

Article

Cleaning and Hygiene in the Air Transport Industry after the COVID-19 Pandemic

Lázaro Florido-Benítez 

Department of Economics and Business Administration, University of Málaga, 29016 Málaga, Spain; lfb@uma.es

Abstract: Bearing in mind the socio-economic consequences of COVID-19 on airports and passengers, this study considers cleaning and hygiene a top priority in airports and airlines' operating processes. Both airport operators and passengers should be aware that the COVID-19 pathogen has not yet gone away and, thus, continues to spread despite mass vaccination. In this context, this paper's objective is to show the importance of cleaning and hygiene in the air transport industry to encourage the passengers' confidence in making decisions to travel on commercial airlines and help airport and airline operators make better decisions in their efforts to improve the cleaning and hygiene protocols. Passengers' awareness of hygiene and cleanliness has increased, but unfortunately, airports and airlines have reduced cleaning and hygiene activities to save costs. Although there is much to do to help the aviation sector recover, we also see plenty of reasons to be optimistic about the air transport industry's future, as long as airport and airline operators can guarantee an adequate quality of service with regard to cleaning and hygiene in order to ensure passengers' safety and well-being. Airports and airlines cannot lower their guard because the SARS, H1N1, MERS, and COVID-19 viruses remain active in society.

Keywords: hygiene; cleaning; airports; airlines; passengers; COVID-19; virus



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1. Introduction

Cleaning and hygiene have completely changed in the aviation industry due to the increase in the number of passengers and airlines' operations in the first decades of the 21st century, and especially because the COVID-19 pandemic in 2020. Although hygiene standards have improved after the coronavirus crisis, there remains a need to safeguard the health of passengers and crews against the transmission of communicable diseases, such as COVID-19, and severe acute respiratory syndrome (SARS) on board aircrafts, which has renewed interest in cleaning and disinfecting aircrafts and airports. The pandemic has put a sharp focus on health, safety, hygiene, and the cleaning of the aviation sector to improve the hygiene of airports and aircrafts and provide germ-killing solutions, as the virus is here to stay [1]. For instance, the international air transport rating agency SKYTRAX has introduced the airport and airline Hygiene Safety Rating as a key part of the process to maintain cleanliness and hygiene improvements following the success of COVID-19 Safety Ratings [2]. The aviation industry has been seriously affected by the pandemic crisis. Airports and airlines were also forced to undertake radical internal reform in operability and efficiency terms due to the imposition of domestic and international travel bans by governments worldwide, leading to a reduction in the number of passengers at airports and airlines [3,4].

Airports will continue with the implementation of strict cleaning and hygiene protocols. This is because the consequences of an infected passenger spreading COVID-19 to other parts of the world is significant. For this reason, airports continue to clean and disinfect surfaces regularly. The World Health Organization (WHO) recommends that passengers follow all the instructions given by airports and commercial airlines in line with the International Civil Aviation Organization (ICAO), International Air Transport

Association (IATA), Eurocontrol, European Aviation Safety Agency (EASA), Airports Council International (ACI), World Tourism Organization (UNWTO), World Travel & Tourism Council (WTTC), European Medicines Agency (EMA), US Food and Drug Administration (FDA), and Emergency Use Authorization (EUA) rules to prevent the transmission of COVID-19 and its variants identified to date [5,6]. Pantouvakis and Renzi [7] found that safety, cleanliness, and hygiene factors at airports and airlines have a positive effect on passengers' satisfaction [8] because of the effort and rapid response of airports to ensure that they are safe, clean, and disinfected environments. Kungwola et al. [9] revealed that the most significant factors of safety measures to prevent the spread of COVID-19 affecting the confidence of passengers deciding to travel in low-cost carriers (LCCs) during the pandemic were passenger hygiene measures, aircraft preparation measures, and service personnel hygiene measures, amongst many others. Cleanliness and hygiene activities are now prioritized over any other factors, and passengers seek health and safety as they pass through airports [10,11].

