual model of the mechanisms of travel well-being in the post COVID-19 pandemic.](image-url)
The research aim in this paper focuses on public transport, so corresponding improvement is made in this study combined with the characteristics of public transport under the influence of COVID-19 pandemic. Considering that COVID-19 has induced anxiety (Dong et al., 2021; Chen et al., 2022) and fear of infection (Meena, 2020; Chen et al., 2022) among public transport users, we supplemented the measurement indexes using “fearful-reassuring” and “anxious-calm”. Considering that crowded public transport where people get closer may increase the sense of oppression, we added the measurement index using “space oppressive-relaxed”. After slightly improving traditional SCAS, we put forward eight items combining the influence of the pandemic. To achieve a more refined measurement, some researchers in a recent study adopted a large measurement range of eleven levels from 0 to 10 (Gao et al., 2020) and have received good effects when measuring, so this paper also expanded the original measurement range of SCAS and adopted new eleven levels from –5 (“most deactivated/negative”) to 5 (“most activated/positive”).

4.1.2. Psychological distance to COVID-19

Psychological distance is based on subjective perception (Wang et al., 2019), which can be posited from four dimensions including space (where the event occurs), society (to whom), time (when), and hypotheticality (likelihood) (Baltatescu, 2014; Dong et al., 2021; Trope and Liberman, 2010). Psychological distance from health crisis events reflects people’s feedback on threat factors (Dong et al., 2021; Kim and Jin, 2020), and is also applicable to the field of travel behaviour analysis under the influence of COVID-19 pandemic. In the context of public transport, the closer the public transport travellers are psychologically to the outbreak, the higher the threat they may perceive (Dong et al., 2021). Therefore, in order to explore how these travellers understand the threat events in public transport, psychological distance was measured on the basis of four statements from the four dimensions of psychological distance: (1) Space: Compared to other places, there is a smaller chance of someone on public transport suffering from COVID-19; (2) Society: There may not be someone on public transport that can spread the virus to me; (3) Time: Someone on public transport may not be infected with COVID-19 in the past few days; (4) Hypotheticality: I may not be infected with COVID-19 because of this trip. Values ranged from –5 (“strongly disagree”) to 5 (“strongly agree”).

4.1.3. Travel satisfaction

Psychological indicators, such as psychological distance and mood, are more suitable for being measured by well-designed psychological scales. During the pre-survey, we found that, if the psychological distance to COVID-19 is directly asked, respondents may feel confused. Therefore, these indexes are not suitable for being directly measured by single-item scale. However, for travellers, the evaluation of satisfaction with different attributes during travel is intuitive and clear. Besides, in view of the obvious practical advantages of the single-item scale, such as easy management, reducing the demand of respondents and shortening the interview time (Gao et al., 2017a), we used the single-item scale to measure travel satisfaction instead of directly asking about the overall satisfaction. Taking the impacts of the COVID-19 pandemic into consideration, this study designed different travel attributes related to anti-pandemic measures. Seven items included indoor ventilation, disinfection of indoor facilities, congestion, wearing masks, indoor cleanliness, implementation of temperature measurement in stations, and safety distance between seats. Respondents were asked to rate their satisfaction with these items. To keep consistent with the measuring scale of mood, values ranged from –5 (“not at all satisfied”) to 5 (“extremely satisfied”).

| Table 4–1 | List of measurement items. |
|-----------------|--------------------------|
| **Dimension**   | **Category**             | **No.** | **Item** |
| Mood            | Value                    | A1      | Depressed - Joyful |
|                 |                          | A2      | Anxious - Calm    |
|                 |                          | A3      | Fearful - Reassuring |
|                 |                          | A4      | Sad - Happy       |
|                 |                          | A5      | Space Oppressive - Relaxed |
| Travel Satisfaction | Antipandemic related service quality during travel | I1      | Indoor ventilation |
|                 |                          | I2      | Disinfection of indoor facilities |
|                 |                          | I3      | Congestion        |
|                 |                          | I4      | Passengers wearing masks on public transport |
|                 |                          | I5      | Safety distance between seats |
|                 |                          | I6      | Indoor cleanliness |
|                 |                          | I7      | Implementation of temperature measurement in stations |
| Psychological Distance to COVID-19 | Space | J1      | Compared to other places, there is a smaller chance of someone on public transport suffering from the COVID-19 |
|                 | Society                  | J2      | There may not be someone on public transport that can spread the virus to me |
|                 | Time                     | J3      | Someone on public transport may not be infected with COVID-19 in the past few days |
| Switching Intention | Hypotheticality | K1      | I am willing to accept more new ways of travel |
|                 | Deliberation             | K2      | I am considering another travel mode as my main travel mode |
|                 | Planning                 | K3      | I will change my current travel mode |

