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PII: S0967-070X(22)00141-X

DOI: https://doi.org/10.1016/j.tranpol.2022.05.010

Reference: JTRP 2835

To appear in: *Transport Policy*

Received Date: 12 May 2022

Accepted Date: 22 May 2022

Please cite this article as: Salesi, V.K., Kan Tsui, W.H., Fu, X., Gilbey, A., Strategies for South Pacific Region to address future pandemics: Implications for the aviation and tourism sectors based on a systematic literature review (2010–2021), *Transport Policy* (2022), doi: https://doi.org/10.1016/j.tranpol.2022.05.010.

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Keywords: SPR countries; Tourism; Aviation; Travel-related policies and measures; Past pandemics; COVID-19

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Strategies for South Pacific Region to address future pandemics: Implications for the aviation and tourism sectors based on a systematic literature review (2010–2021)

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1 Introduction

The COVID-19 outbreak has had a devastating impact on the worldwide aviation industry since its outbreak in December 2019, causing a total estimated loss of US$234 billion in 2020 (International Civil Aviation Organisation (ICAO), 2021) and put many airlines into financial difficulties to the extent that they had to be bailed out with government support (Zhang & Zhang, 2021). The loss to international tourism income is even larger, estimated to be US$300–450 billion during the same period (World Tourism Organisation (UNWTO), 2021). The pandemic, together with the subsequent travel restrictions, drastically reduced global aviation operations and economic activities in the related sectors, notably tourism, trade and supply chains. The aviation industry lost approximately 90% of its projected output in 2020 globally (IATA, 2021), which is in sharp contrast to the 4% decline in international travel experienced during the SARS pandemic of 2003 (Steiner et al., 2013).

Ironically, the aviation industry is often instrumental in spreading pandemics, such as COVID-19, in terms of both distance and time (e.g., Abeyratne, 2006; Grais et al., 2003; Wilson, 1995; Zhang et al., 2020a). Moreover, the impact of pandemics on the aviation industry has arguably worsened as the aviation industry has grown in size (Aripov, 2009; Balkhair, 2020). It is vital for the aviation industry to develop an effective policy and strategy to recover from the COVID-19 pandemic and, as far as possible, safeguard against future pandemics (Tisdall et al., 2021; Tisdall & Zhang, 2020). However, few studies have investigated the travel-related policies and measures that aimed to mitigate the spread of pandemics in the aviation industry (Bielecki et al., 2021). This research gap is particularly damaging for countries that rely heavily on tourism income but have limited medical resources, such as the SPR and many other developing countries. Geographically, the SPR comprises 15 small island countries with emerging economies, limited natural resources and relatively small populations scattered across the Pacific Ocean (Salesi et al., 2021). Unlike countries that can rely on large domestic markets (Czerny et al., 2021), international aviation and tourism are vital for the SPR's economic growth (Cheer et al., 2018; Taumoepeau, 2016). This study aimed to contribute to the emerging literature by studying government policy and market performance in the SPR amid the COVID-19 pandemic, so that the aviation sector and the related sectors, notably tourism, can better manage the current and future pandemics.

The COVID-19 virus has caused by far the most destructive and catastrophic pandemic that the worldwide aviation industry has ever faced (e.g., Le et al., 2021; Scheyvens & Movono 2020; Zenker & Kock, 2020). COVID-19 exposed the inefficiencies of existing strategies and policies (e.g., airport screening, crisis and risk management policies, and travel restrictions) in addressing an unexpected pandemic of huge scale and damage (e.g., Baber, 2020; McLaughlin et al, 2020; Wenzel et al., 2020; Williams & Balaz, 2015). Aviation and tourism are amongst the most impacted sectors during the pandemics (Guan et al., 2020; Scheyvens & Monovo, 2020; Zenker & Kock, 2020), because travellers and tourists fear of virus infections and the travel-related mitigation measures (e.g., border closures, travel restrictions) significantly reduced air travellers and tourist flows across borders. Leisure travel is essential for tourism. During pandemics such "non-essential" travel tends to be more severely affected by people's incentive to reduce travel-related risk exposure. As a result, aviation and tourism often concurrently suffer significant declines amid pandemics. Hence, one of the priorities for governments and aviation stakeholders is to develop effective control responses and recovery

strategies to safeguard against similar crises in the future (e.g., Baber, 2020; Chung, 2015; Guan et al., 2020; Le et al., 2021). With the increase in the global population and urbanisation, the threat of pandemic outbreaks may be intensified in the future (Carlson, 2020).

IATA (2021) projected that the COVID-19 pandemic would primarily impact developing countries, such as the SPR which has developing economies and limited infrastructure. Indeed, the SPR's economies have been devastated by the COVID-19 pandemic because of the restrictions on international travel and flight services (Wenzel et al., 2020). Cliff et al. (2000) noted that although the SPR was an isolated region, its mortality rates could be among the highest if a pandemic reached its shores. The region has limited health infrastructure and medication, and the population is less immune to outside disease (Horwood et al., 2019). In addition, the less developed SPR does not have sufficient capacity to address any public emergencies due to limited access to medical resource, which is the main factor causing the dire outcomes of COVID-19 outbreak in the region. It is noted that due to the remote distance and limited access to air transportation in the SPR may contribute to the significant delay of being contracting the virus (Mei & Hu, 2020).

A relatively large number of studies have investigated the past and current pandemics, including studies conducted in Africa (Avraham & Ketter, 2017; Bogoch et al., 2015; Weiss & McLean, 2004), Australia (Department Infrastructure, Transport, Regional Development and Communications (DITRDC), 2020; Macilree & Duval, 2020), China (e.g., Abdullah et al., 2020; Chinazzi et al., 2020; Czerny et al., 2021; Fu et al., 2021; Fuller et al., 2013), Hong Kong (Chong & Zee, 2012; Bowen & Laroe, 2006; Lam et al., 2011), the Middle East (Bogoch et al., 2015; Dickens et al., 2020), the United Kingdom (UK) (Graham et al., 2020; Transport Commission, 2020), and the United States (US) (Brown & Kline, 2020; Jhung et al., 2001; Zenker et al., 2021). However, few studies have examined the SPR which has unique features in terms of isolated geography, developing economy and limited access to transport services. Additionally, limited contemporary research has focused on the relationships between pandemics and tourism (Hall & Seyfi, 2020; Ryu et al., 2020) and the policy implications for the air transport and tourism sectors amid pandemics (e.g., Baker et al., 2012; Budd et al., 2020; Sharma et al., 2020; Wenzel et al., 2020).

SPR countries are amongst the last region to have COVID-19 cases. However, there is limited literature on the pandemic control within the SPR. It is understood that the SPR relied heavily on border closures and travel restrictions due to lack of resources and funds for other measures to be implemented. The SPR is similar to Iceland (Craig et al., 2020) in terms of being isolated from the rest of the world. However, SPR differs from most regions worldwide as the SPR countries have smaller economies with limited funding for timely upgrading airport infrastructure for handling COVID-19, for example, thermal screening at airports or check-in kiosks to facilitate contactless check-in. The SPR region also relies on foreign donors for vaccinations for its populations. Partly because of the SPR's small market and population size, there is a dearth of research focusing on COVID-19's impact on the region's aviation and tourism sectors (Carlson, 2020; Craig et al., 2020). This study aimed to contribute to a better understanding of pandemic risks to the SPR's aviation and tourism industries, so that the SPR governments and stakeholders can better design effective travel-related policies and measures to address the current and future pandemics. Practical implications can be learnt from the literature about the

factors that contributed to the effectiveness of each of the travel-related policies and measures in controlling and mitigating the impact of pandemics. For instance, the timeliness of the implementations of border closures and travel restrictions are very important for delaying of the viruses and pandemics from reaching the SPR countries. Specifically, this study will attempt to answer the following research questions:

- *What are the key findings of previous studies on the effects of recent pandemics (post-2000) on the aviation and tourism sectors?*
- *What are the key policy changes triggered by past pandemics and COVID-19 pandemic, and how have they influenced the aviation and tourism sectors?*
- *What can be learnt from past pandemics and the COVID-19 crisis so that the SPR can cope better with pandemics?*

This study will systematically review the relevant reports prepared by governments and international institutions, and published studies available from academic databases (academic journals and textbooks) for the period January 2010–February 2021. The pandemics included in this study occurred after 2010, except for SARS, which occurred in 2003. Many studies in the literature have discussed the impacts of SARS, allowing us to cover all major pandemics occurring in the current millennium. Priority will be given to governments' and aviation stakeholders' responses, with the aim of synthesising and recommending travel-related policies and strategies for the SPR countries.

The remaining of this paper is structured as follows: Section 2 provides the methodology and data used for this study. Section 3 reports and discusses the results. Section 4 discusses the lessons learned and the policy implications for the SPR regarding controlling and managing future pandemics. Section 5 summarises the key findings and identifies areas for future study.

2 Methodology and data sources

This study uses a systematic review methodology to analyse publications that focused on the travel-related policies and measures in the air transport and tourism sectors used to mitigate the impacts of pandemics. Section 2.1 explains why a systematic review methodology has been used, Section 2.2 describes the systematic literature review process and Section 2.3 presents the data analysis procedure.

2.1 Systematic literature review

Systematic literature reviews have been widely adopted in the air transport and tourism literature (e.g., Ginieis et al., 2012; Grépin et al., 2021; Pahlevan-Sharif et al., 2019; Papatheodorou, 2021; Weihofen et al., 2019), and other literature, including healthcare (e.g., Aromataris et al., 2014; Lai, 2012; Leitmeyer & Adlhoch, 2012; Moher et al., 2010). The systematic review approach has also been instrumental in establishing practice guidelines and identifying gaps in knowledge in healthcare studies (Shamseer et al., 2015), and it has provided an important way for academics and practitioners to apply existing knowledge for further actions (e.g., policy implications). A systematic literature review fulfils the following: (i) it collects all possible studies related to a chosen topic, (ii) reviews and analyses the results and conclusions, and (iii) reviews both positive and negative results in a particular area (Torgerson

et al., 2003). A systematic review is replicable because of its methodical procedure (Liberati et al., 2009; Mulrow, 1994), which is a notable advantage.

2.2 Data selection

2.2.1 Search strategy

The initial searches were conducted using a broad-scale search of three main academic databases (Web of Science, Scopus, and Google Scholar),[5] focusing on studies published from January 2010 to February 2021.[6] Each of the search engines used the following Boolean search strings: 'COVID-19 pandemic', 'pandemic', 'crisis', 'air transport pandemic', 'airline recovery strategy', 'airport recovery strategy', 'airline response strategy', 'airport response strategy', 'COVID-19 and aviation', 'COVID-19 and airline', 'COVID-19 and air policies', 'SARS and aviation', 'SARS and recovery', 'SARS and pandemic', 'H1NI and aviation', 'HINI and recovery', 'HINI and pandemic', 'Ebola and aviation', 'Ebola and pandemic', or 'Ebola and recovery'.

2.2.2 Literature screening, eligibility and inclusion criteria

Once the relevant studies and documents had been identified, both from academic databases (1856 articles) and through manual collection (166 articles), the titles, abstracts and keywords were exported to Endnote for screening purposes; all duplicated publications (545 articles) were discarded before the initial screening.

