Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Technology in Society 68 (2022) 101830

Contents lists available at ScienceDirect

Technology in Society

journal homepage: www.elsevier.com/locate/techsoc

Conflicting attitudes: Analyzing social media data to understand the early discourse on COVID-19 passports

M. Laeeq Khan [a,*], A. Malik [b], U. Ruhi [c], A. Al-Busaidi [d]

[a] Associate Professor and Director, Social Media Anaytics Research Team (SMART) Lab, Scripps College of Communication, Ohio University, USA
[b] Assistant Professor, Department of Information Systems, Sultan Qaboos University, Oman
[c] Associate Professor and Director, Centre for Business Analytics & Performance, Telfer School of Management, University of Ottawa, Canada
[d] Assistant Professor of Organizational Communication, and Director of Innovation and Technology Transfer Center, Sultan Qaboos University, Oman

ARTICLE INFO

Keywords:
COVID-19
Travel
Passport
Certificate
Health
Social media
Twitter

ABSTRACT

In several countries, vaccine passports are being encouraged to hasten the return to some form of normalcy amidst the COVID-19 pandemic. Vaccine passport is a digital or paper document that may serve as proof of the COVID-19 vaccine, thereby allowing entry to public venues, sporting events, air travel, and unrestricted access to other facilities. This study explores how the COVID-19 passport is being discussed and perceived on Twitter and the prominent entities involved in the early discourse on the issue. Twitter messages were theoretically analyzed for Health Belief Model (HBM) and Theory of Planned Behavior (TPB) variables, as well as message source, engagement, and attitudes towards vaccination certificates. Using quantitative content analysis, tweets were coded on nine dimensions: account type, tweeter profile, tweet content, tweet modality, attitude, self-efficacy, perceived barriers, benefits, and action cues. Most of the tweets originated from personal accounts, followed by media organizations, media-related personalities, politicians, and the travel industry. A significant number of tweets were from male Twitter users. Our analysis revealed that most tweeters had a favorable attitude towards the COVID-19 passports. Unfavorable attitudes toward the COVID-19 passport were based on reasons such as a lack of common standard or consensus, and personal freedoms & human rights. Tweets highlighting the benefits of COVID-19 passports cited travel as the primary reason. Based on a combination of technical, legal, and ethical practices, our study offers a set of vital recommendations for governments, health organizations, and businesses that may help stimulate the acceptance of vaccine passports.

1. Introduction

The COVID-19 pandemic is a major challenge of the current times resulting in various economic and social disturbances and uncertainties. While the effects of the pandemic are visible in varying intensities, it has united the world against a deadly virus and divided it in terms of inequalities such as vaccine access, vaccine hesitancy, and vaccine passports. Governments, state authorities, and health agencies have been rigorously urging the public to get vaccinated. Millions of individuals across the world have received one or two COVID-19 jabs. There is a fundamental longing for re-opening businesses and organizations and regaining a sense of normalcy. Many are also eager to socialize and travel without various restrictions, and the COVID-19 vaccine is needed for that.

Upon receiving the COVID-19 vaccine, a public authority or the healthcare administrator may provide a certification to confirm that the vaccine has been administered. Such a certificate (paper/card or digital) can prove that an individual has been fully vaccinated. In addition to serving as means of verification of the vaccine status of an individual, it may be used to gain access to various facilities, including entrance to restaurants, gymnasiums, and travel. Despite the differences in its modality, COVID passports are considered the way forward to normalcy in mobility and public life and reigniting the global economy, particularly the travel and tourism industry. During the last few months, numerous initiatives aiming to revitalize domestic and international travel and tourism have been initiated [1,2]. These initiatives are considered the much-needed push for the travel industry as they will offer exemptions for travelers [3].

Tourism, the third-largest export sector of the global economy, accounting for roughly 70% of the global trade, is one of the worst-hit

* Corresponding author. Ohio University, School of Media Arts & Studies, 327 Schoonover Center, Athens, OH, 45701, USA.
E-mail addresses: khanm1@ohio.edu (M.L. Khan), malikaqdas@gmail.com (A. Malik), umar.ruhi@uottawa.ca (U. Ruhi), abusaid@squ.edu.om (A. Al-Busaidi).

https://doi.org/10.1016/j.techsoc.2021.101830
Received 17 September 2021; Received in revised form 2 December 2021; Accepted 2 December 2021
Available online 8 December 2021

sectors. Although a vaccine passport is not yet a mandatory requirement by governments, many workplaces, schools, and other organizations weigh the possible alternatives. A strong interest is visible within the travel industry as some cruise companies and airlines have already started conducting trials of smartphone applications to verify the vaccination or COVID-19 negative status for international travel [4]. For example, United Arab Emirates' (UAE) Etihad Airways trialed vaccine passports on its North America flights [5]. Other international health agencies such as the World Health Organization (WHO) and some governments (such as the European Union, UK, and China) have introduced their COVID-passports to certificates to formalize and verify vaccination status.

Despite their significance in vitalizing the needed push to revive the global economy, the concept has also been under strict scrutiny and received backlash on various fronts. Several legal, scientific, practical, and ethical challenges associated with the content and modality of certification are being debated [6–9]. Concerns have also been raised by some authorities, including WHO and governments, to ensure the accuracy of COVID-19 passports [6], as it may create inequality bias and discrimination among vaccinated and non-vaccinated citizens. At the same time, concerns at personal, communal, and societal levels, including portability, equity, accessibility, affordability, and privacy of holders' personal data, have also surfaced.

Certification standardization, compatibility, and acceptability of certain vaccines as verifiable credentials across the globe are also a concern. Restrictions of civil liberties and individual autonomy are also considered a grave concern among many. One of the most significant risks may be faced by people who may not get vaccinated due to accessibility and susceptibility to health reasons and may be denied access to public places and local or international travel.

In addition to traditional media, social media is serving as crucial space for COVID-19 related discussions [10–12]. An analysis of COVID-19 related studies on social media reveal that Twitter was the leading platform for understanding public attitudes about the pandemic [12]. This study is motivated by the desire to understand the positive and negative discourse surrounding the COVID-19 passport system. Based on sound theoretical foundations of the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB), this study offers an exploratory analysis of Twitter data about the COVID-19 passport on Twitter. Our study first offers a review of the literature on the issue. This is followed by a description of methods and an analysis of data using content and thematic analysis. We then offer a presentation of the results and their discussion. The study concludes with five significant recommendations based on our analysis.

2. Literature review

The COVID-19 pandemic has presented itself as a major crisis that has impacted almost every other person in the world. Individuals, societies, trade, and investment sectors have been negatively impacted due to the pandemic. The United Nations data shows that international tourism and its closely linked sectors have suffered an estimated global loss of 2.4 trillion USD in 2020 [13]. Efforts are underway to support sectors including tourism that have been adversely affected due to the depressed demand, mainly due to the fears of catching the virus. Chen et al. [14] studied the COVID-19 related business development challenges in China and offered policy and economic recommendations to effectively deal with the adverse effects of the pandemic.

The COVID-19 passport, also referred to in the popular media as an immunity passport, immunity certificate, COVID-status certification, or Digital Health pass, serves as a license that a person does not pose a danger or threat to others. The information recorded on the digital passport presumes that the individual holding the document has taken the vaccine and is thus less likely to spread the coronavirus due to the immunity against COVID-19 [6,15].

