The Sky's the Limit When it Comes to Acute Care

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Abstract

With over 4 billion passengers expected to fly on international commercial airlines in 2018, doctors on-board face a quagmire when it pertains to in-flight emergencies: act as a good Samaritan in a resource-limited setting, or compromise the duty to act.[2,16,26] In association with Air Canada and WestJet, emergency medicine practitioners at St. Michael's Hospital have identified this gap in medical competency and authored recommendations to assist physicians in managing in-flight health emergencies.[5] Research on in-flight medical emergencies has been hindered by a lack of available information, highlighting the need for international collaboration to further understand the prevalence and outcomes of these events and to ensure passenger safety.[4,9] Concurrently, this health issue reinforces the need to engage patients as partners in their care and may necessitate additional education for both physicians and flight crew.[20,21,24,25,28]

Introduction

"Is there a doctor on board?"

As the number of airline patrons, particularly older adults with pre-existing medical conditions, continues to rise, this sobering call for help is no longer only a Hollywood cliché, but rather manifests as a real and legitimate medical emergency.[1] According to the International Air Transport Association (IATA), the number of air travelers is expected to more than double to 7.8 billion passengers by 2036.[2] While there has been much success in decreasing the number of airliner accidents, the management of ill passengers on-board remains unclear from the standpoint of a volunteer responder.[3,4] New recommendations authored by physicians at St. Michael's Hospital in Toronto serve to aid airline companies and volunteer medical professionals in managing in-flight emergencies.[5] Nevertheless, the incidence and outcome of in-flight health events remain largely unknown due to a paucity of available information.[4] Collation of this data at an international level could better inform policy-makers in the airline industry about necessary on-board medical equipment, requisite training and qualifications for both crew and volunteer responders, and clarify the duties of stakeholders involved.[4] The purpose of this article is to highlight knowledge gaps regarding in-flight health emergencies, the associated consequences for passengers and medical professionals, and future steps to improve flight safety.

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Regulatory Uncertainty

The Aviation Safety Network estimates that there were nearly 37 million flights worldwide in 2017, and it is projected that about 4 billion passengers will fly in 2018.[3,6] A study published in the *New England Journal of Medicine* that reviewed records of in-flight medical emergency calls from five international airlines to a physician-directed medical communications centre between 2008 to 2010 estimates that 1 health event occurs per 604 flights, or 16 medical emergency per 1 million passengers.[7] Using this approximation, there were over 61,000 in-flight medical emergencies last year. However, an accurate incidence of in-flight medical emergencies is difficult to ascertain, with another study suggesting that 1 in-flight medical emergency happens per 7700 passengers.[5,8] These discrepancies stem from the lack of international strategies to monitor need and coordinate services directed to this public health problem.[5,9-11] Since there is no standardized international format or registry to collect data on in-flight medical events, research progress on this topic is stunted and no consensus has been reached in regard to the classification, prevalence, and outcome of these events.[7,10,11] The disparity in definition extends from harmless situations, such as muscle cramping, and go so far as to include life threatening conditions, like myocardial infarction.[9] The process of developing international regulations that require airline companies to report in-flight health events through a standardized system should be initiated as this information may save lives and further avoid inappropriate flight diversion, which have been approximated to cost between $3000 and $900,000.[4,5]

The IATA, the Aerospace Medical Association (AMA), and the International Civil Aviation Organization (ICAO) have agreed on recommendations for medical equipment to be stocked on-board; however, the specific contents of emergency medical kits, training of cabin crew, and emergency treatment protocols are not regulated by any international aviation body.[4] The application of ICAO policy recommendations are at the discretion of each individual nation and its airlines.[12] Therefore, it should not come as a surprise that a study evaluating the medical kits stocked on 12 European airlines identified signifi-

cant variability in both medication and equipment stocked on-board.[13] Indeed, none of the 12 participating airlines fully complied with ICAO standards and recommended practices, with two low-cost carriers possessing insufficient acute care equipment.[13] Domestically, Transport Canada only mandates that any aircraft with at least 100 passenger seats is legally required to carry a medical kit in addition to the standard first aid kit required for aircraft with fewer than 100 passenger seats.[5,14] Although these requirements set out by Transport Canada for medical kits are minimal, many airlines supplement their on-board stock of equipment and medicines based on ICAO guidelines. It is evident that national and international authorities need to more frequently evaluate stocked medical kits and promote better coordination between airline companies, particularly with an eye towards acute medical equipment, to better prepare for potential life-threatening events during commercial flights.