In both passenger and monetary terms, the European airports lost 1.32 billion passengers and €33.6 billion of passenger revenue in 2020 [12]. Due to the decrease in passenger demand, quarantine measures, and reduction in the number of national and international flights, among others, airports and airlines have not yet reached their pre-pandemic levels [13,14]. Most airlines implemented inflight social distancing measures and additional sanitary and hygiene efforts as a means of addressing governments' directives and consumers' concerns over possible transmission during travel [15]. COVID-19 has ushered a new model of cleaning and hygiene at airports and airlines, forcing them to adopt hospital-grade disinfectants to kill any lingering viral particles [16]. We should not forget the relevance of airports and airlines to the country's economy. Indeed, 58% of international tourists reached their destinations around the world using airlines; in the case of Spain, this percentage increases to 75% [17,18]. In this context, this paper's objective is to show the importance of cleaning and hygiene in the air transport industry to encourage the passengers' confidence in making the decision to travel on commercial airlines and help airport and airline operators make better decisions in their efforts to improve the safety and hygiene protocols.

2. Current State of Cleaning and Hygiene in the Air Transport Industry

Airports and planes are the cleanest they have ever been thanks to the changes implemented by the new COVID-19 cleaning practices, which is a positive step for the aviation industry. For instance, to avoid cross-infection inside the aircraft, the cabin area can be divided into a clean area, buffer zone, passenger sitting area, area for close contacts, and quarantine area, according to different utilities [9]. Emirates, Cathay Pacific, and Delta airlines have embraced new protocols of cleaning, such as the disinfection and cleaning of surfaces including windows, seatback screens, in-seat controls, panels; the implementation of hand sanitizer stations onboard each of its aircraft; or even the application of an antimicrobial coating to seats, tray tables, lavatories, overhead bins, and crew stations [15,19,20].

Every aircraft is disinfected and cleaned after each flight. The process takes about 15 min, carved out from the time the plane is already on the ground. Although after the pandemic crisis, some airlines, like Southwest airlines, stopped cleaning all surfaces between flights [21], or reducing the aircraft cleaning time on short haul flights, as in the case of British Airways; this new "Express clean" only takes 6 min (see Table 1), and these cleaning and hygiene practices are not carried out by this airline [22]. On the contrary, EgyptAir, JetBlue, Air Europa, Qatar, Emirates, and Cathay Pacific vowed to carry on the policies after the pandemic. Due to the impact of COVID-19, cleanliness has begun to be measured at the hygienic level [23]. The pandemic crisis not only changed our daily routines, but also the tourism and aviation industries.

Table 1. British Airways' express clean measure (it only takes 6 min).

British Airways' Express Clean on Short Flights	
Cleaning and Hygiene Protocols Will Be Reduced	Cleaning and Hygiene Protocols Will Be Maintained
Headrests will not be changed	Toilet bins will be emptied, and toilets will be stocked
Seatbelts will not be crossed	Galley bins will be emptied
Tray tables will not be checked or wiped	Any large items (such as bags of crisps) will be removed from the floor
Seats will not be wiped	Rubbish will be removed from the seat pocket
The floor will not be vacuumed	Seats will be checked for safety cards
Air freshener will not be sprayed	
Bathroom floors and surfaces will not be cleaned	
Galley floors and surfaces will not be cleaned	

Source: Own elaboration from [22].

Reducing aircraft cleaning saves money and reduces the time between flights, but this initiative is not good for passengers in terms of quality of service. Are airlines capable of keeping planes clean? Some doubts have been raised about the cleaning and hygiene capacity of airline operators in their airplanes. Unfortunate incidents do occur, like the Delta flight that had to make a U-turn due to a passenger suffering from diarrhea, which spread throughout the airplane, or the travelers who were removed from their Air Canada flight after refusing to sit in vomit-soaked seats in August 2023 [24]. This confirms that airline operators should improve their cleaning and hygiene protocols. Although we are fully aware of the fact that these protocols are crucial, they are also time-consuming and costly for airline operators. The management of passengers' safety and hygiene by airport and airline operators must guarantee their safety, because airline activities create the demand for airport services and, in the end, increase the profits of airports.

