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.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.
Commentary

Cabin crew health and fitness-to-fly: Opportunities for re-evaluation amid COVID-19

Andrea Grout\textsuperscript{a, *}, Peter A. Leggat\textsuperscript{b,c}

\textsuperscript{a} College of Business, Law and Governance, James Cook University, Townsville, Australia
\textsuperscript{b} College of Public Health, Medical & Veterinary Sciences, James Cook University, Townsville, Australia
\textsuperscript{c} School of Public Health, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa

\textbf{ARTICLE INFO}

Keywords
Cabin crew
Fitness-to-fly
Health
Aviation
Occupational risks
COVID-19

\textbf{ABSTRACT}

Aircrew fitness-to-fly is among the elements that make aviation the safest form of long-distance transport. The health of cabin crew is a crucial determinant in carrying out safety-related duties. ‘Fitness-to-fly’ is associated with defined workplace conditions, for which airlines have a legal duty to ensure fitness for employment. We explored the literature on fitness-to-fly to obtain a pragmatic assessment of the challenges for aeromedical examinations. Regulations promulgated by aviation regulatory authorities and airline internal policies have similar status and meaning, yet there is no harmonised approach internationally, and an inability to conform periodic medical assessments to actual operational fitness. The COVID-19 pandemic has highlighted the need to better understand fitness-to-fly criteria. Fitness-to-fly measures are mainly based on self-reported data and there is a need for a ‘safety’ factor for self-reports. Aeromedical evaluations should evolve from meeting medical standards to include pandemics as an element of the overall risk of aircraft operations. Re-evaluating criteria for fitness-to-fly assessment will further the goal of linking research to the actual needs of public health decisionmakers. If airlines are to resume operations at pre-pandemic levels, they must demonstrate to the public and public health agencies that fitness-to-fly assessment is appropriate and effective.

1. Introduction

Cabin crew play a key role in maintaining passenger and operational safety in commercial aviation. Prior to the COVID-19 pandemic, cabin crew were a fast-growing occupation, with demand for new recruits expected to rise between 2018 and 2038 to over 300,000 crewmembers in regions such as the Asia Pacific [1]. Similar to the activities involved in the work of police officers, paramedics, and fire fighters [2], there are public health issues associated with the activities of cabin crew. Although good health is a crucial determinant in carrying out safety-related duties, the critical public safety role of cabin crew and the concomitant demands for good health often go unrecognised [3].

Through identifying the effective skills and knowledge required to ensure cabin safety, fitness-to-fly standards aim to contribute to continuous safe flight operations, and to protect the health and safety of passengers.

Cabin crew work in a high-risk environment and are exposed to a multitude of occupational risks and hazards. Although many occupational settings harbour risks to employee health, Powell [4] notes how the cabin environment concentrates risk to individual health. Examples of exposures that occur in routine flight operations include poor cabin air quality from a number of sources; fatigue; cosmic ionising radiation; circadian rhythm disruption; high levels of occupational noise, pesticides; and infectious disease agents [3,5–7]. Cabin crew share the same workspace as pilots and are connected through interlinking roles. However, they remain an understudied field in the aviation/aerospace medicine and occupational health and safety literature [3,6,8,9].

Assessment of fitness for work is typically defined as “the evaluation of a worker’s capacity to work without risk to their own or others’ health and safety” [10]. The purpose of fitness-to-fly assessment is to describe the individual health state necessary for the performance of cabin crew duties, synthesising guidelines and regulations from national aviation administrative bodies [e.g. the U.S. Federal Aviation Administration (FAA) and international agencies [e.g. the International Civil Aviation Organization (ICAO), and the International Air Transport Association (IATA)], as well as incorporating evidence-based and current scientific findings [11]. These medical standards aim to prevent the inability to perform the assigned duties and functions during flight operations that...
could be caused by the physical, medical and psychological disorders held by a crewmember [12,13]. To reflect working conditions and for the protection of the safety of the flight, airlines have a legal duty to ensure fitness for employment and to establish medical clearance procedures that are consistent and based on accepted physiological principles [14–16].

To ensure consistency with required medical standards, fitness-to-fly evaluations seek to detect existing medical conditions in pre-employment assessment and in recurrent medical checks for the existing workforce. Cabin crew must declare any new medical problem with potential safety ramifications, which develops during the period of employment [6,16]. Although fitness-to-fly attestation must specify the state of cabin crew health as a precondition for performing their work role [17], there are no current resources across the industry that provide harmonised tools for aviation medical examination, including guidelines for cabin crew to confirm point-of-time fitness.