The initial screening was carried out on the remaining 1477 publications (title, abstract and keywords) using three main criteria:

(i) non-peer-reviewed articles (conference proceedings, theses, consultant reports) were excluded
(ii) any unpublished articles (pre-published papers, theses, dissertations) were excluded. Only published handbooks, official reports and peer-reviewed journal articles were included
(iii) the title and abstract were used for screening, so that only studies and documents relevant to infectious disease control or pandemic measures with discussions of the air transport and tourism sectors were included

After the initial screening processes, 538 publications were assessed for eligibility by conducting a full-text review of the publications using the following criteria:

(i) the study is relevant to travel-related policies and measures of addressing pandemics
(ii) the study is related to the commercial air transport and tourism sectors

This left 159 publications to be included in the qualitative analysis (i.e. content analysis).[7]

[5] Because this study focused on analysing pandemic response policies and documents, a manual search on Google was also performed to identify relevant government reports or documents. An additional bibliographic snowball technique was used to check the reference lists for related articles.
[6] This search was conducted between November 2020 and February 2021 and was limited to English-language publications only.
[7] Contact the corresponding author for the list of 159 publications to be included in the qualitative analysis.

Further screening was conducted to identify the studies and documents to be included in the second-stage of quantitative analysis (i.e. meta-regression analysis (MRA)) using the following criteria:

(i) the study focused on the effectiveness of travel-related policies or measures for controlling and mitigating pandemics
(ii) the methodology used for the analysis was either case studies, empirical modelling or experiments. All review studies were excluded from the MRA.

Thus, this left 69 publications to be included in the MRA analysis.

2.3 Descriptive analysis

The descriptive analysis sought to investigate the overall trend in terms of how pandemics (i.e., SARS, H1N1, Ebola and COVID-19) have been studied from an air transport and tourism perspective. The study characteristics, publication types, geographical scopes, and research methods applied were analysed, revealing how the extant research on the impact of pandemics on the air transport and tourism sectors has evolved throughout the study period. The aggregated data indicated the trends of epidemics and their possible associations with the interventions, mechanisms or measures implemented.

2.3.1 Content analysis

One important objective of the literature review was to identify the research themes and focus within the selected publications (Vaismoradi et al., 2013; Zhong et al., 2015). Likewise, content analysis in this study was used to identify the impact of the pandemics on various government-level interventions and aviation measures (i.e., airport and airline measures), concentrating on each study's title, abstract and keywords. All of the 159 publications were inserted into VOS viewer software (a tool used to visualise the bibliometric network) to produce co-occurrence networks (i.e., VOS maps) of terms retrieved from the bibliographic data (the keywords provided by authors) and text data (titles and abstracts of publications) (Modak et al., 2019; Wu et al., 2020a). Two co-occurrence maps were produced for this study regarding how pandemics have affected the air transport and tourism sectors.

In addition, content analysis was used to investigate the effectiveness of travel-related policies or measures introduced by governments and relevant stakeholders (i.e., airports, airlines and health agencies) to mitigate the impacts of the pandemics. All 159 studies were imported into QRS-Nvivo software (Version 12) for thematic analysis. This study followed both inductive and deductive approaches (e.g., Creswell et al, 2011; Spasojevic et al., 2018; Thyme et al., 2013; Wu et al., 2020b). The inductive approach considers the main themes developed or identified through the initial literature review. Additional themes could be identified during the thematic analysis (deductive approach), depending on the most significant and most frequent policies implemented during the pandemics. The codes in the thematic analysis represent short phrases, the essence of an issue, or a suggestion regarding the policies or mechanisms for controlling and managing the pandemics. All the themes identified during the eligibility assessment were categorised into themes and subthemes. For example, the statement "Wearing face masks: encouraged to everybody within the airport premises. Mandatory when imposed by the airport home country in public places or means of transport" (Tabares, 2021, p.2) was

categorised under the 'Policies or Mechanisms' theme and categorised under the 'Hygienic measures' subtheme.

2.3.2 Meta-regression analysis

MRA is a statistical approach used to integrate an extensive collection of findings on a particular topic (Cho & Honorati, 2014, Elburz et al., 2017; Weichselbaumer & Winter-Ebmer, 2005). Note that meta-analyses are commonly used in the health and transport economy literature. It is an efficient method (for minimising costs and time) of understanding a specific topic and has commonly been used to aggregate the findings of clinical and medical trials (Égert & Halpern, 2006) and the air transport industry as well (Wu et al., 2020a). Furthermore, it allows a quantitative assessment of the literature from an econometric perspective (Weichselbaumer & Winter-Ebmer, 2005). In the current study, MRA was used to analyse the 69 selected studies (i.e., case studies, modelling or experiments). Previous studies on the impact of the policies and mechanisms used to mitigate and control the spread of the pandemics reported whether the outcomes were positive (effective) or negative (ineffective). Hence, a probit model was used to examine the differences in various types of policies and mechanisms. Similar analyses using a probit model may be found in previous studies (e.g., Cho & Honorati., 2014; Minviel & Latruffe, 2017; Stavropoulos & Burger, 2020; Wu et al., 2020a).

The probit model was used to examine whether the policies and mechanisms were effective. This model is specified as:

$$y^* = x_i \beta_s + \varepsilon_i,$$

where $y^*$is the outcome variable observed, x_i is a vector of explanatory variables including different pandemics (i.e., SARS, H1N1, Ebola and COVID-19) and geographical coverage, β_s d denotes the coefficients to be estimated and ε_i denotes the error term.

For estimation purposes, the explanatory variables extracted from the descriptive analysis and the content analysis of the selected publications were divided into five groups: policies and mechanisms, past pandemics, publication type, geographic areas and research methodology. All of the exploratory variables in the MRA are binary variables (values of either 1 or 0), except for the study period, which is a continuous variable. The definitions of all variables of interest in the probit model are summarized in Table 1:

Table 1

Definition of Variables in the Meta-Regression Analysis

Variables	Description
Effective travel-related policies or measures	= 1 for a positive effect on pandemic containment; 0 otherwise
Border closures or travel restrictions	= 1 if the type of mechanism is border closures or travel restrictions; 0 otherwise
Quarantine or isolation	= 1 if the type of mechanism is quarantine or isolation; 0 otherwise
Hygiene measures	= 1 if the type of mechanism is hygiene measures; 0 otherwise
Airport screening	= 1 if the type of mechanism is airport screening; 0 otherwise
Social distancing	= 1 if the type of mechanism is social distancing; 0 otherwise
Contact tracing	= 1 if the type of mechanism is contact tracing; 0 otherwise
Virus testing	= 1 if the type of mechanism is virus testing; 0 otherwise
Vaccination	= 1 if the type of mechanism is vaccination; 0 otherwise
Other (e.g., information technology innovation, travel advisory)	= 1 if the mechanism is another type; 0 otherwise
Pandemics	
COVID-19	= 1 if the pandemic is COVID-19; 0 otherwise
Ebola	= 1 if the pandemic is Ebola; 0 otherwise
H1N1	= 1 if the pandemic is H1N1; 0 otherwise
SARS	= 1 if the pandemic is SARS; 0 otherwise
Publication types	
Journal article	= 1 for a journal article; 0 otherwise
Report	= 1 for a report; 0 otherwise
Study period	= Continuous variable, the timespan of the studies
Geographical areas	
Africa	= 1 for African countries; 0 otherwise
Asia	= 1 for Asian countries; 0 otherwise
America	= 1 for American countries; 0 otherwise
Europe	= 1 for European countries; 0 otherwise
Oceania	= 1 for Oceanian countries; 0 otherwise
Other regions	= 1 for other regions; 0 otherwise
Research methods	
Empirical study	= 1 when the empirical approach was the primary method used in the study; 0 otherwise
Survey approach	= 1 when the survey approach was the primary method used in the study; 0 otherwise
Simulation/scenario approach	= 1 when a simulation or scenario was the primary method used in the study; 0 otherwise

3 Results

This section includes three parts: Section 3.1 presents a descriptive analysis of the policies and mechanisms for controlling and mitigating pandemics (2010–2021) in the aviation and tourism sectors. Section 3.2 presents the content and thematic analyses, which identify the effectiveness of the policies and mechanisms. Section 3.3 provides the results of the MRA.

3.1 Descriptive analysis

3.1.1 Characterisation of selected publications

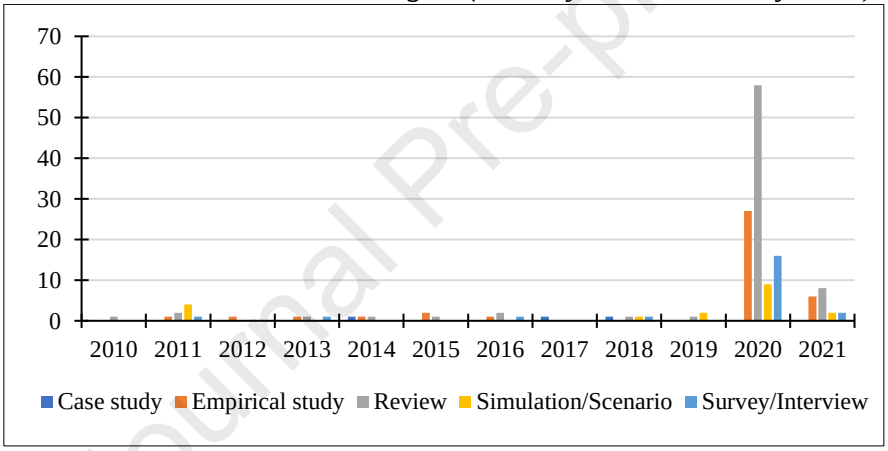
The first research question in the Introduction focuses on how the policies and measures for controlling pandemics have been studied. Figure 1 displays the number of publications and

research methodologies in aviation and tourism publications during January 2010–February 2021. The number of studies was fairly steady until a surge in 2020.[8] Apparently, studies related to the COVID-19 pandemic attracted unprecedented attention from the international research community (Hall & Studdert, 2021). Previous research highlighted that passenger travel is one of the key aspects of disease surveillance and epidemiology (Hon, 2013; Khan et al., 2009), but it had not been a priority in the tourism and aviation literature until the COVID-19 pandemic (Bajardi et al., 2011; Chen et al., 2020c).

Regarding the research methodology, different research designs and approaches have been used, including reviews (47.9%),[9] empirical studies (25.1%), surveys and interviews (13.85), simulations and scenarios (11.3%), and case study (3%). It should be noted that 30.2% of the publications used two or more research methodologies.[10] The large number of review studies reflected the need for effective measures, which called for a systematic review so that research gaps could be more clearly identified (Chetty, 2020b; Tanriverdi et al., 2020).