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- Gao et al., 2017a
- Gao et al., 2020
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- Kim and Jin, 2020
4.1.4. Switching intention

To explore the relationship between travel well-being and travel choice behaviour, this study also measures the switching intention of public transport travellers to other modes from three perspectives: deliberation, plan and action. According to the theory of interpersonal behaviour (TIB) (Triandis, 1977), people do not change their behaviour decisively, but change emerges when they possess volition and enter the pre-actional phase (Heckhausen and Gollwitzer, 1987). In the domain of transport, this theory can be used to understand switching intention, and it is characterised as the volitional self-change phase where the travellers begin to plan for switching in travel behaviour, including deliberation, plan and action (Kang et al., 2019). Therefore, switching intention was measured according to three corresponding statements: (1) Deliberation: I am willing to accept more new ways of travel; (2) Plan: I am considering another travel mode as my main travel mode; (3) Action: I will change my current travel mode. Values ranged from −5 ("strongly disagree") to 5 ("strongly agree").

4.1.5. Overall travel well-being

In this part, respondents were required to integrate the cognitive evaluation and the affective evaluation to rate the overall travel well-being of this trip. Values ranged from 5 ("of low well-being") to 5 ("of high well-being").

4.1.6. Socio-demographic characteristics

Socio-demographic attributes, which were designed for obtaining basic information about travellers, mainly include the following information: gender, age, work type, average monthly income of the family and personally, driving licence ownership, car ownership, average weekly frequency of public transport use, residential location, daily travel modes, working status, daily working hours, and working area (see Table 4-2).

4.2. Sample characteristics

The online survey was conducted through Sina Weibo platform and the offline survey was conducted around bus and rail transit stations in Xi’an during April 2021. During the offline collection process, we were allowed to collect the data through paper questionnaires while maintaining a safe distance from the respondents around the public transport stations. Meanwhile, wearing a mask and disinfectant gloves was required. During the online collection process, the questionnaires were distributed through Sina Weibo, a

Table 4-2
Socio-demographic characteristics of the respondents.