Various authorities and governments have been launching initiatives to streamline COVID-19 vaccination systems. Schemes such as WHO's smart vaccination certificate, EU's Digital COVID Certificate, IATA Travel Pass, Vaccination Credential Initiative (VCI), and IBM Digital Health Pass provides proof (either digitally or in a paper form) about the holder's vaccination status, recovery status, or test results for COVID-19 [16]. The United Arab Emirates (UAE) has introduced a COVID-19 green pass system called the "Al-Hosn" app allowing access to COVID-19 test results [17]. Following the administration of two doses of the COVID-19 vaccines, Pakistan government's National Database and Registration Authority (NADRA) has been issuing digital COVID-19 certificates, and recently launched a digital app to verify vaccination certificates [18]. Anecdotal evidence also suggests that some of these certificates have been required to access workplaces, gyms, hotels, etc. According to a Reuters article, public offices, schools, restaurants, transport, and shopping malls in Pakistan are barring people from entering without COVID-19 vaccination certificates [19].

Overall, some form of certification may provide much-needed societal benefits until herd immunity is reached. It may protect those who cannot be vaccinated for specific reasons (pregnant women and children). For example, Iceland became the first country in the European Union (EU) that allowed travel within the country where international travelers do not have to quarantine or undergo testing upon providing the COVID passport [20]. EU's Digital COVID Certificate aiming to resume safe travels has now been rolled out in almost all the member states including Bulgaria, Czechia, Denmark, Germany, Greece, Croatia and Poland [21]. Within the United States a few states have also been piloting some form of vaccine passport. For instance, the New York State has launched the Excelsior pass in 11 languages as a digital proof of COVID-19 vaccination or negative test results, allowing the holders to attend public gatherings and events [22].

In the context of the possible implementation of the vaccine passports, there have also been concerns at personal, communal, and societal level including portability, equity, accessibility, affordability, and privacy of holder's personal data have also surfaced. Citing various legal, ethical, and practical challenges associated with the implementation and modality of a COVID-19 passport or certification, there is ongoing debate whether such a measure would even be viable [6–9].

Researchers have examined people's privacy concerns and acceptance of various COVID-19 control measures. For example, a survey of U. S. and Korean individuals by Kim and Kwan [23] focused on the geographic location and context in understanding privacy concerns surrounding COVID-19 policies and found that due to the collectivist nature of the Korean society, vaccination passports have a comparatively greater acceptance there. It can thus be deduced that other collectivists cultures in Asia and Africa may have a greater acceptability of COVID-19 passports than Europe and North America. A qualitative study by Ref. [24] based on interviews in Switzerland revealed the public's skepticism of COVID-19 passports in terms if test reliability, privacy concerns, and discrimination. The study also highlighted benefits of COVID-19 passports for leisure and work [24].

Some of the concerns are related to the accuracy of the COVID-19 passports [6]. Others have discussed the rise of inequality based on a country's income level and the associated lessening of global "solidarity" due to COVID-19 passports [25]. There are apprehensions that such health passports are likely to create inequality bias and discrimination among vaccinated and non-vaccinated citizens [26]. Certain groups and ethnic minorities who refused to get vaccine, undocumented migrants, ineligible individuals or last in queue for vaccination (children and pregnant women), and people without smartphones may also be left behind.

Certification standardization, compatibility, and acceptability of certain vaccines as verifiable credentials across the globe is also a concern. Restrictions of civil liberties and individual autonomy is also considered a grave concern among many [27]. Especially for air travel, verification documents in the form of vaccine documents may prove to be vital, yet they come with their own set of challenges [28,29].

Despite the understandable benefits of having a COVID-19 passport that may aid in reviving the global economy by inducing a sense of safety and normalcy, the concept has faced resistance from various people, governments, and organizations. In the United States, calls for vaccine passports have been met with fierce resistance from certain state governments. For instance, the Governor of Florida Ron DeSantis signed an executive order banning the use of vaccine passports within the state [30]. In a similar vein, 72 British MPS have also signed up pledge against coronavirus passports deeming them discriminatory and counterproductive [31]. Governments in developing nations where the vaccine coverage has been low as compared to the developed world have also raised their concerns, where such initiatives have been labelled as highly discriminatory and unfair [32].

Though vaccination passport is not a novel concept, the recent discussions, and efforts in the context of COVID-19 pandemic has been unprecedented. Immunization certification against several diseases is required for attending K-12 schools across several countries. Likewise, travelers to regions with high levels of yellow fever are required to carry an international certificate of destination or appeal access issued by the WHO. The proof of Yellow Fever, Meningococcal Meningitis, and Poliomyelitis vaccination is also a requirement for The Hajj and Umrah pilgrims to Saudi Arabia [33].

Understanding the barriers, intentions, and motivators of COVID-19 acceptance and the subsequent COVID-19 passport is vital from a research perspective. Attitude has also been found to have a positive relationship with people's behavior [34,35]. Past literature in the realm of vaccine acceptance has utilized the Health Belief Model (HBM) to understand health behaviors [36]. For example, the HBM [37,38] has been employed to study childhood influenza vaccines [39], Chagas disease conversations on YouTube [40], willingness to receive the COVID-19 vaccine [41], COVID-19 impact on education [42], and preventive health behaviors against COVID-19 in Iran [43]. Other researchers have employed the HBM to analyze Instagram posts about Zika [44], Twitter messages and vaccine attitudes during the measles outbreak in California [45], and home quarantine during COVID-19 [46].

The Theory of Planned Behavior (TPB [47], has been applied to understand behavioral intentions for health-related behaviors [48], travel choice [49], public computing facilities in libraries [50], and eco-conscious consumer behavior [51]. Shmueli [52] conducted a survey in Israel to gauge the general public's willingness to receive the COVID-19 vaccine by applying both the HBM and the TPB. It was found that people were more likely to get the COVID-19 vaccine if they had higher perceived benefits of the vaccine, higher perceived severity of the COVID-19 infection, and higher cues to action as per the HBM model; and higher subjective norms and self-efficacy according to the TPB [52].

The rollout of the COVID-19 passports in many countries has intensified debate not only among the policy, scientific, and technical communities on mainstream media but also social media. Considering the likely significance of the COVID-19 passport in coming months and years, multifaceted concerns, scale, novelty, and challenges in the adoption and development at local and global level, a broader understanding of the topic is required. Hence, the study explores the following research questions:

RQ1: What is the general public's attitude or sentiment while discussing the COVID-19 passport on the leading social media platform - Twitter?
RQ2: Who is tweeting about the COVID-19 passports?
RQ3: What kind of perceived barriers and benefits were discussed by the Twitter users for the COVID-19 passports?
RQ4: Is there an association between attitudes towards COVID-19 passport (pro/anti passport) and other variables from the health belief model and theory of planned behavior variables (self-efficacy, cues to action, benefits, and barriers)?

3. Methods

3.1. Data collection

By using Twitter API, the keywords COVID* or corona* AND passport OR certificate were queried for the period of three weeks (May 24th, 2021 to June 17th, 2021). Employing this approach, a total of 19,730 tweets were retrieved that include retweets and retweets with replies. From the mined data, only original tweets were extracted for further analysis. The data was cleaned by removing the retweets, duplicate tweets, and non-English tweets, leaving a sample of 13,845 tweets. After the data cleaning phase, 600 tweets were randomly selected for coding. During the coding phase, 88 tweets were further excluded (because they were irrelevant to the research context, tweets deleted by users, or accounts suspended by Twitter). The final analytical sample consisted of 512 tweets.

3.2. Analytical sample and coding approach

The analytical sample (n = 512) was coded according to nine dimensions. These nine dimensions are: (i) account type (male, female, or organization), (ii) tweeter occupation (see Table 1), (iii) tweet content (personal opinion, news & information, and link to a petition or a poll), (iv) tweet modality (text, URL/link, image, and/or video), (v) attitude (positive, negative, neutral), (vi) self-efficacy (whether the tweet implied knowledge, confidence, or information of how to get the COVID passport), (vii) perceived barriers, (viii) perceived benefits, and (ix) cues to action.

