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Global commercial passenger airlines and travel health information regarding infection control and the prevention of infectious disease: What's in a website?

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ABSTRACT

Background: Air travel has never been easier, cheaper or faster, with large volumes of people travelling around the world. These factors increase the risk of the spread of infectious diseases by air travel. Little is known, however, about the extent to which airlines provide information to passengers on infection control and measures to prevent the spread of infectious diseases. This study examined the websites of the global commercial passenger airlines to see if they contained information about infection control and prevention of infectious diseases and appraised the clinical usefulness of that information.

Method: A cross-sectional text-based analysis of the 73 airline websites from the six global commercial passenger airline conglomerates was performed to identify information about infection control and prevention of infectious between July and August 2019.

Results: Of the 73 airline websites, less than half (n = 35, 28.6%) contained information deemed useful for passengers. While there was a range of general health advice within the websites, there was limited information about infection control and preventing infectious diseases. A minority of websites contained information about vaccination status prior to travel, and to a lesser extent handwashing and hand hygiene, with very few including disease-specific advice or preventive measures.

Conclusions: Airline websites are an underutilised source of information for infection control and the prevention of infectious diseases. Providing passengers with information on basic infection control and prevention measures may support the global efforts against the spread of infectious diseases.

1. Background

Air travel has never been easier, cheaper or safer [1]. The speed, accessibility and efficiency of air travel sets it well apart from land and sea travel with respect to the volume and speed at which people travel around the world [2]. Low airfares and a series of socioeconomic factors have made global air travel popular, with unprecedented volumes of passengers moving quickly from one side of the world to the other, in as little as 14 h [3]. The number of passengers has increased year on year from approximately 642 million in 1980 to just over four billion in January 2019 [4].

The speed, accessibility, efficiency and volume of air travel brings with it the challenges for the spread of infectious diseases, with particular implications for population and public health [1]. In recent years, there have been many documented outbreaks of infectious diseases associated with the movement of humans via air or other forms of travel [5]. Regions including the Indo-Pacific, Africa and Latin America are highly popular travel destinations and bear particular challenges with respect to hyperendemic infectious diseases [6]. Recent outbreaks of Measles [7], Ebola [8], sexually transmitted infections (STIs) [9], influenza [10] and Middle East Respiratory Syndrome Coronavirus (MERS-CoV) [11] have been associated with human air travel. The large scale and rapid spread of many of these outbreaks is facilitated by high volumes of intercontinental air travel. Fuelling the outbreaks are transnational flight times that are shorter than the incubation periods for several infectious diseases, meaning that asymptomatic or

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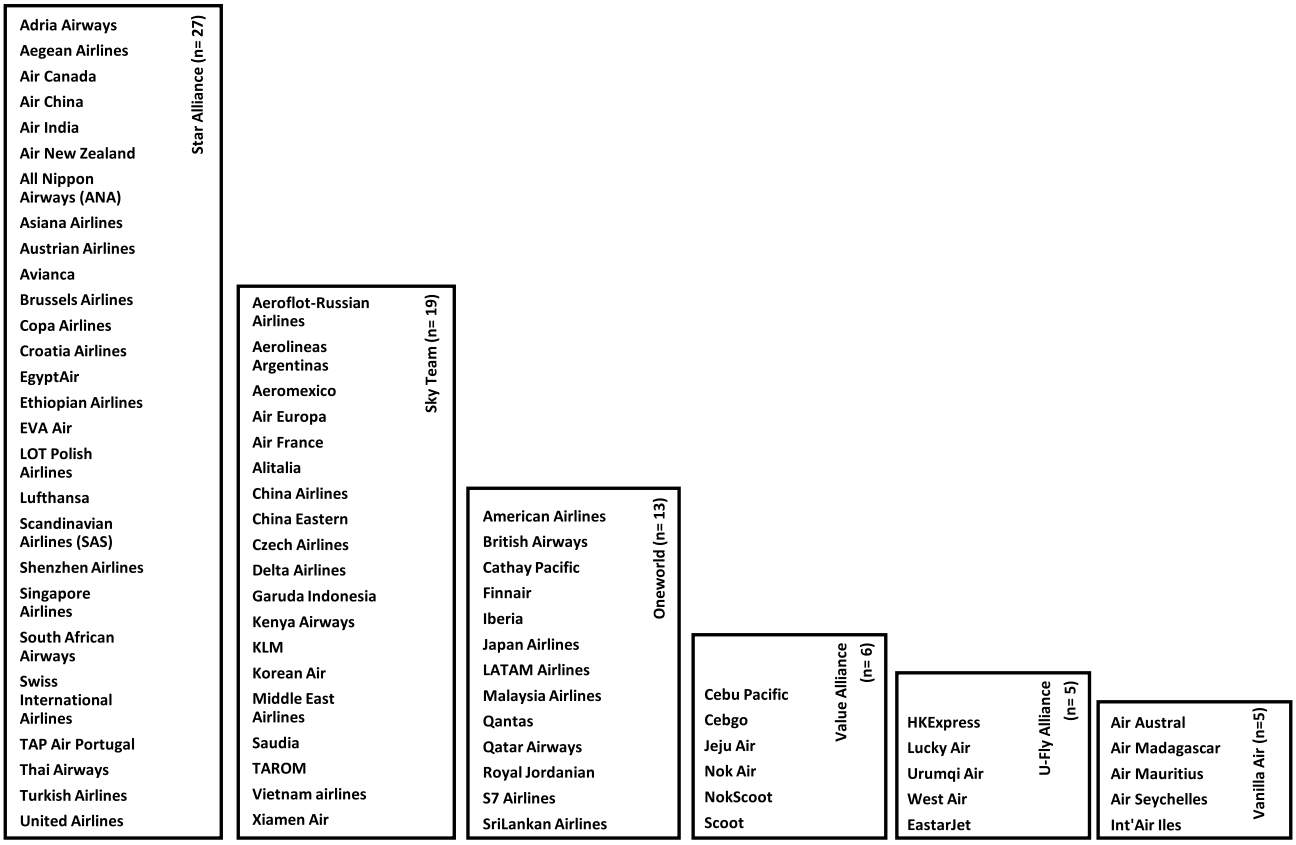