| Total sample: 604 respondents |
|-------------------------------|
| **Work type**                  | **Age**          | **Sample (Percentage)** | **Average monthly income personally (RMB)** |
| Student                       | 86 (14.2%)       | <18 yrs. old            | 23 (3.8%) |
| Company employee              | 294 (48.7%)      | 18-34 yrs. old          | 143 (23.7%) |
| Government employee           | 92 (15.2%)       | 35-50 yrs. old          | 355 (58.8%) |
| Service industry              | 74 (12.3%)       | 51-64 yrs. old          | 75 (12.4%) |
| Others                        | 39 (6.5%)        | >65 yrs. old            | 8 (1.3%) |
| **Average monthly income of family (RMB)** |
| <3000                         | 19 (3.1%)        | 1000-2000               | 23 (3.8%) |
| 3000-5000                     | 104 (17.2%)      | 2000-3000               | 82 (13.6%) |
| 5000-10000                    | 210 (34.8%)      | 3000-5000               | 81 (13.4%) |
| 10000-15000                   | 170 (28.1%)      | 5000-8000               | 157 (26.0%) |
| >15000                       | 101 (16.7%)      | 8000-15000              | 174 (28.8%) |
| **Car ownership**             | 157 (26.0%)      | >15000                  | 74 (12.3%) |
| 0                             | 372 (61.6%)      | Driving licence ownership | 462 (76.5%) |
| 1                             | 51 (8.4%)        | Yes                     | 142 (23.5%) |
| >2                            | 24 (4.0%)        | No                      | |
| **Working status**            | 483 (80.0%)      | Average weekly frequency of public transport use | 73 (12.1%) |
| On the job                    | 106 (17.5%)      | < 1 time                | 204 (33.8%) |
| Dismissal/job seeking         | 15 (2.5%)        | 1-2 times               | 204 (33.3%) |
| Retiremant                    | 106 (17.5%)      | > 6 times               | 123 (20.4%) |
| **Daily working hours**       | 483 (80.0%)      | Residential location    | 262 (43.4%) |
| <3h                           | 18 (3.0%)        | Urban area              | 440 (72.8%) |
| 3.5-5 h                       | 77 (12.7%)       | Urban-rural junction    | 99 (16.4%) |
| 5-7 h                         | 147 (24.3%)      | Suburb                  | 34 (5.6%) |
| 7-9 h                         | 300 (49.7%)      | Rural area              | 31 (5.1%) |
| >9 h                          | 62 (10.3%)       | Working area            | 328 (54.3%) |
| **Daily travel modes**        | 72 (11.9%)       | Urban Xi’an             | 276 (45.7%) |
| Walking                       | 107 (17.7%)      | Urban-rural junction/Suburb in Xi’an | 204 (33.8%) |
| Bicycle                       | 63 (10.4%)       | Other                   | 138 (22.8%) |
| Taxi or Private Car           | 298 (49.3%)      | Gender                  | 328 (54.3%) |
| Bus                           | 64 (10.6%)       | Male                    | |
| Urban Rail Transit            |                  | Female                  | |
Chinese social media platform, and forwarded to more users in Xi’an in combination with the function of Weibo Promotion. Finally, we collected 816 questionnaires altogether, including online samples and offline samples. After the audit, we cleared invalid questionnaires and finally got 604 valid questionnaires with an effective response rate of 74%.

In addition, the specific information of the sample respondents is shown in Table 4-2. Nearly half of the passengers in the sample are company employees, and the respondents are with basically the same proportion of men and women. Most of them live and work in urban areas, with a monthly income of no more than 10,000 yuan. Bus occupies the largest proportion in daily travel modes, and more than 80% of respondents have only one car or no car at home. However, part of the data were collected online to decrease exposure to COVID-19. Older people use the Sina Weibo platform less than younger people (Luo and He, 2021), which is considered to be why most respondents are between the ages of 18 and 50. The young are over-represented and the elderly are under-represented. Despite this, the sample characteristics are generally consistent with the characteristics of public transport travellers in Xi’an.

Socio-demographic factors affect travel behaviour, and the differences of travel well-being vary between age, gender, and etc. (Ettema et al., 2011). However, socio-demographic indicators do not belong to the dimension of travel well-being. This study aims to explore the internal mechanisms of travel well-being under the influence of COVID-19. Although socio-demographic factors are important, they belong to important external factors rather than internal constructs. The focus of this study is to compare the relative importance of travel well-being and travel satisfaction, as well as their relationship with travel choice, so as to know which aspects to measure in a travel survey. Therefore, socio-demographic factors were used to reflect the reliability of the sample, but they were no longer put in the conceptual model. This paper aims to concentrate more on the psychological level and compare the relative importance of travel satisfaction and well-being in the post COVID-19 pandemic.

5. Structural equation modelling

5.1. Initial establishment and evaluation of SEM

We adopted SEM to analyse the internal mechanisms of travel well-being in the post COVID-19 pandemic. In the SEM family, there is a distinction between Partial Least Squares-SEM (PLS-SEM) and Covariance-based SEM (CB-SEM). PLS-SEM uses the partial least square method to estimate the coefficients of the structural equation system, and determines the relationships by minimising the error terms and maximising the explained variance of the endogenous constructs (Mandhani et al., 2020); while CB-SEM follows the procedure of maximum likelihood estimation (MLE) and estimates the relationship by minimising the difference between the theoretical and estimated covariance matrices (Astrachan et al., 2014).