Two researchers were involved in the coding process and employed the open coding approach [53]. The first author coded the analytical sample across all the assessed dimensions. In cases of conflicting codes being assigned by each researcher, consensus was reached following mutual discussion among the coding team. Inter-coder reliability was calculated based on a random sample of 10% of tweets using Scott's pi [54]. The coefficients for all coded variables fell between the acceptable range of 0.78–0.91 [55]. The final data that were used to generate codes and themes were N = 512 categorized as pro-passport, anti-passport, and neutral tweets with 283, 182, and 47, respectively. Since data yielded to a small number of neutral tweets (47), they were removed

Table 1
Tweeter occupation.

Variable/sub-variable	Definition	Count (%)
Media Organization	Media Organization (TV Station, Newspaper, Media House, Production Company, Magazines, Film Studios.	111 (23.87)
Art & Media personality	Journalist, TV anchor, Radio presenter, Film maker, blogger, Director, Cinematographer, Video Editor, Documentary Maker, Photographer, Celebrity, Actor Singer, Musician, Performer, Artist, Contributor, Writer, Novelist	66 (14.19)
Lay Person	Commoner, ordinary citizen, not identifiable as any other category	226 (48.60)
Business/Commercial Organization	Non-media, non-travel, businesses, investors, companies	4 (0.86)
Travel Industry	Airline, tour operator, or any other company working to promote travel services or industry	12 (2.58)
Politician	Somebody who identifies him/herself as such.	21 (4.51)
Healthcare	Private or public health organization, ministries, hospital, care unit, agency, safety	5 (1.07)
Government Entities	Any government entity (FBI, DOJ, White House, State govt., senate, house of representatives, foreign governments, etc)	8 (1.72)
Not-for-Profit or Foundation	A non-business entity advocating a particular social cause, travel industry or services	4 (0.8)
Activist	Someone who identifies explicitly as an activist or an advocate	8 (1.72)

from the cross-sectional analysis, yielding to a final used sample size of N = 465.

3.3. Data analysis

We used Pearson chi-square to examine the association between the categorical variables. Using chi-square with classified categories to examine associations from Twitter data has been widely used (e.g., Refs. [56–58]. Assumptions of chi-square were met for all analyses except for one RQ where there were 5 cells (30%) with values less than 5 violating the maximum allowed of 20%. We accounted for the low frequency for some cells by using Fisher's exact test.

4. Results

The overall analysis provided valuable insights. RQ1 inquired about the general public's attitude while discussing the COVID-19 passport. We found that most Twitter users indicated favorable attitudes (61%; n = 283) toward COVID-19 passport compared to 39% of tweets (n = 182) stating negative sentiment (anti-passport) towards COVID-19 passport. With respect to categorization of tweet content, most of the tweets (82.4%; n = 383) were personal opinions followed by tweets that shared news & information (70.3%; n = 327).

The second research question (RQ2) inquired about the type of Twitter users who were tweeting about the COVID-19 passports. As depicted in Table 1, almost half of the tweets within the analyzed data set originated from personal accounts (49%; n = 226). Tweets from media organizations, and art & media personality accounted for 23.87% (n = 111) and 14.19% (n = 66) respectively. Meanwhile, a fair number of tweets was from politicians (4.5%; n = 21) and the travel industry (2.58%; n = 12). With respect to gender of the person sharing the tweet, over half of the tweets (52%; n = 241) were from males, 16.1% (n = 75) were from females, meanwhile the rest were either unidentifiable or from an organizational account.

RQ3 concerned the variables in the Health Belief Model. We wanted to explore what was being tweeted (main topics being discussed) in reference to the perceived barriers and benefits regarding the COVID-19 passports. Table 2 depicts the distribution of tweets by theme coded according to the relevant variables from the theoretical models.

Amongst the perceived barriers, tweets were classified in 4 major categories. Lack of consensus on a common standard (17%; n = 79), digital divide (6%; n = 3), privacy considerations (2.6%; n = 12), and personal freedoms and human rights (9.9%; n = 46) stood as the most salient barriers. Travel emerged as the dominant theme within the Perceived Benefits category. There were 137 tweets (29.5%) that referred to travel as a benefit of having some sort of a COVID-19 passport, followed by social (4.3%), and economic benefits (3.9%).

Cues to Action theme included two sub-themes: general cues to action and calls for protests. The former included tweets that encouraged or implied getting the COVID-19 certificate, and the latter included tweets about protests discourse. Majority of the tweets did not indicate any general cues to action (71%; n = 330), while (29%; n = 135) included statements implied extrinsic motivation for getting COVID-19 certificate. The second sub-theme of cues to action (call for protests) resulted in (10.1%; n = 47) tweets stating encouraging messages for protesting. Predisposition and knowledge was another reoccurring theme with predisposition and knowledge as sub-themes. Predisposition included statements about mistrust, conspiracy, and lack of information (see Table 2 for descriptive statistics). Self-efficacy was the second sub-theme of predisposition and knowledge and resulted in (23.2%; n = 108) of tweets indicating knowledge, and confidence on how to get COVID-19 passport compared to (76.8%; n = 357) of tweets that lacked self-efficacy messages (the emerged themes and sub-themes are described in Table 2).

Since the aim was to understand the public's attitudes towards COVID-19 passport, we used attitudes as our response variable and whether pro (anti) passport attitudes vary based on predisposition and knowledge, cues to action, benefits, and barriers (RQ4). To answer RQ4 we performed a two-way contingency table analysis (results of RQ4 are summarized in Table 3). We first used a 2 × 2 contingency table with two variables: knowledge/*self-efficacy* (stated and not stated) and *attitudes* (pro-passport and anti-passport). Self-efficacy and attitudes were found to be statistically and significantly associated, Pearson χ^2 (1, N = 465) = 86.24, $p < .001$, with medium effective size of Cramér's V =

Table 2
Distribution of tweets by theme.

Variable/sub-variable	Definition	Count (%)
Predisposition & Knowledge		
Predisposition		
Mistrust	Tweet critical of such a passport because of a lack of trust in the system or vaccine. This could also include mistrust about fake passports.	13 (2.8)
Conspiracy	Tweets having mention of a conspiracy related to the COVID-19 vaccine or the passport	9 (1.9)
Lack of information/ literacy	Tweet indicating the need for further information, or understanding the COVID passport	7 (1.5)
Unknown	Tweets that do not belong to any of the other themes and could not be classified into a meaningful category	436 (93.7)
Knowledge		
Self-Efficacy: Vaccine Passport	Tweet indicates knowledge, confidence, or information of how to get the COVID passport	108 (23.2)
Self-Efficacy: No evidence of	Self-efficacy is not reflected in the tweet	357 (76.8)
Cues to Action		
Cues to Action: Stated	Tweet encourages or implies getting the COVID passport/certificate (can include tweet which indicates if my friends, family, or someone you know are getting the passport; shows approval)	135 (29)
Cues to Action: Not Stated	Tweet does not provide any cues to action	330 (71)
Protests		
Protests: Stated	Tweet supports, shows, or reports demonstration, riots, or protest against the vaccine passport	47 (10.1)
Protests: Not Stated	Twee does not provide any sing of protests	418 (89.9)
Perceived Benefits		
Travel	Tweet highlighting or promoting significance of COVID passport for travelling purposes	137 (29.5)
Social inclusion	Tweet highlighting how COVID19 passport will lead to doing away with social distancing measures thus encouraging normal pre-pandemic social interaction	20 (4.3)
Economic	Tweet highlighting the positive impact of COVID vaccine passport on businesses and economy in general	18 (3.9)
Unknown	Tweets that do not belong to any of the other themes and could not be classified into a meaningful category	290 (62.4)
Perceived Barriers		
Lack of Consensus on a Common Standard	Tweet stating or implying a lack of consensus on a common standard for the COVID-19 passport	79 (17)
Privacy Considerations	Tweet portraying privacy fear, threat, or risk associated with COVID passport	12 (2.6)
Digital Divide	Tweet expressing the issues related to lack of equal access to the vaccine passport	3 (0.6)
Personal Freedoms & Human Rights	Tweet identifying such a passport as a human rights issue that can curtail free movement of people	46 (9.9)
Unknown	Tweets that do not belong to any of the other themes and could not be classified into a meaningful category	325 (69.9)

Table 3
Chi-square analysis of HBM/TPB categories towards attitudes.

