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Mask-wearing intentions on airplanes during COVID-19 – Application of theory of planned behavior model

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ABSTRACT

The COVID-19 pandemic has devastated the air transport industry, forcing airlines to take measures to ensure the safety of passengers and crewmembers. Among the many protective measures, mask mandate onboard the airplane is an important one, but travelers’ mask-wearing intentions during flight remain uninvestigated especially in the US where mask use is a topic of on-going debate. This study focused on the mask use of airline passengers when they fly during COVID-19, using the theory of planned behavior (TPB) model to examine the relationship between nine predicting factors and the mask-wearing intention in the aircraft cabin. A survey instrument was developed to collect data from 1124 air travelers on Amazon Mechanical Turk (MTurk), and the data was statistically analyzed using structural equation modeling and logistic regression. Results showed that attitude, descriptive norms, risk avoidance, and information seeking significantly influenced the travelers’ intention to wear a mask during flight in COVID-19. Group analysis further indicated that the four factors influenced mask-wearing intentions differently on young, middle-aged, and senior travelers. It was also found that demographic and travel characteristics including age, education, income, and travel frequency can be used to predict if the airline passenger was willing to pay a large amount to switch to airlines that adopted different mask policies during COVID-19. The findings of this study fill the research gap of air travelers’ intentions to wear a mask when flying during a global pandemic and provide recommendations for mask-wearing policies to help the air transport industry recover from COVID-19.

1. Introduction

The COVID-19 pandemic has had a catastrophic impact on air transportation. A comparison between June in 2019 and 2021 showed that the total demand for air travel (measured by revenue passenger kilometers) was down 60.1% globally (International Air Transport Association, 2021). Compared to other industries, the airline industry has been dealing with unique challenges with regards to infectious disease outbreaks. An aircraft cabin is a tightly packed, enclosed environment where physical distancing is not possible during flight. Passengers sitting in the aircraft for a long duration would likely have an increased chance of contracting the virus by inhaling aerosols that remain airborne and touching surfaces that could contain large droplets, especially when sitting in close approximation to others who may already be infected by the disease (Mangili and Gendreau, 2005; Mangili et al., 2015). Consequently, airlines must rely on effective measures to protect the safety of passengers and crewmembers during flights, with mask-wearing being one of the most important measures.

Face masks were originally designed for hospital use to protect surgical wounds from staff-generated nasal and oral bacteria (Abboah-Offei et al., 2021). Their use in protecting the general public from infectious disease, however, has been a topic of on-going debate. Early studies suggested that face masks may provide a physical barrier to curb the spread of respiratory disease, but cautioned that more evidence is needed to support their effectiveness (Cowling et al., 2010; Sim et al., 2014). With regards to air transport, studies have long recognized that air travel is a likely means for the rapid spread of infectious disease. Because of the lack of consensus on mask use, however, the main focus has been on hygiene measures, contact tracing, and educational programs to ensure safety in air travel during a pandemic (Huizer et al., 2014; Mangili and Gendreau, 2005; Sevilla, 2018). Face masks have received renewed attention following the WHO’s recommendation that healthy adults should wear nonmedical masks to control the spread of COVID-19 (Betsch et al., 2020). Mask policies have since been adopted globally, but doubts remain especially in the US in terms of the comfort, convenience, and even the potential health risks in wearing a mask.
While researchers continue to produce evidence on the effectiveness of masks, little is known regarding the intention of air travelers to wear a mask on airplanes (if they have a choice) when they travel during COVID-19. Important factors that drive the mask-wearing decisions have been explored at a general level, including social norms, knowledge about COVID-19, and empathy (Barceló and Sheen, 2020; Pfattheicher et al., 2020; Zhou et al., 2021). Mask-wearing during COVID-19 has also been found to be related to demographic characteristics such as age, gender, and education (Barceló and Sheen, 2020; Egan et al., 2021; Haischer et al., 2020; Zhou et al., 2021). While these studies have shed light on mask-wearing behaviors, they are not related to air transport, a particularly relevant industry during the COVID-19 pandemic. There is also a lack of understanding of air travelers’ mask use in the US. Although the US has had the most cases of COVID-19 and related deaths in the world, it has been slower than most other countries to adopt the mask-wearing approach (Egan et al., 2021). Despite the surge in mask use across the country, following the CDC’s recommendations, factors driving the intention to voluntarily wear a mask remain unclear, especially within the aircraft cabin. A better understanding is imperative for US airlines as they try to recover from the pandemic quickly and safely. As the vaccination rates pick up, airlines will gradually relax the restrictive measures onboard airplanes including the mask mandate. At the same time, COVID-19 continues to evolve and may still put travelers at risk for some time into the future. The key question is, if mask-wearing becomes a personal choice when flying during this transitional period (and beyond), will airline passengers in the US wear masks during their flights, what factors are influencing their mask-wearing intention, and in what way policy makers can utilize the findings to help the air transport industry recover from COVID-19 and better prepare for future pandemics.

This study performed three analyses to answer the questions, with a focus on air travelers in the US. First, this study proposed a framework for examining the intention to wear a mask when flying during COVID-19 and tested the model statistically using survey data. Second, this study compared mask-wearing intentions across different age groups when flying during COVID-19. The third analysis focused on passengers’ willingness to pay more to switch to airlines that adopted different mask policies, if such options were available. The remaining sections of this article are organized as follows: Section 2 reviews the literature on mask use with a focus on research related to COVID-19; Section 3 describes the data collection and research methods; Section 4 presents the results, and the discussion and conclusion sections interpret the results with concluding remarks.

2. Literature review

2.1. Mask use in air travel during COVID-19

On March 11, 2020, the WHO declared the COVID-19 outbreak a global pandemic (WHO, 2020). Protective measures including mask-wearing have since been taken to limit the spread of the virus. In the US, airlines have required all passengers to wear a mask onboard airplanes, which is an important measure given the increased risk of contracting and spreading COVID-19 in an aircraft cabin environment. Aircraft uses an automatic system to deliver mixed and recirculated air to the cabin during flight. While this process filters out large amounts of virus, a crowded, enclosed aircraft cabin for prolonged periods of time may increase the risk of inflight transmission of COVID-19 (Wang et al., 2021). Early studies of air travel and infectious disease focused on protective measures such as handwashing, social distancing, contact tracing, and educational programs to ensure passenger safety during flights (Huizer et al., 2014; Sevilla, 2018). Face masks were rarely mentioned as a protective measure in air travel, partially due to mixed evidence for their effectiveness in reducing transmission of virus (Cowling et al., 2010). With the emergence of COVID-19, masks have gained renewed attention. Recent studies have re-examined the role of masks in preventing COVID-19 transmission in the aircraft cabin, suggesting a significant decrease in average infection if facemasks were properly worn by all passengers during the flight (Wang et al., 2021).