Figure 1

Trends in Research Methodologies (January 2010–February 2021)



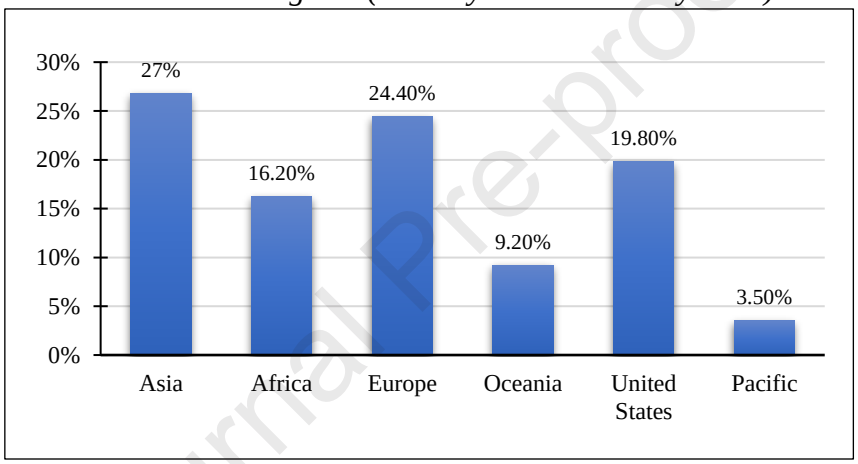
With respect to the distribution by publication type, journal articles take the biggest share (86.2%), followed by government publications and reports (11.9%), and books and other sources (1.9%). The selected journal articles were sourced from various disciplines (i.e. aviation, tourism and medical).[11] This highlighted that the research interests on pandemics and related measures are not limited to a particular discipline. Additionally, this reinforced the need for multi-faceted efforts from cross-sectional organisations (airports, airlines and healthcare) and multiple countries to manage pandemics. Many of the reports and handbooks included in this study were from specialised international agencies.[12]

[8] Contact the corresponding author for the number of aviation and tourism publications related to pandemics (January 2010–February 2021).
[9] Desktop analyses, literature reviews and descriptive analyses.
[10] These 48 publications are grouped in accordance with the primary research design used for analysis, which avoids double counting.
[11] The top three journal sources include Journal of Air Transport Management (16 articles), followed by Travel Medicine and Infectious Disease (seven articles), and Annals of Tourism Research (six articles).
[12] For example, IATA, ICAO, UNWTO, WHO, European Union Aviation Safety Administration (EASA), Civil Aviation Administration of China (CAAC), DITRDC; Federal Aviation Administration (FAA), and United Kingdom Civil Aviation Authority (UKCAA).

Figure 2 shows the geographic regions that are examined in the selected publications and the number of publications for each region: Asia (27%), European (24.4%), the U.S (19.8%), Africa (16.2%), Oceania (9.2%) and Pacific (3.5%). Most of the selected studies focused on Asia (27%) because many of the Asian economies were badly hit by previous pandemics (e.g., SARS), although COVID-19 imposed a globally devastating damage. The global geographical coverage of the selected publications shows that pandemics are not limited to any particular countries, even though they may start in specific locations. There is a lack of research on travel-related mitigation measures related to the SPR's aviation and tourism sectors. Since the SPR shares features of other developing countries that rely extensively on aviation and tourism, our study not only contributes to these SPR's two crucial sectors, but offers insights into this understudied field in general.

Figure 2

Trends in Research Regions (January 2010–February 2021)



3.1.2 Research focus

- **Past and present pandemics occurring during the study period**

For pandemic studies about the air transport and tourism sectors, the majority of the selected publications (69.9%) focused on the COVID-19 pandemic and were published in 2020 and 2021. There were limited air transport and tourism studies on other pandemics between 2010 and 2020, but presented a sharp increase in 2020 (66%) and in January–February 2021 (14%). Many of the studies were carried out shortly after a significant breakout of the disease, with only a few revisiting pandemics that took place years ago. This may not be very helpful in developing long-term strategies. Indeed, the viruses such as H1N1 virus and Ebola have been detected multiple times over the years. Even though each virus or epidemic may have some unique features, systematically reviewing the measures adopted and lessons learnt in dealing with these pandemics can be useful, so that effective control policies and measures can be identified to inflict minimum damage to the economy, especially the aviation and tourism sectors.

- **Policies and mechanisms for controlling and mitigating past pandemics**

The policies and measures considered in the selected publications are categorised into eight main groups: border closures and travel restrictions (27.4%), airport screening (12.9%), mandatory quarantine and isolation (14%), contact tracing (6.7%), social distancing (10.6%), hygiene measures (8.5%), virus testing (19%), vaccination (2.3%), and other measures (e.g., IT innovations and travel advisories for passengers). The majority of the selected publications (64.8%) focused on two or more measures and policies. During the COVID-19 outbreak, although traditional travel related-measures (e.g., border closures and travel restrictions) have been extensively used, there are concerns that they are insufficient for containing the crisis (Wenzel et al., 2020). Instead, vaccination has been regarded as the main tool in most countries, which has not been a focus in previous studies. This highlights the significant heterogeneity and complexity in pandemic control strategies and policies."

3.2 Content and thematic analyses

3.2.1 Content analysis: Network analysis with VOS viewer

Figure 3 shows the co-occurrence of words listed in the selected publications' keywords. The keywords represent the key ideas or focus of each publication as defined by the authors. VOS viewer software was used to find the minimum number of occurrences to maximise the pool of keywords used. The keywords most frequently used were "COVID-19", "coronavirus", "air travel", "crisis", "lockdown", "outbreak", "pandemics", "SARS-COV-2", "travel restrictions" and "tourism". As indicated by the colour spectrum (or the key) in Figure 3, blue represents the keywords in abstracts that are found in earlier publications (2010) and the yellow keywords are found in publications after 2020 (Wu et al., 2020a). The common measures mentioned throughout the decade include "isolation", "quarantine", "screening", "border closure" and "contact tracing", which revealed the travel-related policies and measures used over time. "Air travel" and "tourism" also share the common keyword "risk". This reflects their dual role in pandemic control: on the one hand, these sectors suffer significantly from a pandemic and thus sufficient support should be provided. On the other hand, air travel and tourism activity can facilitate the spread of a pandemic, and thus tight control is needed. A good understanding of the associated risk is of critical importance for balancing the conflicting objectives of industry support *vs*. pandemic control.

Figure 3

Co-occurrence of Words Listed in Keywords

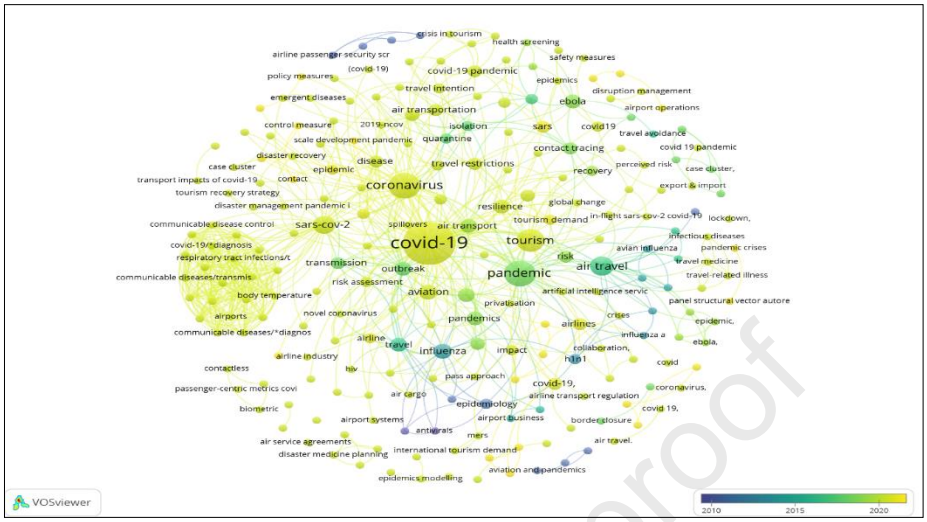
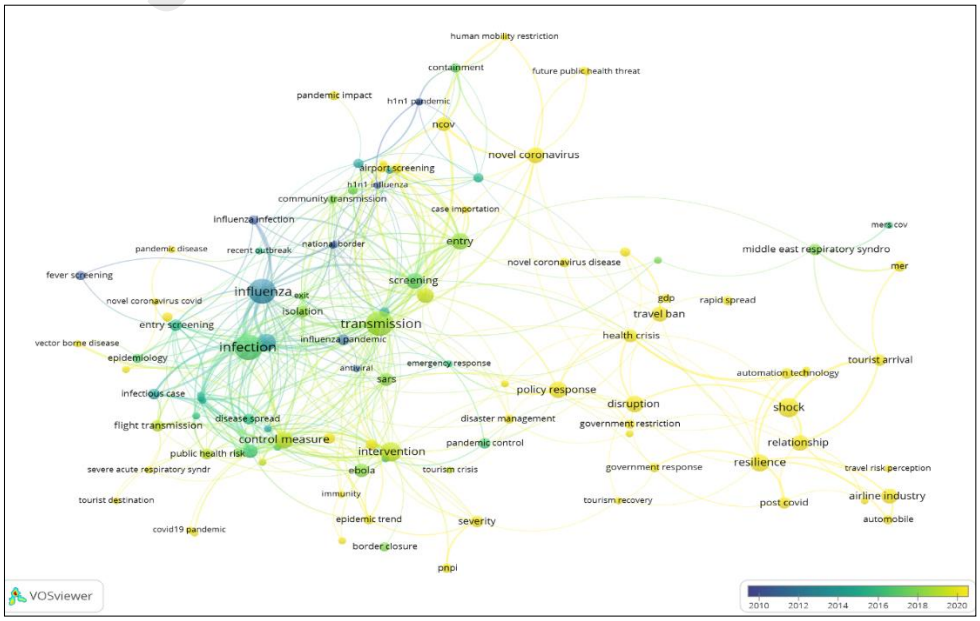


Figure 4 demonstrates the co-occurrence of words in the selected publications' titles and abstracts. The minimum number (two occurrences) and the 113 most frequently (commonly) used words were included in order to get the most results. The keywords that are the most frequently used were: "COVID-19", "coronavirus", "pandemic", "tourism", "air travel", "influenza", "risk", "recovery", "SARS-COV-2", "travel restrictions" and "tourism industry". Again, blue represents keywords that are found in the earlier selected publications (2010), and yellow represents keywords are found in the selected publications after 2020 (Wu et al., 2020a). Overall, it seems that after 2020, the issues related to "policy response" and industry performance (e.g., resilience, disruptions) received increased attention.

Figure 4

Co-occurrence of Words Listed in Titles and Abstracts



Overall, Figures 3 and 4 show that most studies and publications were seen after 2020 because of the unprecedented and prolonged COVID-19 pandemic across the globe. Importantly, these two figures also highlight policies and mechanisms implemented to control and mitigate past pandemics, as reflected by the words "travel restrictions", "border control", "policy response", "control measures", "restriction", "quarantine", "vaccine", "fever screening", "government restrictions", "travel ban", "PNPI"[13]and "isolation". This is in line with the observations in Section 3.1, namely that since 2020, there has been a substantial increase in air transport and tourism publications related to policies and mechanisms for controlling and mitigating pandemics. It should be noted that this study did not combine synonyms into one word for the analysis; for example, "COVID-19", "coronavirus" and "SARS-2" were listed as separate terms, although they all refer to the same virus. These words show how the COVID-19 virus was referred to in the early stages of the outbreak before its name was changed and confirmed by the World Health Organization (WHO) (e.g., Chen et al., 2020a; Fang et al., 2020; Haider et al., 2020; Hoque et al., 2020).[14]

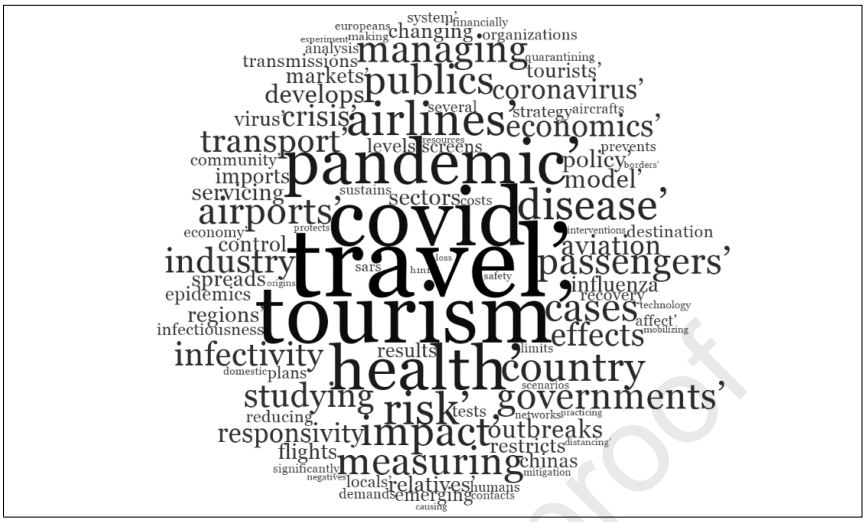
3.2.2 Content analysis: Word frequency

Figure 5 identifies the words that were the most frequently used within the selected publications. The word cloud displays the words in the list produced after arranging with a frequency of 100 or more. The size of the words that appear in Figure 5 corresponds to the frequency of the words used in the selected publications. The most frequently used words in the text, after excluding some stop words[15] and irrelevant words[16], are "travel", "tourism", "COVID", "pandemic", "government", "health", "coronavirus", "impact", "measures", "screening" and "restrictions".[17] The most frequently used words in the text are similar to those presented in Sectio3.2.