Nevertheless, one measure that has remained is the air filtration carried out by American, United, Delta and Southwest airlines, which continue to use hospital-grade filtration systems on their planes that replace air every few minutes. Furthermore, US and European airports employ filters called Minimum Efficiency Reporting Value (MERV), especially the MERV-13 filters [25]; however, according to the American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE), airport and airline operators should use the High-Efficiency Particulate Air (HEPA) filters because they are at the highest MERV level and are the most efficient at protecting against air pollutants [26]. There is a new technology for safe chemical air treatment that kills viruses, namely Triethylene Glycol-based products, which may become important in containing future pandemics [27]. Figure 1 presents the MERV ratings, filter types, and particles removed. HEPA filters are at the highest MERV level and are the most efficient at protecting against air pollutants. For example, a MERV 13 will trap less than 75% of air particles that are 0.3–1.0 micron in size (the coronavirus is 0.1 microns), but a MERV with a 17 rating will trap 99.97% of air particles that are 0.3–1.0 micron in size [28]. In addition, airports have a predetermined capacity based on their area, which is set to avoid overcrowding, as well as include the provision of hand-based sanitizers, maintaining social distancing, and the wide availability of contactless payment methods to avoid any future spread of COVID-19 and its new variants [29].

Bearing in mind the socio-economic consequences of COVID-19 on airports and passengers, this study considers the safety, cleaning, and hygiene measures a top priority within airports and airlines' operating processes (e.g., PCR tests, temperature screenings, use of masks, physical distancing, hand sanitation, air filtration systems, and cleaning of surfaces, among others). Both airport operators and passengers should be aware that the COVID-19 pathogen has not yet gone away, and this continues to spread despite mass vaccination [30]. Despite hygiene measures, microorganisms present in public and private spaces may be responsible for virus infections [31]. According to the European Centre for Disease Prevention and Control (ECDC), COVID-19 transmission has increased in August 2023 in the European Union/European Economic Area (EU/EEA) due to factors such as

large gatherings and increased travel during the seasonal holidays [32,33]. The travel and tourism industries are viewed as a significant transmission pathway that aids the spread of various diseases across the world through the mobility of infected persons [34]. For this reason, airports and airlines' websites and apps must provide all information related with safety, hygiene, and cleaning measures, because it will be easier for passengers to comprehend what awaits them at the airport or during the flight [35,36].

MERV Rating	Air filter will trap particles sized .3 to 1.0 microns	Air filter will trap particles sized 1.0 to 3.0 microns	Air filter will trap particles sized 3.0 to 10 microns	Filter Type & Particles Removed
MERV 1	<20%	<20%	<20%	Fiberglass and Aluminum Mesh pollen, dust mites, spray paint, carpet fibers, pet dander
MERV 2	<20%	<20%	<20%	
MERV 3	<20%	<20%	<20%	
MERV 4	<20%	<20%	<20%	
MERV 5	<20%	<20%	20% - 34%	Disposable Filters mold spores, kitchen aerosols, hair spray, furniture polish, household cleaning sprays
MERV 6	<20%	<20%	35% - 49%	
MERV 7	<20%	<20%	50% - 69%	
MERV 8	<20%	<20%	70% - 85%	
MERV 9	<20%	>50%	85% or better	Home Box Filters lead dust, flour, auto fumes, welding fumes
MERV 10	<20%	50% - 64%	85% or better	
MERV 11	<20%	65% - 79%	85% or better	
MERV 12	<20%	80% - 90%	90% or better	Commercial Filters bacteria, wildfire smoke, respiratory droplets
MERV 13	>75%	90% or better	90% or better	
MERV 14	75% - 84%	90% or better	90% or better	
MERV 15	85% - 94%	95% or better	90% or better	
MERV 16	95% or better	95% or better	90% or better	HEPA and ULPA viruses, carbon dust
MERV 17	99.97%	99% or better	99% or better	
MERV 18	99.997%	99% or better	99% or better	
MERV 19	99.9997%	99% or better	99% or better	
MERV 20	99.99997%	99% or better	99% or better	

Figure 1. Particles removed by type of MERV filter. Source: Courtesy of [28]. Note. MERV is Minimum Efficiency Reporting Value; High-Efficiency Particulate Air (HEPA); and Ultra-low Penetration Air (ULPA).