Despite the evidence of the effect of masks, there are mixed views of mask use in COVID-19. Studies conducted in different countries found that multiple factors may be associated with the intention to wear masks. Rieger (2020) examined factors that affected mask use in Germany, indicating that worries about the COVID-19 situation, self-protection and protection of others, concerns of the look of mask-wearing, and being afraid of others’ judgement were determinants of mask-wearing. A study from Spain suggested that social norms of mask use is associated with voluntary use of masks in COVID-19 (Barceló and Sheen, 2020). Pfattheicher et al. (2020) collected data from Germany, the UK and the US to investigate the relationship between pro-social emotions and protective measures such as mask use. The results showed that mask adoption and compliance were largely motivated by empathy for people who were most vulnerable to infection of COVID-19. In China, similar studies were conducted, with findings suggesting the importance of environmental and personal factors, and factors related to pandemic stage, knowledge of the pandemic, and social influence in mask use (Kwok et al., 2021; Zhou et al., 2021). Noticeably, studies frequently suggested the relationship between certain demographic characteristics and mask compliance, indicating that older adults and females were more likely to wear masks (Barceló and Sheen, 2020; Haischer et al., 2020; Zhou et al., 2021). Surprisingly, mask-wearing has received only limited attention in the research of transportation. Dzisi and Dei (2020) examined the compliance to the policy on facemasks in public transportation, suggesting willingness to comply to the social distancing guidelines while the facemask policy was followed only partially. Only one study examined airline passengers’ health concerns and attitudes toward protective measures in COVID-19 (Sotomayor-Castillo et al., 2021). One of the findings related to mask use suggested that, compared to the use of sanitary measures, fewer respondents were willing to wear a mask even it was provided by their preferred airline.

Clearly, substantial gaps exist in the research on the intention to wear a mask during COVID-19. In particular, more research is needed to understand the mask-wearing intention in air travel, especially within the confined space of the aircraft cabin where passengers may face a greater risk of contracting COVID-19. The factors that drive the intention to wear a mask when flying may be unique in the context of air transport. To the best of our knowledge, no prior studies have examined air travelers’ intention to wear a mask on airplanes, even though such information is essential in the US where air travel is a major mode of travel. It should be noted that coronavirus can be a potentially path-changing disruption to existing transport policies (Marsden and Docherty, 2021). The findings of this study can therefore provide much-needed evidence for policymakers to re-think air transport policies in order to accelerate safe and active travel. In addition, the application of well-established behavioral models should be broadened to investigate mask use during COVID-19 in the context of air travel. While several studies have used behavioral models to examine cognitive processes in the decision to wear a mask, their application to the specific context of air travel is untested. Finally, several questions are still unanswered in regards to how different demographic groups might be motivated by different factors to wear a mask when flying during COVID-19. Vulnerable populations such as elderly travelers may face greater risks in contracting COVID-19 when traveling by air and the factors that shape their intentions to use masks need to be investigated further.
2.2. Theoretical Framework and factor selection

This study was based on the theory of planned behavior (TPB) model, with the inclusion of additional, context-specific factors to examine mask use intentions onboard airplanes in COVID-19. The TPB posits that behavior is immediately determined by behavioral intention, which in turn is affected by three factors—attitude, subjective norms, and perceived behavioral control (PBC) (Ajzen, 1991). The theory has been successfully applied in various domains including air transportation for predicting intentions and behaviors (Buaphiban and Truong, 2017; Hsiao & Yang, 2020; Jing et al., 2014; Pan and Truong, 2018). Recent studies have also applied the TPB to examine mask-wearing intentions and behaviors of leisure activity participants, international students, parent and children, and general public in COVID-19 (Coroiu et al., 2021; Irfan et al., 2021; Kim et al., 2020; Si et al., 2021; Sun et al., 2020). For this study, context-specific factors were added to the original TPB model. The final model, shown in Fig. 1, contains nine exogenous variables (attitude, injunctive norms, descriptive norms, perceived behavioral control, comfort, information avoidance, information seeking, risk avoidance, individualism) and one endogenous variable (mask-wearing intention). This study focused on the direct relationship between the nine factors and mask-wear intentions. Given that no previous research examined voluntary mask-wearing when flying during pandemics, a clear understanding of the direct factor impact on the mask-wearing intention is the important first step in this research area. The remainder of Section 2.2 justifies the factor selection in this study.

In the original TPB model, behavior intention is influenced by three predictors-attitudes that refer to a psychologically favorable or unfavorable evaluation toward a particular outcome or behavior; subjective norms that represent the pressure a person feels from his or her significant others to perform or not perform a behavior; and perceived behavioral control that is concerned with perceived ease or difficulty in performing a certain behavior (Ajzen, 1991). Numerous studies in the transport domain suggested that attitudinal, social, and control factors can explain significant portions of the behavioral intention in various travel-related activities (Hsiao and Yang, 2010; Jalilvand and Samiei, 2012). Similar effects were observed in recent TPB studies of mask-wearing in COVID-19. Attitude, subjective norms, and PBC significantly influenced mask-wearing intentions of international students (Sun et al., 2020) and affected post-pandemic mask saving in China (Si et al., 2021). The three constructs, however, appeared to exhibit different impact in mask-related studies. While attitudes and PBC influenced mask use of leisure activity participants in Korea (Kim et al., 2020), attitudes and subjective norms were important in mask-wearing intention in Pakistan during COVID-19 (Irfan et al., 2021). The effect of attitudes was frequently reported, indicating that negative attitude toward masks led to refusal to wear masks and positive attitude of mask enhanced mask compliance (Cheok et al., 2021; Taylor and Asmundson, 2021).

There were mixed views of whether subjective norms should be used as a sole indicator of normative influence in the TPB model. Forward (2009) suggested other normative influence, such as descriptive norms, may contribute uniquely to the explanation of behavioral intentions. Fishbein (2011) stated that the limitation of subjective norms lies in their representation of only a narrowly defined perceived normative pressure. The authors further suggested that injunctive norms should be used to replace subjective norms when dealing with perceptions of what others think we should do while descriptive norms should be used when referring to the perceived behavior of others. In the present study, the terms of injunctive norms and descriptive norms were used to represent the two types of normative influence tested in the study model. Descriptive norms have drawn increasing attention in the research, with studies using this normative factor to predict travelers' intention to violate (Forward, 2009), university students' intention to limit their alcohol consumption (Park et al., 2009), and travelers’ intention to use different travel modes (Jing and Juan, 2013). Studies of COVID-19 further indicated that enhancing social norms including descriptive norms is likely to promote compliance to COVID-19 prevention and control guidelines (Young and Goldstein, 2021). Descriptive norm was thus added to the original TPB model. The first four hypothesis statements were stated below:

**H1.** Attitudes toward mask are positively related to mask-wearing intention when flying during COVID-19

**H2.** Injunctive norms are positively related to mask-wearing intention when flying during COVID-19

**H3.** Descriptive norms are positively related to mask-wearing intention when flying during COVID-19

**H4.** Perceived behavioral control is positively related to mask-wearing intention when flying during COVID-19

**H5.** Comfort is positively related to the intention to wear a mask on-board airplanes during COVID-19

Comfort is a complex construct encompassing thermal, air quality, visual, acoustic, ergonomic, and psychological dimensions (Huebner et al., 2013). In this study, comfort of mask-wearing was conceptualized as a psychological and physical state wherein an air traveler’s anxiety concerning mask-wearing has been eased and he/she enjoys peace of mind, relaxation, and calm wearing a mask during flight (Lloyd and Luk, 2011). Comfort was often an important factor in travel decisions. In a study of elevated airport procedure in Jordan, passengers’ feeling of comfort toward the enhanced procedure positively affected their intention to re-travel (Al-Saad et al., 2019). Comfort was also found to significantly influence the choice of low-cost carrier passengers especially those traveling long-haul in the trans-Atlantic market (Hunt and Truong, 2019). The relationship between mask-wearing and comfort has been reported during COVID-19. In a study conducted in New Zealand, over 40% of the survey respondents reported discomfort wearing a mask during COVID-19, suggesting that comfort may factor in people’s views of mask use (Gray et al., 2020). For passengers sitting in the enclosed aircraft cabin for a long duration, comfort is likely to affect their intention to wear a mask. H5 was stated:

**H5.** Comfort is positively related to the intention to wear a mask on-board airplanes during COVID-19

Human beings have the tendency to avoid risky activities that they perceive as having negative outcomes (Lorian and Grisham, 2011). Risk avoidance is often used to understand health behaviors, with many studies been conducted at the macro level to investigate how people perceive the risk of contracting infectious disease and take protective actions (Carvalho et al., 2008); Wang et al. (2020), for example, found that some countries such as Brazil perceived a higher risk of COVID-19 than others, such as the US and the UK. Risk perception, in turn, may trigger risk avoidance behaviors such as hand-washing, social distancing, and mask-wearing (Dryhurst et al., 2020). Studies also found relationships between risk factors and the intention to wear a mask during COVID-19. Irfan et al. (2021) indicated that risk perception,
together with attitude, subjective norms, and perceived benefits, significantly enhanced willingness to wear masks during COVID-19 in Pakistan. Similar observations were made in China where risk perception was found to be important in mask-saving behavior following the outbreak of COVID-19 (Si et al., 2021). Studies generally view risk avoidance as an adaptive response to environmental challenge, which can be particularly important in transportation during a global pandemic (Zhang, 2020). The risk factor is highly relevant to this study because air travelers may intend to wear a mask to avoid health risks when flying during COVID-19. H6 was thus stated:

**H6.** Risk avoidance is positively related to the intention to wear a mask when flying during COVID-19

When people face aversive event, they generally exhibit two types of information process behaviors - information seeking (the extent an individual seeks out and monitors for information about threat) and information avoidance (the extent to which one cognitively distract from and psychologically blunt threat-relevant information) (Miller et al., 1988). These information behaviors were investigated in the contexts of social media (Guo et al., 2020), environmental protection (Hmielowski et al., 2019), and coping with health challenges (Ek & Heinstein, 2011). Information plays an essential role in fighting against the spread of COVID-19 as well as providing guidance for health actions. Various information behaviors have been observed during COVID-19. In the US, for example, people searched for information immediately following the first report of COVID-19, while the search for information of community level policies or personal health strategies (e.g., mask-wearing) was much slower (Bento et al., 2020). Excessive, incomplete, or incorrect information can affect information behaviors. Soroya et al. (2021) suggested that the more people seek information on social media during COVID-19, the more they would feel information overload and information anxiety, and the more likely they would engage in information avoidance. Similarly, misinformation exposure brings negative consequences, leading to greater information avoidance in COVID-19 (Kim et al., 2020). Searching for health information was relevant to this study given the critical role of public health information in facilitating mask decisions of airline passengers during COVID-19. H7 was thus stated.

**H7.** Information searching is positively related to the intention to wear a mask when flying during COVID-19

**H8.** Information avoidance is negatively related to the intention to wear a mask when flying during COVID-19

Individualism and collectivism are two types of culture that affect how people think and behave. Individualism is defined as the degree to which a person stresses the needs of individual over the needs of the group as a whole, as opposed to collectivism which emphasizes the collective needs and goals of the group over the needs and desire of the individual (Hofstede, 1994, 2001). Individualism and collectivism significantly influenced how people perceive and respond to a health crisis. A cross-countries study found that individualistic worldview, among other factors, was significantly associated with the risk perception of COVID-19 (Dryhurst et al., 2020). Compared to individualism, collectivistic culture may be more effective in reducing the spread of COVID-19 and increasing compliance to mask-wearing guidelines (Biddlestone et al., 2020; Lu et al., 2020). Furthermore, Bazzi et al. (2021) suggested that American culture is characterized by a combination of individualism and anti-statism and this unique culture may undermine collective action against COVID-19, as evidenced by less compliance to COVID-19 guidelines including mask-wearing in the US. To further investigate the effect of individualism on mask-wearing intentions of American travelers in COVID-19, H9 was stated:

**H9.** Individualism is negatively related to the intention to wear a mask when flying during COVID-19

3. Research method

3.1. Sample and data collection

This study used a convenience sampling method to collect survey data from the online platform of Amazon Mechanical Turk (MTurk). Two measures were taken to further ensure data quality in this study. First, to be eligible to participate, MTurk workers must have completed 100 approved online tasks (or HIT) with an overall performance approval of 98% or higher to ensure qualification and experiences needed for the survey. Second, measures were taken to prevent those participating in the pilot study from taking the survey again in the main study.

Data collection took place between May 12 and May 15, 2021. The time was intentionally selected to best capture air travelers’ opinions on mask-wearing when flying during COVID-19. As of May 2021, over 60% of the adults in the US received at least one dose of vaccination (CDC, 2021), which contributed to falling COVID-19 cases across the country. As the vaccination rates increased, new rules were introduced for fully vaccinated adults to safely resume activities indoors or outdoors without needing to wear a facemask (CDC, 2021). At the time of data collection, it was reasonable to expect that COVID-19 restrictions including mask mandate on airplanes would be gradually removed. In the meantime, however, the possible twists in COVID-19 could make the pandemic unpredictable. Consequently, many people may still choose to wear masks in public settings even masks are no longer mandatory, especially in aircraft cabin where social distancing is not possible. Conducting the survey of mask-wearing in this transitional period (moving from mask mandate to non-mask mandate) means that participants can better understand the survey context and provide useful information of the important factors that drive their intention to voluntarily wear a mask onboard airplanes.

Two pilot studies were conducted to test the survey questionnaire, followed by the modification of the questionnaire for the use in the main survey. After data cleaning, the final sample size for data analysis was 1124. There were 198 incomplete questionnaires in which participants provided some demographic information. As these cases were not included in the data analysis, they were treated as non-respondents and were used to test the non-response bias of the study. A chi-square test was performed to compare the demographic characteristics of the respondents and non-respondents. The results showed no significant difference between the two groups (Age: $X^2 = 6.692, p = .245$; Gender: $X^2 = 1.895, p = .169$; Education $X^2 = 4.620, p = .329$; Marital status: $X^2 = 5.586, p = .232$), indicating minimal impact of non-response bias.

3.2. Survey instrument

The survey questionnaire for this study consisted of four major sections: (1) demographics, (2) travel and mask experience, (3) factor impact on mask-wearing intentions during flight, and (4) willingness to pay more to switch to airlines that offer different mask policies. Section 3 asks participants to evaluate the relationship between various factors and their intentions to wear a mask when flying in COVID-19, based on a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). Each factor was measured by at least three scale items. These scale items were either adopted and modified from validated scales in the literature (Bao et al., 2003; Cosma, 2011; DuBenske et al., 2009; Esposito et al., 2016; Harvey et al., 2014; Hmielowski et al., 2019; Hsiao and Yang, 2010; Jing and Juan, 2013; Jing et al., 2014; Meertens and Lion, 2008; Oborne and Clarke, 1975; Park et al., 2009; Raju, 1980; Soroya et al., 2021; Taylor and Todd, 1995; Triandis and Gelfand, 1998; Yang and Kahlor, 2012) or developed by the authors to reflect the context of this study. Section 4 provides a scenario in which participants were given the option to pay a fee to switch from a mask mandate airline to a non-mask mandate airline, or vice versa, to assess their willingness to pay (WTP) more to switch to airlines that adopted different mask
policies in COVID-19. The scale items measuring the ten constructs are provided in Appendix A. Appendix B summaries passenger profiles.