Aviation Physiology

Patients may ask their physicians whether or not it is feasible for them to fly.[1] Therefore, physicians must be knowledgeable of the physiologic effects of flight on the body to provide appropriate advice. The cruising altitude of a commercial airliner ranges between 29,000 and 39,000 feet, and aircraft cabins are typically pressurized between 6000 and 8000 feet.[1,4] At these elevated altitudes, passengers are exposed to a number of physiologic stressors that increase the risk of health complications in individuals with pre-existing conditions, particularly elderly people with cardiopulmonary co-morbidities.[1,4] One retrospective study estimated the mean age of passengers that experience in-flight health events to be 48 +/- 21 years, ranging from 14 days to 100 years.[7] Symptom exacerbations during flight are often attributable to the relative hypoxia experienced by passengers, with a decreased oxygen saturation of 90%, compared to the sea-level norm of 95-100% saturation.[1,15] Since atmospheric pressure drops at higher altitude, gas within the body cavity expands which can precipitate various symptoms that include earache, facial pain, abdominal pain and distention, as well as increase the severity of pneumothoraces.[1,16] In addition, low cabin humidity may aggravate mucosal dryness, provoking dry eyes and reactive airway diseases.[1,17]

Considering these possible complications, the most frequent in-flight medical emergencies are categorized as syncope or presyncope (37.4%), respiratory symptoms (12.1%), and nausea and vomiting (9.5%).[7] From a practitioner point of view, medical education focused on the physiologic stressors associated with aviation can capacitate physicians to proactively counsel at-risk patients about flight and better triage sick passengers during emergencies. At the same time, awareness campaigns directed towards the general population may empower patients to advocate for their health, as well as appraise symptoms experienced in flight.

Patients As Partners

It is fortunate that the majority of in-flight medical emergencies are self-limiting, or are adequately managed on-board without the need for flight diversion.[7] For example, a report of a 63-year-old female smoker (80 pack-years) on-board a flight from Athens, Greece to Amsterdam, Netherlands is a case in point.[18] She had been diagnosed with hypertension, moderate chronic obstructive pulmonary disease (COPD), and mild cardiac failure. At sea level, she had satisfactory oxygen saturation (SaO_2 94%); however, thirty minutes after take-off, she started to experience severe dyspnea. After administration of oxygen at 2L/min, the symptoms slowly improved, and she arrived in Amsterdam.[18] From a prevention perspective, this person should have been counselled by their physician about the increased health risks associated with high altitudes, and subsequently been placed on supplemental oxygen during the flight.[17-20] Physicians that oversee the care of at-risk patients with chronic disease, or any illness that can be adversely affected by changes in altitude, notably fluxuations in oxygen content of inspired air, air humidity, and atmospheric pressure, should be familiar with the contraindications to commercial air travel and guidelines on how to assess fitness to fly.[17] These imposed limitations should be interpreted within the context of a patient's preferences and lifestyle.

This patient-centric approach to chronic disease management promotes proactive self-care practices by patients and, therefore, has a clear application in the prevention of in-flight health events.[19] Integration of the patient perspective into the treatment process has been associated with higher patient satisfaction and compliance, as well as greater continuity of care.[20] An educational framework that augments patient experiential knowledge with scientific and technical know-how can facilitate the process of establishing a clear treatment plan with definable outcomes in terms of what a patient should comprehend and be able to do in order to manage their health.[19]

Specifically, self-management education with the aim of developing medication adherence, coping strategies, and the ability to interpret disease changes and manifestations has been shown to produce long-lasting benefits, including reduced symptoms and significantly less need for medical treatment.[20,21] Indeed, someone who understands their health will be better equipped to advocate on their own behalf. This research suggests that building patient competency and autonomy may prove effective in avoidance of in-flight health emergencies.

The Volunteer Responder

When it comes to in-flight frontline care, medical professionals receive little to no training.[7,22] This knowledge gap begs the question, what is the role of the most novice of medical professionals, the medical student, in these emergent situations? Approximately 20% of American medical students have already been on-board a flight with a potential medical emergency; yet, a multicenter survey indicates that fourth-year medical students feel inadequately prepared to respond to in-flight emergencies and possess sub-optimal knowledge.[23] Another pilot project that recruited medical students in different stages of training demonstrated a lack of preparedness to respond to health events during flight, and that a focused curriculum, including simulation-based training, could improve their confidence and competence in rendering aid in these foreign circumstances.[24] There is no specific portion of the medical school curriculum that pertains to how to best manage in-flight health emergencies.[25] Regardless, like physi-

cians, medical students must be conscious of the limitations of their scope of practice.[16] Medical trainees should be aware and act within their level of competency, and refrain from being overconfident in their abilities. In such instances, the medical student should not assume the primary management of the ill passenger as they are not qualified or licensed to provide this care.[16] In the case of an emergency, the medical student should inform the cabin crew that is exactly what they are, a student. The ability of the student to assist in a medical emergency is limited, but their role can be to assist the cabin crew or a physician, if one is available and responds.[16]