Categories	Attitude Towards COVID-19 Passport	
	Pro-Passport n (row %)	Anti-Passport n (row %)
Predisposition & Knowledge		
Predisposition		
Mistrust	4 (30.8%)	9 (69.2%)
Conspiracy	2 (22.2%)	7 (77.8%)
Lack of Information	5 (71.4%)	2 (28.6%)
Unknown[b]	272 (62.4%)	164 (37.6%)
χ^2 (2, N = 29) = 4.56, *p*-value = .102, Cramér's *V* = .39, *p*-value = .102		
Knowledge[a]		
Self-Efficacy[a] *Not Stated*	176 (49.3%)	181 (50.7%)
Self-Efficacy[a] *Stated*	107 (99.1%)	1 (0.9%)
χ^2 (1, N = 465) = 86.24, $p < .001$, Cramér's *V* = .43, $p < .001$.		
Cues to Action[a]		
General cues to action		
Stated	135 (100%)	0 (0.0%)
Not Stated	148 (44.8%)	182 (55.2%)
χ^2 (1, N = 465) = 122.3, $p < .001$, Cramér's *V* = .51, $p < .001$.		
Protests		
Protests -Stated	2 (4.3%)	45 (95.7%)
Protests – Not Stated	281 (67.2%)	137 (32.8%)
χ^2 (1, N = 465) = 70.32, $p < .001$, Cramér's *V* = .39, $p < .001$.		
Benefits		
Travel benefits	129 (94.2%)	8 (5.8%)
Social inclusion	20 (100%)	0 (0.0%)
Economic	18 (100%)	0 (0.0%)
Unknown[b]	116 (40%)	174 (60%)
χ^2 (2, N = 175) = 2.32, $p = .31$, Cramér's *V* = .11, $p = .31$.		
Barriers[a]		
Lack of Consensus on a Common Standard	69 (87.3%)	10 (12.7%)
Privacy Considerations	5 (41.7%)	7 (58.3%)
Digital divide	1 (33.3%)	2 (66.7%)
Personal Freedoms & Human rights	3 (6.5%)	43 (93.5%)
Unknown[b]	205 (63.1%)	120 (36.9%)
χ^2 (3, N = 140) = 78.71, $p < .001$, Cramér's *V* = .75, $p < .001$.		

[a] Significantly associated with attitudes towards vaccine passport (sentiment).
[b] Unknown categories were excluded from the Chi-square analysis.

0.43, $p < .001$. The proportion of pro-vaccine passport tweets that contained self-efficacy statements or the lack thereof were 0.99, and 0.49 respectively. However, we did not find a significant association between predisposition categories (e.g., mistrust, conspiracy and lack of information) towards attitudes, χ^2 (2, N = 29) = 4.56, *p*-value = .102, Cramér's *V* = 0.39, *p*-value = .102.

Next, we tested the association between the sub-themes of cues to action and attitudes. A significant association was found between general cues to action and attitudes χ^2 (1, $N = 465$) = 122.3, $p < .001$ with large effect size, Cramér's $V = 0.51$, $p < .001$. The proportion of pro-vaccine passport tweets about cues to action statements or the lack thereof were 1.0, and 0.45 respectively. Anti-passport tweets contained no statements about general cues to action (0.0). We did not find statistical significant association between categories of reported benefits (travel, social, and economic) and attitude, χ^2 (2, $N = 175$) = 2.32, $p = .31$, Cramér's $V = 0.11$, $p = .31$. Lack of such association might be attributed to the low number of statements about benefits among anti-passport users as there were only 8 tweets in this group. As per the descriptive statistics, there was a total of 167 pro-passport tweets, of which most of them contained statements about travel benefits 129 (77%), compared to 20 (12%), and 18 (11%) for social inclusion and economic benefits respectively.

Regarding the association between reported barriers and attitudes, we found that the proportions of pro/anti-passports tweets vary based on the type of the reported barriers, χ^2 (3, N = 140) = 78.71, $p < .001$, with large effect size of Cramér's $V = 0.75$, $p < .001$, see Table 3.

While omnibus chi-square indicates a strong association between attitude and barriers, the test does not report which subcategories contribute the most to such association or the chi-square value. To find out which categories contribute the most to the reported relationship, we used the adjusted standardized residuals (AdjR) approach as suggested by Agresti [59]; and Shan and Gerstenberger [60]. AdjR provides evidence of interrelation between the categories or cells within a contingency table [59]. AdjR values are simply z-score and are considered significant when larger than 1.96, equivalent to $\alpha = 0.05$. Since the reported barrier themes has 4 categories (e.g., *lack of consensus on a common standard, privacy considerations, digital divide, and personal freedoms & human rights*) and 2 categories of attitude, 8 cells are formed.

Performing eight separate multiple comparisons may lead to Type I error and produce biased estimates. We accounted for Type I error by using Bonferroni correction by dividing $\alpha = 0.05/8 = 0.0062$. Using AdjR values, the only significant categories at $p < .0062$ are lack of consensus on a common standard, χ^2 (1, N = 140) = 73.51, $p < .001$, and human rights, χ^2 (1, N = 140) = 67.2, $p < .001$. Hence, they are the main two categories responsible for forming (un)favorable attitudes towards COVID-passport based on our data. These significant categories of barriers are also evident in Fig. 1 below.

5. Discussion

With the accelerating rate of SARS-COV-2 vaccinations around the globe, many countries are considering to rollout the proof-of-vaccination documentation through vaccination certificates or passports. As a public health measure, such interventions are aimed at helping with the re-opening of the economy and easing of other public health restrictions such as masking and physical distancing.

Based on our content analysis of Twitter data, we observe that while many people have a positive (pro-passport) attitude towards vaccine passports– viewing them as an assurance of low risk of infection from other people, there is also a large segment that comport a negative sentiment towards them, and deem these tools to be limiting their freedom, and even to be discriminatory. To make sense of these perspectives, we used the health belief model (HBM) [37,38] and applicable TPB variables [47] as a lens of analysis to unpack and present various viewpoints about vaccine passports.

Using HBM as a socio-psychological theoretical model, we consider the potential adoption of vaccine passports as a health-related behavior that is impacted by people's beliefs about COVID-19 as a disease, their subjective assessment of the benefits of vaccine passports, and the barriers that impede the uptake of these interventions. Our model is an adaptation of the HBM and the TPB. The factors that were applicable in the context of our Twitter data have been depicted in Fig. 2, where we offer a summary of our content analysis categorized using HBM and TPB. As highlighted in the discussion below, HBM proved to be an effective framework allowing us to employ a dialectical method of analysis to understand contradicting or opposing points of view about vaccine passports.