3.3. Data analysis

Data analysis was performed in three stages. First, structural equation modeling was conducted to identify major determinants of the air travelers’ intentions to wear a mask onboard an airplane. The formular developed by Westland (2010) was used to determine the lower bound of the sample size (475), which was satisfied in this study. Second, further SEM analysis was performed to compare mask-wearing intention across three age groups – Young Group, Mid-Aged Group, and Senior Group. The Senior Group was comprised of adults aged over 60 to reflect the high-risk population in COVID-19 as identified by CDC (CDC, 2021). The remaining respondents were divided into Young Group (ages 18–40) and Mid-Age Group (Ages 41 to 60). Finally, respondents were given the scenarios to indicate if they were willing to pay more to switch from a mask mandate airline to a non-mask mandate airline, or vice versa. For respondents who indicated their willingness to pay more to switch to airlines that adopt different mask policies.

4. Results

4.1. Intention to wear a mask – total sample

A two-phase structural equation modeling approach was employed to examine mask-wearing intention onboard airplanes during COVID-19 in the US. First, confirmatory factor analysis (CFA) was performed to evaluate and validate the measurement model. To start the CFA, multivariate and normality of the data were checked. All kurtosis values were less than 7, indicating no substantial departure from normality of the dataset (Byrne, 2010). Three cases with large Mahalanobis distance ($D^2$) were removed from the data to avoid the impact of outlier. The CFA analysis was then performed on the survey sample containing 1121 respondents. Three rounds of model estimation were conducted, with measures taking to improve the model following each round of estimation. Measures for model improvement included removing scale items with low factor loadings (0.70), removing scale items associated with large error scores, and correlating error terms with large values. The final measurement model met the CFI, GFI, CMIN/df and RMSEA requirements for a good model fit (cutoff values were adopted from Byrne, 2010: CFI>0.95, GFI>0.90, CMIN/df < 3, and RMSEA<0.05). Following the model estimation, reliability and validity of the model were tested. Evidence of model reliability was obtained from two measures – Cronbach’s alpha and construct reliability (CR). For the final measurement model, the Cronbach’s alpha and CR values for constructs were greater than 0.70, indicating satisfactory internal consistency in scale items. Construct validity of the model was established by convergent validity and discriminant validity of measurement. All factor loadings except for items DN4 and ID1 (both close to 0.70) exceeded the recommended threshold of 0.70 and all the average variance extracted (AVE) values passed the .50 threshold, suggesting sufficient convergent validity in the scale items. A comparison between the square root of AVE values for any two constructs and the correlation estimate between these two constructs provide evidence of discriminant validity of the measurement. For the proposed measurement model, all the square root of AVE values for any two constructs were greater than the correlation between these two constructs, demonstrating discriminant validity of the model. Consequently, the measurement model was successfully validated. Table 1 summarises the reliability and validity results of the measurement model. Table 2 shows discriminant validity of the measurement model.

The second phase of SEM addressed the full structural model, focusing on testing the relationship between the nine predictors and behavioral intentions to wear a mask when flying. Model fit assessment showed minimal change from the CFA fit indices, again indicating satisfactory model fit for the structural model. Hypothesis statements were then tested. The results indicated that five paths – AT→BI, IN→BI, DN→BI, RA→BI, IS→BI – were statistically significant at p < 0.05 while the other four paths – PBC→BI, CO→BI, IA→BI, and IDV→BI – were not statistically significant. Further examination revealed that injunctive norms, while statistically significant, generated a negative regression coefficient that was not in line with the hypothesis direction. Consequently, four constructs, namely attitude, descriptive norm, risk avoidance, and information seeking, were significant determinants of the behavioral intention to wear a mask when flying in COVID-19, while the remaining constructs were not significant predictors of the mask-wearing intention. Among the four significant factors, attitude had the largest standardized coefficient (0.570), followed by risk avoidance (0.323), descriptive norm (0.135), and then information searching.

### Table 1

Model reliability and validity results – all sample.

| Construct       | Item | Cronbach’s Alpha | Factor Loading | CR   | AVE  |
|-----------------|------|------------------|----------------|------|------|
| Information     | IS1  | .903             | .792           | .908 | .665 |
| Searching       | IS2  | .823             |                |      |      |
| IS3             | .763 |                  | .919           |      |      |
| IS4             | .769 |                  |                |      |      |
| IS5             |      |                  | .970           | .888 |
| Attitude        | AT1  | .919             | .946           |      |      |
| AT2             | .942 |                  |                |      |      |
| AT3             | .936 |                  | .946           |      |      |
| AT4             |      |                  |                |      |      |
| Injunctive Norm | IN1  | .903             | .913           | .949 | .823 |
| IN2             | .874 |                  | .927           |      |      |
| IN3             | .915 |                  |                |      |      |
| Descriptive Norm| DN1  | .847             | .889           | .840 | .639 |
| DN2             | .815 |                  |                |      |      |
| DN3*            | –    |                  | .681           |      |      |
| DN4             | –    |                  |                |      |      |
| DN5*            | –    |                  |                |      |      |
| Perceived       | PBC1*| .892             | –              | .854 | .662 |
| Behavioral      | PBC2 | .763             |                |      |      |
| Control         | PBC3 | .834             |                |      |      |
| PBC4*           | –    |                  | .842           |      |      |
| Comfort         | CO1* | .849             | –              | .938 | .790 |
| CO2             | .878 |                  |                |      |      |
| CO3             | .896 |                  |                |      |      |
| CO4             | .895 |                  |                |      |      |
| CO5             | .886 |                  |                |      |      |
| Information     | IA1  | .875             | .873           | .926 | .759 |
| Avoidance       | IA2  | .858             |                |      |      |
| IA3             | .876 |                  |                |      |      |
| IA4             | .877 |                  |                |      |      |
| Risk Avoidance  | RA1* | .819             | –              | .947 | .857 |
| RA2*            | –    |                  |                |      |      |
| RA3             | .943 |                  |                |      |      |
| RA4             | .917 |                  |                |      |      |
| RA5             | .917 |                  |                |      |      |
| Individualism   | ID1  | .826             | .658           | .813 | .594 |
| ID2*            | –    |                  |                |      |      |
| ID3             | .795 |                  |                |      |      |
| ID4             | .846 |                  |                |      |      |
| Behavioral intention | BI1 | .93  | .946           | .957 | .881 |
| BI2             | .940 |                  |                |      |      |
| BI3*            | –    |                  |                |      |      |
| BI4*            | –    |                  |                |      |      |
| BI5             | .929 |                  |                |      |      |

Note: * indicates removed items during model improvement.
(0.037). These coefficients indicated the magnitude of the impact, meaning air travelers were most strongly influenced by their attitudes toward masks when making mask decisions onboard airplanes in COVID-19, followed by avoiding the risks of COVID-19, other people’s mask behaviors, and information searching behaviors. Table 3 shows the model fit indices for the measurement and structural models, and hypothesis testing and standardized coefficient results. Collectively, the factors in the model explained 90.6% of the variance in mask-wearing intentions onboard airplanes during COVID-19. This suggested that adding context-specific factors to the TPB model may further enhance the predictive power of the model in mask-wearing, as demonstrated by the finding of strong, direct factor impact on the mask use intention.