Figure 2 displays the extraordinary joint safety, cleaning, and hygiene measures applied by airports and airlines during the pandemic crisis. The measures adopted were agreed upon by national governments, public and private organizations, insurance companies, airports, and airline operators to reduce the uncertainty of passengers and companies and establish a roadmap to restore the air transport and tourism activities. The effectiveness of cleaning and hygiene measures at airports and airlines must be checked and recorded by ground staff. For example, the meticulous cleaning of toilets at airports and on aircrafts, together with the sanitary treatment, handling, and disposal of toilet waste must be an obligation and priority of the airport and airline operators (e.g., airport's toilets should be cleaned three times every 24 h). Nicolaides et al. [37] found that by increasing travelers' engagement with hand hygiene at all airports, a potential pandemic can be inhibited by 24% to 69% (the sample consisted of 2500 airports around the world). As stated by Bailey and WHO [38], regular cleaning and hygiene inspections by health authorities at intervals not exceeding one month are advisable, but the frequency may be varied according to the conditions found on inspection.

Moreover, the EU Digital COVID Certificate (DCC) was another measure implemented by airports for controlling and reducing the impact of COVID-19 on the aviation industry. DCC is a digital proof that a person has been vaccinated against COVID-19, but, according to Halpin [39], the DCC does not preserve the passengers' fundamental privacy rights, and the DCC does not ensure immunity against the virus [5,40]. However, the International Society of Travel Medicine (ISTM) advocate for a reliable, equitable, interoperable, and globally accepted DCC [41].



Figure 2. Extraordinary joint safety/cleaning/hygiene measures during the pandemic crisis. Source: Prepared by author from [5].

From an operational expenditure (OPEX) point of view, the increase in safety, cleaning, and hygiene costs and the reduction in the number of passengers and operations for airports and airlines created a big problem in their balance sheet and income statement, which has forced a significant number of airports and commercial airlines to reduce the cleaning and hygiene activities. Serrano and Kazda [42] note that airport and airline operators are implementing strategies that will maximize the business in the short due to the high losses experienced during the pandemic crisis [4]. Concerning the restaurants and shops' hygiene and cleaning rules inside of airport's terminal, these must be strictly complied in accordance with the norms stated by government bodies and airports' rules.

The cleaning and hygiene services provided by airport operators are part of the service that is supplied to passengers inside of the airport's terminal. Bogicevic et al. [43] found that cleanliness and hygiene factors have a direct impact on the passenger's satisfaction. Airports' aeronautical and commercial revenues are largely dependent on airlines' operations and passengers who tend to travel many times [44–46]. This is also one of the main reasons why airport and airline operators need to provide specific information and communication strategies directed at passengers, airports, and airline operators, to stimulate tourism demand in times of uncertainty. Pittau et al. [47] claims that public and private organizations must enhance health information and communication targeted at passengers and tourists. In 2023, airport and airline operators established measures that protect passengers, increase efficiency, and ensure a quality customer experience anchored on employees' health and passenger safety [48]. Moreover, passengers must comply with protective measures as considered appropriate by the country of departure, the country of arrival, airports, and airlines [49].

When an infected passenger boards the aircraft, measures are unnecessary. Indeed, most research concentrates directly on the flight and transmission of the virus onboard the aircraft, with little mention of the spread of the virus at airports or the adoption of measures [50]. For instance, foreign travelers have a clear risk of contracting individually and socially significant infectious diseases. More than half of travelers to risk areas received no vaccinations before the trip, and all of them passed through an airport [51]. It is completely impossible to reach an international consensus in terms of safety, hygiene, and cleaning at airports because any decision to implement new actions and measures requires

adequate resourcing supported by economic budgets, and all airports do not have the same economic resources to include these measures. For example, the Shannon (IATA code is SNN) and the Cork (ORK) airports are regional Irish airports that receive 1.5 and 2.5 million passengers annually, and these two airports do not need the same cleaning and hygiene systems as that of the Dublin (DUB) hub airport, where over 30 million passengers pass through on a yearly base [52].