Firstly, individual perceptions about susceptibility to health ailments caused by COVID-19 play an important role in shaping positive or negative attitudes towards vaccine passports. Positive opinions about the usefulness of vaccine passports are predicated on the assumption that vaccinated individuals are protected from severe COVID-19 infection, and they will not spread the virus to others. Hence, vaccine passports provide an effective means to establish proof of immunity from the disease, and to facilitate environmental settings that ensure personal and public health. This is in line with the research by Shmueli [52] and Wong et al. [41] which found that participants were more likely to be willing to get vaccinated if they reported higher levels of perceived benefits of COVID-19 vaccine and higher perceived severity of the COVID-19 infection. On the other hand, people with negative opinions about COVID passports point out that vaccinated people can still be carriers, i.e., they can contract and transmit the virus. Hence, many people with a negative attitude towards vaccine passports contend that

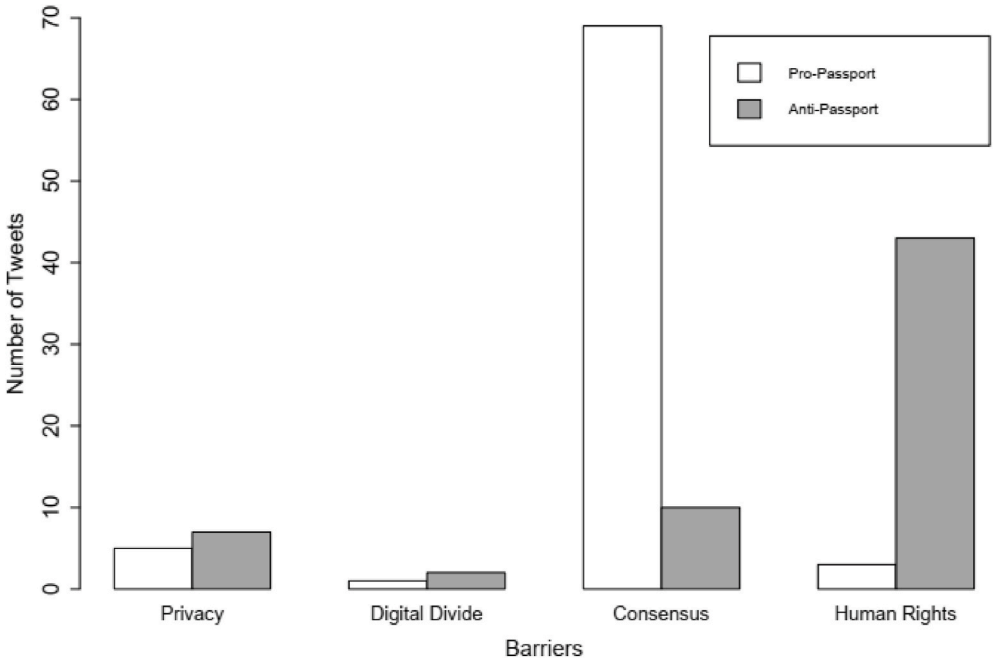

Fig. 1. COVID-19 Passport Sentiment/Attitudes Classified based on Barriers.

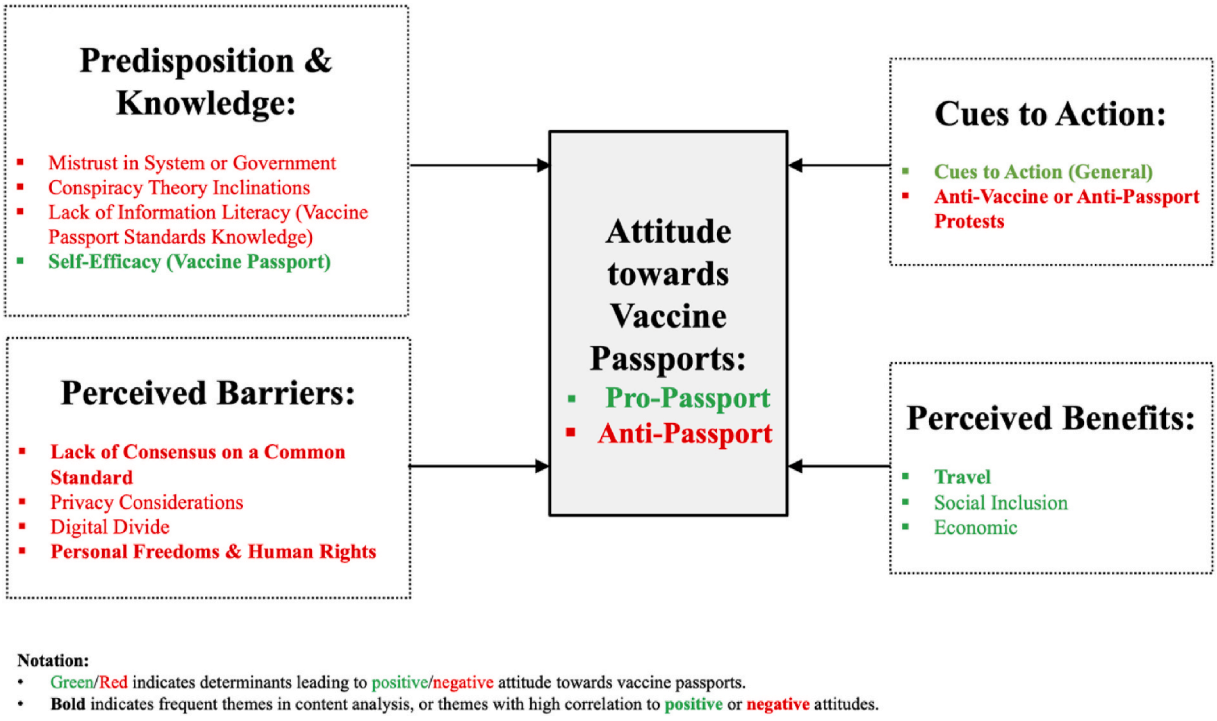

Fig. 2. Analysis of Attitude Towards Vaccine Passports using the Applicable HBM & TPB Variables.

they do not effectively demonstrate protection from the illness.

Positive or negative attitudes towards vaccine passports are also directly associated with beliefs about the severity of health issues caused by the virus at individual and collective levels [52]. People who perceive the illness as potentially dangerous or believe that contracting it can lead to health complications are generally more accepting of COVID passports. Similarly, those who consider the implications of not mitigating against the virus in terms of the additional cost and burden to the healthcare system are more likely to favor vaccine passports.

Our analysis also reveals that those in favor of vaccine passports cite various perceived social and economic benefits. International travel is by far the most frequently cited reason for the adoption of vaccination passports [29]; and many people see their use in a similar vein as immunization records and vaccine certificates that have been required for travel to many countries in the past. These people view getting vaccinated and carrying proof of immunization as nothing new. A recent Ipsos survey also indicates strong support for vaccine passports for international travel [61]. Our data also revealed some Twitter users expressing satisfaction at the adoption of COVID-19 passport as it could facilitate international travel and tourism.

Another driver for adopting vaccine passports is the potential for their use at large gathering events such as concerts and sports venues. In our analysis, the general public and many commercial organizations seem to support the use-case for proof of vaccination as a tool to allay public fear and mitigate health risks at such events. The Excelsior Pass in the U.S. state of New York is a prime example of enabling individuals to attend large public gatherings [22]. Many people view vaccine passports as an alternative to public health restrictions, including masking and physical distancing, and as a means to attain a sense of normalcy.