Over the last two decades, the airline industry has undergone major reorganisation, and risks have changed. For cabin crew, the operational environment has undergone significant changes regarding extended flight times, increasing passenger loads, job insecurity, and exposure to new or re-emerging health risks [18,19]. For example, ultra-long-haul (ULH) flights have extended the time crew are exposed to a potential hazard, which in turn may pose greater risks. e.g. infectious disease transmission [20]. The detection of a novel coronavirus (SARS-CoV-2) leading to the illness COVID-19 demonstrated the rationale for adequate assessment for crew fitness-to-fly. For example, reports about cabin crew with COVID-19 operating domestic and international flights have raised questions about the safety of the exemption of the 14-day self-isolation rule [21]. Although clusters of confirmed cases are thought to have contracted COVID-19 while overseas rather than inflight, reports of in-flight transmission of respiratory infectious disease exist [22,23]. Importantly, Olsen et al. [24] note how a passenger travelling from Hong Kong to Beijing infected people well outside the WHO’s two-row boundary, indicating that airborne transmission was likely the main transmission route for severe acute respiratory syndrome coronavirus 1 (SARS-CoV-1) in aircraft cabins. These reports further illustrate how air travel is an enabler of the rapid spread of newly emerging infections with pandemic potential. In the case of COVID-19 transmission may have occurred; either from passengers to crewmembers, among crew-members, or infected crew members may have spread the infection to passengers and the wider public.

The airline industry and occupational health and aerospace medicine professionals need to be aware of the remitting nature of many health conditions, as well as the foreseeability of future states of poor fitness-to-fly. Past studies of the health of cabin crew have only been weakly matched to the demands of aviation regulators and aerospace medicine. For example, Mangili et al. [22] reported that cabin crew frequently fly when ill and typically have low vaccination rates. Substantial disparities exist between aircrews flying for U.S. regional carriers and European flag carriers relating to self-declaration when ill and routine influenza vaccination, with the rate of annual influenza vaccination ranging between 21 and 27% among aircrew [25].

Although the Centers for Disease Control and Prevention (CDC) and IATA consider it essential that aircrew are vaccinated against the common endemic diseases (such as measles-mumps-rubella, diphtheria-tetanus-pertussis, varicella, polio, and the seasonal influenza vaccine), and to keep vaccination records current [16,26], there are no established requirements for vaccinations in aircrew. Compulsory vaccinations may be based on country-specific entry requirements and include yellow fever [16,26]. Under the airline industry’s plan to restart international air travel, Qantas further stated that vaccination for COVID-19 will be mandatory for flight for aircrew and passengers [27], raising the question of whether a similar policy will be administered industry-wide.

Several authors noted that stringent fitness-to-fly criteria, which apply to pilots, should also apply to cabin crew [7,17]; and that assessment criteria must be cognisant of the need to maintain flight safety [28]. Correspondingly, Griffiths and Powell [6] question whether statutory fitness-to-fly assessment will benefit either flight safety or occupational health, indicating that evaluations are deficient in the essential resources and components required to be effective. These views hinge on the notion that flight safety anchors on the success of uniform medical clearance, standardised training programmes, and a solid understanding of workplace exposure to hazards, for which the evidence base is currently insufficient and/or inconclusive. With passenger confidence largely resting on the assurance of hygienic conditions and healthy staff [29], auditing fitness-to-fly requirements amid the COVID-19 crisis is an opportunity to assess the operational usefulness of fitness-to-fly examinations; the scope and elements in flight operations; to implement changes; and to introduce remedial measures.

In this commentary, we present a novel viewpoint on fitness-to-fly to highlight externally imposed, and individually and socially generated factors that shape fitness-to-fly decisions. We discuss the implications of the rapidly evolving situation and future directions of the COVID-19 pandemic, including conceptual tensions that exist when managing operational fitness in cabin crew. In questioning whether selected medical criteria truly represent an impact on health and safety outcomes that matter most to flight safety and public health, we aim to promote scientific discourse that challenges the current approaches to fitness-to-fly evaluation. Derived from consistent themes in the aeromedical literature, the following sections discuss six major areas which require consideration to support existing fitness-to-fly evaluation.

2. Discussion

2.1. Statutory fitness-to-fly medical assessment

The requirements for fitness-to-fly assessment are based upon Standards and Recommended Practices (SARPs). These include recommendations published in the World Health Organisation (WHO) International Health Regulations (IHR); national legislation and regulations; airline-internal standards for medical assessments; and a fitness-to-fly medical guide for pilots, which is also applicable to cabin crew [11]. While the responsibility for cabin crew fitness is shared among the airline, aviation regulatory bodies and the crewmember, national aviation agencies are to ensure that airlines comply with their responsibilities in providing fit crewmembers. These agencies typically set requirements for aviation medical examiners (AMEs) to conduct fitness-to-fly evaluations. New cabin crew recruits require an initial medical examination, followed by periodic medical assessments at intervals of no more than 60 months [30].