4.2. Intention to wear a mask – age group comparison

The second goal of this study was to examine age group differences in the intention to wear masks when flying during COVID-19. For this to happen, the all-sample dataset was divided into three parts based on the variable of age: Young Group (age 18–40, n = 672), Mid-Age Group (age 41–60, n = 353), and Senior Group (age over 60, n = 96). As there is a close relationship between age and COVID-19, as indicated by the CDC’s analysis of COVID-19 infection, hospitalization, and death by age group in 2021 (Appendix C), it is logical that group creation in this study considers the relationship between age factor and COVID-19. The CDC analysis provided that the rate of death was 30 times higher in the 50-to-64 years olds, which was further increased to 90 times higher in those who were between 65 and 70 years old, compared to the reference age group (between 18 and 29 years old). This dramatic increase in the death rate served as a basis for creating a senior age group consisting of passengers older than 60. While this group had a relatively small sample size, analyzing the intention of travelers most at risk of COVID-19 infection can provide valuable insight into the vulnerable population facing the pandemic. A two-phase structural equation modeling analysis was performed on the three group datasets, following the same procedure in the all-sample analysis. The measurement models for the Young, Mid-Age, and Senior groups exhibited good, moderate, and acceptable model fit, respectively, and all of them demonstrated satisfactory convergent validity. For the senior group (See results in Appendix F), the p value associated with the Chi-square test was less than .001. Due to the sample size of this group been slightly smaller than 100, additional goodness of fit indices were examined, including Tucker-Lewis index (TLI) and 90% confidence interval for RMSEA. Specifically, TLI was used to replace GFI. Despite the similarity between the two model fit measures, TLI is less affected by sample size and the number of indicators (Sharma et al., 2005), making it more suitable for assessing a SEM model with a small sample size. Both the low and high confidence intervals for RMSEA were above 0.05, indicating generally unsatisfactory model fit (MacCallum et al., 1996). However, as both confidence intervals were not significantly higher than the cutoff value, and both the GFI and TLI values exceeded the recommended values (0.95 and 0.90, respectively), the decision was made to continue with the analysis of the senior traveler group while keeping in mind the limitation of its small sample size. Discriminant validity was then assessed. For BI in the Young Group and RA in the Mid-Age Group models, the square roots of their AVE were less than the absolute values of their correlation with AT. As the differences were minor (BI: 0.930 vs. 0.936; RA: 0.939 vs. 0.941) and the AVE values for both BI and RA exceeded the 0.50 threshold, both factors were retained in the models to avoid losing information. Appendices D, E, and F show the measurement model fit and model validation for the three age groups.

In the structural modeling phrase, hypothesis testing again revealed the significant impact of four factors – AT, DN, RA, and IS on the mask-wearing intention, although they affected the three age groups differently. For Young Group, the paths of AT→BI, DN→BI, RA→BI, and IS→BI were statistically significant, indicating that attitude, descriptive norms, risk avoidance, and information searching significantly influenced the decision of young travelers to wear a mask when flying during COVID-19. For the models representing Mid-Age Group and Senior Group, only the paths of AT→BI, DN→BI, and RA→BI were significant, indicating that middle-aged and elderly travelers were affected by attitude, descriptive norms, and risk avoidance when deciding on mask-wearing during flight. Noticeably, the magnitude of the effect of AT, DN, and RA varied across the three groups. Attitude most strongly influenced Young Group, followed by Mid-Age Group and Senior Group. The effect of risk avoidance showed a reversal pattern with the strongest impact on Senior Group, followed by Mid-Age Group and then Young Group. The effect of descriptive norms decreased from Young Group to Mid-Age Group, then increased again for Senior Group. The factor of information seeking affected only the Young Group with a small effect. Fig. 2 illustrates the hypothesis testing results and standardized coefficients. Table 4 summarizes the characteristics of the three age groups.
Transport Policy 119 (2022) 32–44

Notes: Y=Young Group; M=Mid-Age Group; S= Senior Group. ***indicates p < .001; **indicates p < .05.

Fig. 2. Hypothesis Testing and Standardized Coefficient—Age groups
Notes: Y=Young Group; M=Mid-Age Group; S= Senior Group. ***indicates p < .001; **indicates p < .05.

Table 4
Age Group Characteristics – Summary.

| Age Group Characteristics | Young Group | Mid-Age Group | Senior Group |
|---------------------------|-------------|---------------|--------------|
| Travel                    | Air travel mostly 2-3 times | Air travel mostly 2-3 times | Air travel mostly 2-3 times |
| Age Group Characteristics | annually before COVID -19, followed by once a year. | annually before COVID -19, followed by once a year. | annually before COVID -19, followed by once a year. |
| Mask Behavior and perception | 13% wore a mask when sick in crowded settings before COVID -19. | 13% wore a mask when sick in crowded settings before COVID -19. | 3% wore a mask when sick in crowded settings before COVID -19. |
| Top four sources of information for COVID-19: (in the order of frequency of use) | Major News media, Health Agency, Doctor, Social media | Major News media, Health Agency, Doctor, Social media | Major News media, Health Agency, Doctor, Social media |
| Determinants of intention to wear a mask when flying: (in the order of importance) | Attitude, Risk Avoidance, Descriptive, Norm | Attitude, Risk Avoidance, Descriptive, Norm | Attitude, Risk Avoidance, Descriptive, Norm |

4.3. Mask wearing - willingness to pay more to switch airline

The last section of the survey questionnaire collects data of passengers’ willingness to pay extra to switch to airlines that adopt different mask policies (Appendix G shows the survey instruction). Of the 1121 respondents, 155 or 13.8% indicated the willingness to pay more to switch from a mask mandate flight to a non-mask mandate flight (referred to as M—NM) if they were to travel by air in the coming months. More respondents, 366 or 32.6%, were willing to pay extra to switch from a non-mask mandate flight to a mask mandate flight (referred to as NM—M). Respondents further indicated the amount they were willing to pay to switch airlines, in both US dollars and the percentage of roundtrip airfare. There were seven cases in which respondents stated the willingness to pay over 100% of roundtrip airfare and four cases in which respondents stated the willingness to pay $1000 or more to switch. These cases were treated as outliers and excluded from the analysis. Fig. 3 compared two groups (M—NM vs. NM—M) in terms of the amount they were willing to pay (in percentage of the roundtrip airfare and in US dollars) to switch airlines. The M—NM group was willing to pay from $2 to $700 dollars (M = 131.35, SD = 147.74), or 1%–100% of roundtrip airfare (M = 27.82, SD = 25.33) to switch airlines. The amounts most likely to be paid were $100, $50, and $200, or 10%, 20%, and 50% of roundtrip airfare. The NM—M group was willing to pay between $1 and $700 (M = 96.88, SD = 103.48), or 1% and 100% (M = 24.45, SD = 25.19) of roundtrip airfare to switch, with $50, $100, and $200 or 10%, 20%, and 5% being the most frequently stated amounts.

As the amounts of WTP varied, a logistic regression analysis was performed to identify factors that can be used to predict the willingness to pay a large amount vs. a small amount to switch airlines for both M—NM and NM—M groups. This analysis was based on the percentage of roundtrip airfare that respondents were willing to pay to switch airlines, using 15% as a cutoff value to create a binary dependent variable. Thus, a respondent would be considered paying a small amount if he/she was willing to pay 15% or less of the roundtrip airfare to switch airlines, whereas more than 15% was considered a large amount to be paid. The use of the 15% cutoff value was arbitrary based on two considerations. First, this value divided both the M—NM and NM—M participants into equal parts. This is beneficial as recent studies suggested a stricter event per variable (EPV) rule to determine sample size for logistic regression (e.g., EPV > 20) (Ogundimu et al., 2016), especially given a relatively small number of participants (153) willing to pay to not wear a mask. Second, given that 5%, 10%, 20% and 50% of roundtrip fare were most likely to be paid to switch airline, the 15% cutoff value was arbitrary based on two considerations. Multicollinearity statistics showed low values of variance inflation factor (VIF) (<5) for all predictors in the model, indicating minimal concern of multicollinearity.