Further, in SEM literature, there is a distinction between representing a latent variable as a reflective construct vs a formative construct. A reflective construct is assumed to cause the measured indicator variables (Chi et al., 2021). For example, we cannot measure a psychological concept directly, so we make multiple measurements of things that we assume are all indicators of that concept, whose values are closely affected by the concept itself. A formative construct is assumed to be caused by the measured indicator variables, which is a weighted sum of indicator variables (Kenny, 2016). It might not exist, but it is composed of the various elements we measure. In other words, a formative construct can be understood as a linear function of measured formative indicators that may theoretically be not related (Chi et al., 2021).

In this study, we designed four latent variables. Psychological distance, emotion and switching intention were measured using psycho-social scales as shown in Table 4-1, and these latent variables are more appropriate to use a reflective construct because it is hard to measure a psychological concept directly. However, the measurement of travel satisfaction was conducted by measuring satisfaction with different attributes related to epidemic prevention during the travel process, in which case, it is more appropriate to...

| Latent variable            | Measurement item                                                                 | Factor loading | Cronbach’s α | CR  | AVE  |
|----------------------------|-----------------------------------------------------------------------------------|---------------|--------------|-----|------|
| Mood                       | Depressed - Joyful                                                                | 0.817         | 0.924        | 0.927| 0.654|
|                            | Anxious - Calm                                                                     | 0.837         |              |     |      |
|                            | Fearful - Reassuring                                                              | 0.708         |              |     |      |
|                            | Sad - Happy                                                                       | 0.824         |              |     |      |
|                            | Space Oppressive - Relaxed                                                        | 0.826         |              |     |      |
|                            | Passive - Active                                                                  | 0.792         |              |     |      |
|                            | Sleepy - Awake                                                                   | 0.818         |              |     |      |
|                            | Dull - Peppy                                                                      | 0.841         |              |     |      |
| Switching Intention        | Deliberation: I am willing to accept more new ways of travel                      | 0.918         | 0.915        | 0.971| 0.852|
|                            | Planning: I am considering another travel mode as my main travel mode             | 0.906         |              |     |      |
| Psychological Distance to COVID-19 | Space: Compared to other places, there is a smaller chance of someone on public transport suffering from the COVID-19 | 0.881         | 0.888        | 0.897| 0.747|
|                            | Society: There may not be someone on public transport that can spread the virus to me | 0.885         |              |     |      |
|                            | Time: Someone on public transport may not be infected with COVID-19 in the past few days | 0.892         |              |     |      |
|                            | Hypotheticality: I may not be infected with COVID-19 because of this trip          | 0.795         |              |     |      |
use a formative construct composed of the various indicators we measured.

In order to allow the coexistence of formative and reflective constructs, we adopted PLS-SEM, because one of the significant advantages of PLS-SEM is the flexibility to handle both reflective and formative constructs (Hair et al., 2011). Another reason is that the well-being data is heterogeneous and does not strictly follow the normal distribution. Using PLS-SEM can be free from the restriction that the sample must obey the normal distribution (Astrachan et al., 2014).

5.1. Initial reliability and validity test

For different constructs, the parameters to be tested are different.

For reflective constructs, we need to check factor loadings, Cronbach’s alpha value, composite reliability (CR), and average variance extracted value (AVE). As shown in Table 5-1, all factor loadings are greater than 0.6, which shows acceptable indicator reliability for exploratory studies (Mandhani et al., 2020). For each latent variable, Cronbach’s α is greater than 0.6, CR is greater than 0.7, which indicates good internal consistency reliability; AVE is greater than 0.5, which indicates good convergent validity (Mandhani et al., 2020).

For formative constructs, we need to check factor weights, variance inflation factor (VIF), T-statistic, and p-values. As shown in Table 5-2, all VIF values are below 3 and no collinearity issues were observed. But two indicators (p > 0.1) are not significantly correlated with the construct at 0.1 level. This suggests that the implementation of temperature measurement at the station and indoor cleanliness are not related to overall travel satisfaction. In subsequent measurements, these two measurement indicators can be removed.