The third argument in favor of vaccine passports is related to the general resumption of the economy with the re-opening of businesses and the potential return to work and school. Proponents suggest that businesses and employers can ensure the safety of their customers and employees through the use of vaccine passports, and their use could also potentially enable a faster re-opening of non-discretionary settings (e.g., stores, schools, and workplaces) with increased capacity. For example, some tweets in our data directly referred to the vaccine passport and the wearing of a mask as important in getting the economy back on track, helping businesses, and encouraging a sense of normalcy. In a similar vein, researchers have been studying other measures to facilitate economic resurgence. For example, Iqbal and Campbell [62] studied the use of touchless technologies such as facial recognition, eye tracking, biometrics, hand gestures in different industries to ensure health and hygiene.

Looking at perceived barriers in the adoption of vaccine passports, those opposed to them often relate their potential use in non-discretionary settings as a restriction of their civil liberties and freedom [27]. The argument is that when vaccination passports are used to restrict the freedoms of those who are not vaccinated, this leads to problematic social divides, stigmatizing work environments. It further perpetuates discrimination of marginalized or underserved communities [26]. In our data, some tweeters were pointing out the issues with vaccine passports leading to possible discrimination against specific demographic segments, such as younger people who may not be eligible to receive the vaccine and those who may not want to get it for religious reasons.

Regarding individual rights and personal freedoms, people who oppose vaccine passports also raise concerns about data privacy [63], reasoning that such initiatives would typically entail large-scale data collection and processing, and the databases created for implementing vaccine passports may lead to mass surveillance. Questions have also been raised about the lawfulness and ethics of vaccine passports [9,64,65]. Alongside privacy concerns, other technical barriers related to the digital divide are also brought up in the debate, citing inequities resulting from lack of access to the internet, smartphones, or printers [25].

In their stance against vaccine passports, detractors also cite an apparent lack of consensus on a common standard among various organizations and jurisdictions about the need and efficacy for such measures. At a regional level, different jurisdictions in the same country may be adopting their policies – e.g., in the U.S., while New York is adopting the Excelsior Pass program, other states have issued bans against the use of COVID passports. Additionally, some people highlight that the World Health Organization (WHO) continues to advise against the use of vaccine passports for international travel (World Health Organization, 2021), while organizations such as the International Air Transport Association (IATA) continue to develop their Travel Pass initiative which is being trialed by multiple airlines [66].

Aligned with HBM, our analysis also indicates that structural factors are important determinants of health-related behavior [37]. We classify these factors under predisposition and knowledge. Specifically, a negative trust predisposition towards one's government and an inclination towards conspiracy theories are related to negative sentiments towards vaccine passports. A frequently observed example in our data is that vaccines are a conspiracy of the governments to put chips in people's arms to track their movements, and vaccine passports will further enable such surveillance.

On the other hand, people who have knowledge about obtaining and utilizing vaccine passports for specific contexts and are also well-informed about various global efforts on standardization of vaccine passports are more likely to purport a positive attitude towards their adoption. In terms of self-efficacy, people who are informed about the specific uses of vaccine passports and are also aware of different technologies that allow individual control over personal health information are generally in favor of vaccine passports. Furthermore, as an example of common standards, people also commented positively about the EU Digital COVID-19 certificate and the cooperation among EU member countries to allow cross-border travel for vaccinated citizens. Lastly, our analysis also revealed potential external factors that can act as triggers in the decision-making process about vaccine passports. We categorized these factors as cues to action (using standard terminology from HBM).

Among the positive cues that shape favorable attitudes towards vaccine passports, subjective norms play a crucial role, i.e., people are more likely to adopt vaccine passports if their close friends and family are in favor of adopting them. Secondly, public health messaging that provides valuable information about vaccine passports' intended use and benefits is associated with positive sentiment towards vaccine passports.

Many people who oppose vaccine passports also link to websites or directly provide information about protests that denounce government plans for imposing such systems and call for their revocation. Some people also point out that these are not "anti-vaxxer" protests but an attempt to voice concerns about violation of personal freedoms and health information privacy considerations.

5.1. Policy recommendations

Overall, our analysis reveals that in the debate on vaccine passports, while a significant proportion of people believe in the merits of vaccine passports in ensuring personal safety and public health, there is a large segment that is opposed to them due to concerns about personal freedoms, social inequities, and invasion of privacy. To address these issues and promote the acceptance of vaccine passports, governments need to adopt policies and tactics that foster trust and transparency through a combination of technical, legal, and ethical practices. Toward this, we offer the following five recommendations:

1. Define specific use-cases: The uses of vaccine passports need to be clearly defined and rationalized to alleviate public concerns about employers' discrimination and ensure equitable access to business and government services.
2. Ensure interoperability: Adopted solutions must be interoperable and should leverage standards that enable the seamless exchange of information across disparate technology platforms and different geographic boundaries.
3. Safeguard personal and health data: Data protection and privacy requirements should be seriously considered and openly communicated to alleviate concerns about data breaches, fraud, and forgery and disallow technology used for tracking and surveillance.
4. Establish legal guidelines: Clear laws that define the scope of vaccine passport programs and their permissible use, along with a timeline for the planned duration of such programs, would help improve public confidence and achieve greater acceptance.
5. Community consultation and engagement: Public dialogue can help reduce tensions in implementing vaccine passport programs and engaging trusted community members can help foster trust in the program and improve the uptake of vaccine passports.

6. Conclusion

The study advances our understanding of the challenges facing governments and health organizations in implementing a COVID-19

passport system. By analyzing Twitter data on the issue, we offer insights into the issue considering established theoretical constructs from the Health belief model (HBM) and Theory of Planned Behavior (TPB). By unpacking social media posts on a public platform, our findings help illuminate the path forward in implementing an effective COVID-19 passport system. In the context of the current pandemic, it is understandable that the COVID-19 passports aim to revive international trade, travel, and other social activities without compromising public health and safety. We have found that the media can play a pivotal role in creating positive awareness about a vaccine certificate or a passport to facilitate the return to some form of normalcy. Our analysis revealed that media organizations and media-related personalities were at the forefront of tweeting about the issue.

Contrary to the general perception of a significant push against COVID-19 passports, our analysis shows that most tweeters had a favorable attitude towards the COVID-19 passport. This finding can help build further consensus and a common standard towards the need for a COVID-19 passport system. Health-related messaging can also be more cognizant of the need for allaying fears of individuals who are unclear about what a COVID-19 passport would do. Lastly, travel was a major factor that emerged as a perceived benefit of such a certificate. This indicates a realization that a COVID-19 passport would help revive the travel industry.

Our research has various strengths. It unpacks the general public's attitudes towards the COVID-19 vaccine passport, informs who was tweeting about the issue, and discusses the main themes. Furthermore, our research provides the foundation for future scholarship in dealing with the impediments in implementing a standard vaccine passport. The findings of this study have global implications as the concerns being raised by social media users resonate in various countries.

Our study has its limitations. We chose one social media platform for analysis. Twitter can be a great source of discourse surrounding issues; however, there are other platforms such as Facebook where such issues are also being discussed. Additionally, our sample consisted of English-only tweets. Moreover, it may be argued by some that Twitter data may not be fully inclusive of a broad spectrum of the society, and thus biased towards certain sociodemographic characteristics such as younger audiences. Future studies can encompass a variety of social platforms and languages and employ other research methods to provide further understanding of issues surrounding COVID-19 passports.