Likewise, physicians who answer the call to action often face many of the same uncertainties and barriers as medical learners.[16] Physicians should be mindful of their skill set and work within the confines of their specialty training and experience.[4,16] Comparable to any treatment setting, the physician should communicate their appraisal of the situation with the care team (the crew) and initiate the process of informed consent prior to providing treatment to an ill passenger.[16] In contrast to regular practice, aircraft often have unique operational procedures in the case of health events, and few, if any familiar tools.[5,7,17] For example, many airlines mandate that a ground-based medical agency be consulted prior to the use of an emergency medical kit.[7] Once equipped with the necessary tools, physicians may discover that 'bread and butter' clinical techniques, including auscultation for breath sounds or obtaining blood pressure measurements using a stethoscope, are complicated by the loud, cramped, and dimly lit cabin of most airplanes.[5] These circumstances may also complicate the ability to protect patient confidentiality. Consequently, if viable, responders should attempt to establish a private setting to provide care. Therefore, before attending to a sick passenger, a volunteer physician should understand their abilities, familiarize themselves with the roles of the parties involved, and acclimatize to this turbulent environment.

On-board an airplane, the pilot is in command and accountable for the safety of all passengers.[16] In the case of a health emergency, the pilot acts as a conduit between on-board care providers and ground-based medical consulting services, and is also responsible for the decision to divert a flight.[7,16] Concurrently, the cabin crew is charged with managing in-flight passenger services, and maintaining communication with the cockpit.[16] The cabin crew are trained to identify symptoms of frequent medical problems and perform first aid and basic cardiopulmonary resuscitation, as well as administer medical oxygen.[1,7,16] With these roles in mind, the physician should take a collaborative, team-based approach to facilitate the delivery of medical care to any ill passenger.[1,5,7,16]

Although physicians have a moral and professional obligation to respond to in-flight health crises, issues of legality and liability may act as deterrents to good intentions.[16,17,26] These concerns are exacerbated by the reality of flying over various legal jurisdictions and aboard different airlines in which contextual legal obligations may be unfamiliar. From a Canadian perspective, the legal principles regarding the duty to treat varies provincially. While Quebec imposes a legal duty on physicians to provide aid to those in emergent situations, this obligation does not pertain to health care professionals in other Canadian provinces or territories.[26] Internationally, a law defining a physician's duty to respond to in-flight emergencies does not exist.11 The Canadian Medical Association encourages physicians to offer appropriate assistance to any person in need of care. The Canadian Medical Protective Agency (CMPA) is generally able to cover current and ex-members providing emergent care as good Samaritans irrespective of location and patient nationality.[26] The CMPA defines a good Samaritan as "a member offering or called up to provide medical care to someone requiring urgent or emergent medical assistance when such assistance is not otherwise immediately available.[26]" Physicians are encouraged to document these instances in their records. The fear of a physician being successfully sued for providing emergent care is largely unfounded; however, it is important to keep in mind that the CMPA does not provide blanket coverage and good Samaritan laws rightfully do not offer protection against gross negligence or misconduct.[26] In these emergency situations, physicians should only provide care within their scope of practice and level of training while maintaining the best interests of the patient. In general, physicians should educate themselves and be aware of their obligations during out-of-office health emergencies.[17,26]

The Need For Leadership

Nearly 50% of on-board voluntary assistance is provided by a physician.[7] Moreover, the fiduciary nature of the doctor-patient relationship coupled with the culture of civic professionalism in medicine warrants that physicians advocate for changes that ameliorate human suffering.[16,26] The discrepancies and associated risks to health surrounding in-flight medical events ought to be addressed by the medical community. The specialty of emergency medicine is the primary medical discipline that employs a systems-level approach to triage by providing healthcare professionals with the expertise to make expeditious decisions and take necessary action to prevent death or additional disability, both in pre-hospital and emergency department settings.[4] It follows that the emergency specialization has assumed a leadership role in advocating for the field of aviation medicine by consulting with the airline industry.[5] Beyond the practical recommendations developed by Kodama and colleagues in association with Air Canada and WestJet, more research is required to guide physician volunteers on-board aircraft in the diagnosis and treatment of acute or episodic illness and injury. The development of training programs for medical professionals and higher-level preparation for senior flight crews on the management of in-flight health emergencies will bring these good ideas into practice and alleviate common concerns.