If the purpose of fitness-to-fly is to achieve a balance between minimising any operation-related flight safety risks for the individual and the community posed by the crewmember’s state of health, and maintaining the crewmember’s occupational health, then any emerging risk to health should be accounted for. Given that international standards differ both within and between jurisdictions, as national airline regulators (such as the FAA) determine medical standards from their own jurisdictions [12,31], then this new assemblage of risks implies that new vulnerabilities are created that must be addressed through several medical dimensions that are underpinned by safety considerations. (See; Box. 1–6)

2.2. Cabin crew: exposure to risks and hazards and general health concerns

For cabin crew, reported occupational injuries and illnesses represent only a fraction of the true events [56,57]. The impact of work-related psychosocial factors is even less understood [58,59]. Risk assessment frameworks toward cumulative risk assessment have recognised that exposure to a single hazard rarely occurs in isolation [60]. Examples for exposure risks include:

A. Grout and P.A. Leggat

Travel Medicine and Infectious Disease 40 (2021) 101973
Adequate responses amid the COVID-19 crisis require cabin crew and airlines to know what employment actions are lawful in the face of a pandemic, and how staff can protect themselves as well as passengers. Until recently, the priority of travel health advice has not focussed on preventing the spread of infectious disease [32]. To prevent cases of infected cabin crew operating flights, IATA [33] recommends inclusion of self-certification statements from cabin crew, certifying the absence of COVID-19 symptoms when reporting for duty, or providing evidence of recent negative test results, “where rapid testing is available”. The challenge is to ensure that recommendations are a) adopted, b) implemented consistently by the airline industry, and c) do not carry any disciplinary actions if a crewmember reports unfit for duty. According to European Union Aviation Safety Agency (EASA) guidelines, aircrew should be exempt from an airport’s COVID-19 screening procedures [34]; however, some Australian states now require aircrews to take a COVID-19 test on arrival before self-isolating at home [35]. Other country-specific testing requirements include: - Cabin crew employed at Singapore carriers will be routinely tested for COVID-19 upon their return from overseas flights [36], and Singaporean aircrew travelling to China are required to undergo a pre-departure COVID-19 PCR test and IgM serology test [37]; - Delta Airlines requires routine testing for COVID-19 before each tour of duty, using a rapid-response PCR test [38]; - International aircrew arriving in New Zealand are mostly exempt from a 14-day isolation or quarantine period provided they meet certain conditions both inflight and during layover [39].

In addition, airlines will need to consider local requirements in the country of departure and arrival, and monitor local practices as they evolve with respect to immunity certificates or passports, or contact-tracking apps. While COVID-19 in and of itself will generally not affect fitness-to-fly, the mental effects of lockdown-related measures may impact a crewmember’s decision-making ability and fatigue level [40].

- Pesticide use in aircraft cabins to control the spread of vector-borne diseases

Although Pang et al. [61] found no evidence of an association between crew exposure to certain insecticides and negative health impact, uncertainty remains about the potential adverse health effects on human health in the absence of longitudinal exposure assessment that correlate insecticide exposure (including carrier substances) and physiological uptake of insecticides to possible toxicity [20]. In addition to cumulative exposure to contaminants, researchers must explicitly measure the association between different types and levels of exposure and ill-health symptoms [62].

- ULH operations

The longer crews are exposed to a hazard, the greater the likelihood that harm may result. This also applies to determinants of fatigue. Originally designed to accommodate unpredictable factors such as delays or weather conditions, reduced-rest patterns under ‘exceptional conditions’ have become increasingly common [18]. This requires consideration and management of the interactive effects of workload and fatigue [63].

- Foodborne and respiratory disease

Reports of likely transmission of norovirus from symptomatic cabin crewmembers to passengers [64] illustrate how crewmembers may also act as reservoir for pathogen transmission, such as in their role as food handlers [65]. Similarly, an ill cabin crewmember could pass on a respiratory illness to passengers or to other crewmembers. For example, for influenza A (H1N1), the potential for inflight transmission has been calculated at five to ten infections which could occur during an 11-hr flight, if the index case travels in economy class [66]. WHO guidance purports that the primary inflight transmission risk for most respiratory infectious diseases is sitting within two rows of an infectious passenger [67,68]. However, this guidance does not directly take into account the biological bases of droplet transmission and indirect contact via fomites, and does not account for the movement activities of seated passengers and crew which can significantly increase infection risks [69]. Depending on their movements and interactions with passengers, Hertzberg and Weiss [23,70] note the probability of an infectious crewmember to infect several passengers. Potential modes of transmission include contact occurring in waiting areas (e.g. near galleys where cabin crew work), indirectly through contact with contaminated fomites, or through airborne transmission which was likely the main transmission route for SARS-CoV-1 in aircraft cabins [24] (See Box 2).