Logistic regression analysis was performed, using a forward stepwise method to add predictors to the choice model in a stepwise procedure until the optimal model was achieved. Table 5 shows the model results for the two groups. For the M—NM group, -2LL scores, Hosmer and Lemeshow X², and Cox and Snell R² showed improvement in the two-
To only 53.6% of the null model. Of the five predictors, Age (Exp(B) = 0.671) was significant before adding the independent variables. The classification table as part of the SPSS output was thus used to assess the effectiveness of the predicted classification model in absolute value.

Note: NS = Not significant; ** refers to \( p < .05 \); \( \Delta \) = Improvement from base model in absolute value.

Logistic regression estimates the probability of willingness to pay a large amount to switch occurring. This is achieved by predicting whether cases can be correctly classified (predicted) from the independent variables. The classification table as part of the SPSS output was thus used to assess the effectiveness of the predicted classification against the actual classification. The classification accuracy of the final model was 60.8%, compared to 53.6% of the null model (no predictor was added). In other words, with the independent variables added, the final model can now correctly classify 60.8% of cases overall, compared to only 53.6% of the null model. Of the five predictors, Age (\( \beta = -0.399 \), Exp(B) = 0.671) and travel frequency since COVID-19 (\( \beta = 0.438 \), Exp(B) = 1.550) were significant predictors of paying a large amount to switch to a mask mandate airline. Thus, for each point increase in educational level and travel frequency, the odds of respondents paying more percentage of roundtrip airfare to switch to a mask mandate airline would increase by 1.681 and 1.311, respectively. For each point increase in income, the odds of respondents paying more percentage of roundtrip airfare to switch to a mask mandate flight would decrease by .817. Table 5 shows the results of the logistic regression analysis.

### Table 5

#### Logistic Regression Results – WTP Large Amount to Switch to Airlines that Offer Different Mask Policies.

| Model Factor | M→NM (153 participants) | NM→M (361 participants) |
|--------------|--------------------------|--------------------------|
| Coefficient (Odds Ratio) | Coefficient (Odds Ratio) |
| Gender | NS | NS |
| Age | -0.399 (Exp(B) = 0.671)** | NS |
| Educational Level | NS | 0.191 (Exp(B) = 1.194)** |
| Income | NS | -0.202 (Exp(B) = 0.817)** |
| Travel Frequency since COVID-19 | .438 (Exp(B) = 1.550)** | .271 (Exp(B) = 1.311)** |

#### Model Fit measurement

- 2LL = 195.805(\( \Delta \)6.58) vs. 147.227(\( \Delta \)11.29) in the null model
- Hosmer and Lemeshow \( X^2 = .625(\Delta .194) \) vs. .939(\( \Delta .528 \))
- Cox and Snell R2 = .096(\( \Delta .039 \)) vs. .054(\( \Delta .031 \))
- Nagelkerk R2 = .129(\( \Delta .053 \)) vs. .072(\( \Delta .041 \))
- Classification Accuracy = 60.8%(\( \Delta .7% \)) vs. 61%(\( \Delta .8% \))

Note: NS = Not significant; ** refers to \( p < .05 \); \( \Delta \) = Improvement from base model in absolute value.

5. Discussion

Compared to the national average, respondents in this study were generally younger, more educated, earned less income and, on race, they slightly underrepresented Hispanic population (United States Census Bureau, 2019a,b). These characteristics mirrored the findings of Berinsky et al. (2012) suggesting that demographic differences may exist between MTurk workers and the national population. Interpretation of the findings should take the variations into consideration.

Respondents demonstrated different patterns in air travel and mask use before and during COVID-19. They traveled more frequently before COVID-19 (2–3 times were mostly selected) than during COVID-19 (less than one time was mostly selected), which was in line with the dramatic decrease in travel demand during the pandemic. Mask use in crowded settings increased largely, from 10% before COVID-19 to over 90% during COVID-19, demonstrating massive mask adoption following CDC’s recommendations on mask use in the US. However, only less than 80% and slightly over 80% of the respondents believed that wearing masks can keep them and others safe. Clearly, disagreement still exists in the US regarding the usefulness of mask-wearing in COVID-19. Respondents reported obtaining the information of COVID-19 mostly from major news media, national, state, city, or county health department/agency, and doctors/other health providers. This demonstrated that traditional sources remain the most trusted and utilized sources for the information of COVID-19 in the US.

The all-sample analysis showed that attitude significantly influenced mask-wearing intention. Thus, the more favorable feeling air travelers have toward masks, the more likely they would intend to wear one when flying during COVID-19. The finding was consistent with prior studies of mask use in COVID-19 (Irfan et al., 2021; Kim et al., 2020; Si et al., 2021; Sun et al., 2020) demonstrating the importance of attitudinal and cognitive effect on mask decisions during public health crises. Noticeably, attitudes, among all the predictors in this study, had the strongest impact on mask-wearing intentions. This may be related to the mixed attitudes toward masks in the US. While most people in the US think masks were important in limiting the spread of COVID-19, a small yet
vocal groups of individuals hold a negative attitude toward masks, rarely or never wearing one in public (Taylor and Asmundson, 2021). This study demonstrated that the same attitudinal impact exists in air travel where passengers make mask decisions in the aircraft cabin during COVID-19.

Of the two types of social norms tested in this study, injunctive norms were not a important factor. While differing from previous studies (Irfan et al., 2021; Sun et al., 2020; Si et al., 2021), the finding appeared to support the view that subjective norms (injunctive norms) alone may not provide a complete assessment of normative influence in behavioral intentions (Forward, 2009). The reason for the finding of injunctive norm in this analysis can be two-fold. First, injunctive norm (equivalent to subjective norm in the original TPB model) has been traditionally a weak predictor of the intention and behavior compared to the other two factors – attitudes and perceived behavioral control. The second reason may be related to the study context and the presence of descriptive norms as another normative factor in the study model. Descriptive norm has been routinely reported to increase the variance explained in behavioral intention particularly when the study context is considered “risky” (Forward, 2009). It is thus likely that in the context of flying during COVID-19, descriptive norm took over injunctive norm as a more important contributor to mask-wearing intention during flight due the health risks involved. This study found descriptive norms to be significant. Thus, the behaviors of others to wear a mask (descriptive norms), rather than the expectations from important others for an individual to wear a mask (injunctive norms), actually motivated the air traveler to wear a mask when flying during COVID-19. The finding was consistent with previous studies showing a positive relationship between information seeking and preventive behaviors including mask-wearing during COVID-19 (Young and Goldstein, 2021). In the real world, this could mean the air traveler observing friends, family members, airline employees, fellow passengers, and public figures wearing masks during flight, and wanting to wear one him/herself. It demonstrated that people tend to follow actions than words, and they are more likely to adhere to a recommendation if they see others are doing it (Young and Goldstein, 2021). The concrete action of mask-wearing sends out a clear message that mask-wearing is a desirable behavior. For air travelers, this can create a strong social and psychological impact, increasing their intention to wear a mask when flying in COVID-19.

Perceived behavioral control was not a significant factor in the mask-wearing intention of air travelers. Previous studies of mask use produced mixed findings of the effect of PBC (Irfan et al., 2021; Kim et al., 2020; Si et al., 2021; Sun et al., 2020), partially supported the finding of this study. In this study, the PBC referred to the perceived control on mask acquisition, and knowledge and ability to wear a mask. The insignificant effect of PBC may be related to the time of conducting this study (one and half years into the pandemic). While masks were in short supply and many people lacked the knowledge of masks at the beginning of COVID-19, supply and knowledge of masks dramatically increased one and half years into the pandemic. The findings indicated that American travelers can easily obtain masks and they were confident in their knowledge and ability to properly handle mask-wearing during flight. Consequently, they may not perceive control-related factors to be important in their mask-wearing intention during flight.