Fig. 1. Global commercial passenger airline conglomerates and their affiliated airline members.

prodromal infected travellers pass health screening measures and reach their destination undetected [12].

In addition to outbreaks of infectious diseases, there are growing concerns regarding the rapid global spread of antimicrobial-resistant pathogens [13]. Global travel to and from countries with poor sanitation and high rates of antimicrobial resistance (AMR) are particularly problematic [14]. Over 300 million travellers visit these high risk areas each year worldwide and more than 20% return as new carriers of resistant organisms [15]. The Western Pacific, Southeast Asia and Eastern Mediterranean regions have the highest burden of resistance, with more than 60% of AMR carriage occurring via Thailand and India [16]. These popular destinations, as well as the Middle East, have high rates of extended spectrum beta-lactamase (ESBL) resistance, one of the most commonly acquired resistance mechanisms worldwide [17]. The rapid emergence of drug-resistant *Candida auris* has gained international attention with outbreaks in healthcare facilities around the world, including in patients within Victoria and New South Wales in Australia who acquired the infection from overseas hospitals [18]. The human, societal, commercial and economic impacts of AMR and outbreaks of infectious disease is high, including airlines which suffer economic and reputational losses in the order of tens of millions of dollars [19].

There is a well-established body of global literature and research addressing airline passengers' health and wellbeing that focuses predominately on preventing and ameliorating the effects of oedema [20], jet lag [21], dehydration [22], and most notably venous thromboembolism (VTE) [23,24]. There is also an established body of literature and research regarding infection control and the prevention of the spread of infectious diseases via sea travel, including guidelines focusing on the containment and prevention of gastrointestinal [25–28] and respiratory infectious diseases such as norovirus [29,30] and influenza [31,32], as well as other highly contagious infectious diseases [33–37]. There is however, by comparison, a dearth of corollary published literature and research on infection control and the prevention of infectious diseases associated with air travel [1]. While there is growing research exploring airborne spread of pathogens within aircraft [38–44], little of this appears to have been translated to passenger and staff health and wellbeing programs to contain and prevent the spread of infectious diseases. In 1997 Leggat argued that airline magazines were an underutilised source of traveller health advice [45]. Some studies have examined passenger's health information within commercial travel websites [46], travel agencies [47], and airline inflight magazines [48], which overall conclude an ongoing lack of the provision of health advice provided to passengers travelling by air particularly in respect to infectious diseases control and prevention.

This research examined the content of the official websites of the airlines belonging to the six global airline conglomerates, to answer two research questions: Do airline websites contain information about infection control and prevention of infectious diseases; How useful is that information with respect to infection control and the prevention of infectious diseases?

2. Methods

2.1. Study design

A descriptive analysis of the official websites of the airlines belonging to the six global airline conglomerates, namely Oneworld™, Star Alliance™, Sky Team™, Vanilla Air™, U-Fly Alliance™ and Value Alliance™, was undertaken to determine the presence of information with respect to infection control and the prevention of infectious diseases.

2.2. Inclusion and exclusion criteria

All leading airline members (n = 75) of the six global airline conglomerates within the July–August 2019 period were considered for the

Table 1
Analytic variable, keyword search and questions.

No.	Variables/Keywords for search	Question
1	Airline's name	What's the name of the airline?
2	Airline's conglomerate	Which conglomerate is the airline a member of?
3	Airline's country of origin	What's the airline's country of origin?
4	Hand hygiene	Does the website contain the word/s **hand hygiene**?
5	Cough etiquette	Does the website contain the word/s **cough etiquette**?
6	Hand wash	Does the website contain the word/s **hand washing**?
7	Wipes	Does the website contain the word/s **wipe(s)**?
8	Infection control	Does the website contain the word/s **infection control**?
9	Infection prevention	Does the website contain the word/s **infection prevention**?
10	Outbreak(s)	Does the website contain the word/s **outbreak(s)**?
11	Communicable disease(s)	Does the website contain the word/s **communicable disease(s)**?
12	Infection(s)	Does the website contain the word/s **infection(s)**?
13	Infectious disease(s)	Does the website contain the word/s **infectious disease(s)**?
14	Hygiene/hygienic	Does the website contain the word/s **hygiene or hygienic**?
15	Disinfect/disinfection	Does the website contain the word/s **disinfect/disinfection**?
16	Sanitary/sanitation	Does the website contain the word/s **sanitary/sanitation**?
17	Health	Does the website contain the word **health?**

analysis. The six commercial passenger airline conglomerates and their member airlines are listed in Fig. 1.