3. Cleaning and Hygiene Activities Should Remain a Priority at Airports and Airlines after the Pandemic Crisis

Airports are crowded, confined areas with usually poor hygiene and efficient air ventilation [36], and viruses are also transmitted easily in airport terminals or during flights, causing infectious diseases to expand into global epidemics [53]. Zaho et al. [54] revealed that seats, tray tables, gate bench armrests, handrails, elevator buttons, door handles at airports, and water fountain buttons are all known to have high microbial contamination and are frequently touched by passengers at airports. Infectious diseases affect a large number of people, and these create health emergencies that are classified as pandemic or epidemic depending on their severity. Figure 3 illustrates the map of the four most important viruses and infectious diseases that have occurred in the last 20 years. In 2003, the SARS virus was the first and identified in Hong Kong; followed by H1N1 virus; Middle East respiratory syndrome (MERS); and finally, COVID-19, detected in China in 2019. For instance, Chirico et al. [55] note that there are several modes of aerogenic transmission of the SARS-CoV-2 pathogen, by Flugge droplet [56] or by aerosol [57]. The studies available to date are not sufficient to support the conclusion that air-conditioning systems favor the spread of the SARS-CoV-2 infection in office and indoor community environments [54]. For this reason, de Oliveira et al. [58] stress the need for air change through ventilation to reduce the risk of disease transmission during indoors activities.



Figure 3. The timeline map history of major health emergencies in the last 20 years. Source: Prepared by author from [59].

Wang et al. [60] suggest that mask wearing, particularly high-efficiency ones, significantly reduces the risk of in-flight infection. The risk of contracting COVID-19 by aerosol transmission in an aircraft cabin is low, but it is not zero. Mask wearing reduces aerosol transmission in the aircraft cabin [61]. Identifying economically viable intervention measures to reduce COVID-19 transmission on aircrafts is of critical importance, especially as new SARS-CoV2 variants emerge. Computational fluid-particle dynamic simulations were employed to investigate aerosol transmission and intervention measures on a Boeing 737 cabin zone. The results revealed that using sneeze shields on full-capacity flights can reduce aerosol transmission [62].

In this study, the COVID-19 pandemic is considered a health and economic crisis for citizens and organizations. Notwithstanding, we should also add to the coronavirus crisis the high inflation of the price of basic commodities in Europe [63], the Russia's invasion of Ukraine, and Brexit [3], which are affecting the tourism and air transport demand across the globe in 2023. Colak et al. [64] note that airport and airline operators have to spend money on increasing cleaning and hygiene measures to maintain passengers' safety and confidence after the COVID-19 pandemic. Conversely, airports and airlines are cutting costs in cleaning and hygiene activities because they want to recover the lost profits during the pandemic, and passengers are more price-sensitive than they have ever been; in fact, Gualini et al. [65] suggest that these strategies are being used by US airports and Southwest, Delta, United, and American airlines to reduce aeronautical and commercial costs.

The standards of airport cleanliness have become much more important to passengers, and airports want to maintain these standards as an added value against their main competitors. Tokyo Haneda (HND) in Japan, Singapore Changi (SIN) in Singapore, and Doha Hamad (DOH) in Qatar were awarded by SKYTRAX as the world's cleanest airports in 2023 [66]. In the case of airlines, ANA All Nippon Airways have been named the world's cleanest airline in 2023, followed by Asiana, and Qatar airlines [67]. Holdik et al. [68] revealed that passengers' perspectives of COVID-19 cleaning and hygiene measures need to be improved by airport and airlines operators. The winners among airports and commercial airlines will be those who best respond to their customers' concerns regarding hygiene. Passengers value hygiene and cleanliness greatly at airports and airlines [69], but unfortunately, airports and airlines have reduced cleaning and hygiene activities to reduce costs. In 2023, airports and airlines are not forced to prioritize cleaning and hygiene activities in their operations [70]. This is despite the fact that the quality of airport services is very important from the point of view of the international strategy of the airport. Although, after the coronavirus crisis, airport and airline operators needed to reduce costs and maximize profit.

Airport facilities and services play a significant role in the overall satisfaction of passengers travelling through an airport. Though airport service quality parameters have fewer roles in the purchase decision of an airline ticket, cleaning and hygiene at airports becomes momentous when the customers are in the airport's terminal [71]. Mckernan et al. [72] revealed that while the aircraft is attached to the airport terminal handling system or portable air units, it is likely that some fungi from both inside and outside the terminal are migrating onto the aircraft. The airport will have clear safety measures covering the structure, cleaning, hygiene, and disinfection of airport terminals, personnel safety, physical distance, security screening, check-in area, disembarkation, gate facilities, transfer of passengers, baggage claims, and arrivals areas [5,73]. Moreover, terminal facilities and all equipment should be regularly cleaned and disinfected, and the frequency at which this is carried out should be increased as required due to traffic and use; the available products for cleaning and sanitizing should also be increased [5,6]. On the other hand, physical distancing inside the plane, embarking, disembarking, and arrivals measures are under the airline operator's responsibility. Therefore, contracting COVID-19 between the time the passengers leave the aircraft and the time they enter the terminal building should, in principle, be considered within the period of the air carrier's liability [73].