5.1.2. Initial results of SEM

In this study, the Partial Least Squares (PLS) were adopted to estimate the parameters of the model. Table 5-3 shows the path coefficient, standard error (S.E.) and significance level of the model. Except for three groups of pathways (overall travel well-being ← psychological distance to COVID-19; overall travel well-being ← mood; switching intention ← travel satisfaction) with p-value greater than 0.1, other pathways are significantly correlated.

5.2. Final results of SEM

From the initial modelling results, the results are mostly consistent with the hypotheses set in the previous part of this study despite H1, H5 and H8. In order to give a more accurate analysis, we deleted the insignificant path and insignificant indicator in the formative construct, and fit the model again using SmartPLS software. Because we made some changes to the formative construct, we also repeated the test in Section 5.1.1 for the adjusted formative construct and checked the corresponding parameters, as shown in Table 5-4. All parameters meet the requirements as analysed in Section 5.1.1.

Further, for PLS-SEM, the goodness-of-fit of the model can be assessed based on some fit parameters such as Standardised Root Mean Squared Residual (SRMR), Standardised Fit Index (NFI), and Root Mean Squared Residual (RMS_theta) (Mandhani et al., 2020). SRMR and NFI belong to the family of approximate fit indices, and SRMR values <0.08 and NFI values >0.9 are considered to represent a well-fitted result. RMS_theta is a measure of how correlated the model residuals are, and RMS_theta values <0.12 are considered to represent a good model fit. As shown in Table 5-5, all the parameters meet the requirement. We also reported R-square values of dependent variables in Table 5-6. Some researchers suggested that the R-square values equal to or greater than 0.10 can be considered to represent adequate explained variance (Miller, 1992; Van Tonder and Petzer, 2018). Although the R-square values in this study are not very high, the values are deemed acceptable according to the above-mentioned literature. Then, the behavioural analysis will be conducted in Section 5.3 based on the results as shown in Figs. 5-3, 5-4 and Table 5-6.

5.3. Analysis of the results

5.3.1. Psychological distance to COVID-19 and mood

Psychological distance to COVID-19 is positively related to mood, which means that those who think COVID-19 is far from themselves may feel more positive mood. For example, these travellers may believe that significant progress has been made in containing the pandemic (Dong et al., 2021), thus feeling more reassured. Conversely, individuals are more inclined to pay attention to low-level construals if the crisis events are approaching them psychologically (Lee et al., 2021). That is to say, even if there are only a few cases of COVID-19 in the city where the travellers are located, they may enlarge the details and worry that there is COVID-19

| Latent variable | Measurement item                                      | Factor weight | VIF   | T-statistic | P-value |
|-----------------|--------------------------------------------------------|---------------|-------|-------------|---------|
| Travel Satisfaction | Indoor ventilation                                      | 0.256         | 2.263 | 3.472       | 0.000   |
|                  | Disinfection of indoor facilities                      | 0.259         | 2.159 | 3.624       | 0.000   |
|                  |Congestion                                              | 0.214         | 1.586 | 3.393       | 0.000   |
|                  | Passengers wearing masks on public transport           | 0.304         | 2.008 | 4.057       | 0.000   |
|                  | Safety distance between passenger seats                | 0.110         | 2.098 | 1.707       | 0.088   |
|                  | Indoor cleanliness                                      | 0.053         | 2.194 | 0.830       | 0.407   |
|                  | Implementation of temperature measurement at the station| 0.079         | 2.147 | 1.198       | 0.231   |
around them (Dong et al., 2021). However, the relationship between psychological distance and overall travel well-being is not significant, so it was not included in the final model, but there exists an indirect correlation mediated by travel satisfaction.

### 5.3.2. Travel satisfaction and psychological distance to COVID-19

In terms of traffic management under the influence of COVID-19, anti-pandemic measures are supposed to give public transport travellers the sense that COVID-19 is less likely to be found on public transport (Dong et al., 2021), which means the COVID-19 prevention measures provided by public transport is significant for regulating the psychological distance to COVID-19 of travellers within a reasonable range. This study adopted travel satisfaction towards seven aspects related to COVID-19 prevention to measure the