Airline websites were eligible to be included for analysis if they were the official website for the airline and were published in English. Airline websites that were not official, as in owned by the parent airline (n = 2), were excluded. Of the 75 airlines belonging to the six global conglomerates, 73 met the inclusion and exclusion criteria.

2.3. Data collection and analysis

Data collection and analysis occurred during the months of July and August 2019, and followed one of two streams depending on the availability of a built-in search engine tool within the airline's website.

2.3.1. Stream 1: Airline websites with a built-in search tool

Of the 73 airline websites, 50 featured a built-in search tool. For those 50 airline websites, the data were collected and analysed in three sequential phases. During Phase 1, two of the researchers (CS and JM) searched each airline website for 14 specific keywords relating to infection control and prevention of infectious diseases (listed in Table 1) using the website's built-in search engine tool. The result outcome was recorded as binary: *yes, the website search did yield one or more hits*, or *no, the website search yielded no hits*. These results were then independently verified by two additional researchers (RS and CL).

For Phase 2, the affirmative keyword search results in Phase 1 were analysed and the number of hits were recorded as a frequency. For those keywords where the search for a singular noun and a plural noun (e.g. *outbreak* or *outbreaks*) yielded different frequencies, the largest number was recorded. These results were also then verified by two researchers (RS and CL). There was no discordance of the results across the researchers. For Phase 3, the actual text for each affirmative keyword search results from Phase 2 was appraised as to whether the content was useful with respect to infection control and prevention of infectious diseases. The result of the appraisal was recorded as binary: the content of the webpage *did* contain useful information regarding infection prevention and control of infectious diseases, or it *did not*. The determination of clinical usefulness was based on an expert appraisal by a panel of four researchers with expertise in infection control and the prevention of infectious diseases, who considered whether the information was instructive to passengers in providing advice to reduce their risk of contracting an infectious disease. This appraisal was undertaken by two researchers (CS and JM), and these results verified independently by two other researchers (RS and CL). There was no discordance of the results across the researchers.

2.3.2. Stream 2: Airline websites without a built-in search tool

For the remaining 23 airline websites without a built-in search engine tool, a Python™ script-based search was undertaken to search for all 14 keywords. The Python™ script was constructed and drew on the Google™ Search Engine, reporting the frequency for each keyword for each website. Following this, two researchers (CS and JM) manually crosschecked all the results from Python™ search by inspecting each webpage yielding a positive search result, for specific information and advice for passengers about infection control and prevention of infectious diseases. These results were verified independently by two other researchers (RS and CL), and no discordance of the results was found across the researchers.

The data for both streams of analysis was collected in Microsoft Excel®, and were combined into one data set for the purposes of reporting the results.

3. Results

For the period of July–August 2019, there were 73 airline websites within the six global airline conglomerates included in this study. Phase 1 of the analysis revealed that all 14 keywords related to infection control and prevention of infectious diseases were present within all 73 airline websites. The word *health* was the most frequently found keyword, appearing in almost all (n = 68; 93.2%) websites. *Cough etiquette* was the least most frequently located keyword (n = 9; 12.3%). The keywords *infection prevention, infection control, communicable diseases(s)* and *infectious disease(s)* were on average present in just over one-third (38.3%) of the websites. The frequencies for the presence and absences of all 14 keywords for all 73 websites is illustrated in Fig. 2.

For Phase 2, the frequency of the keyword search outputs across all 73 websites was recorded. Across all 73 websites, the word *health* was present 20,385 times, followed by *hand washing* (n = 1954), *hand hygiene* (n = 1889) and *infection control* (n = 1583). The keywords *disinfect/disinfection* (n = 15) and *cough etiquette* (n = 35) were least present within the 73 websites. The keywords *infection prevention, infection control, communicable disease(s)* and *infectious disease(s)* were very seldomly present across the websites. The results from Phase 2 have been graphically presented in Fig. 3.