2.3. Fitness-to-fly self-assessment: to fly or not to fly?

Reporting fit-for-work is an individual responsibility [71]. Similar to
how a designated physician can refuse transport to a person with acute illness that might compromise the overall safety of the flight [72], cabin crew become their own assessor upon reporting for duty – directed by their perceptions of what makes them fit or unfit for work. Cabin crew showed a higher prevalence of work-related upper respiratory tract symptoms, colds and influenza compared to the general working population, and were less likely to report medically diagnosed asthma [73]. For mental health symptoms, self-disclosure is often affected by fear of stigma and discrimination [74]. Calling in layover or potential schedule disruption Crewmembers often override concerns over making a poor decision with a “can do” attitude, despite the presence of ambiguous cues, goal conflicts, and uncertain outcomes by presenting for work Organisational norms, values, safety culture and punitive measures influence cabin crew’s decision-making when reporting for work Cabin crew largely perceive occupational hazards and associated risks to be beyond their control

The pervasive culture of fear and punishment at some airlines creates a bias against disclosing a medical issue to the organisation Table 1

| Online blog results                                                                 | Research questions                                                                 |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Crewmembers perceived fitness-to-fly as an activity in its own right; “an inconvenient annual procedure that just has to be ticked off” | Are decisions about which health issues are risky enough to justify “unfitness” driven by safety considerations? |
| Cabin crew form a health perception score of a particular flight based on their perception of flight-specific risk attributes. To arrive at a decision of reporting fit or unfit to fly, this score is in turn traded-off against other flight operational attributes, such as type of layover or potential schedule disruption | What procedural changes in assessment would increase crewmembers’ confidence in fitness-to-fly attestation? |
| Crewmembers often override concerns over making a poor decision with a “can do” attitude, despite the presence of ambiguous cues, goal conflicts, and uncertain outcomes by presenting for work | Does “good overall health” resemble fitness-to-fly? |
| Organisational norms, values, safety culture and punitive measures influence cabin crew’s decision-making when reporting for work | Would self-reported health-related incidents provide some evidence as to the effectiveness of the scheduling tool? |
| Cabin crew have poor trust in scientific evidence airlines use to address exposure to hazards and concerns about staff health | What motivates crewmembers to exhibit safe or unsafe behaviour? |
| The pervasive culture of fear and punishment at some airlines creates a bias against disclosing a medical issue to the organisation | What can improve crewmembers’ ability to judge their fitness upon reporting for work? Through which processes do cabin crew assess their fitness, report or not report for work, and consequently adopt curative and/or preventive measures? |

A. Grout and P.A. Leggat

Travel Medicine and Infectious Disease 40 (2021) 101973

3. Conceptual considerations

From an aeromedical perspective, it is helpful to conceptualise the potential impact of any risk associated with poor fitness that could result in the potential for harm [81]. Fitness-to-fly can be conceptualised as defining element of both professionalism and error; involving complex, layered constellations that have resulted in novel empirical processes that are productive of unfitness-to-fly. As such, fitness-to-fly appears to be a concept of faith in the individual’s medical assessment, one that exists in a virtual realm, rather than an operational reality. The problem with this application is that it does not explain the purposiveness of fitness-to-fly assessment; it presupposes it. Theoretical motives behind fitness-to-fly should thus be formed by factors that pull toward potential and foreseeable events, rather than pushing from an experienced past. Such approaches move from statutory medical clearance, which carries the risk for fitness-to-fly to be perceived as symbolic attestation of a “blank cheque for a certain period’s worth of good health”, to an extension of assessment protocols in the form of a pre-flight fit check. The conceptual spheres for fitness-to-fly are depicted in Fig. 1 (See Box 5).

In addition, we suggest five thematic intersections between fitness-to-fly, occupational and public health, and flight safety:
A. Grout and P.A. Leggat

formal mutual acknowledgment of national regulatory bodies, airlines, and AMEs.

4. Conclusion

Through the COVID-19 crisis, the airline industry illustrated the operational purpose for fitness-to-fly, and how changes in hazards alter the nature of risk to the cabin crew workforce and the travelling public. Significant gaps in risk assessment for known risks remain unaccounted

Box 3
Fitness-to-fly self-assessment and COVID-19

By reporting for work, crewmembers declare themselves as fit-to-fly. Amid emerging public health threats, such as COVID-19, questions arise as to what extent do crewmembers consider their own risk factors in terms of early disclosure of underlying symptoms. IATA [33] has issued guidance for crew health precautions during pandemic noting that:

“Crew members must not report for training or flying duties if they:

- Are within a mandated period of isolation or quarantine related to previous travel and/or duty;
- Have tested positive for COVID-19 regardless of symptoms evident;
- Know that they have been exposed to a person having, or suspected of having, symptoms of COVID-19;
- Are experiencing symptoms of COVID-19;
- Have recovered from COVID-19 symptoms but have not been assessed by the local Health Authority or the airline’s occupational health program” (page 5).