Credit author statement

Khan, M. Laeeq: Methodology, Data curation, Formal analysis, Investigation, Project administration, Resources, Software, Supervision, Validation, Writing – original draft, review and editing; Malik, A: Conceptualization, Methodology, Writing – original draft. Ruhi, U.: Writing – original draft, Validation, review and editing. Al-Busaidi, A: Writing, Investigation, Formal analysis, Software, Visualization, Writing – original draft, review and editing.

References

[1] M. Katz, D. Michaels, Covid-19 Vaccine Passport System Gets First Test in Europe, 2021, July 01. https://www.wsj.com/articles/covid-19-vaccine-passport-system-gets-first-test-in-europe-11625145761.

[2] J. Cusmano, Border Closure Have Bought the Travel Industry on its Knees, 2021, September 16. https://www.traveldailymedia.com/border-closure-have-bought-the-travel-industry-on-its-knees/.

[3] A. Pavli, H.C. Maltezou, COVID-19 vaccine passport for a safe resumption of travel, J. Trav. Med. 28 (4) (2021), https://doi.org/10.1093/jtm/taab079.

[4] C. Rizzo, Cruise Canceled? This App's New Feature Will Keep All Your Info Organized until You Can Finally Set Sail, 2021, January 27. https://www.travelandleisure.com/cruises/shipmate-first-cruise-credit-tracker-app.

[5] Etihad Airways trials vaccine passport on flights from Abu Dhabi to North America, Arabian Business, 2020, June 20. https://www.arabianbusiness.com/transport/462330-etihad-airways-trials-vaccine-passport-on-flights-from-abu-dhabi-to-north-america.

[6] T.C. Voo, A.A. Reis, B. Thomé, C.W. Ho, C.C. Tam, C. Kelly-Cirino, S. Munsaka, Immunity certification for COVID-19: ethical considerations, Bull. World Health Organ. 99 (2) (2021) 155.

[7] S. Gerke, G. Katznelson, D. Reiss, C. Shachar, COVID-19 antibody testing as a precondition for employment: ethical and legal considerations, J. Law Med. Ethics 49 (2) (2021) 293–302.

[8] M.A. Hall, D.M. Studdert, "Vaccine passport" certification—policy and ethical considerations, N. Engl. J. Med. (2021).

[9] L.O. Gostin, I.G. Cohen, J. Shaw, Digital health passes in the age of COVID-19: are "vaccine passports" lawful and ethical? J. Am. Med. Assoc. 325 (19) (2021) 1933–1934.

[10] Y. Luo, Using tweets to understand how COVID-19–Related health beliefs are affected in the age of social media: Twitter data analysis study, J. Med. Internet Res. 23 (2) (2021), e26302.

[11] A. Malik, M.L. Khan, A. Quan-Haase, Public health agencies outreach through Instagram during COVID-19 pandemic: crisis and emergency risk communication perspective, Int. J. Dis. Risk Reduc. 61 (2021) 102346, https://doi.org/10.1016/j.ijdrr.2021.102346.

[12] S.F. Tsao, H. Chen, T. Tisseverasinghe, Y. Yang, L. Li, Z.A. Butt, What social media told us in the time of COVID-19: a scoping review, Lancet Digit. Health (2021), https://doi.org/10.1016/S2589-7500(20)30315-0.

[13] UNWTO, Global Economy Could Lose over $4 Trillion Due to Covid-19 Impact on Tourism, UNWTO Reports, (2021, June 30), World Tourism Organization, 2021. Retrieved from: https://www.unwto.org/news/global-economy-could-lose-over-4-trillion-due-to-covid-19-impact-on-tourism.

[14] J. Chen, J. Huang, W. Su, D. Štreimikienė, T. Baležentis, The challenges of COVID-19 control policies for sustainable development of business: evidence from service industries, Technol. Soc. 66 (2021) 101643.

[15] R.C. Brown, J. Savulescu, B. Williams, D. Wilkinson, Passport to freedom? Immunity passports for COVID-19, J. Med. Ethics 46 (10) (2020) 652–659.

[16] H. Brandler, Vaccine Passports - a Guide to the Different Options, 2021 July 27. https://www.businesstraveller.com/features/vaccine-passports-a-guide/.

[17] AlHosn, AlHosn App, United Arab Emirates, 2021. https://alhosnapp.ae/en/home/.

[18] Z. Qureshi, Pakistan Launches App to Verify COVID-19 Certificates, 2021, August. https://gulfnews.com/world/asia/pakistan/pakistan-launches-app-to-verify-COVID-19-certificates-1.81594044.

[19] A. Shahzad, Pakistan Demands Proof of Vaccine for School, Restaurant, Transport Staff, 2021 July. https://www.reuters.com/world/china/pakistan-ban-public-sector-education-malls-air-travel-unvaccinated-2021-07-29/.

[20] A. Fox, Iceland Will Allow Residents to Skip its Quarantine, Testing Requirements if They Show Proof of a COVID-19 Vaccine, 2021, January 28. https://www.travelandleisure.com/travel-news/iceland-issuing-covid-vaccine-passports.

[21] European Union, EU Digital COVID Certificate: EU Gateway Goes Live with Seven Countries One Month Ahead of Deadline [Press Release], 2021, June 01. https://ec.europa.eu/commission/presscorner/detail/en/IP_21_2721.

[22] Excelsior Pass, Be a Part of New York's Safe Reopening, 2021. https://COVID19vaccine.health.ny.gov/excelsior-pass.

[23] J. Kim, M.P. Kwan, An examination of people's privacy concerns, perceptions of social benefits, and acceptance of COVID-19 mitigation measures that harness location information: a comparative study of the US and South Korea, ISPRS Int. J. Geo-Inf. 10 (1) (2021) 25.

[24] V. Fargnoli, M. Nehme, I. Guessous, C. Burton-Jeangros, Acceptability of COVID-19 certificates: a qualitative study in Geneva, Switzerland, in 2020, Front. Publ. Health 9 (2021).

[25] K. Voigt, E. Nahimana, A. Rosenthal, Flashing red lights: the global implications of COVID-19 vaccination passports, BMJ Glob. Health 6 (5) (2021), e006209.

[26] K. Mitchell, M. Grupac, A. Zauskova, Ethical management and implementation of COVID-19 immunity passports and vaccination certificates: lawfulness, fairness, and transparency, Ling. Phil. Invest. 20 (2021) 45–54.

[27] J. Kirkman, Would COVID-19 testing and vaccination status certificates Erode civil liberties? Ling. Phil. Invest. (20) (2021) 65–74.

[28] Z.A. Memish, A. Alharthy, S.A. Alqahtani, D. Karakitsos, COVID-19 air travel restrictions and vaccine passports: an ongoing debate, Trav. Med. Infect. Dis. (2021).

[29] X. Sun, S. Wandelt, A. Zhang, Vaccination passports: challenges for a future of air transportation, Transport Pol. 110 (2021) 394–401.

[30] L. Mower, A. Ross, DeSantis Signs Bill Banning Vaccine 'passports,' Suspends Local Pandemic Restrictions, 2021 May. https://www.tampabay.com/news/florida-politics/2021/05/03/desantis-signs-bill-banning-vaccine-passports-suspends-local-pandemic-restrictions/.

[31] G. Heffer, COVID-19: More than 70 MPs Warn against Domestic COVID Passports - as Govt Considers Trialling Their Use at UK Events, 2021 April. https://news.sky.com/story/COVID-19-more-than-70-mps-warn-against-COVID-passports-as-govt-considers-trialling-their-use-at-uk-events-12263326.

[32] S. Parashar, COVID-19: India Opposes 'vaccine Passport' Ahead of G7 Summit, Harsh Vardhan Says Idea 'discriminatory, 2021 June. https://zeenews.india.com/india/COVID-19-india-opposes-vaccine-passport-ahead-of-g7-summit-harsh-vardhan-says-idea-discriminatory-2366796.html.