From the results of Phase 2, a manual review of each of the keyword search outcome was performed to identify the number of websites (out of the 73 in total) that had information that was useful with respect to infection control and prevention of infectious diseases. Nearly half (n = 35; 47.9%) of all airline websites featured some information or advice that was useful for infection control and prevention of infectious diseases for 13 of the 14 keywords. Overall, *health* was the keyword that resulted in the largest number of instances of information (n = 26;

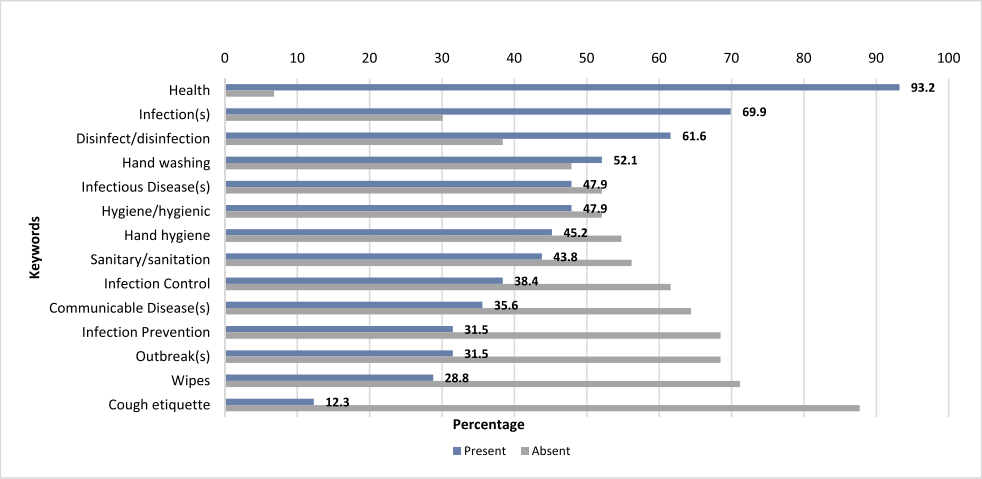

Fig. 2. Presence of keywords across all 73 global airline websites.

35.6%). This was followed by 22 websites providing advice linked to the keyword *infectious disease(s)* (30.1%), 20 for *infection(s)* (27.4%), and 17 providing passengers with some advice relevant to the term *communicable disease(s)* (23.3%). For the keywords *hand washing* and *hand hygiene* there were few instances (n = 3 and n = 2, respectively) of useful information with respect to infection control and prevention of infectious diseases. Only one airline website provided information related to the keywords *disinfect/disinfection* and *sanitary/sanitation* (1.4%). No airline website was assessed as having useful information for infection control and prevention of infectious diseases with respect to *cough etiquette*. All keywords and the number of instances of advice/information found across all websites are listed in Table 2.

Additionally, we assessed the extent to which the website content yielded from the keyword searches was useful in terms of infection control and prevention of infectious diseases. The search using the keyword *infectious disease(s)* yielded 244 results across all 73 websites, and of these only 22 (9%) provided information that was deemed useful for infection control and preventing the spread of an infectious disease. By comparison, the keywords *handwashing* and *hand hygiene* yielded the lowest number (n = 2; 0.1% and n = 3; 0.2%, respectively) of instances of useful information for infection control and preventing the spread infectious disease. The proportions of the content that were deemed useful for infection control and preventing the spread infectious disease for all 14 keywords are listed in Table 3.

Table 2
Number of websites with information on infection control and the prevention of infectious diseases by searched keyword (n = 73).

Keyword	Number of websites with presence of advice (%)
Health	26 (35.6%)
Infectious disease(s)	22 (30.1%)
Infection(s)	20 (27.4%)
Communicable disease(s)	17 (23.3%)
Outbreak	8 (10.9%)
Infection prevention	7 (14%)
Infection control	6 (8.2%)
Hygiene/hygienic	6 (8.2%)
Wipes	4 (5.5%)
Hand hygiene	3 (4.1%)
Hand washing	2 (2.7%)
Sanitary/sanitation	1 (1.4%)
Disinfect/disinfection	1 (1.4%)
Cough etiquette	0

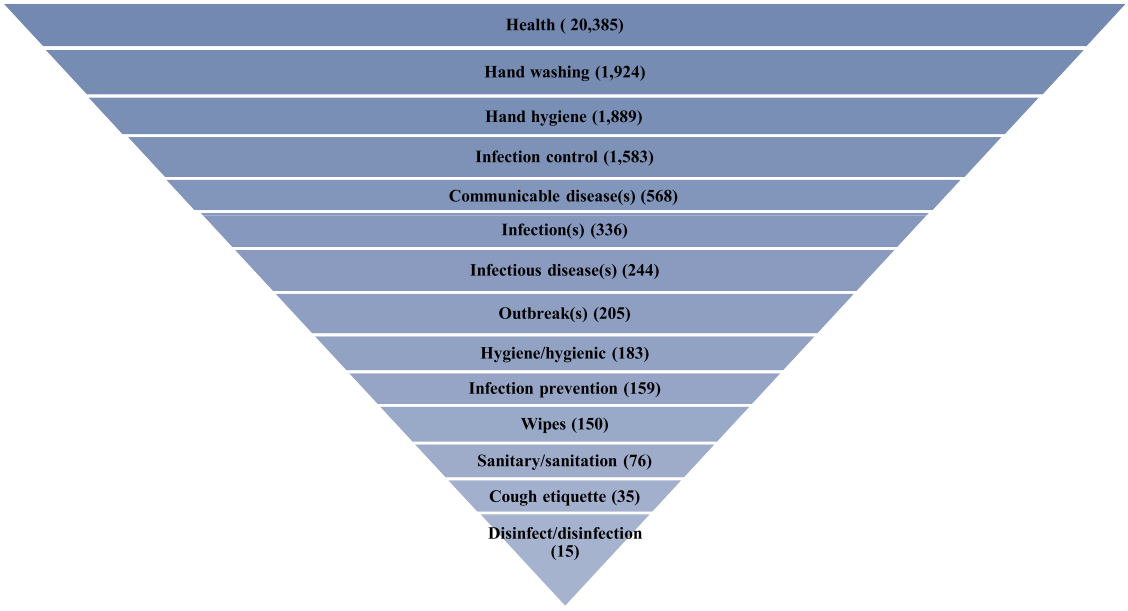

Fig. 3. Keywords and their search result output frequencies across all 73 airline websites.