### Table 5-3

| Path | Path Coefficient | S.E. | T-statistic | P-value |
|------|------------------|------|-------------|---------|
| Overall Travel well-being ←— Travel Satisfaction | 0.276 | 0.060 | 4.575 | <0.001 |
| Switching Intention ←— Overall Travel well-being | −0.153 | 0.036 | 4.255 | <0.001 |
| Travel Satisfaction ←— Psychological Distance to COVID-19 | 0.131 | 0.039 | 3.833 | 0.001 |
| Mood ←— Psychological Distance to COVID-19 | 0.306 | 0.046 | 6.665 | <0.001 |
| Travel Satisfaction ←— Mood | 0.581 | 0.043 | 13.458 | <0.001 |
| Switching Intention ←— Travel Satisfaction | −0.063 | 0.042 | 1.502 | 0.134 |
| Overall Travel well-being ←— Psychological Distance to COVID-19 | 0.027 | 0.041 | 0.656 | 0.512 |
| Overall Travel well-being ←— Mood | 0.078 | 0.052 | 1.507 | 0.132 |

### Table 5-4

| Latent variable | Measurement item | Factor weight | VIF | T-statistic | P-value |
|-----------------|------------------|---------------|-----|-------------|---------|
| Travel Satisfaction | Indoor ventilation | 0.275 | 2.214 | 3.630 | <0.001 |
| | Disinfection of indoor facilities | 0.271 | 2.052 | 4.040 | <0.001 |
| | Congestion | 0.243 | 1.414 | 4.278 | <0.001 |
| | Passengers wearing masks on public transport | 0.342 | 1.770 | 4.448 | <0.001 |
| | Safety distance between passenger seats | 0.127 | 2.045 | 1.980 | 0.048 |

### Table 5-5

| Model Fit Index | Observed Value | Acceptable Value |
|-----------------|----------------|------------------|
| SRMR | 0.043 | <0.08 |
| NFI | 0.919 | >0.9 |
| RMS_theta | 0.106 | <0.12 |

Fig. 5–3. Initial results of SEM (Note: ***: p < 0.001; ns: not significant).
effectiveness of protection measures on public transport, and the results indicate that satisfaction with anti-pandemic related service quality during travel is positively related to psychological distance. The decision-makers of public transport ought to strengthen pandemic prevention and control during travel, in order to expand the psychological distance between travellers and COVID-19.

5.3.3. Mood and travel satisfaction

This paper also explored the correlation between travel satisfaction and mood. SEM can detect the correlation between the two constructs, and the results show that mood is positively related to travel satisfaction. This suggests that travellers will be affected by personal mood when making cognitive evaluations. This also provided a broader perspective for future research on the formation mechanisms of travel well-being, because the cognitive dimension and affective dimension are not independent and there exists a correlation between travel satisfaction and mood.

5.3.4. Travel satisfaction and overall travel well being

Consistent with previous studies mentioned in Section 3.2, travel satisfaction is positively related to travel well-being. When public transport travellers are more satisfied with the COVID-19 pandemic prevention measures, overall travel well-being is possible to be higher. However, this study did not detect the direct impact of mood on travel well-being, but mood and psychological distance to COVID-19 are directly positively related to travel satisfaction at the cognitive level. Then, travel satisfaction is positively related to travel well-being, which indicates mood and psychological distance will indirectly affect overall travel well-being through travel satisfaction.

5.3.5. Overall travel well-being (or travel satisfaction) and switching intention

When the COVID-19 pandemic prevention and control enter the stage of normalised management, whether the increase of travel well-being will really improve the travel choice of public transport travellers is in need of verification. In this study, results indicate that travel well-being is negatively related to public transport users’ willingness to switch to other travel modes. When travel well-being declines, it will promote public transport users to switch to other travel modes. This shows that, in the post COVID-19...
pandemic, by improving travel well-being, more users could be retained for public transport.

Travel satisfaction is not related to switching intention, but travel satisfaction is positively related to travel well-being, which in turn has an indirect impact on switching intention. This shows that travel satisfaction does not directly affect switching intention, but affects travel choice behaviour through travel well-being. Previously, policies aimed at improving travel satisfaction were often recommended to guide travel behaviour. However, under the influence of the pandemic, travel choice behaviour is not completely dependent on travel satisfaction, which is also affected by psychological levels including mood and psychological distance to COVID-19. Therefore, it can provide a new idea for similar studies to study the effects of overall travel well-being on travel behaviour by incorporating travel satisfaction, mood and psychological distance.