IATA [33] further cautions against additional human factor concerns throughout the COVID-19 crisis, some of which may adversely affect crewmember health and performance, as well as introduce additional safety risks. For example, ongoing fear around employment uncertainty, infection, and protection may induce increased risk-taking to protect the operation, and lead to reduced reporting of noncompliance with procedures. For cabin crew, the difficulty in self-declaration may be in distinguishing between ‘compliance’, meaning they perceive themselves as being able to function (albeit at the expense of their own health), and ‘non-compliance’ that potentially compromises flight safety or public health by not being able to foresee the consequences of their impaired state of health.

In addition, EASA [34] has advised airlines to provide operational recommendations to minimise the risk of infection of cabin crew during layovers. Airlines should further inform crewmembers that the most efficient preventive measure to limit the potential transmission of SARS-CoV-2 from contaminated surfaces is frequent handwashing [45]. In practice, this may prove challenging due to the lack of designated crew handwashing facilities [46,47]. While crewmembers may carry their own disinfectants to ensure an additional layer of protection, the EASA has advised against the use of personal disinfectants in the aircraft cabin. Surfaces disinfected with self-provided products may cause corrosive reactions with chemicals used for general disinfection agents which can have damaging effects on the aircraft or lead to adverse health effects for passengers and crew [48]. Cabin crew must therefore rely on company enforcement and appropriate application of disinfection procedures.

For crewmembers reporting fit-for-duty, questions include whether and how IATA and EASA recommendations are communicated to cabin staff, and what monitoring systems are in place to check crewmembers’ reporting behaviour. Importantly, could reporting for duty resemble a safety breach in the case of a knowingly unwell state of health? Reporting for duty behaviour may largely be based on individual perception of health and safety, which resonates that perceptions may influence reporting or not reporting for work decisions stronger than objective variables. Depending on the type and length of flight sectors, or type and length of layover, other factors may also influence the decision of reporting fit-for-duty (e.g. the quality of health services available at a layover destination). The self-declaration form developed by the Collaborative Arrangement for the Prevention and management of Public Health Events in Civil Aviation (CAPSCA) [49], and the “I’m safe checklist” developed by the FAA for pilots [50] could be useful tools to help with self-assessment. In this way, cabin crew may become more aware of their innate capacity to report fit-to-fly, and could better recognise the importance of safety and regulatory concepts deemed important not only for their own health, but for the wider public.

(1) National regulation;
(2) Spaces of airline-specific regulation and assessment;
(3) Health monitoring and maintenance;
(4) Environmental factors; and
(5) Individual vulnerability and coping capacity.

To support a harmonised approach, these intersections require formal mutual acknowledgment of national regulatory bodies, airlines, and AMEs.

Box 4
Public perfections of a healthy workforce amid COVID-19

One purpose of fitness-to-fly is its social value, understood as its ability to produce the conditions needed to ensure safe flight operations. The return to air travel hinges on trust, and will fall on the airlines to reassure air travellers that it is safe to fly. Although IATA recommendations bear no legal grounds for enforcement, they make a strong claim to best practice and authority relating to IATA’s core principles on passenger protection [51]. Another component is feasibility: Fitness-to-fly must have a credible prospect of meeting its purpose while scientific evidence is still lacking. The historical distinction between work and non-work exposures has become less useful in understanding risks. As globalization has exacerbated poor regulatory oversight [52], airlines must re-consider their own risk assessment processes and compliance mechanisms for fitness-to-fly reporting to ensure cabin crew do not report for work unwell. With passenger confidence largely hinging on the assurance of hygienic conditions and healthy staff amid the COVID-19 pandemic [29], airlines should further monitor whether any COVID-19 control measures have introduced new problems, e.g. the use of gloves and masks when responding to an inflight medical case.
The fit check can be used to parsimoniously engage, educate and promote proactive, positive fitness-to-fly activities to cabin crew. For cabin crew to minimise chances of reporting for work unwell, and to give them a feeling of serenity, especially in the sphere of uncertainty, approaches do not ascribe to any belief system but offer powerful ways for self-assessment: pre-flight fit-check analysis engages the knowledge of fitness-to-fly as the notion of risk due to unforeseen events and ad-hoc changes which should incorporate more precise systematic response systems to address individual health issues that require monitoring. Holistic approaches that examine all potential factors that can influence cabin crew health, alongside the promotion of a non-punitive reporting culture to not sabotage their own health, will go a long way towards maintaining a healthy workforce, which can benefit all stakeholders.