Table 3
Instances of useful information on infection control and prevention of infectious diseases with respect to total keyword search output.

Keyword	Instances of useful information within keyword search output
Infectious disease(s)	22/224 (9%)
Disinfect/disinfection	1/15 (6.7%)
Infection(s)	20/336 (6%)
Infection prevention	7/159 (4.4%)
Outbreak	8/205 (3.9%)
Hygiene/hygienic	6/183 (3.3%)
Communicable disease(s)	17/568 (3%)
Wipes	4/150 (2.7%)
Sanitary/sanitation	1/76 (1.3%)
Infection control	6/1583 (0.4%)
Hand hygiene	3/1889 (0.2%)
Health	26/20385 (0.13%)
Hand washing	2/1954 (0.1%)
Cough etiquette	0/35

There were some websites where the information provided based on the keyword search was considered useful regarding terms of infection control and prevention of infectious diseases. Of the 73 websites, ten (13.7%) contained information for passengers suggesting they review their vaccination status prior to travel, as part of the destination countries' migration policies. There were eight airline websites (11%) that contained information for passengers recommending immunisation for vaccine-preventable diseases, particularly Cholera and Yellow Fever. One Asian airline, namely Air China, directed individuals to seek information on vaccines against influenza, malaria, hepatitis B virus and epidemic encephalitis B. Two airline websites, South African Airways and HK Express, provided information about Ebola Virus Disease (EVD) for passengers who may have visited endemic areas, and included website links to official government advisory websites. Five airline websites (two from Japan, one from Great Britain, one from Middle East and one from South Africa) featured a list of common and highly contagious infections (including Influenza, Measles, Chicken Pox and Tuberculosis) and their respective transmission periods. The website for Thai Airways provided comprehensive advice on handwashing, advocating it as an effective way for passengers to prevent infectious diseases. The website for Jeju Air, a Korean airline, was the only one to feature information about Middle Eastern Respiratory Syndrome (MERS-CoV). This was presented in the form of a safety guide that featured advice on hand washing, mask use, cough etiquette, and contact details for a 24-h MERS-CoV hotline. The websites of Air Canada, Japan Airlines, All Nippon Airways (ANA), Saudia and South African Airways featured website URL links to their respective countries' department of health website and advised passengers to visit these websites for further official information about infectious diseases.

The website for Turkish Airlines contained multiple forms of information and advice that encompassed the importance of infection control and the prevention of infectious diseases, particularly during the in-flight period. These included explicit statements on hygiene procedures for hands and in-cabin surfaces, which were supported by URLs to scientific publications. The website also recommended the use personal protective equipment (PPE) such as masks to prevent the spread of potential infectious agents while onboard.

4. Discussion

The purpose of this study was to examine the content of the websites for the global commercial passenger airlines within the six major airline conglomerates to determine: a) the extent to which the airline websites contained information about infection control and prevention of infectious diseases, and b) to determine how useful that information was with respect to infection control and the prevention of infectious diseases. More than three billion passengers travel by air annually, with the majority of journeys occurring in less than 24 h [49]. This brings significant challenges for measures to minimise the spread of infectious diseases and to prevent and control infectious diseases outbreaks. Passengers are vectors for the spread of infectious issues, with well-documented cases of inflight and post-flight transmission of influenza [50], measles [51], meningococcal infections [52] and multi-drug resistant tuberculosis [53] among several other infectious agents [44,54]. Air travel has been a facilitator of the emergence or re-emergence of once eradicated infectious agents. A single case of imported measles by air travel in 2005, resulted in the re-emergence of this disease in the state of Indiana and USA [55]. South Korea has reported an increase in travel-related cases of dengue [56].

The findings of this study suggest that overall there is limited information about infection control and the prevention of infectious diseases within the websites for the global commercial passenger airlines. Only 35 out of the 73 websites analysed featured some useful information about infection control and the prevention of infectious diseases. When there was information about infection control and the prevention of infectious diseases it was limited in nature and often reflected specific migration requirements for specific countries. The information provided was most commonly about passenger vaccination status prior to travel, passengers fitness to travel, with some suggestions to seek medical advice and clearance if the passenger thought they were unwell with an infectious disease. The airline websites did not feature systematic advice recommending passengers not to travel (or to defer their travel) if they self-suspected they had an infectious disease or were confirmed as being infected with an infectious disease by a healthcare professional.