The pandemic created an opportunity for numerous airports to implement smart technology and solutions that enhance safety, cleaning, and hygiene and offer a contactless, seamless passenger experience [74]. In contrast, airports' cleaning and hygiene activities are part of the quality of services evaluated by public and private organizations. Passenger experience and evaluations form the everyday reality of airports and airlines, so it is important to be open to these opinions [75]. In 2021, ACI Europe [76] awarded the Alicante-Elche (ALC) airport in Spain as the best airport in Europe for quality services and its hygiene measures, followed by Granada-Jaén (GRX) airport, Menorca (MAH) airport, Pamplona (PNA) airport, and Murcia (RMU) airport, all of them localized in Spain. ACI' Airport Service Quality (ASQ) surveys are carried out at 386 airports worldwide and over 75% of the 100 top airports in the world are ASQ survey members [77]. In this context,

Spanish airports have seen how cleaning and hygiene measures have been an added value for passengers with regard to airports' service quality. Airports and airlines' safety, cleaning, and hygiene measures will be always associated with passengers' experience and satisfaction, especially after the coronavirus crisis [78].

Considering the previous articles and data shown in this paper, Figure 4 presents the cleaning and hygiene protocols currently adopted by airports and airlines. At this point in time, PCR tests, temperature screenings, mask wearing, physical distancing, and hand sanitation, among other factors, are not mandatory in airports and airlines. In this same vein, Bielecki et al. [49] note that temperature screening, masks, hand hygiene, and physical distancing are ineffective measures at airports, but these are key elements of preventing COVID-19 transmission. Airport operators undertake different cleaning and hygiene measures than airlines. For example, the terminal building processing passengers from the landside to the airside, and vice versa, as well as all the restaurants and shops inside its facilities [79]; that is why cleaning and hygiene measures must be a priority and not just a necessity. From an airline point of view, to restore passengers' confidence in air travel, it is important for airline operators to implement cleaning, hygiene, and safety measures, such as safety delivery systems for food and beverages, mass disinfectant treatments, disinfecting aircrafts with ultraviolet light, and touchless technologies at airports, amongst many others [80]. Cleaning and hygiene protocols are subject to change and may be enhanced as new information about the virus becomes available.