For the public, fitness-to-fly requires demonstration rather than mere assertion. Failure to protect the public from unfit staff can entail significant liability for airlines. Medical evaluation should include assessments of the safety risks associated with a crewmember reporting for duty unwell, be proportionate to the public health risk, and be reconsidered regularly as new hazards evolve. Follow-up measures such as performing cabin crew testing after an illness, or after rehabilitation measures, could act as additional layer to benefit flight safety. Significant benefits may be gained from developing perspectives on fitness-to-fly that focus not only on physical functions, but on the protection of public health. Environmental and operational contexts attract causal factors that go beyond current knowledge. To maintain a healthy workforce, which can benefit all stakeholders, integration of up-do-date scientific evidence and continuous dialogue with all stakeholders is essential to further strengthen the aeromedical assessment system. Such research can further assist in gaining a better understanding of how passengers perceive the need for a healthy workforce.

How far the ideal of fitness-to-fly standards corresponds to the practices of self-assessment during the COVID-19 pandemic remains debatable. Airlines should consider the possibility that reporting behaviours may reflect an underlying dimension of response to a work situation. Illnesses, or patterns of illnesses, are typically picked up by frequent supervisory observations or work performance checklists, providing an indication of a health issue. However, these are difficult to observe in the cabin crew workforce due to frequent changes in crew formation. Ground supervisors for cabin crew typically do not see crewmembers very often, putting the bulk of responsibility on the individual to be self-critical and to manage their health well. To ensure that unfitness does not escape regulation altogether, airlines and crewmembers could further benefit from the promotion of a non-punitive reporting culture to not sabotage their own health, will go a long way towards maintaining a healthy workforce, which can benefit all stakeholders.

What is beneficial to all stakeholders amid COVID-19

The analytical angle of fitness-to-fly is informed by various disciplines, rendering it valuable to scholars from medical to aviation studies, and as well as to those from tourism. Exploring the operational make-up of fitness-to-fly makes an important contribution to the literature. It enlarges the remit of aviation risk management research to a more complicated field constituted not just by the most visible outcomes (i.e. incidents and accidents), but also by a host of covert health threats. Just for and the emergence of new occupational risks requires a review of risk assessment. The uncertainty created by the COVID-19 pandemic is a reminder that fitness-to-fly evaluations require an observant state of mind. To achieve a sustainable decision on fitness-to-fly is not primarily a medical responsibility, but requires globally harmonised, and mutually accepted criteria for evaluation. These criteria should be compatible with safety requirements; proportionate to the exposure to occupational hazards and risks; flexible where appropriate to allow for a specific exception; and safeguarded not to discriminate.

To better understand the inherent dynamics of fitness-to-fly amid COVID-19, we distinguish basic constituents of the assessment system and the drivers of operational features, as well as occupational and environmental change. This relates to technological development that has often outpaced scientific knowledge related to the determinants of health, as well as the nature of the operational setting and physical condition of a crewmember that may modify susceptibility to exposures inherent to their activities. While this theory may explain why the alignment of fitness-to-fly with medical standards and operational practice is not absolute, it may imply that crewmembers compensate for any fitness deficits by retreating into non-compliance spaces divorced from the safety concept. Consequently, the collective basis of fitness-to-fly and thus the capacity for operational resistance is abstracted from the employment relationship rather than being integral to its contested nature. We see the essential feature of fitness-to-fly as the notion of risk due to unforeseen events and ad-hoc changes which should incorporate more precise operationalisation of the probability of harm and better explain the relationship between fitness, illness and perception of health status. This approach does not ascribe to any belief system but offers powerful ways for self-assessment: pre-flight fit-check analysis engages the knowledge production about fitness-to-fly on which many aspects of contemporary assessment practices are predicated. Fit checks thus aim to act as vehicle for cabin crew to minimise chances of reporting for work unwell, and to give them a feeling of serenity, especially in the sphere of uncertainty. The fit check can be used to parsimoniously engage, educate and promote proactive, positive fitness-to-fly activities to cabin crew.
as how safety in aviation has consolidated standards among international airlines, the arrangement of ancillary functions such as ‘health safety’ must likewise be recognised for its indispensable role in supporting fitness-to-fly and safety goals towards safe travel outcomes. It is by tracing these complex spaces for fitness-to-fly that the true pervasiveness of global air travel can be appreciated, along with a fuller appreciation of its impacts on populations in terms of disease transmission and spread. Delining the pragmatics of fitness-to-fly production affords added insight into recent analyses depicting air transport as main driver in the frequency and reach of infectious disease epidemics.

CRediT authorship contribution statement

Andrea Grout: Conceptualization, Methodology, Literature search, Writing - original draft. Peter A. Leggat: Writing - review & editing.