There were, however, some notable exceptions. Thai Airways and Turkish Airlines websites did provide advice recommending the use of hand sanitiser and/or wipes for both hand hygiene and surface disinfection on board. It is well-documented that the use of disinfectant wipes to decontaminate the common-use and high touch surfaces (e.g. tray table, entertainment screen, remote control units and seatbelt buckles) within a passenger's local environment helps to break the chain of infection [57–59]. Only one airline website, Jeju Air from Korea, provided information about MERS-CoV. This may reflect national concerns following the outbreak of MERS-CoV in South Korea in 2015 which originated from a passenger who travelled by air from the Kingdom of Saudi Arabia [60].

Existing research demonstrates that air travellers actively seek health advice with respect to the risk of infectious diseases and their travel destinations [61]. Leggat [45], in 1997, identified the need to do more regarding the availability of travel health advice provided by airlines using inflight magazines. Yet, more than 20 years later, the results of this study suggest that airlines have appeared to not take advantage of the opportunity to provide passengers with tailored and comprehensive advice regarding how they can protect themselves from infectious diseases. Such advice should be included among the other health and wellbeing advice provided to passengers in the pre-flight [62,63], inflight [45,64] and post-flight [65,66] periods of their journey. It may be argued that such advice can be found in official government websites, such as Australia's SmartTraveller™, and that the travelling public should consult those sources of information. In this study there were very few airline websites that directed passengers to such sources of information based on the keyword search strategy used, which suggest missed opportunities to inform passengers of measures to reduce the risk of the spread of infectious disease and improve their overall travel experience. Our study found that in most cases where information regarding infection control and the prevention of infectious diseases was present it was not easy to locate. Only 50 of the 73 airline websites had a built-in search engine tool. The lack of a built-in search engine tool in the remaining 23 airline websites is a barrier to passengers wanting to search for information that a specific airline provides to its passengers about infectious diseases and how they can lower

their risk. In this study we used a computational Python™ script to search for the keywords of interest in websites that had no built-in search tool, which the everyday travelling public would not have access to. The availability, prominence and searchability of this kind of information may help inform and improve passengers' health-related behaviours, particularly those relating to infection control and the prevention of infectious diseases.

This study has some limitations. Airline websites are not static. They are dynamic, ever-changing, and constantly being updated. Performing the same keyword search on the same website at different times, even hours apart on the same day, yielded different results. Not all 73 websites were analysed on the same day and time, and the analysis of the websites on another day or time would yield different results. Furthermore, although the assessment of the clinical usefulness of the information within the websites for infection control and the prevention of infectious diseases was made by a panel of researchers that are duly qualified and experienced to do so, they were general in nature and the professional opinion of one group of experts. Other objective measures may be useful.

5. Conclusions

Airlines communicate to their passengers through a range of media. Websites are chief among them as they are the source of original information for passengers. The results from this study suggest that websites are an underutilised source of information for passengers with respect to infection control and how they can prevent, or lower the risk of, contracting an infectious disease via air travel. Providing passengers with contemporary advice and guidance on basic infection control measures, such as hand hygiene and cough etiquette, within official airline websites could enhance passengers' health and wellbeing and aid the global efforts against the spread of infectious diseases.

Author contributions

Ramon Zenel Shaban: Conceptualisation, Methodology, Validation, Formal Analysis, Investigation, Data Curation, Writing Original Draft, Writing Review and Editing, Project Administration. **Cristina Sotomayor-Castillo**: Conceptualisation, Methodology, Validation, Formal Analysis, Investigation, Data Curation, Writing Original Draft, Writing Review and Editing, Project Administration. **Jeremy Malik**: Data Curation, Validation, Formal Analysis, Investigation, Writing Review and Editing. **Cecilia Li**: Formal Analysis, Writing Original Draft, Writing Review and Editing. All authors contributed to the final analysis and interpretation of the results. All authors contributed to the drafting of this manuscript and approved it for submission.

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Declaration of competing interest

The authors have declared no conflicts of interest.