Comfort was not an important factor in air travelers’ intentions to wear a mask when flying during COVID-19. Previous studies found mask-wearing uncomfortable and discomfort such as short of breath and sweating would negatively affect mask use (Gray et al., 2020; Cheok et al., 2021). While the finding of this study may seem to be counter-intuitive, it should be interpreted in the specific context of traveling during COVID-19. Respondents may perceive a higher risk of contracting the virus in the enclosed aircraft cabin where social distancing is not possible. As such, they may not consider comfort a priority when deciding on mask-wearing onboard airplanes. The finding was in line with Cheok et al. (2021) indicating that mask compliance can be attained during the COVID-19 outbreak, despite the significant discomforts associated with mask-wearing in Singapore. It is likely that some other factors, such as the risks of COVID-19, may override comfort as more important contributors to mask-wearing intentions. In other words, in the aircraft cabin where the risk of infection is potentially high, people may choose to sacrifice comfort in exchange for safety.

Risk avoidance was a significant factor in this study, having the second strongest impact on the mask-wearing intention when flying during COVID-19. The finding was consistent with previous studies indicating the strong relationships between risk factors and mask intentions and behaviors during COVID-19 (Irfan et al., 2021; Si et al., 2021). The significant, strong effect of risk avoidance identified in this study was not surprising given the risk awareness of COVID-19. It is widely known that COVID-19 transmits through invisible respiratory droplets that can be carried by air for a prolonged period of time (Wang et al., 2021). In addition, about 40% of COVID-19 transmission was made by asymptomatic individuals who were not aware of their infection, which can make enclosed, small environment such as aircraft cabin potentially more likely for airborne transmission. The finding of this study showed that air travelers were aware of the risk associated with the contagious virus, carefully assessed the risk of in-flight infection, and intended to use masks to avoid the risk when flying during COVID-19.

Of the two types of information behaviors (information avoidance and information seeking) tested in this study, information avoidance was not a significant factor. Similar with previous findings, this showed that information avoidance reduced the chance of people receiving important information, which in turn prevented them from taking necessary actions in COVID-19 (Soroya et al., 2021). Information seeking was found to be a significant factor in this study. This was consistent with previous findings showing a positive relationship between information seeking and preventive behaviors including mask-wearing during COVID-19 (Liu, 2020). Contrary to information avoidance, information seeking is an act of searching information. It is likely that air travelers, when engaging in active information searching, can stay informed about the latest development of COVID-19. This would allow them to exercise better judgement regarding mask-wearing onboard airplanes. In other words, information seeking is likely to provide air travelers timely and sufficient information of COVID-19, which increase their intention to wear masks during flight.

Finally, individualism was not a significant predictor of the mask-wearing intention. Prior studies of culture and mask-wearing in the US were mostly conducted at a macro level, showing that mask use was more common in collectivistic US states (Lu et al., 2020) and the combination of individualism and opposition to government intervention undermined collective action against COVID-19 in the US (Bazzi et al., 2021). The present study examined individualism at a micro level, indicating that individualism was not a significant factor affecting air travelers’ intention to wear a mask when flying during COVID-19. Noticeably, the standardized coefficient associated with individualism is close to zero (Table 3), indicating a borderline result. Further investigation of the relationship between individualism and mask-wearing in the aircraft cabin may be needed to verify the finding of this study.

The group analysis indicated that attitude, descriptive norms, risk avoidance, and information seeking significantly affected mask-wearing intentions of young, mid-aged, and senior air travelers during COVID-19, although the magnitude of impact varied across the groups. The Young Group was affected by the four factors, with attitude having the strongest impact. This indicated that young travelers’ intentions to wear masks when flying were highly driven by their fear of illness and unfavorable toward masks. Risk avoidance was the second most important factor, indicating that young travelers were aware of and tried to avoid the risk of COVID-19 during flights. Whether or not others wearing a mask also influenced the mask-wearing intention of this age group. Noticeably, Young Group was the only group that was affected by information seeking, which aligned with the passenger profile in this study showing that young travelers were the only age group using social media as an important source for the information of COVID-19 (Table 4).
This indicated that young travelers used a wide variety of different information sources, which contributed to their mask-wearing intention when flying during COVID-19. The Mid-Age Group was most strongly affected by attitude, followed by risk avoidance and descriptive norms. Information seeking was not a significant factor for this group. Compared to Young Group, attitude had a decreased impact while risk avoidance had an increased impact. This may suggest that, while attitude toward masks still had the dominant impact on the mask-wearing intention of middle-aged travelers, the factor of risk avoidance carried more weight in their mask use decisions compared to younger travelers. For the Senior group, attitude, risk avoidance, and descriptive norms remained the significant factors, but risk avoidance became the most important factor in the mask-wearing intention. This means that elderly travelers focused mostly on avoiding the risks associated with COVID-19 rather than their attitude toward masks when deciding on mask-wearing onboard airplanes. The finding was supported by the literature indicating that mask use increased with age and it was especially popular among elderly people (Barceló and Sheen, 2020). It indicates that elderly travelers are more cautious during COVID-19 and likely to make rational decisions of masks in the aircraft cabin. The finding may also be related to CDC’s message that older adults are at much higher risk for severe illness with COVID-19 (CDC, 2021). The message may have reinforced the risk perception of COVID-19 among senior travelers, increasing their intentions to avoid the health risks during flights.

The analysis of willingness to pay more to switch airlines provided another lens to examine mask use of air travelers in the US, which can further help airlines and policy makers understand mask-wearing intentions when flying in COVID-19. When having the option to pay more to switch from a mask mandate airline to a non-mask mandate airline (M→NM), or vice versa (NM→M), slightly over half of the respondents chose not to pay to switch either way. Among those who were willing to pay more to switch, 153 were willing to pay more to not wear a mask when flying, while 361 were willing to pay more to wear a mask. The findings were consistent with the literature, demonstrating that (1) more American travelers considered masks essential in controlling COVID-19 and (2) opposing attitudes toward masks still exist in the US (Taylor and Asmundson, 2021). Logistic regression analysis was performed to identify the demographic and travel-related factors that can be used to predict the willingness to pay a large amount to switch to airlines that offered different mask policies. For those wanting to pay more to switch to a non-mask mandate airline (M→NM), age and travel frequency during COVID-19 were significant predictors of their willingness to pay a large amount to switch. Younger travelers were more likely to pay higher amount to not wear a mask during flight. The finding was supported by previous studies indicating that younger age was often associated with less mask use during COVID-19 (Haischer et al., 2020). In addition, the more frequently travelers in this group had to fly during COVID-19, the more likely that they would be willing to pay a large amount to switch to an airline that did not require masks. For travelers willing to pay extra to switch to a mask mandate airline (NM→M), education, income, and travel frequency during COVID-19 were significant predictors of their willingness to pay a large amount to switch. Younger travelers were more likely to pay higher amount to not wear a mask during flight. The finding was supported by previous studies indicating that younger age was often associated with less mask use during COVID-19 (Haischer et al., 2020). In addition, the more frequently travelers in this group had to fly during COVID-19, the more likely that they would be willing to pay a large amount to switch to a mask mandate airline. The finding of the educational impact was supported by the literature, which showed that people with higher education tend to be more rational in mask decisions and are generally more willing to wear masks during COVID-19 (Zhou et al., 2021). Income was found to be negatively related to willingness to pay a large amount to switch airline. This finding may be related to the lower income levels reported by the respondents in this study, which is a common characteristic of the sample obtained from MTurk. The finding, while not consistent with Zhou et al. (2021), was in line with Rader et al. (2021) which showed that mask-wearing during COVID-19 was more commonly reported among certain socioeconomic groups including lower income groups in the US. Further investigation is warranted given the mixed evidence of the impact of income on mask-wearing in the US during COVID-19.