6. Conclusions and policy implication

6.1. Conclusions

Travel well-being reflects the traveller’s satisfaction and mood during the trip. This paper reviewed the previous research about travel well-being, and summarised the theoretical framework of travel well-being combined with existing literature, including the affective and cognitive levels. This paper also introduced the psychological distance to COVID-19 into the theoretical framework to further explore their effects on the travel well-being of public transport travellers. Since the COVID-19 pandemic has already happened and its negative effects may still last for a relatively long time period (Van Wee and Witlox, 2021), this study focused on the internal mechanisms of travel well-being in the post COVID-19 pandemic and discussed about the relative importance between travel satisfaction and travel well-being. The main conclusions of this study are summarised as follows.

Firstly, this study expounded the internal relationship between the constructs of travel well-being and provided inspiration for future studies of travel well-being of public transport travellers in the post COVID-19 pandemic. There exists a positive correlation between mood and travel satisfaction, a positive correlation between psychological distance and travel satisfaction, and a positive correlation between psychological distance and mood. This study specially introduced the psychological distance to COVID-19 into the internal framework of travel well-being, and the results show that psychological distance and other original constructs of travel well-being are related. Though the current work of epidemic prevention and control is desirable, the psychological impacts of the COVID-19 pandemic are long-lasting. Therefore, psychological distance can be considered as a measurement index or exploratory influencing factor of travel well-being in the context of the pandemic.

Secondly, this study distinguished the direct correlation and indirect correlation between different constructs of travel well-being. In the post COVID-19 pandemic, public transport travellers’ satisfaction with COVID-19 pandemic prevention during travel will directly affect overall travel well-being. Mood and psychological distance to COVID-19 are not directly related to travel well-being, but indirectly related to travel well-being through travel satisfaction, which means that we need to mainly focus on travel satisfaction when designing travel well-being scales and the mood measurement is relatively less important.

Thirdly, this study verified the relationship between travel well-being and the switching intention of public transport travellers under the influence of COVID-19. With the improvement of travel well-being, the willingness of public transport users to switch to other modes of transport can be effectively reduced, and the loss of existing passenger flow can be avoided. Travel satisfaction does not directly affect the behaviour of travellers to switch to other modes of transport but indirectly affects the switching intention through overall travel well-being. Compared with travel satisfaction, travel well-being can provide a more comprehensive decision-making perspective for improving public transport passenger flow, which also indicates that the mood still cannot be ignored. Improving the overall travel well-being of travellers can attract more passenger flow for public transport in the post COVID-19 pandemic.

COVID-19 has exerted unignorable changes on various aspects of transport. Though some traditional studies take traffic crashes or natural disasters as emergencies in transport into consideration, lots of previous studies ignored the impacts of public health events. The study is one of the few to examine travel well-being since the COVID break, providing a new reference for research on travel evaluation and behaviour analysis under the influence of COVID-19. This paper emphasised that travel well-being is relatively more important than travel satisfaction, and recommended adopting travel well-being instead of travel satisfaction in future research of public transport service because travel choice behaviour is not totally a cognitive choice depending on service quality but a subjective choice affected by mood and psychological distance as well. This study provided new implications for attracting public transport passengers and predicting travel choices in the post COVID-19 pandemic.

6.2. Policy implications

6.2.1. Adopting travel surveys oriented to travel well-being

In this study, travel well-being is directly related to switching intention, while travel satisfaction is indirectly related. In the field of transport, there are many surveys and literature on travel satisfaction, and relatively fewer travel surveys are oriented to travel well-being. For researchers and policymakers, in order to provide more effective recommendations on public transport operations or enable more precise prediction of travel choices, it is inadequate to simply investigate travel satisfaction when designing travel surveys. It is necessary to take travel well-being as the perspective of behaviour research. In this process, mood could not be ignored.