[13] Personal non-pharmaceutical interventions (social distancing, thermal body screening; hygiene measures – masks, sanitization, etc.).
[14] Contact the corresponding author for the top 20 co-occurrence in keywords, titles, and abstracts.
[15] Stop words (e.g., according", "after" and "because") are irrelevant for search purposes because they are commonly used in English publications (Banks et al., 2018). Other words such as "able" "about" were also filtered and eliminated when performing the word frequency queries.
[16] Irrelevant words represent the words that are not relevant for search purposes. This research aimed to identify travel-related mitigating measures. Hence words such as "across", "action", "arrival", "cabin" and "centre" were considered as irrelevant words and were removed when performing the frequency queries.
[17] Contact the corresponding author for the results of the 30 most frequently used words.

Figure 5

Word Cloud of the Most Frequently Used Words



3.2.3 Content and Thematic analyses

The second research question in the Introduction section focused on the impacts of pandemics on the air transport and tourism sectors, including those associated with travel-related policies and measures. Keywords such as "border closure", "quarantine or isolation", "travel restrictions or ban", "screening" and "contact tracing" are repeatedly reported in Figures 3, 4 and 5. As mentioned, the analysis started with the deductive approach, namely a content analysis of the 159 selected publications. The content and thematic analyses in this study aimed to identify the crucial policies and measures implemented by governments and stakeholders to control and mitigate pandemics. This section presents the studies and findings related to the identified themes (i.e., policies or measures for controlling and mitigating pandemics).

- **Border closures and travel restrictions**

Border closures and travel restrictions is a general measure for the pandemic. However, from the aviation perspective, a vast amount of research supported the significant role of the aviation sector as a vector for spreading infectious diseases (e.g., Abeyratne, 2006; Ali & Keil, 2006; Brownie et al., 2016; Grais et al., 2003). This notion supports the border closure and travel restriction policies implemented by governments, especially for controlling passengers and travellers originating from high-risk (infected) countries. This has commonly been an immediate response to prior and pandemics (e.g., SARS, H1N1, Ebola and COVID-19) to limit and prevent the entry of infected passengers who may transmit viruses across countries. For example, Mei and Hu (2020) highlighted that "countries such as Fiji have already started to monitor high-risk persons and strengthen the management of international borders" (p. 2).

Still, there is some debate on the effectiveness and success of border closures and travel restrictions for controlling the spread of viruses across borders (e.g., Bielecki et al., 2020; Bogoch et al., 2015; Boyd et al., 2017; Burns et al., 2020). Several researchers concurred that border closure and travel restriction policies had been effective (Bogoch et al., 2015; Burns et

al., 2020; Tuncer & Le, 2014), especially in small and isolated countries (e.g., Bielecki et al., 2020; Boyd et al., 2017; Mateus et al., 2014, Steffen, 2010). However, two studies (Chen et al., 2020b, Czerny et al., 2021) argued that such policies are only effective if applied promptly from the outset of the outbreak. Chong and Zee (2012) and Wilder-Smith (2021) suggested that these policies could not stop the virus from spreading to other countries but would be effective as a short-term measure or delaying mechanism. In another extreme, some studies suggested that border closures and travel restrictions were completely ineffective, especially considering the high implementation costs imposed on different sectors (tourism and trade) (Bajardi et al., 2011; Huizer et al., 2015; Lam et al., 2011). Overall, major concerns have been raised about the negative impacts on the aviation and tourism industries, noting the lack of empirical evidence to support the claimed effectiveness of these policies for controlling inbound virus transmission (Bogoch et al., 2015).

- **Airport screening for inbound passengers and travellers**

The airport screening policy requires passengers and travellers to undergo temperature checking on arrival, complete health declaration forms and watch for flu symptoms (e.g., Fisher et al., 2011; Gold et al., 2019; Khan et al., 2009; Priest et al., 2011). Airport screening and related procedures have been implemented worldwide as one of the default government responses to pandemics (Cowling et al., 2010). Bogoch et al. (2015) and Gold et al. (2019) pointed out the effectiveness of airport screening. Tabares (2021) also asserted that "With the detection technologies available in the 21st century, it is expected that health screening can satisfactorily replace quarantine measures" (p. 3).

However, many aviation and tourism researchers (e.g., Bielecki et al., 2021; Chung, 2015; Khan et al., 2013; Nishiura & Kamiya, 2011) argued that airport screening policies has been ineffective in the past. In particular, Steffen (2010) highlighted that "WHO explicitly states that it 'does not believe entry and exit screenings would work to reduce the spread of this disease'" (p. 182). Prior studies pointed out that airport screening allowed asymptomatic passengers to slip through (Nishiura & Kamiya, 2011; Priest et al., 2011; Tuite et al., 2019). Asymptomatic travellers might not be successfully detected, as they do not show any symptoms during the incubation period of being infected. One of the major concerns voiced by previous studies is related to the extensive resources (equipment and human resources) required, leading to inefficient and ineffective outcomes (e.g., Burns et al., 2020; Gold et al., 2019; Le et al., 2021; Zenker & Kock, 2020).

- **Quarantine and isolation for inbound passengers**

In conjunction with border closures and travel restrictions, quarantine and isolation have also been commonly used as initial responses to pandemics (Bielecki et al., 2020). Inbound passengers and travellers are required to be quarantined or isolated from the destination community for a specified period (which usually varies from 7 to 14 days). In the case of onboard quarantine, seats on aircraft are allocated to asymptomatic passengers. Additionally, passengers and travellers who may have been exposed to any infected persons during the flight will also be required to quarantine or isolate themselves after landing. Quarantining and isolation are either mandatory (as in New Zealand) or voluntary (as in Malaysia) (WHO, 2015). For example, in New Zealand, all passengers must spend 14 days in mandatory isolation quarantine (Swadi et al., 2020).

This measure is general measure implemented by government, but from the aviation perspective, academics and governments have generally accepted that quarantine and isolation policies are effective in controlling the spread of the virus (e.g., EASA, 2020b; Khan et al., 2020; Tay et al., 2020; WHO, 2015). Indeed, during the 2009 H1N1 outbreak, four Pacific Island nations could delay or prevent the inflow of the influenza virus by imposing a strict maritime quarantine upon sailors (Kool et al., 2013). On the other hand, several studies argued that quarantine and isolation measures are only effective when combined with other policies such as travel restrictions, efficient testing and contact tracing (Bielecki et al., 2020; EASA, 2020c; WHO, 2015). Extensive resources are required (e.g., human resources related to medical, service and enforcement activities, and quarantine facilities and infrastructure) for the implementation of these travel-related policies and measures. There are significant costs to passengers, aviation and tourism, and other sectors in the economy, such as trade and supply chains. Therefore, arguments have also been made that quarantine and isolation policies are ineffective for controlling and mitigating past pandemics, especially when the high associated costs are considered (e.g., Cahyanto et al., 2016; Huizer et al., 2015; Tuncer & Le, 2014; Vickerman, 2020). Some researchers have even argued that such policies devastated the aviation and tourism industries (Huizer et al., 2015; Tay et al., 2020). For example, this policy prompted airlines in the UK to take legal actions against the UK government to remove the mandatory quarantine requirements on tourists (Chen et al., 2020c).

- **Hygiene measures in airports and airline operations**

One significant risk of pandemics is that a virus can be transmitted via the air or through direct contact with infected persons or on any infected surface for a prolonged period (FAA, 2020). This discussion is related to aviation operations. Therefore, the global aviation industry has been required to enhance hygiene measures for passengers and travellers, such as wearing masks at airports and during flights, more frequent sanitisation, more frequent cleaning and disinfection of aircraft and airport facilities, and making personal protective equipment available to employees (e.g., EASA, 2020a; Organisation for Economic Co-operation Development (OECD), 2020a; Pongpirul et al., 2020; Wilder-Smith, 2021).

Most of the selected publications in our study indicated that the hygiene measures implemented by aviation operators have been effective for controlling and mitigating pandemics and virus spread (e.g., Cahyanto et al., 2016; Chen et al., 2020b, 2020c; Serrano & Kazda, 2020; Uva & Ratajczyk, 2020). One specific hygiene measurement is that "Hand hygiene…entering an airport until leaving an airport as well as continuous face coverings are key elements of preventing SARS-CoV-2 transmission" (Bielecki et al., 2020, p. 7). Again, during the H1N1 pandemic, Chou and Lu (2011) found that passengers and airline staff were satisfied with the hygiene measures implemented to control the spread of the virus. For the COVID-19 pandemic, Zenker et al. (2021) and Tuchen et al. (2020) highlighted that passengers and travellers felt more anxious about their health in response to the hygiene measures implemented by aviation operators rather than feeling safer. Masks can be controversial in certain cases, probably because they are constantly visible. For example, the EASA (2020a) stated that "the use of face masks in airports should be considered only as a complementary measure and not as a replacement for established preventive measures" (p. 23). Concerns about the high costs to the

aviation industry of implementing such measures have also been voiced (Ribeiro et al., 2020; Serrano & Kazda, 2020).

- **Contact tracing at airports and inflight**

This discussion is related to aviation operations. The air transport industry can positively contribute to safeguarding borders by identifying and detecting any infected persons through efficient and robust contact tracing systems that identify and trace infected passengers flying across international borders. Contact tracing, as implemented by airports and airlines, includes collecting passengers' details for tracing purposes, targeting infected persons or those exposed (close contact) to any infected persons and who are thus at risk of contracting the virus during the flight. This assists the later quarantine and isolation for those passengers accordingly. For example, the passengers' manifests were a crucial component for contact tracing in Australia (Draper et al., 2020). In addition, airlines and airports may collect passengers' contact and health information and pass this to the destination countries' governments, thus minimising the risk of the virus spreading across borders (EASA, 2020c).