6. Conclusions and implications

Masks have been widely adopted in the US to limit the spread of COVID-19, though mask-wearing is still a controversial subject. For airlines in the US, mask use is considered an effective measure to ensure the safety of passengers and crewmembers. At the time of writing this article, the airline industry has been recovering from the COVID-19 pandemic. With the ongoing vaccination roll-out, airlines will begin to gradually relax their mask-wearing mandate, and eventually, mask-wearing will likely become a personal choice onboard airplanes. In the meantime, masks will likely continue to be used given the risks and uncertainties about COVID-19, especially in the aircraft cabin environment. This study identified factors that affect airline passengers’ intention to wear a mask when flying during this transition period. Based on an TPB model, it was found that attitude, risk avoidance, descriptive norms, and information seeking were significant determinants of the intention to wear a mask when flying during the COVID-19 pandemic. Attitude had the strongest impact, followed by risk avoidance. The four factors also affected the mask-wearing intention differently across age groups. While young and middle-aged airline passengers relied mostly on their favorable or unfavorable attitudes toward masks in making their mask-wearing decisions during flight, senior passengers focused mainly on avoiding the risk of COVID-19 in their decision about wearing a mask in the aircraft cabin. It was also found that more airline passengers were willing to pay extra to switch to an airline with a mask-wearing mandate than vice-versa, if given a choice. This demonstrated the general acceptance of mask-wearing and the existence of opposing attitudes toward masks in the US. Younger people and frequent travelers during COVID-19 were willing to pay larger amounts to switch to an airline with a non-mask mandate, and for travelers who wanted to switch to an airline with a mask-wearing mandate their willingness to pay more to switch was influenced by their education, income, and travel frequency during COVID-19.

This study contributes to the literature of mask use during a global health crisis. First, the findings help the understanding of mask-wearing intentions of airline passengers during COVID-19. Despite the research efforts into mask use during COVID-19, a substantial gap exists regarding how cognitive, attitudinal, normative, and information factors drive the intention to wear a mask in the aircraft cabin environment. To the best of our knowledge, this study is the first to investigate important factors that underlie the intention to wear a mask onboard an airplane during COVID-19. The findings are especially relevant in the US context where face-coverings remain a subject of serious debate. Second, this study proposed a new conceptual framework based on the theory of planned behavior, with the context-specific factors as additional predictors. It broadened the application of the TPB to air transportation, providing much-needed insights into cognitive and normative influences of the intention to wear a mask when flying during COVID-19. Finally, the findings show that attitudinal and risk factors affect age groups differently in terms of their mask-wearing intention during flight, and certain demographic characteristics can be used to predict the willingness of travelers to pay more to switch to airlines that offer different mask-wearing policies. The results provide further empirical evidence to understand the impact of demographic characteristics on mask use in the US.

The policy implications of this study are particularly important given that we are facing a public health crisis the world has not seen in living memory, yet the transport sector is largely un-prepared to respond to COVID-19. Marsden and Docherty (2021) suggested that COVID-19 may potentially present a major opportunity to re-think transport policy by understanding how people would adapt their travel behavior to the new normality, but pointed out that the pandemic can be “a very limited window to enact change in transport policy” (p. 95). From this point of
view, the three analyses in this study provided aviation policy makers much needed empirical evidence of mask-wearing intentions of airline passengers, contributing to improvement in policy response and preparedness in the face of global pandemics. Some important practical contributions of this study are listed below. First, given the strong impact of attitude on mask-wearing intention, efforts should be made to foster positive attitudes toward mask-wearing. The mixed views on mask-wearing in the US revealed in this study means that further changes in attitude may be needed. The government and health agencies should play an active role communicating a clear and consistent message about mask use in the general public in order to promote positive attitude toward masks and mask-wearing intentions of airline passengers. Second, as risk avoidance is a key motivator for mask-wearing, public guidance should be in place for air travelers to continue acknowledging the risk of COVID-19 as it evolves and be aware of the protective behaviors that can limit the spread of the disease. The risk assessment of COVID-19 must be based on science to help air travelers make informed decisions about mask-wearing onboard an airplane.

Third, the significance of descriptive norms indicates that role modeling can be an effective way to drive the mask-wearing intention in air travel. For example, when public figures and celebrities model appropriate mask behaviors during flight, they provide visual proof of learning and inspiration for mask-wearing. Airlines can integrate this element into mask strategies, which can be particularly important for young travelers to increase their mask use intention when flying during COVID-19. Fourth, the findings from this study show that information seeking facilitates the cognitive process for determining mask use during flight. Thus, air travelers need to be able to access accurate and timely information about mask-wearing. The various perceptions of mask-wearing are partly due to the varied exposure to information. The information and key facts about mask-wearing should be made uniform to provide consistent information for the decisions to wear a mask onboard airplanes. Finally, older air travelers, compared to younger ones, appear to pay more attention to risk avoidance when deciding about mask-wearing during a flight. Elderly travelers will likely continue to wear masks during flights as long as they perceive the risks of COVID-19. Policy makers and airlines should take necessary measures to accommodate the needs of this vulnerable population.

This study has some limitations. First, the survey used a cross-sectional design for collecting self-reported, online data about mask-wearing from MTurk. Consequently, the findings may not be representative of the national population of the US. Nevertheless, the findings can be generalized to online communities in the US and in other countries such as Canada and the UK where mask-covering is not a traditional practice. Second, while the four significant factors in this study provide a plausible explanation for mask-wearing intentions when flying during COVID-19, the remaining five factors that were not found to be significant merit further investigation. In particular, the effect of the two cultural factors – injunctive norms and individualism – may warrant further examination given their relationship with mask use in previous studies. Thirdly, the use of online data may limit the understanding of demographic influences in the willingness of travelers to pay more to wear or not wear a mask during their flights. The results should be verified using different data from the US market. Fourthly, while the findings of senior travelers’ mask-wearing intentions were valuable given the relationship between age and mask use, the limitation of a small sample size in the SEM analysis must be recognized. SEM often requires a large sample to produce more information and greater stability in model estimation, especially when the model is complex (Hair et al., 2019). A small sample size may introduce bias to the age group analysis, which should be taken into consideration when interpreting the results of the senior traveler group. It is important that the researchers perform a follow-up study with a sufficient sample size for senior travelers to verify the findings of this study. Finally, the analysis of willingness to pay more to switch airline was based on a simplified scenario, as some other factors such as length of flight may also affect the willingness to pay. The findings of this study open new avenues for future research on mask use in air travel. Given that MTurk skews the data toward slightly younger, higher educated, lower income populations in the US, further research can be extended using different sampling and data collection methods to verify the findings of this study. Research efforts can also be made to test the effect of the non-significant factors in this study using different data. For example, a new conceptual framework can be developed to test the relationship between cultural factors and mask-wearing intention in the air travel context during COVID-19. Another possible research direction is a comparative analysis of mask-wearing intentions of air travelers across countries. Given the global nature of air transport, a broader understanding of mask-wearing can help countries recover from COVID-19 sooner and improve their readiness for future health crises. This study provides a starting point for discussions about air travelers’ mask use intentions during a global pandemic.

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Declaration of competing interest

There is no conflict of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.tranpol.2022.01.023.

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