References

[1] Statista. Demand for new cabin crew members in the aviation industry between 2018 and 2038, by region. 2020. Available at: https://www.statista.com/statist/617681/new-cabin-crew-demand-globalaviationindustry/. Accessed on 13 June 2020.

[2] Sluiter JK, Frings-Dresen MHW. What do we know about ageing at work? Evidence-based fitness for duty and health in fire fighters. Ergonomics 2007;50(11):1897–913. https://doi.org/10.1080/00140130701676605.

[3] McNeely E, Morholland J, Tideman S, Galle C, Jourd C. Estimating the health consequences of flight attendant work: comparing flight attendant health to the general population in a cross-sectional study. BMC Publ Health 2018;18(1):346. https://doi.org/10.1186/s12889-018-5221-3.

[4] Powell DMC. The health of flight attendants. Chicago, Illinois: The 84th Annual Scientific Meeting of the Aerospace Medical Association; 2013.

[5] Grout A, Howard N, Coker R, Speakman EM. Guidelines, law, and governance: conceptualization, methodology, literature search, other causes in commercial airline crews: a joint analysis of cohorts from 10 January 2018 and 2038, by region. 2020. Available at: https://www.statista.com/statist/617681/new-cabin-crew-demand-globalaviationindustry/. Accessed on 13 June 2020.

[6] McNeely E, Morholland J, Tideman S, Galle C, Jourd C. Estimating the health consequences of flight attendant work: comparing flight attendant health to the general population in a cross-sectional study. BMC Publ Health 2018;18(1):346. https://doi.org/10.1186/s12889-018-5221-3.

[7] Powell DMC. The health of flight attendants. Chicago, Illinois: The 84th Annual Scientific Meeting of the Aerospace Medical Association; 2013.

[8] McNeely E, Morholland J, Tideman S, Galle C, Jourd C. Estimating the health consequences of flight attendant work: comparing flight attendant health to the general population in a cross-sectional study. BMC Publ Health 2018;18(1):346. https://doi.org/10.1186/s12889-018-5221-3.

[9] Omholt M, Tveito T, Ihlebæk C. Subjective health complaints, work-related stress and wellbeing among flight attendants. J Austral Soc Aerospace Med 2004;1(1):11–4.

[10] Serra C, Rodriguez MC, Delclos GL, Plana M, Guevara K, Garcia Landa G, et al. Asthma among airline personnel: a systematic review. Trav Med Infect Dis 2019;28:6–14. https://doi.org/10.1016/j.tmaid.2018.10.011.

[11] International Civil Aviation Organisation. Fitness to fly - a medical guide for pilots. 2018. Available at: https://store.iaco.int/products/fitness-to-fly-a-medical-guide-for-pilots. Accessed on 05 May 2020.

[12] Shahab RZ, Somotomayor-Castillo CF, Malik J, Li C. Global commercial passenger airlines and travel health information regarding infection control and the prevention of infectious disease: what's in a website? Travel Med Infect Dis 2020 Jan-Feb;33:101528. https://doi.org/10.1016/j.tmaid.2018.10.011.

[13] European Union Aviation Safety Agency. COVID-19 – Aviation Health Safety Protocol. Operational guidelines for the management of air passengers and aviation personnel in relation to the COVID-19 pandemic. 2020. Available at: http://ec.europa.eu/transport/safety_cabin_crew_operational_guidelines_cabi19_coronavirus.pdf.

[14] Aviation. NSW toughens international air crew quarantine on tuesday. 2020. Available at: https://australianaviation.com.au/2020/12/nsw-toughens-internati onal-air-crew-quarantine-on-tuesday/. Accessed on 26 December 2020.

[15] Civil Aviation Authority. Health safety guidelines to mitigate the risk of COVID-19 in aviation. Available at: https://www.caas.gov.sg/docs/default-source/dsa/Cabin-Crew-Medical-Report/ . Accessed on 02 May 2020.

[16] European Union Aviation Safety Agency. COVID-19 – Aviation Health Safety Protocol. Operational guidelines for the management of air passengers and aviation personnel in relation to the COVID-19 pandemic. 2020. Available at: http://ec.europa.eu/transport/safety_cabin_crew_operational_guidelines_cabi19_coronavirus.pdf.

[17] Future Travel Experience. 5 innovative airline initiatives to ensure the safety of passengers and crew. Available at: https://www.futuretravelexperience.com/2020/08/airline-initiatives-safety-passengers-and-crew/ ; 2020. Accessed on 26 December 2020.

[18] Ministry of Health New Zealand. COVID-19: aviation sector. 2020. Available at: https://www.health.govt.nz/covid-19-virus-in-nz/covid-19-covid-19-coronavirus/COVID-19-in-aviation . Accessed on 30 June 2020.

[19] Microorganisms @ materials surfaces in aircraft: potential risks for public health - a systematic review. Trav Med Infect Dis 2019;28:6–14. https://doi.org/10.1016/j.tmaid.2018.07.011.