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References

[1] Grout A, et al. Guidelines, law, and governance: disconnects in the global control of airline-associated infectious diseases. Lancet Infect Dis 2017;17(4):e118–22.
[2] MacPherson DW, et al. Population mobility, globalization, and antimicrobial drug resistance. Emerg Infect Dis 2009;15(11):1727–32.
[3] Webster CH. Airline operating realities and the global spread of infectious diseases. Asia Pac J Public Health 2010;22(3 Suppl):137s–43s.
[4] Australian Governement. Department of infrastructure regional development and cities International airline activity. Aviation Statistics 2019 [cited 2019 04/04/19]. https://bitre.gov.au/statistics/aviation/international.aspx.
[5] Mangili A, Vindenes T, Gendreau M. Infectious risks of air travel. Microbiol Spectr 2015;3(5):1–10.
[6] Moore M, et al. Identifying future disease hot spots: infectious disease vulnerability index. Rand Health Quarterly 2017;6(3):5.
[7] Edelson PJ. Patterns of measles transmission among airplane travelers. Trav Med Infect Dis 2012;10(5–6):230–5.
[8] Bogoch II, et al. Assessment of the potential for international dissemination of Ebola virus via commercial air travel during the 2014 west African outbreak. Lancet 2015;385(9962):29–35.
[9] Zoldi V, et al. Destination specific risks of acquisition of notifiable food- and waterborne infections or sexually transmitted infections among Finnish international travellers, 1995-2015. Trav Med Infect Dis 2018;25:35–41.
[10] Saunders-Hastings PR, Krewski D. Reviewing the history of pandemic influenza: understanding patterns of emergence and transmission. Pathogens 2016;5(4).
[11] Regan JJ, et al. Tracing airline travelers for a public health investigation: Middle East respiratory syndrome Coronavirus (MERS-CoV) infection in the United States, 2014. Public Health Rep 2016;131(4):552–9.
[12] Mangili A, Gendreau MA. Transmission of infectious diseases during commercial air travel. Lancet 2005;365(9463):989–96.
[13] Ferri M, et al. Antimicrobial resistance: a global emerging threat to public health systems. Crit Rev Food Sci Nutr 2017;57(13):2857–76.
[14] MacFadden DR, et al. A passage from India: association between air traffic and reported cases of New Delhi Metallo-beta-lactamase 1 from 2007 to 2012. Trav Med Infect Dis 2015;13(4):295–9.
[15] Kuenzli E. Antibiotic resistance and international travel: causes and consequences. Trav Med Infect Dis 2016;14(6):595–8.
[16] Wiklund S, et al. Knowledge and understanding of antibiotic resistance and the risk of becoming a carrier when travelling abroad: a qualitative study of Swedish travellers. Scand J Public Health 2015;43(3):302–8.
[17] Woerther PL, Andremont A, Kantele A. Travel-acquired ESBL-producing Enterobacteriaceae: impact of colonization at individual and community level. J Travel Med 2017;24(suppl_1):S29–34.
[18] Victoria Health. Candida auris case detected in Victoria. Health and Human Services ed. Victoria: Communicable Disease Epidemiology and Surveillance 2018 [cited 2018 17/12/18]. https://www2.health.vic.gov.au/about/news-and-events/healthalerts/candida-auris-case-detected-in-victoria.
[19] Fenichel EP, Kuminoff NV, Chowell G. Skip the trip: air travelers' behavioral responses to pandemic influenza. PLoS One 2013;8(3). e58249.
[20] Belcaro G, et al. Long-haul flights, edema, and thrombotic events: prevention with stockings and Pycnogenol(R) supplementation (LONFLIT Registry Study). Minerva Cardioangiologica Europea 2018;66(2):152–9.
[21] Herxheimer A. Jet lag. BMJ Clinical Evidence, 2014; 2014.
[22] Hammadah M, et al. Navigating air travel and cardiovascular concerns: is the sky the limit? Clin Cardiol 2017;40(9):660–6.
[23] Korzeniewski K. Travel health prevention. Int Marit Health 2017;68(4):238–44.
[24] Philbrick JT, et al. Air travel and venous thromboembolism: a systematic review. J Gen Intern Med 2007;22(1):107–14.
[25] Mouchtouri VA, et al. Gastroenteritis outbreaks on cruise ships: contributing factors and thresholds for early outbreak detection. Euro Surveill 2017;22(45).
[26] Dahl E. Vessel sanitation inspection scores and acute gastroenteritis outbreaks on cruise ships. Int Marit Health 2018;69(4):223–4.
[27] Yamakawa M, et al. Diarrhea and related factors among passengers on world cruises departing from Japan. Trav Med Infect Dis 2018;23:56–63.
[28] Taylor CJ. Gastroenteritis outbreaks on cruise ships: are sanitation inspection scores a true index of risk? Int Marit Health 2018;69(4):225–32.
[29] Bert F, et al. Norovirus outbreaks on commercial cruise ships: a systematic review and new targets for the public health agenda. Food and Environmental Virology 2014;6(2):67–74.
[30] Carling PC, Bruno-Murtha LA, Griffiths JK. Cruise ship environmental hygiene and the risk of norovirus infection outbreaks: an objective assessment of 56 vessels over 3 years. Clin Infect Dis 2009;49(9):1312–7.
[31] Mouchtouri V, et al. Preparedness for the prevention and control of influenza outbreaks on passenger ships in the EU: the SHIPSAN TRAINET project communication. Euro Surveill 2009;14(21).
[32] Centres for Disease Control and Prevention. Outbreak of 2009 pandemic influenza A (H1N1) on a Peruvian Navy ship - June-July 2009. MMWR Morb Mortal Wkly Rep 2010;59(6):162–5.
[33] Rooney RM, et al. A review of outbreaks of foodborne disease associated with