Similar to other policies discussed above, there have been debates on the effectiveness of contact tracing (e.g., Cheng et al., 2020; Chetty et al., 2020a; FAA, 2020; Pavli et al., 2020). Aviation regulators (EASA, 2020b; FAA, 2020) have indicated that contact tracing is an effective policy for controlling the COVID-19 virus if implemented promptly at the outset of the pandemic. The EASA (2020b) suggested that "Test-Trace-and-Isolate (TTI) strategies are a useful tool to limit the spread of SARS-CoV-2" (p. 13). However, the FAA (2020) mentioned that contact tracing needs to complement other measures (e.g., quarantine, travel restrictions and testing) and needs good coordination with the relevant stakeholders. This report also mentioned that "Early case finding and rapid isolation, contact tracing…and quarantine of exposed contacts/isolation of infected persons are critical components of aggressive containment of the virus" (FAA, 2020, p. 15). On the other hand, Huizer et al. (2015) insisted that contact tracing can be ineffective because it is resource-intensive for the aviation sector and was ineffective in controlling the H1N1 virus. More importantly, Pavli et al. (2020) claimed that only limited studies have tried to examine the effectiveness of contact tracing policies for controlling and mitigating pandemics such as the COVID-19 pandemic.

- **Social distancing at airports and in-flight**

Governments worldwide have relied on social distancing to manage the risk of spreading (Fu et al., 2021). This discussion is specially related to the aviation industry. "Social distancing is at the core of crisis management" (OEDC, 2020b, p. 5). The European Commission (EC) (2020) highlighted that developing countries rely heavily on large-scale physical distancing to slow down human-to-human spread of viruses. The EC (2020) also emphasised that social distancing becomes effective when combined with other policies and hygiene measures. Wearing masks and social distancing have confirmed to be effective and powerful countermeasures.

Social distancing at airports and during flights effectively controls the spread of a virus (e.g., Abdullah et al., 2020; Chen et al., 2020a; EC, 2020; Fu et al., 2021). High-risk virus transmission is often due to close contact with infected passengers or travellers, which highlights the importance of social distancing (i.e., 1–2 m apart) at airports and in-flight. Social

distancing measures at the airport environment often involve using floor markers for queue management (check-in and waiting points) and seat arrangement at airport terminals (Abdullah et al., 2020, Khan et al., 2013; Lee, 2020). The WHO (2019) identified any passengers seated in the same row or in the adjacent two rows (front and behind) inside the cabin as close in-flight contacts. There are concerns about the difficulty and high costs of implementing a 1- to 2-m social distance at crowded airports and during flights (Airport Council International and IATA, 2020; Khan et al., 2013).

Social distancing (seat arrangement) is practised in flights by several airlines (Leitmeyer & Adlhoch, 2016). The IATA (2020) strongly opposed this policy because there is a lack of empirical evidence to support it, and the financial constraints it entails can be significant. Similarly, there is insufficient evidence to support the relationship between in-flight transmission and in-flight social distancing (e.g., Khan et al., 2013; Leitmeyer & Adlhoch., 2016; Neatherlin et al., 2013), and a simple cost-efficient strategy such as a hygiene policy (wearing masks and offering sanitisation) may suffice (Chen, 2020; Leitmeyer & Adlhoch, 2016). A more recent study provided solid evidence that in-flight virus transmission is highly possible, as shown by the transmission detected during a flight from Singapore to China (Chen et al., 2020a).

- **Virus testing for flying**

The early detection of any infection could provide information on whether a virus or other diseases are being transmitted across countries. A virus testing policy relies heavily on a reliable testing strategy for all outbound passengers and travellers before they show any symptoms (Tabares, 2021). This measure can be a general measure but this discussion is focused on the aviation sector. Infected passengers and travellers detected by the mandated virus testing are immediately isolated (WHO, 2015). Usually, virus testing for passengers and travellers is conducted before departure and upon arrival at the destination. Testing is often conducted by taking a nasal or throat swap from passengers and travellers at medical clinics or airports (EASA, 2020b). The time required for the test results varies in different countries. For example, COVID-19 test results are received within 1 hour in Moscow (Tabares, 2021), but may take weeks in the Pacific, where COVID-19 test samples are transferred to Fiji or New Zealand because local facilities are limited (Kool et al., 2013). A swab testing policy at international airports is mandatory in most countries (WHO, 2019), but is voluntary in Malaysia (Elias, 2020; Vickerman, 2020).

Virus testing policies have been effective and successful at controlling the spread of COVID-19 (OECD, 2020b; WHO, 2019). The OECD (2020b) specified that "Testing is an essential component of exit strategies from containment" (p. 34). More importantly, virus testing is an essential component of other mitigation measures, including border closures and travel restrictions, quarantine and isolation, and hygiene measures. Additionally, if testing is conducted effectively, "Testing to mitigate or replace quarantines" would be possible (Tabares, 2021, p. 2), which would benefit the tourism and airline industries. However, limited research effort has focused on the effectiveness of virus testing policies (Tabares, 2021).

- **Vaccination for passengers and travellers**

Pandemics are caused by an infectious bacterium or virus that becomes capable of spreading widely and rapidly (Wilson, 2004). A vaccination policy involves the development of antiviral drugs or vaccines to reduce the risks of being susceptible to infection and transmitting the disease in the community (Lai et al., 2021; Lim, 2006; Wilder-Smith et al., 2012). It is a general measure, but this discussion is associated with the aviation sector. In the airline industry, many airlines started to require passengers to provide evidence of being vaccinated before they were allowed to travel. For example, Australia, Denmark and Sweden have committed to implementing a 'vaccine passport' (Hall & Studdert, 2021).

It is accepted that vaccination is the most effective approach to overcome pandemics (e.g., CAAC, 2020; Chong & Zee, 2012; EASA, 2020c; Lee, 2021; WHO, 2015). Vaccination alone can effectively control and mitigate most epidemics by minimising the infection risk of a susceptible individual, thus minimising the possibility of spreading the disease across the community (Chong & Zee, 2012). However, the vaccination policy implemented by governments is considered to be a long-term strategy because the development of antiviral drugs requires high costs and an extensive time for preparation, trials and distribution. As such, there is a need for other short-term policies and measures, such as border closures and travel restrictions, hygiene measures, quarantine and isolation, social distancing and virus testing (EASA, 2020b; WHO, 2015). One main concern regarding the vaccination strategy is the lack of public acceptance, which was observed during the H1N1period (Chong & Zee, 2012). Importantly, this study found that vaccination policies were among the least examined measures by air transport and tourism researchers, possibly because of the expertise required to analyse this particular policy (Padron-Regalado, 2020).

- **Other measures (IT Innovation, travel information and advisory)**

Governments and aviation stakeholders (e.g., airport operators) have expended tremendous effort to control and mitigate the spread of COVID-19 through information technology (IT) innovations. It is a general measure, but this discussion is associated with the aviation sector. Various IT innovations have been adopted at airports, such as additional contactless or touch-free kiosks, automated self-serving facilities for various processes, electronic check-ins, modified security checks to avoid contact, and modified customs and immigration controls to avoid changing documents (Choi, 2021; Serrano & Kazda, 2020; Tabares, 2021). The US government encourages the use of IT innovations to minimise human interactions at all US airports (FAA, 2020). Travel information and advisories for passengers and travellers involve providing timely and appropriate information on new travel requirements for different cities and countries during a pandemic, such as the risk of disease, testing requirements and vaccination. In the US, the relevant aviation stakeholders are required to provide travel information in multiple languages to travellers (FAA, 2020). This ensures that all passengers and travellers are fully aware of and comply with the updated travelling requirements or choose not to travel after knowing the relevant information.

It is generally acknowledged that such measures (IT innovations, travel information and advisories) have been effective in controlling and mitigating the COVID-19 pandemic (e.g., EASA, 2020a; Serrano & Kazda, 2020; Tabares, 2021; WHO, 2019). Serrano and Kazda (2020) commented that technology is, as of now, the main driver for ensuring that the safety objectives can be achieved, and that touchless travel can be offered to passengers at airports.

With regards to travel information and advisories for passengers and travellers, the WHO also encourages health professionals to provide relevant information on the pandemic to the public, as practiced in Africa (Gilbert et al., 2020) and India (Kumar, 2020). In the US, pandemic information is also shared between aviation employees and passengers (FAA, 2020). During the pre-COVID-19 era, Huizer et al. (2015) found that travel advisories were ineffective in controlling and mitigating the spread of a virus. This argument has not been widely accepted. Surprisingly, despite their increasing use, IT innovations and travel information and advisories have not been thoroughly examined in the literature compared with the other policies and measures discussed above.

3.3 Meta-analysis

All the selected 159 publications were used in the descriptive analysis, and the content and thematic analyses to maximize the literature coverage. In the subsequent MRA analysis, 69 publications produced 613 observations regarding the effectiveness of travel-related policies and measures for controlling and mitigating the impacts of the pandemics (see the selection process in Section 2.2). For estimation purposes, some travel-related policies or measures implemented were grouped according to similarities in their characteristics, as reported in Table 2.

Table 2

Definitions and Grouping of Policies and Measures Used in Past Pandemics

Policies and measures	Definition	Examples
Border closures	Governments close borders against entry into domestic or international cities	The New Zealand government completely closed its borders in March 2020
Travel restrictions	Governments restrict any international travellers from entering their countries	The Malaysian government has restricted any international travellers entering the country since 2020
Hygiene measures	Governments require passengers and travellers to wear masks, along with the sanitation and extra cleaning regimes for airports and airlines	Inbound travellers to Australia were required to wear masks, along with restriction of in-flight passenger movements and pre-packaged sanitation packages for travellers
Airport screening	Screening of inbound passengers' temperature on arrival or departure at airports	The South Korean government implemented the health declaration forms and thermal camera scanning for inbound passengers arriving at international airports in 2012
Quarantine or isolation	Passengers are required to quarantine or be isolated at a specified location for a specified period (e.g., 14 days) upon arrival	Taiwan's government has imposed mandatory home isolation or hotel quarantine for 14 days since April 2020
Vaccination	Passengers are required to be vaccinated before travel (confirmation of vaccination)	The governments of Australia, Denmark and Sweden require all travellers to provide vaccination immunity passports for entry to start in 2021
Virus testing	Passengers required to provide confirmation of negative test results before travelling	Virus testing was conducted at Taiwanese international airport in 2020
Contact tracing	Governments require airlines and airports to trace the movements of arriving passengers or record inbound passengers' contact details	Vietnam's government considered inbound passengers flying on the same flights as primary contacts in 2020. All passengers were required to self-isolate and quarantine, as one of the passengers being tested positive for COVID-19
Social distancing	International travellers must keep 1–2 m apart from other passengers (at airports and inside aircraft).	European airlines were encouraged to adhere to social distancing measures during the flight (to the extent possible) in 2020
Other	IT innovations and travel information and advisory	Spanish airports modernised their airport operations (e.g., digital identification, video analytics, remote control towers) to limit human-to-human interactions in 2020
Grouping		
Border control and travel restrictions	Border control and travel restrictions	Refer to the examples mentioned above
Vaccination and virus testing	Vaccination and virus testing	Refer to the examples mentioned above

Table 3 shows the estimation results of the probit model for determining (probability) of the effectiveness[18] of the travel-related policies and measures studied in prior publications for controlling and mitigating different pandemics.

[18] The definition of the effectiveness of particular policies or measures mentioned in the selected publications are based on the interpretation of empirical results of the selected publications as specified in the methodology section. Previous studies reported the impacts of policies and measures used to control and mitigate the spread of the pandemics with the outcomes were positive (effective) or negative (ineffective). The policies or measures implemented are considered as effective or ineffective as per the empirical results from the selected publication included in the study.