[33] J.A. Al-Tawfiq, Z.A. Memish, The Hajj 2019 vaccine requirements and possible new challenges, J. Epidemiol. Glob. Health 9 (3) (2019) 147.

[34] M. Fishbein, I. Ajzen, Predicting and Changing Behavior: the Reasoned Action Approach, Psychology Press, New York, NY, 2010.

[35] M.L. Khan, I.K. Idris, Recognise misinformation and verify before sharing: a reasoned action and information literacy perspective, Behav. Inf. Technol. 38 (12) (2019) 1194–1212.

[36] V.L. Champion, C.S. Skinner, The health belief model, Health Behav. Health Edu.: Theor. Res. Prac. 4 (2008) 45–65.
[37] N.K. Janz, M.H. Becker, The health belief model: a decade later, Health Educ. Q. 11 (1) (1984) 1–47.
[38] I.M. Rosenstock, The health belief model and preventive health behavior, Health Educ. Monogr. 2 (4) (1974) 354–386.
[39] M.F. Chen, R.H. Wang, J.K. Schneider, C.T. Tsai, D.D.S. Jiang, M.N. Hung, L.J. Lin, Using the health belief model to understand caregiver factors influencing childhood influenza vaccinations, J. Community Health Nurs. 28 (1) (2011) 29–40.
[40] A.W. Otieno, J. Roark, M. Laeeq Khan, S. Pant, M.J. Grijalva, S. Titsworth, The kiss of death – unearthing conversations surrounding Chagas disease on YouTube, Cogent Soc. Sci. 7 (1) (2020) 1858561, https://doi.org/10.1080/23311886.2020.1858561.
[41] L.P. Wong, H. Alias, P.F. Wong, H.Y. Lee, S. AbuBakar, The use of the health belief model to assess predictors of intent to receive the COVID-19 vaccine and willingness to pay, Hum. Vaccines Immunother. 16 (9) (2020) 2204–2214.
[42] R.A. Abumalloh, S. Asadi, M. Nilashi, B. Minaei-Bidgoli, F.K. Nayer, S. Samad Mohd, O. Ibrahim, The impact of coronavirus pandemic (COVID-19) on education: the role of virtual and remote laboratories in education, Technol. Soc. 67 (2021) 101728.
[43] H. Shahnazi, M. Ahmadi-Livani, B. Pahlavanzadeh, A. Rajabi, M.S. Hamrah, A. Charkazi, Assessing preventive health behaviors from COVID-19: a cross sectional study with health belief model in Golestan Province, Northern of Iran, Infect. Dis. Pover. 9 (1) (2020) 1–9.
[44] J.P. Guidry, K.E. Carlyle, J.G. LaRose, P. Perrin, M. Messner, M. Ryan, Using the health belief model to analyze Instagram posts about Zika for public health communications, Emerg. Infect. Dis. 25 (1) (2019) 179.
[45] C.Z. Meadows, L. Tang, W. Liu, Twitter message types, health beliefs, and vaccine attitudes during the 2015 measles outbreak in California, Am. J. Infect. Control 47 (11) (2019) 1314–1318.
[46] M.Q. Al-Sabbagh, A. Al-Ani, B. Mafrachi, A. Siyam, U. Isleem, F.I. Massad, Q. Alsabagh, M. Abufaraj, Predictors of adherence with home quarantine during COVID-19 crisis: the case of health belief model, Psychol. Health Med. (2021) 1–13.
[47] I. Ajzen, M. Fishbein, The prediction of behavior from attitudinal and normative variables, J. Exp. Soc. Psychol. 6 (1970) 466–487.
[48] G. Godin, G. Kok, The theory of planned behavior: a review of its applications to health-related behaviors, Am. J. Health Promot. 11 (2) (1996) 87–98.
[49] P. Lanzini, S.A. Khan, Shedding light on the psychological and behavioral determinants of travel mode choice: a meta-analysis, Transport. Res. F Traffic Psychol. Behav. 48 (2017) 13–27.
[50] K. DeMaagd, H.E. Chew, G. Huang, M.L. Khan, A. Sreenivasan, R. LaRose, The use of public computing facilities by library patrons: demography, motivations, and barriers, Govern. Inf. Q. 30 (1) (2013) 110–118.
[51] I. Hameed, I. Waris, M.A. ul Haq, Predicting eco-conscious consumer behavior using theory of planned behavior in Pakistan, Environ. Sci. Pollut. Control Ser. 26 (15) (2019) 15535–15547.
[52] L. Shmueli, Predicting intention to receive COVID-19 vaccine among the general population using the health belief model and the theory of planned behavior model, BMC Publ. Health 21 (1) (2021) 1–13.
[53] A. Strauss, J. Corbin, Basics of Qualitative Research, Sage Publications, Thousand Oaks, CA, 1998.
[54] W.A. Scott, Reliability of content analysis: the case of nominal scale coding, Publ. Opin. Q. 19 (1955) 321–325.
[55] D. Riffe, S. Lacy, F.G. Fico, Analyzing Media Messages: Using Quantitative Content Analysis in Research, Lawrence Erlbaum, Mahwah, NJ, 2005.
[56] B.L. Hoffman, J.B. Colditz, A. Shensa, R. Wolynn, S.B. Taneja, E.M. Felter, T. Wolynn, J.E. Sidani, #DoctorsSpeakUp: lessons learned from a pro-vaccine Twitter event, Vaccine 39 (19) (2021) 2684–2691, https://doi.org/10.1016/j.vaccine.2021.03.061.
[57] S. Muralidharan, L. Rasmussen, D. Patterson, J.-H. Shin, Hope for Haiti: an analysis of Facebook and Twitter usage during the earthquake relief efforts, Publ. Relat. Rev. 37 (2) (2011) 175–177, https://doi.org/10.1016/j.pubrev.2011.01.010.
[58] A.N. Smith, E. Fischer, C. Yongjian, How does brand-related user-generated content differ across YouTube, Facebook, and twitter? J. Interact. Market. 26 (2) (2012) 102–113, https://doi.org/10.1016/j.intmar.2012.01.002.
[59] A. Agresti, Categorical Data Analysis, third ed., Wiley, New Jersey, 2013.
[60] G. Shan, S. Gerstenberger, Fisher's exact approach for post hoc analysis of a chi-squared test, PLoS One 12 (12) (2017), e0188709, https://doi.org/10.1371/journal.pone.0188709.
[61] Lacey, Boyon, Post-COVID Vaccination Behaviours and Return to Activities, IPSOS, 2021. https://www.ipsos.com/en/post-COVID-vaccination-behaviours-and-return-activities.
[62] M.Z. Iqbal, A.G. Campbell, From Luxury to Necessity: Progress of Touchless Interaction Technology, Technology in Society, 2021, p. 101796.
[63] K.K. Tsoi, J.J. Sung, H.W. Lee, K.K. Yiu, H. Fung, S.Y. Wong, The way forward after COVID-19 vaccination: vaccine passports with blockchain to protect personal privacy, BMJ Innov. 7 (2) (2021).
[64] J. Meaney, The ethics of COVID-19 vaccine passports, Ethics & Medics 46 (4) (2021) 1–2.
[65] T. Osama, M.S. Razai, A. Majeed, COVID-19 Vaccine Passports: Access, Equity, and Ethics, 2021.
[66] IATA, IATA Travel Pass Initiative, 2021. https://www.iata.org/en/programs/passenger/travel-pass/.