Moving Forward

The prevalence of in-flight health events is predicted to rise not only because of the growing number of air travelers, but also as a result of aging populations in North America and Europe with an associated increase in chronic disease prevelance.[1,27] Given this caution, the objective of improving flight safety should be threefold: mandate a standardized method to document in-flight health events for research purposes, engage patients with pre-existing conditions as partners in their care, and expand educational initiatives to improve the

ability of medical professionals and experienced flight attendants to act as effective responders.

The current competency level of medical students to triage a patient based upon urgent or emergent care needs and the ability to apply basic and advanced life support as indicated has been shown to be insufficient to address in-flight health emergencies.[23,24,28] Learners today need to develop the ability to apply the information they are presented with in the classroom. Firsthand experience develops practical skills and enables students to recognize knowledge gaps.[24,28] To better prepare the physicians of tomorrow for in-flight or resource-limited health emergencies, additional medical education is necessary. However, it is challenging to conduct real-time evaluations during trauma or emergency scenarios due to the hectic and patient-focused environment.[28] Likewise, these situations are not always conducive to learning and may prove to be intimidating or exclusionary situations for students.[28] Therefore, simulation-based education has been endorsed as a modality that provides learners with hands-on and controlled experiences to achieve adequate proficiency.[24,28] A study found that mechanical simulation models may be more realistic and dynamic compared to standardized live patient models.[28,29] Analogous to Wilderness First Aid training sessions offered to medical students, in-flight simulation programs can be established to fill this gap. Such opportunities can provide comprehensive and practical perspectives on a range of in-flight health emergencies, ranging from common to life-threatening, utilizing both classroom and simulation formats.[30]

This increase in the expertise of traveling physicians and medical students to conduct field assessments is necessary, but dependency on physician assistance is impractical. In conjunction, senior flight crew members may need to receive additional training to achieve the same basic level of competency as emergency medical technicians to ensure appropriate care of ill passengers.[22] High-yield learning objectives can be formulated once documentation of health emergencies are standardized, or a registry is established, and this data is analyzed.

Research efforts should focus on the development of an evidence-based framework for the identification and evaluation of the key determinants of flight diversion for medical purposes. Such a guide could organize pertinent information, define alternative options, and make the decision to divert more deliberate. In consultation with in-flight and ground-based medical personnel, the pilot must weigh operational feasibility versus patient prognosis in the decision to divert a flight. Factors that often tip the scale towards an unscheduled landing are differential diagnosis of the patient's condition and AED use.[4,7] The most prevalent symptoms that prompt flight diversion include syncope/presyncope (25%), cardiac symptoms (19%), seizures (9%), respiratory symptoms (9%), and possible stroke (4%).5,7 Persistence of altered mentation or suspicion of time-sensitive conditions, such as myocardial infarction, increase the likelihood of diversion.[7] A 2010 study investigating the reasons for Air Canada flight diversions over a 4 year span found that the majority of diversions occurred following cardiac symptoms.[31] Nevertheless, 92.7% of in-flight emergencies are managed on-board and passengers arrive at their scheduled destinations.[7] Additional research focused on medical causes for flight-diversion and associated training of responders, both cabin crew and physicians, to effectively triage common in-flight symptoms that may be causally associated with high altitude travel can help address and potentially decrease the remaining 7.3% of health-related flight diversions.[22] Beyond the economic benefit, this approach may improve the quality and timeliness of care passengers receive by enhancing the skill sets of responders and informing policy-makers on how to regulate the contents of medical kits.

Conclusion

The academic study of in-flight health events is necessary as more people choose to travel by air. As the need for this information increases, faculties of medicine, especially emergency medicine programs, may consider introducing educational opportunities specific to in-flight scenarios.[4] However, physician competency only addresses one-side of a two-dimensional dilemma, as a medical professional may not always be available to provide on-board assistance.[22] In the community, physicians need to engage patients, particularly those living with chronic illness, as partners in their care to build capacity and self-management skills through education.[20,21] This holistic approach will ease tensions medical professionals face when duty calls on-board, while increasing the confidence of patients to make smart decisions that reduce the risk of symptom exacerbations. The sky should not be the limit when it comes to patient care.

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