Table 3

Estimation Results of the Probit Model

Dependent variable = *Effectiveness of policies and measures*		
Explanatory variables	**Coefficients**	**Robust standard error**
Policies and mechanisms		
Border closures and travel restrictions	0.322**	0.184
Hygiene measures	1.696 ***	0.585
Quarantine or isolation	0.824**	0.317
Social distancing	0.647	0.347
Contact tracing	0.858**	0.334
Vaccination and virus testing	0.712**	0.315
Others	0.555	0.337
Pandemics		
COVID-19	1.065**	0.221
H1N1	-0.632***	0.281
SARS	0.676**	0.330
Geographic regions		
Africa	1.358***	0.402
America	1.121***	0.347
Asia	0.784**	0.367
Europe	0.976 ***	0.360
Oceania	1.342***	0.394
Research methodology		
Empirical study	-0.335	0.239
Simulations and scenario	0.631**	0.315
Study characteristics		
Journal publications	-1.189	0.315
Study year		
Study period	-0.043***	0.009
Constant	0.530	0.889
Observations	613	
Pseudo-R^2	0.402	

Remarks: *, ** and *** indicate that the explanatory variable is statistically significant at 10%, 5% and 1% levels, respectively. Twelve observations were omitted because of collinearity.

As mentioned earlier, the dependent variable was a binary variable, taking a value of 1 if a study suggested that the travel-related policies and measures could effectively control and mitigate the impacts of the pandemics, and 0 otherwise. All policies and measures discussed above were included as explanatory variables, except for airport screening, which was used as the reference. A significant positive coefficient estimate indicated that there is a higher likelihood (i.e., a higher chance or frequency) that a prior study found that an explanatory variable (a particular policy or measure) effectively controlled and mitigated past pandemics compared with the base line reference (i.e., airport screening). Conversely, a significant negative coefficient indicated that compared with airport screening, the explanatory variable was less likely to be identified as effective by a prior study. Therefore, the regression analysis revealed the effectiveness of travel-related policies and measures found in prior publications. For example, if the coefficient estimates are statistically significant and positive at either the 1% or 5% level, this suggests that prior publications provide more support for the effectiveness

of the policies and measures for tackling past pandemics, compared with airport screening (the reference measure in the model)[19]. As reported in Table 3, hygiene measures were most frequently identified as being effective by previous studies, followed by, in decreasing frequency, contact tracing, quarantine or isolation, vaccination and virus testing, and border closures or travel restrictions. Social distancing and other measures (e.g., IT innovations) were positive but not statistically significant. In other words, although previous studies tended to regard them as more effective than airport screening, there were quite some mixed views. For example, the positive but insignificant estimate of "social distancing" suggests that although some studies recommended social distancing, there are still significant reservations about its actual effectiveness.

Another result of the probit model relates to the effectiveness in controlling and mitigating past pandemics and/or viruses, including SARS, Ebola, HINI and COVID-19. This study found that the COVID-19 and SARS pandemics had statistically significant and positive coefficient estimates at the 5% statistical level, and HINI had a significant negative coefficient estimate at the 1% statistical level, compared with Ebola (the omitted variable in the models, which served as the reference base). These findings indicate that previous publications more frequently provided positive views on the policies and measures against COVID-19 and SARS, but tended to be less satisfactory about the policies and measures for stopping the spread of the H1N1 virus.

Geographic regions were also controlled for in the model, with "other regions" used as the reference base (i.e., the omitted variable). Interestingly, previous studies were more likely to provide positive comments on the policies and measures in Africa and Oceania, followed by America, Europe and Asia. This ranking is not entirely consistent with each region's performance during the COVID-19 pandemic, because the estimation includes all previous pandemics in the past two decades. This highlights the significant heterogeneity of pandemics, and should warn governments that past experiences do not ensure future success in pandemic control.

Research methodology variables were also included, with "case study" serving as the reference base (the omitted variable). The significant positive coefficient of simulations and scenarios suggests that prior research using this method were more likely to find policies and measures to be effective compared with case studies and empirical studies. Since the latter are more directly based on reality, this suggests to researchers that careful validation and model calibration are needed in pandemic control studies.

Study characteristics included journal publications and other types of publications (the omitted variable or reference). The negative but insignificant coefficient of journal publications suggests that academic researchers tended to be more conservative than government agencies and industrial organisations, although this difference was not statistically significant. The study period variable was significant negative, which indicates that prior studies that included a

[19] The choice of airport screening as the base model for the travel-related policies group was found to be ineffective (Bielecki et al., 2021; Chung, 2015). Asymptomatic passengers might not be successfully detected, as they do not show any symptoms during the incubation period of being infected (Nishiura & Kamiya, 2011). This implies that the airport screening is less important for controlling and mitigating past pandemics in comparison with other travel-related policies and measures identified.

longer period had a lower chance of finding the policies and measures to be successful at dealing with past pandemics.

Overall, the likelihood of the effectiveness of the travel-related policies and measures for controlling and mitigating past and current pandemics that were examined in prior articles was quite sensitive to the types of policies and measures implemented, the pandemic types involved, the geographic regions being studied, the research methodology used and the study periods. Specifically, the likelihood of attaining results that are relevant to the outcome of effective of control and mitigation of past and current pandemics can be affected by (1) the implementation of border closures and travel restrictions, hygiene measures, quarantine or isolation, contact tracing and biomedical measures; (2) the COVID-19, H1N1 and SARS pandemics; (3) pandemic control in Asia, Africa, Europe, Oceania and America; (4) and applied simulation and scenario analyses. The prior publications' findings of the effectiveness of policies and measures in controlling and mitigating past pandemics can be lessons to be learnt for addressing future pandemics in the SPR

4 Discussions and policy implications for the SPR's aviation and tourism industries

One of the key objectives of this study was to identify the lessons learnt from past studies, and thus to enable SPR countries to cope with current and future pandemics. The analysis results provide the foundations for the proposed policies and strategies for the SPR to address future pandemics. For example, the descriptive analysis of the selected publications suggested the various travel-related policies and measures were widely researched in many regions and countries, and that highlighted the lack of research and focus on the SPR region. The content and thematic analyses also showed the determinants that contributed to the effectiveness of travel-related policies and measures, such as timelines of implementing of travel restrictions and border control, the effectiveness of social distancing, etc). These findings are important and useful information for the proposed policies and strategies for the SPR being discussed this section. The unique characteristics of the SPR (geographic isolation, lower economies, small population sizes and extensive spread across the Pacific Ocean) will be considered for providing policy and operational recommendations.

4.1 Short-term strategies: Travel-related policies and measures

Prior studies suggested that travel-related policies and measures were effective short-term strategies, including border closures and travel restrictions, quarantine or isolation, hygiene measures, social distancing, virus testing and contact tracing (e.g., Chong & Zee, 2012; FAA, 2020; Gwee et al., 2021; Wilder-Smith & Freedman, 2020). Although the SPR is geographically isolated, it is still vulnerable to pandemic risks, as witnessed during the 1918–1919 influenza, H1N1 and COVID-19 pandemics (e.g., Craig et al., 2020; Dean, 2020; Eichner et al., 2020; Grydehøj et al., 2020; McLeod et al., 2008; Shanks, 2016; Xu et al., 2018). Although the 15 SPR countries implemented almost all of the above discussed policies and measures during the COVID-19 outbreak, as of September 2021, most SPR countries still have COVID-19 cases, except for the Cook Islands, Kiribati, Nauru, Niue, Tokelau, Tonga, and Tuvalu. Therefore, SPR policymakers and stakeholders, such as the civil aviation authorities

and aviation operators (airports and airlines), should recognise that travel-related policies and measures only delay the inevitable or provide a "time buffer". Because SPR countries have inadequate medical infrastructures (e.g., limited hospital beds and capacity and inadequate virus testing facilities) (Horwood et al., 2019; Mei & Hu, 2020), limited airport infrastructure capacity (e.g., limited space for airport screening and social distancing at airports) (Miles & Marchi, 2020) and outdated IT infrastructure at airports (e.g., no self-check-in kiosks at SPR airports) (Miles & Marchi, 2020), SPR countries have to utilize the time buffer for preparation purposes (e.g., securing the stock of medical supplies, and providing updated training or briefing to medical and operation teams).

Moreover, travel-related policies and measures disrupt the operation of the aviation and tourism sectors and, ultimately, economic development across countries, because the aviation sector is of critical importance to many sectors, including tourism, trade and logistics (Gong et al., 2018; Tsui et al., 2021a, 2021b; Fu et al., 2021). It is apparent that border closures and travel restrictions, and quarantine or isolation policies have had a catastrophic economic impact on SPR countries (Horwood et al., 2019; Pacific Region Infrastructure Facility (PRIF), 2021; South Pacific Tourism Organisation (SPTO), 2020) because the SPR's economies are heavily dependent on tourism revenues, including the Cook Islands (87% of GDP), Vanuatu and Samoa (47% of GDP), and Fiji (38% of GDP). Therefore, the SPR's governments could seriously consider and follow the travel-related policies and measures adopted by New Zealand (which is also a tourism-oriented and geographically isolated nation), where COVID-19-related strategies were effective. The practices adopted in New Zealand included a timely border closure, compulsory quarantine and isolation of inbound passengers, strict hygiene measures, virus testing, social distancing, contact tracing and airport screening since February 2020 (Huang et al., 2020; Summers et al., 2020a). As a result, New Zealand (partly) resumed international tourism by establishing 'travel bubbles' between New Zealand and Australian cities in late 2020, followed by agreements with the Cook Islands and Niue in mid-2021. Additionally, the SPR's policymakers should also consider the largely successful strategies adopted by Taiwan (also an island economy), notably early border control and travel restrictions, airport screening and quarantine (14 days), contact tracing, social distancing, hygiene measures, technology and transparency (e.g., Chen, 2020; Hsieh et al., 2021; Huang et al., 2020; Gwee et al., 2021; Wang et al., 2020a). Importantly, Taiwan's approach seemed to be less intrusive than that of other countries, as mass lockdowns and closure of schools and organisations were not widely used.

4.2 Long-term strategy: appropriate vaccination legislation framework

Many studies argued that vaccination is the most effective long-term pandemic control measure (e.g., CAAC, 2020; Daou, 2021; Lee, 2021; Lee & Sibley, 2020). In response to the COVID-19 outbreak, the Emergency Use Listing (WHO, 2021) approved 13 different vaccinations against the COVID-19 virus, including the Pfizer/BioNTech Comirnaty vaccine (listed December 2020), the SII/Covishield and AstraZeneca/AZD1222 vaccines (listed February 2021), Janssen/Ad26.COV 2.S (listed March 2021), the Moderna COVID-19 vaccine (listed April 2021), the Sinopharm COVID-19 vaccine (listed May 2021) and Sinovac-CoronaVac (listed June 2021). In light of the recent COVID-19 variants (Delta, Delta plus, Omicron variants). Preliminary assessments of vaccine effectiveness have supported the notion that most vaccines stimulate sufficient immunity against most variants, although further studies are still

required (WHO, 2021). Vaccine approval procedures (i.e., vaccine development, testing and approval) are often time-consuming and costly. Vaccine development may take up to 10 years (EC, 2020). Given the formidable and unprecedented impact of the COVID-19 pandemic, experts aimed to provide widespread access to vaccines within 12 to 24 months (e.g., Elias, 2020; IATA, 2020; Movsisyan et al., 2021; WHO, 2021). For instance, the Pfizer/BioNTech vaccine was developed within 12 months (March–December 2020) (Centre for Disease Control and Prevention, 2021; Re et al., 2021). However, such speed may not always be possible in future pandemics.