passenger ships: evidence for risk management. Public Health Rep 2004;119(4):427–34.
[34] Cramer EH, et al. Management and control of varicella on cruise ships: a collaborative approach to promoting public health. J Travel Med 2012;19(4):226–32.
[35] Rice ME, et al. Maritime varicella illness and death reporting, U.S., 2010-2015. Trav Med Infect Dis 2018;23:27–33.
[36] Schlaich C, et al. Public health significance of chickenpox on ships - conclusions drawn from a case series in the port of Hamburg. Int Marit Health 2010;61(1):28–31.
[37] LaMar JE, et al. Sentinel cases of community-acquired methicillin-resistant Staphylococcus aureus onboard a naval ship. Mil Med 2003;168(2):135–8.
[38] Grubaugh ND, et al. Tracking virus outbreaks in the twenty-first century. Nat. Microbiol. 2019;4(1):10–9.
[39] Lam TT, et al. Genomic analysis of the emergence, Evolution, and spread of human respiratory RNA viruses. Annu Rev Genom Hum Genet 2016;17:193–218.
[40] Tatem AJ. The worldwide airline network and the dispersal of exotic species: 2007-2010. Ecography 2009;32(1):94–102.
[41] Tatem AJ. Mapping population and pathogen movements. Int. Health 2014;6(1):5–11.
[42] Dudas G, et al. Virus genomes reveal factors that spread and sustained the Ebola epidemic. Nature 2017;544(7650):309–15.
[43] Leitmeyer K, Adlhoch C. Review article: influenza transmission on aircraft: a systematic literature review. Epidemiology 2016;27(5):743–51.
[44] Hertzberg VS, Weiss H. On the 2-row rule for infectious disease transmission on aircraft. Ann Glob Health 2016;82(5):819–23.
[45] Leggat PA. Travel health advice provided by in-flight magazines of international airlines in Australia. J Travel Med 1997;4(2):102–3.
[46] Horvath LL, Murray CK, DuPont HL. Travel health information at commercial travel websites. J Travel Med 2003;10(5):272–8.
[47] Grabowski P, Behrens RH. Provision of health information by British travel agents. Trop Med Int Health 1996;1(5):730–2.
[48] Shaban RZ, et al. Passenger travel health advice regarding infection control and the prevention of infectious diseases: what's in airline inflight magazines? Trav Med Infect Dis 2019. https://doi.org/10.1016/j.tmaid.2019.07.009.
[49] Grout A, et al. Guidelines, law, and governance: disconnects in the global control of airline-associated infectious diseases. Lancet Infect Dis 2017;17(4):e118–22.
[50] Brannen DE, et al. International air travel to Ohio, USA, and the impact on malaria. Influenza, and Hepatitis A. Scientifica; 2016. p. 8258946. 2016.
[51] Nic Lochlainn L, et al. A unique measles B3 cluster in the United Kingdom and The Netherlands linked to air travel and transit at a large international airport. Euro Surveill 2016;21(13). February to April 2014.
[52] Centres for Disease Control and Prevention. Exposure to patients with meningococcal disease on aircrafts–United States, 1999-2001. MMWR Morb Mortal Wkly Rep 2001;50(23):485–9.
[53] Jackson C, Abubakar I. Ending tuberculosis in risk groups in Europe: challenges from travel and population movement. Euro Surveill 2017;22(12).
[54] Dahl V, Wallensten A. Self-reported infections during international travel and notifiable infections among returning international travellers, Sweden, 2009-2013. PLoS One 2017;12(7). e0181625.
[55] Parker AA, et al. Implications of a 2005 measles outbreak in Indiana for sustained elimination of measles in the United States. N Engl J Med 2006;355(5):447–55.
[56] Choe YJ, Choe SA, Cho SI. Importation of travel-related infectious diseases is increasing in South Korea: an analysis of salmonellosis, shigellosis, malaria, and dengue surveillance data. Trav Med Infect Dis 2017;19:22–7.
[57] Bruhwasser C, et al. Self-disinfecting surfaces and activity against Staphyloccocus aureus ATCC 6538 under real-life conditions. J Hosp Infect 2017;97(2):196–9.
[58] Lopez GU, et al. Evaluation of a disinfectant wipe intervention on fomite-to-finger microbial transfer. Appl Environ Microbiol 2014;80(10):3113–8.
[59] Kenters N, et al. Effectiveness of cleaning-disinfection wipes and sprays against multidrug-resistant outbreak strains. Am J Infect Contr 2017;45(8):e69–73.
[60] Oh MD, et al. Middle East respiratory syndrome: what we learned from the 2015 outbreak in the Republic of Korea. Korean J Intern Med 2018;33(2):233–46.
[61] Bauer IL. Travel health advice as recalled by 552 tourists to Peru. J Travel Med 2002;9(6):293–6.
[62] Rolling T, et al. Pre-travel advice at a crossroad: medical preparedness of travellers to South and Southeast-Asia - the hamburg airport survey. Trav Med Infect Dis 2017;18:41–5.
[63] Rowe K, Chaves N, Leder K. Challenges to providing pre-travel care for travellers visiting friends and relatives: an audit of a specialist travel medicine clinic. J Travel Med 2017;24(5).
[64] Israels J, et al. Fitness to fly in the paediatric population, how to assess and advice. Eur J Pediatr 2018;177(5):633–9.
[65] Silverman D, Gendreau M. Medical issues associated with commercial flights. The Lancet 2009;373(9680):2067–77.
[66] Gordon CJ, et al. The effect of consecutive transmeridian flights on alertness, sleep-wake cycles and sleepiness: a case study. Chronobiol Int 2018;35(11):1471–80.