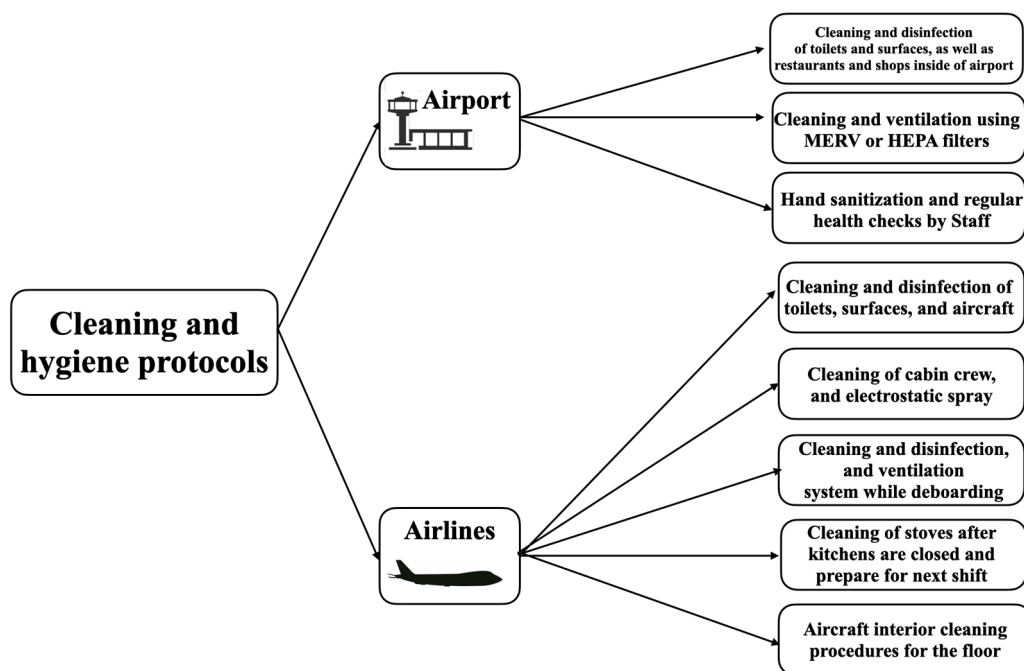


Figure 4. Cleaning and hygiene protocols currently adopted by airports and airlines. Source: Prepared by author.

In addition, we would like to emphasize that in most cases, the cleaning, hygiene, and maintenance of airports and airlines are externalized, that is, these services are developed by external specialized companies that are granted competitive tendering. Sometimes, these external companies provide deficient cleaning services at airports and airlines, and this has a negative impact on passengers' experience and satisfaction and airports and airlines' operational activities. Thus, total quality management at airports and airlines should be implemented to guarantee hygiene and cleaning delivery of airports' services [81]. At the end, the adoption of cleaning and hygiene measures may help to prevent disease spread aboard aircrafts and airports' terminals [82,83]. Airports also serve food, requiring the cleansing of tables, chairs, and kitchen equipment. Bathrooms require surface

cleaning, disinfection, garbage removal, and replenishment of toilet paper and paper towels [84]. The Hartsfield-Jackson Atlanta International (ATL) airport in Georgia (US) has over 1300 toilets, and these must be kept clean at all hours by the cleaning company [85]. In 2018, a study carried out by Sofidel reported that 86% of Americans said that a clogged toilet would negatively impact their perception of a business [86].

Overall, an organized approach will help to maintain the highest standards of hygiene and cleanliness at airports and airplanes. However, that does not mean that airports and airlines can lower their guard, because the SARS, H1N1, MERS, and COVID-19 viruses remain active in society. Centers for Disease Control and Prevention (CDC) reported that that surface transmission of coronavirus is rare. It estimates the risk of fomite transmission as less than 1 in 10,000 [87]. Luo et al. [88] found no significant difference between the attack rates of SARS-CoV-2 in flights where the passengers were wearing masks and those where they were not. The spatial distribution of inflight SARS-CoV-2 outbreaks was more similar to that of the influenza A (H1N1) virus outbreaks than to that of SARS-CoV-1. The inflight infection of SARS-CoV-2 should be controlled mainly by blocking the short-range airborne and droplet transmission route [88]; for this reason, passengers should wear masks. That is why this study is so important to staging the importance of cleaning and hygiene in the air transport industry and helping airport and airline operators make better decisions in their efforts to improve cleaning and hygiene protocols. This research also takes into account the industry's adaptation to changes in the market environment in cleaning and hygiene requirements.

4. Conclusions

This manuscript has put into perspective the cleaning and hygiene values in the aviation industry in accordance with the established objective of this study. The findings suggest that it is essential to maintain high standards of cleaning and hygiene at all airports to protect the crew and passengers. Passengers value hygiene and cleanliness greatly at airports and airlines, but unfortunately, airports and airlines have reduced cleaning and hygiene activities to reduce costs. These findings are in line with the work carried out by Michelmann et al. [89], who claim that most COVID-19-related cleaning and hygiene measures along the travel chain disappeared after the pandemic crisis. Although there is much to do to help the aviation sector recover, we also see plenty of reasons to be optimistic about the air transport industry's future, as long as airport and airline operators can guarantee an adequate service quality with regard to safety, cleaning, and hygiene, in order to ensure passengers' security and well-being. The knowledge of the proper handling and cleaning techniques are available to safeguard public health in these respects, but the general knowledge to employ them is lacking. The significance of cleanliness and hygiene cannot be overlooked by any business, nowadays. For an airport, the presentation and cleanliness of the facility can be the determining factor on whether a customer decides to come back. In the end, the most important thing is passengers' health and safety.

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