Studies also supported the notion that access to the vaccine was the critical milestone for the resumption of air transport and tourism activities (e.g., CAAC, 2020; Hall & Studdert, 2021; IATA, 2021; Movsisyan et al., 2021). The IATA (2021) launched the 'IATA travel pass' initiative (vaccine travel passport) to facilitate the resumption of international air travel and tourism (without a quarantine). Such an initiative will ensure that the governments are confident that the risk of importing COVID-19 is mitigated by allowing only vaccinated passengers to visit. Several airlines (e.g., Air New Zealand, British Airways, Etihad, Emirates, Korean Air, Qantas, Jetstar, Singapore Airlines and Sri Lankan Airlines) have implemented or agreed to trial the 'travel pass' initiatives (IATA, 2021; Lee & Sibley, 2020; Movsisyan et al., 2021). In addition, Singapore Airlines also established a vaccinated travel lane for France, Italy, South Korea, the UK, and the USA.

In light of the dependence of the SPR countries on aviation and tourism, policymakers in the region, together with the executives of aviation and tourism operators, should consider and prioritise the 'travel pass' initiative as a recovery pathway. In addition, the high level of vaccine hesitancy (Chakraborty et al., 2021; Huh & Dubey, 2021) and a lack of access to vaccines are evident and problematic within the SPR (Pacific Region Infrastructure Facility, 2021). Furthermore, the strong opposition to COVID-19 vaccination by many church leaders (influential figures within the SPR) (Lee & Sibley, 2020; Seal, 2021), the rapid misinformed news cycle (e.g., Abbas et al., 2021; Chand, 2021; Huh & Dubey, 2021; Kant et al., 2021; Lazarus et al., 2021) and limited access to vaccines (PRIF, 2021; Wilson et al., 2020) may all negatively influence vaccination schemes within the SRP. Therefore, SPR policymakers may consider some of the other regions' successful strategies for gaining public trust in the vaccination roll-out through robust, continual and coordinated vaccination campaign awareness (e.g., discussions on in the case of Taiwan as reported by Huh and Dubey (2021), Kuo (2021) and Summers et al. (2020a)). It may also be helpful to establish an appropriate legislative framework and policies for health to enable effective vaccination roll-out (Movsisyan et al., 2021; Summers et al., 2020b).

4.3 A risk-based approach to tackling the pandemics

The literature supports the risk-based approach to tackling the pandemics (e.g., EASA, 2020a; FAA 2020; ICAO, 2020; Patel & Sridhar, 2020). The risk-based approach supports adjustment of the mitigation measures based on geographical differences and pandemic stages and the associated risks of spreading the virus. For example, Taiwan is geographically closer to the COVID-19 outbreak's epicentre in Hubei, in China. A stringent border closure policy was immediately imposed on passengers originating from China, and airport screening was introduced in December 2019. Asymptomatic passengers were required to finish quarantine or

home isolation in January 2020; this was extended to all passengers in February 2020 (Lee & Sibley, 2020, Summers et al., 2020a). New Zealand, which is geographically far away from the COVID-19 outbreak, responded by banning travellers from mainland China in February 2020 in the onset of the COVID-19 outbreak and conducted airport screening of passengers from high-risk regions (e.g., China, Hong Kong, Japan, Singapore, and Thailand) in February 2020, and ordering passengers from overseas to self-isolate for 14 days in March 2020. Importantly, Taiwan established a three-level approach,[20] and New Zealand established a four-level alert system[21] to mitigate the risks of COVID-19 spreading across their borders. These risk-based approaches recognised that resorting to stringent measures in early stages are necessary if the risk of spreading the virus is high. Such a risk-based approach will provide a more cost-effective approach to control and mitigate the adverse negative impacts of pandemics (e.g., Christidis & Christodoulou, 2020; Jamal & Budke, 2020; Macilree & Duval, 2020; Rahman et al., 2020). For example, Taiwan's risk-based approach has contained a large COVID-19 outbreak (550 cases and seven deaths) while sustaining its net GDP compared with the losses made by other countries such as New Zealand, Italy, and the US (International Monetary Fund, 2020; Lee & Sibley, 2020; Patel & Sridhar, 2020).

In contrast to a risk-based strategy, a few regions, such as China, Vietnam, and Hong Kong, have effectively implemented a "zero COVID" strategy. Australia and New Zealand imposed very strict control in the early days, but after some outbreaks and especially after the availability of vaccines, they joined most countries in adopting the "live with COVID" strategy. As of the year end in 2021, mainland China remains the only large economy still pursuing the "zero COVID" target. In terms of COVID-19 infection and death numbers, mainland China probably performed the best in terms of pandemic control outcomes (i.e., infection cases and the number of deaths) among the world's large economies after the major outbreak in Hubei. However, this came at very high social costs and medical inputs, and passenger flows to and from China has been restricted to minimum levels (Czerny et al., 2021). Many have also argued that it is extremely difficult, if not impossible, for other countries to adopt some of the restrictive measures (e.g., compulsory contact tracing, virus testing and vaccination requirements).[22] Mainland China government agencies insist that the "zero COVID" strategy has been the best choice which has allowed the country to largely maintain normal life and economic activity; otherwise, as it is the world's largest population but limited medical resources per capita, the "live with COVID" strategy would have brought disaster to the country. We have not seen a

[20] Taiwan adopted a three-level approach: (1) Watch (remember to follow usual precautions), (2) Alert (strengthen early warning) and (3) Warning (avoid nonessential travel) (Taiwan Central Epidemic Command Centre, 2021; Summers et al., 2020a).

[21] New Zealand adopted a four-level alert system: Level 1 – Border restrictions for non-NZ citizens and permanent residents. All passengers (irrespective of origin or symptomology) are required to go into managed isolation and quarantine for 14 days (except for travel bubbles); no lockdown. Level 2 – Border restrictions for non-NZ citizens and permanent residents. All passengers (irrespective of origin or symptomology) are required to go into managed isolation and quarantine for 14 days (except for travel bubbles). Lockdown lifted with hygiene measures. Level 3 – Border restrictions for non-NZ citizens and permanent residents. All passengers (irrespective of origin or symptomology) are required to go into managed isolation and quarantine for 14 days. Partial lockdown (travel is restricted during Level 3). Level 4 – Border restrictions for non-NZ citizens and permanent residents. All passengers (irrespective of origin or symptomology) are required to go into managed isolation and quarantine for 14 days. Full lockdown (Unite Against COVID-19, 2021; Summers et al., 2020a).

[22] Although compulsory vaccination policies were also imposed in some other countries, they are often restricted to special groups (e.g., airport employees, civil servants etc.). In mainland China, vaccination requirements have been imposed on many more sectors, if not universally.

systematic comparison between the "zero COVID" strategy *vs*. "live with COVID" strategy, which would be of great academic and practical value. It also remains to be seen how long China can continue with such a strategy, especially since the long-awaited vaccines have become available.

The unprecedented impact of COVID-19 arguably revealed gaps within the SPR's health sector and their ineffective pandemic control policies. Because the region has high dependence on international business and passenger flows, but has quite limited resources (e.g., funds, human resources and medical infrastructure), a risk-based approach is likely to be the best choice. However, there is no report of any risk-based approach or strategies for addressing health crises and pandemics within the SPR. Most SPR countries merely imposed stringent border closures, travel restrictions and lockdowns while awaiting vaccines to be delivered. Although the SPR is geographically isolated, the possible severe impacts of future pandemics on the SPR are likely to be higher than those on developed countries such as Australia, New Zealand, and the US. First, the SPR population has a higher level of underlying health conditions (e.g., high blood pressure, obesity, diabetes, and cancer) which suggests that future pandemics will have a devastating impact (e.g., Baker et al., 2012; Horwood et al., 2019; Kool et al., 2013; Mei & Hu, 2020). The WHO (2021) reported that Fiji recorded 44,745 confirmed COVID-19 cases and 631 deaths (78% with underlying health conditions) in the 5-month period of March–September 2021, compared with New Zealand, which, over 19 months (February 2020–September 2021), only recorded 2,871 COVID-19 cases and 26 deaths. It is thus appropriate for the SPR to implement stringent measures (e.g., border closures and travel restrictions coupled with quarantine and isolation, social distancing, vaccination, effective virus testing and contact tracing) until a comprehensive risk-based approach is established.

4.4 Coordination and collaboration among sectors and regions

Effective implementation of travel-related policies and measures for controlling and mitigating past pandemics is heavily reliant on holistic coordination and collaboration across government agencies and industrial sectors in multiple countries (e.g., Belhadi et al., 2021; Gilbert et al., 2020; Paraschi et al., 2020; Sheller, 2021). Therefore, public health crises, including pandemics, require a holistic or whole nation approach. This involves government departments (e.g., health departments, civil aviation authorities, and border agencies such as customs, immigration and quarantine) and industries (airlines, airports, quarantine hotels, bus or taxi operators, and inbound passengers), so that streamlined implementation of travel-related policies and measures can successfully tackle the spread of the virus (IATA, 2020; ICAO, 2020; Rahman et al., 2020). For instance, Hsieh et al. (2021) praised the implementation of travel-related policies and measures for the COVID-19 pandemic in Taiwan, which was executed by Taiwan's National Epidemic Prevention Team (NEPT), including central and local governments, private organisations, and local citizens, which was led by the Central Epidemic Command Centre (CECC) with clear communication among all parties. There was also cooperation between Taiwan's NEPT and CECC, which formulated and amended travel-related policies and measures, with input from local residents (who suggested quarantine taxi services for inbound passengers to their designated quarantine facilities).[23] The SPR is yet to

[23] Taiwan experienced some significant challenges amid the COVID-19 outbreaks in mid-2021 (see, for example, https://www.reuters.com/world/asia-pacific/taiwan-scrambles-vaccines-domestic-covid-19-cases-rise-2021-05-

develop good collaboration and coordination, and there is no evidence of any comprehensive crisis management plans to address pandemics within the SPR (Douglas et al., 2020). For instance, Fiji's National Disaster Management Plan does not include any specific response to pandemics (Fiji National Disaster Management Council, 1995). The SPR's governments may consider the effective strategies used by the NEPT and CECC in Taiwan, such as coordination and open communication among stakeholders for managing the COVID-19 pandemic.

Furthermore, research has supported the idea that intergovernmental coordination and collaboration need to extend to regional and international regimes as a pandemic becomes a global crisis (e.g., EASA, 2020a; Gossling et al., 2020; Macilree & Duval, 2020; Paraschi, 2020). As mentioned, travel-related policies and measures aim to mitigate the risk of the virus spreading across countries (Gossling et al., 2020; Gwee et al., 2021). Hence, good coordination and collaboration is important, which often call for the sharing of information between national departments across countries (e.g., EASA, 2020b; Gilbert et al., 2020; Rahman et al., 2020; Sheller, 2021). For example, all member countries of the OECD are urged to coordinate, collaborate and share information regarding their respective travel-related strategies for stopping the spread of COVID-19, such as border closures and reopening, containment measures and existing strategies (OECD, 2020c).