[20] Bogoch II, Watts A, Thomas-Bachli A, Huber C, Kraemer MUG, Khan K. Potential for global spread of a novel coronavirus from China. J Trav Med 2020;27(2):taa031. https://doi.org/10.1093/jtm/taa031.

[21] Civil Aviation Safety Authority. Cabin safety bulletin 13: management of odours, smoke and fumes during flight. 2018. Available at: https://www.caas.gov.sg/aircraft/publication/cabin-safety-bulletin-13-management-odours-smoke-and-fumes-during-flight. Accessed on 08 July 2020.

[22] Horns M, Lange B, Schröter N, Rieg S, Kern WV, Wagner D. Anoma in COVID-19 patients. Clin Microbiol Infect 2020;26(5):743X(20):30294–9. https://doi.org/10.1016/j.cmi.2020.05.017. Advance online publication.
Sweeney LM, Gearhart JM, Ott DK, Pangburn HA. Considerations for development of flight crew health precautions during pandemic. J Environ Health 2020;82(4):30–23.

Burgard SA, Lin KY. Bad jobs, bad health? How work and working conditions affect health. Am J Ind Med 2014;57(10):1028–36. https://doi.org/10.1002/ajim.22382.

Wagner BG, Coburn BJ, Blower S. Calculating the potential for within-flight transmission of influenza A (H1N1). BMC Med 2009;7. https://doi.org/10.1186/1741-7015-7-81.

World Health Organization. Prevention and control of severe acute respiratory syndrome (SARS). 2003. Available at: https://www.who.int/hot/r/healthtopics/2003/050511_sars/WHO_SARSManual.pdf. Accessed on 05 May 2020.

Word Health Organization. WHO technical advice for case management of influenza A(H1N1) in air transport. 2009. Available at: https://www.who.int/hot/r/healthtopics/2003/050511_sars/WHO_SARSManual.pdf. Accessed on 05 May 2020.

Han Z, To GNS, Fu SC, Chao CYH, Weng W, Huang Q. Effect of human movement on airborne disease transmission in an airplane cabin: study using numerical modeling and quantitative risk analysis. BMC Infect Dis 2014;14(1):434. https://doi.org/10.1186/1471-2334-14-434.

Hertberg VS, Weiss H, Eton L, Si W, Norris SL, TheHealthy Research Team. Behaviors, movements, and transmission of droplet-mediated respiratory diseases during transcontinental airline flights. Proc Natl Acad Sci USA 2018;115(14):3623–7. https://doi.org/10.1073/pnas.1716111115.

International Air Transport Association. Guidelines for assessment of fitness to work as Cabin Crew. 2018. Available at: https://www.iata.org/whatwedo/safety/health/Documents/guidelines-cabin-insulin-diabetes.pdf. Accessed on 26 Dec 2020.

Graf J, Stüben U, Pump S. In-flight medical emergencies. Dtsch Arztebl Int 2012;109(37):591. https://doi.org/10.1023/B:ANOR.0000019091.54417.ca.

Whelan EA, Lawson CG, Grajewski B, Petersen MR, Pinkerton LE, Ward EM, Schnorr TM. Prevalence of respiratory symptoms among female flight attendants and occup. Environ Res 2003;98(2):129–34. https://doi.org/10.1111/j.1096-0464.2003.tb50001.x.

Wu AC, Donnelly-McLay D, Weisskopf MG, McNeely E, Betancourt TS, Allen JG. Airplane pilot mental health and suicidal thoughts: a cross-sectional descriptive study via anonymous web-based survey. Environ Health 2016;15(1):121. https://doi.org/10.1186/s12940-016-0209-0.

Nicol ED. Assessing aeromedical risk: a three-dimensional risk matrix approach. J Air Transport 2015;49:46–52. https://doi.org/10.1016/j.jairtraman.2015.08.001.

Prentice C, Singh PM. The influence of risk perception and brand image on airline passengers’ travel behaviours. In: Young T, Stolk P, McGinnis G, editors. Caute 2018; get smart: paradoxes and possibilities. Tourism, Hospitality and Events Education and Research. Newcastle, NSW: Newcastle Business School, The University of Newcastle; 2018. p. 600–3.

Isaac F, Gorhan D. Making the case for population health management: the business value of a healthy workforce. In: Nash DB, Fabius RJ, Skoufalo A, Clarke JL, editors. Population health: creating a culture of wellness. Burlington, US: Jones & Bartlett Learning; 2015. p. 309–29.

Wilson ME. What goes on board aircraft? Passengers include Aedes, Anopheles, Maculinea, and beyond. Health Care Anal 2018;26(4):310–17. https://doi.org/10.1007/s10728-016-0334-2.