However, does “could not be ignored” necessarily mean that “it is most important”? It turns out not. Mood and psychological distance are not directly related to travel well-being, but indirectly affect travel well-being through travel satisfaction. This shows that researchers and managers could still adopt travel satisfaction as a major component when designing travel well-being scales in the future. The measurement items could focus more on travel satisfaction and less on mood, but mood is suggested to be included in travel
surveys in the post COVID-19 pandemic. In addition, travel surveys could also cover psychological distance to COVID-19, so as to deeply understand the behavioural mechanisms of travellers and provide a new perspective rarely seen in public transport management before the COVID-19 pandemic.

6.2. Dialectical response to the role of communication media on pandemic and public transport

Internet-based communication media provides a vital boost to the effective exchange of information during public health emergencies or other crises, but these seemingly convenient communication channels may also hinder valuable information exchange due to the rapid dissemination of false information (Schultz et al., 2011; Liu et al., 2016; Kim, 2018; Dong et al., 2021). In the domain of public transport, we should not only utilise the advantages of the Internet to attract traffic volume for public transport, but also curb bad public opinion on the Internet.

The results show that the psychological distance to COVID-19 will indirectly affect travel well-being. In the context of the pandemic, misinformation on the web that exaggerates the severity of the outbreak may bring travellers psychologically close to the pandemic. In particular, social media will become the primary venue where organisations or individuals communicate and obtain information during crisis events due to its powerful communication capabilities (Liu et al., 2016). Therefore, on Internet platforms, online regulators are suggested to promptly withdraw false negative reports about public transport, including grossly exaggerating the dangers of taking public transport, wrongly reporting the number of people infected with COVID-19, deliberately discrediting public transport anti-pandemic efforts, unreasonably accusing necessary COVID-19 prevention requirements during travel, unscientifically recommending anti-pandemic drugs for travellers, and etc. Besides, more comprehensive pandemic information with high credibility, such as accurate infection number data and valid anti-pandemic measures, could be provided to help curb the accelerated spread of rumours about COVID-19 (Dong et al., 2021). For example, at the public transport stations in Xi’an, the latest progress of epidemic spread based on real-time big data is suggested to be reported through the display boards of the stations, and Xi’an COVID-19 prevention policy could be updated to the public in time, so that travellers can ensure that there are no COVID-19 carriers around and make them feel at ease through easy access to accurate pandemic information.

In addition, mood is also a non-negligible dimension of travel well-being, which will indirectly affect travel choices. Traffic managers are recommended to change the public’s bad mood and negative attitude towards public transport with the help of emerging online media. For example, through microblogging, Tik-Tok and other short video platforms with a large number of Internet users, Xi’an public transport managers could produce some attractive and interesting popular-science short videos about introducing some effective COVID-19 preventive measures and rationally analysing the safety of taking public transport when epidemic prevention work is sufficient. These videos could also be posted on electronic billboards around public transport stations with large traffic volumes such as Xiaozhai station and Zhonglou station in Xi’an, so as to further expand their influence on attracting the usage of public transport.

6.3. Limitations and outlook

We acknowledge that there are still some limitations in this study. Firstly, our conceptual model included both formative and reflective constructs, so we adopted PLS-SEM instead of CB-SEM. Although the model fit meets the requirements, the research of PLS-SEM is more concerned with the prediction accuracy of the model. The R-square of the dependent variables in our model is relatively low. One of the future directions is to improve the PLS-SEM model to enhance prediction accuracy. Secondly, the psycho-social concepts are the central part of the model analysis in this paper, but socio-demographic characteristics are not included in the final model analysis. There might be some interesting overall personal differences in these concepts to be uncovered. Therefore, socio-demographic characteristics will be considered in future work, to reveal heterogeneity in the perception of COVID-19 among different public transport users. Thirdly, older travellers are underrepresented in the online sample in this study. The samples could be further expanded, combined with more offline surveys collected along public transport lines.

CRediT authorship contribution statement

**Yucheng Wang:** Conceptualization, Investigation, Data curation, Methodology, Software, Validation, Formal analysis, Visualization, Writing - original draft. **Yanan Gao:** Supervision, Funding acquisition, Project administration, Resources, 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.

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