Additionally, the SPRs' governments may consider devising a more integrated approach to disaster management in case of future pandemics. The recent increased frequency, scale and complexities of disasters (e.g., tropical cyclones) and pandemics within the SPR highlight the need for close coordination and collaboration among the SPR countries. For instance, four Pacific countries (e.g., Fiji, the Solomon Islands, Tonga, and Vanuatu) were devastated by the Tropical Cyclone Harold (Category 4) in April 2020 as the COVID-19 pandemic emerged within the SPR (Mei & Hu, 2020; Paraschi, 2020). The current Pacific Islands Emergency Management Alliance project for the SPR aims to strengthen the Pacific Islands' preparedness and responses, and recovery from emergencies and disasters. However, there is still a clear lack of regional platforms for sharing, coordinating and collaborating on relevant disaster information within the SPR (South Pacific Commission, 2021). Cooperation among stakeholders and sometimes even competitors has been increasingly studied in the disaster prevention and mitigation literature in recent years, notably regarding climate change-related disasters (Zheng et al., 2019, 2021). These studies suggest that it is often in all stakeholders' interests to cooperate in efforts such as disaster prevention and pollution control, even if some stakeholders have conflicting interests (Homsombat et al., 2014). Pandemic control is important to all countries. An integrated approach would provide the SPR with a more effective and efficient approach to controlling and mitigating the spread of any pandemics and other disasters, and it could be led by regional organisations such as the Pacific Island Forums or the South Pacific Commission.

4.5 Recovery for the post-pandemic era: Tourists' behavioural change

Travel-related policies and measures could have adverse impacts on the air transport and tourism industries, as well as affecting tourist behaviour (e.g., Chen et al., 2020c; Ilgaz et al., 2021; Tsui et al., 2021a; Škare et al., 2021; Yan et al., 2021; Zhang et al., 2021, 2020a). The

17/) but managed to contain the outbreaks through increased vaccination rates. Some concerns remain over its locally produced vaccine (see, for example, https://www.taiwannews.com.tw/en/news/4325662)

reduction in tourist flows during the COVID-19 outbreak was mainly caused by border closures and travel restrictions imposed by governments (Lai et al., 2021; Ilgaz et al., 2021; Liu et al., 2021), and the hygiene measures and social distancing measures imposed by airports and airlines, which induced passenger's travel anxiety (Chen et al., 2020a; Donaire et al., 2021). However, travel anxiety can be overcome by ongoing campaigns and updated information on the effectiveness of travel-related policies and measures (Donaire et al., 2021). Apparently, tourist demand reduction is primarily caused by pandemics or disease avoidance by travellers and their confidence about air travel, regardless of the travel-related policies and measures implemented (IATA, 2020; Kock et al., 2020).

Additionally, lockdowns forced people to work from home and they are now accustomed to online business meetings (e.g., Zoom meetings and online conferences) (Hensher et al., 2021; Kock et al., 2020). Specifically, business travel demand decreased during the pandemic (Kock et al., 2020; Wachyuni & Kusumaningrum, 2020). Therefore, international aviation and tourism operators (including those in the SPR) should embrace the 'new normal' during and after the pandemic and identify opportunities for aviation and tourism operators to adapt and transform their business models (Czerny et al., 2021; Beck & Hensher, 2020). Finally, it is worth noting that most tourists are likely to or be willing to travel after the pandemic, including millennial tourists (Donaire et al., 2021; Kusumaningrum & Wachyuni, 2020) and aged passengers (Graham et al., 2020). It may be very helpful for governments and airports to provide incentive programmes to the airline industry to lower their operation costs. Such measures will be particularly attractive to the low-cost carriers serving many price-sensitive leisure travellers, because they are very sensitive to input costs (e.g., Chung & Whang 2011; Dresner et al., 1996; Fu et al., 2006, 2015; Wang et al., 2017, 2020c). Even under normal market conditions, regional markets and small economies such as those of the SPR need to work hard to promote air connectivity and aviation services (Wang et al., 2020b; Zhang et al., 2017). Extra effort is needed for recovery from pandemics.

Travellers' reactions and travel intentions regarding the SPR during the COVID-19 era and post-COVID-19 era have not been empirically examined by prior studies. However, the SPR's governments and aviation and tourism decision-makers may learn from international travel and tourism changes in other countries. Therefore, the SPR's governments should effectively collaborate with aviation and tourism stakeholders to adapt or transform strategies for the recovery of the aviation and tourism industries in the SPR. The good examples of Macau and Taiwan may serve as useful references by the SPR governments (Lin et al., 2020; Yeh, 2021). Both Asian economies quickly recovered their international tourism demands by focusing on the short-haul Asian markets (Japan, South Korea and Malaysia), with well-planned safety campaigns and flexible 'travel bubbles' policies being implemented (Yeh, 2021). In addition, the SPR's airlines may consider strengthening and improving their domestic and intra-regional air routes and connectivity through government support and financial aid once the COVID-19 pandemic is finally eradicated.

4.6 Importance of government subsidies for air transport, aviation and tourism

The worldwide air transport and tourism sectors are among all the sectors that suffered the most devastating impact in past and current pandemics (e.g., Ali & Keil, 2006; Bogoch et al., 2015;

Le et al., 2021; Zenker & Kock, 2020). Air transport operators, such as airlines, airports, tourism operators and the hospitality industry, have been experiencing significant financial distress because of border closures and travel restrictions, and mandatory quarantine and isolation during the COVID-19 era (Chinazzi et al., 2020; Ying et al., 2021). Hence, governments in many countries tried to support and subsidise their aviation and tourism-related operators to assist their recovery, which is a vital component for stabilizing supply chains and stimulating economic development (e.g., Abate et al., 2020; Elias, 2020; Li, 2021; Suau-Sanchez et al., 2020; Yeh, 2021). For example, for tackling the impacts of the COVID-19 outbreak, US airlines received more than US$80 billion in financial aid from the US government in 2020. In addition, the Taiwanese government provided NT$105 trillion to airlines, hotels and travel agencies (Wu et al., 2021).[24] In addition, the substantial costs of travel-related policies and measures (e.g., hygiene measures such as masks, sanitization, extra cleaning regimes, and social distancing) are financially supported by the government in many countries (Li, 2021; Wu et al., 2021).

Aviation and tourism are critical for the economic development of the SPR (Ali et al., 2020; Salesi et al., 2021). Hence, government support or subsidies for these two pillar sectors in the SPR should be prioritised in their pandemic control and recovery plans (Miles & Marchi, 2020; Singh et al., 2021). The SPR's governments often encounter the problem of insufficient funds but, have in some cases, relied on foreign aid donors or international institutions for providing support to these industries. For example, financial support for tourism-related businesses in some SPR countries (e.g., Fiji, Samoa, Niue, Tonga and Vanuatu) has provided by international institutions and governments, such as the Asian Development Bank, the World Bank, and the governments of Australia, China and New Zealand (PRIF, 2021; SPTO, 2020). Similarly, the New Zealand government has also funded upgrades of the immigration and ticketing counters and kiosks at Niue Airport (Miles & Marchi, 2020). Importantly, governments in the SPR should encourage their national and regional carriers to operate more intra-SPR routes (especially among COVID-19 free countries) and attract more international airlines to increase flight connectivity to the SPR regions through effective subsidisation policies and schemes. For example, the government of New Zealand provided NZ$9.1 million to the PASO, the regional safety oversight organisation for the Pacific, to improve the Pacific's aviation safety and security, leading to better connectivity and enabling regional economic development and prosperity (PASO, 2021).

In summary, the risks and adverse impacts of any pandemic are inevitable in the SPR, similar to other countries. In order to safeguard and mitigate the impacts of pandemics, policymakers and aviation and tourism executives in the SPR should carefully consider the travel-related policies and measures that have been successfully implemented in different regions, such as New Zealand and Taiwan. Additionally, effective travel policies and measures to deal with future pandemics should carefully consider the risk-based approach, which identifies the most appropriate travel-related policies and measures by balancing the risks and benefits of candidate measures. There is also a compelling need for effective communication, inter-regional coordination between relevant stakeholders, and ongoing government subsidies.

[24] Contact the corresponding author for more examples of government supports provided to the aviation industry in view of the COVID-19 pandemic.

5 Conclusion

The COVID-19 pandemic highlighted the ineffective travel-related policies and measures implemented by governments and aviation industries, and the need for enhanced readiness for controlling and mitigating the spread of the COVID-19 virus. This study aimed to learn lessons from past studies so that they can be applied in the SPR to cope with future pandemics, with a focus on the aviation and tourism sectors. Importantly, this study proposes several pragmatic policy implications for SPR policymakers to help them overcome the challenges of future pandemics.

A systematic literature review (159 publications) and a meta-analysis were applied to prior studies (69 selected publications) between January 2010 and February 2021. It was found that the unprecedented impacts of the COVID-19 pandemic led to a significant increase in studies on travel-related policies and measures. Asia was the most researched region and the SPR was the least researched region. The MRA results obtained from the probit model suggested that the likelihood of obtaining effective measures in the literature are sensitive to: (i) the implementation of border closures and travel restrictions, hygiene measures, quarantine or isolation, contact tracing and biomedical measures; (ii) studies analysing the COVID-19, H1N1 and SARS pandemics; (iii) studies conducted in Asia, Africa, Europe, Oceania and America; and (iv) studies that applied simulations and scenarios.

The geographical isolation of the SPR cannot fully eliminate its vulnerability to future pandemics. The most effective response to future pandemics in the SPR is vaccination (a long-term strategy). In the short term, the SPR should use timely strategies such as border closures and travel restrictions, quarantine and isolation, hygiene measures, contact tracing, virus testing and airport screening. In order to ensure the effective implementation of travel-related policies and measures within the SPR in light of the costs and resources, the SPR's governments are urged to implement the risk-based approach (i.e., different levels of restriction concerning the risk of spreading the virus within the SPR) and work hard toward inter-governmental and regional coordination.

Furthermore, aviation and tourism operators in the SPR are encouraged to identify recovery strategies and understand how past pandemics have impacted tourists' behaviour and travel intentions. Hence, they can identify ways to regain customer trust and confidence about visiting the SPR. Strategies may include boosting domestic and intra-regional flight services (especially within the countries that are COVID-19 free) and attracting international airlines once the COVID-19 pandemic has been contained. In light of the importance of the aviation and tourism sectors to the SPR's economic development and supply chains, government financial support is vital for the recovery and sustainability of the aviation sector in the SPR. Governments may seek foreign donors and international institutions to provide the much-needed support, given the limited resources and funding available to the SPR countries for tackling future pandemics.

There are two potential limitations to the current study. First, although the author systematically reviewed the literature and publications published on Web of Science, Scopus, Google Scholar, and websites from January 2010 to February 2021, the COVID-19 pandemic is ongoing and the implications of variants such as Delta are not yet known. As such, more recent publications may present new perspectives and insights. Second, this study was limited to English-language

studies, and it is therefore possible that additional insights may be found in articles published in other languages.

In light of these practical limitations, several interesting areas for future research can be suggested: (i) a closer examination to quantify the impacts of the COVID-19 pandemic on aviation, tourism and economic development within the SPR; and (ii) an updated investigation of publications relevant to the aviation and tourism sectors during the post-COVID-19 era would provide a more systematic and thorough view of the impacts of the COVID-19 pandemic within the SPR.

Acknowledgement

The authors acknowledge Mr Hu Wan for his advice regarding the MRA of this study. Financial support from the Hong Kong GRF P0037794 (Q85W) is gratefully acknowledged.

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