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# Management of In-Flight Medical Emergencies: Are Senior Medical Students Prepared to Respond to this Community Need?

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**Introduction:** In-flight medical emergencies on commercial aircraft are common in both domestic and international flights. We hypothesized that fourth-year medical students feel inadequately prepared to lend assistance during in-flight medical emergencies. This multicenter study of two U.S. medical schools obtains a baseline assessment of knowledge and confidence in managing in-flight medical emergencies.

**Methods:** A 25-question survey was administered to fourth-year medical students at two United States medical schools. Questions included baseline knowledge of in-flight medicine (10 questions) and perceived ability to respond to in-flight medical emergencies.

**Results:** 229 participants completed the survey (75% response rate). The average score on the fund of knowledge questions was 64%. Responses to the 5-point Likert scale questions indicated that, on average, students did not feel confident or competent responding to an in-flight medical emergency. Participants on average also disagreed with statements that they had adequate understanding of supplies, flight crew training, and ground-based management.

**Conclusion:** This multicenter survey indicates that fourth-year medical students do not feel adequately prepared to respond to in-flight medical emergencies and may have sub-optimal knowledge. This study provides an initial step in identifying a deficiency in current medical education. [West J Emerg Med. 2014;15(7):925–929.]

## INTRODUCTION

In-flight medical emergencies are not uncommon occurrences on commercial aircraft. There is no required reporting for all incidents, but it has been estimated that at least 20,000 of these events occur in the United States annually.<sup>1</sup> One study estimated the incidence of emergencies on U.S. flights to be one per 753 flights,<sup>2</sup> while another estimated one per 604 flights.<sup>3</sup> A retrospective study of one year for a single airline found that one in 11,000 passengers experienced an in-flight emergency.<sup>4</sup> An estimated 40-90% of commercial aircraft flights in the U.S. have a physician among

the passengers.<sup>5,6</sup> Physicians have noted that the loud, confined space environment of an aircraft cabin can make it challenging to render aid.<sup>7</sup> The reduced humidity and atmospheric pressure and loss of personal mobility present specific pathophysiologic considerations for physicians who respond to a passenger in need.<sup>8-10</sup> At the same time, the population of air travelers has transitioned to a demographic that is older with more comorbidities.<sup>10</sup>

The general public relies on Good Samaritan physicians of all specialties to respond to in-flight emergencies, yet there are no medical school curriculum

requirements specific to this community need.<sup>11</sup> As noted in prior research, “the provision of medical assistance to passengers during flights aboard commercial aircraft is a matter of concern to most physicians.”<sup>13</sup> We are interested in the knowledge and confidence of fourth-year medical students because they will soon be licensed physicians, and physicians of all specialties may be called upon to assist with in-flight emergencies. We believe that medical school serves as an appropriate venue for this training, and it will equip students with a skillset that is important to serve their communities when they become licensed physicians. A heterogeneous pilot project on medical students in different stages of training suggested that a deficit in this skillset exists, and that a focused curriculum, including simulation, could improve their attitudes and fund of knowledge.<sup>12</sup>

To further explore the issue and to ultimately develop curriculum around in-flight medical emergencies, we employed the first two steps of the six-step approach to curriculum development proposed by Kern et al.<sup>14</sup> In this framework, the educational issue can be analyzed first through problem identification and a needs assessment of the learners. We hypothesize that fourth-year (senior) medical students do not feel comfortable assisting during an in-flight medical emergency, nor do they have an adequate fund of knowledge in this area. We structured a multi-site needs assessment study, as there is no documentation to this point of medical student knowledge or present instruction received on inflight emergencies.

## METHODS

This study is an observational, cross-sectional investigation of medical student comfort levels and fund of knowledge regarding responses to in-flight medical emergencies. We used questionnaires and fund of knowledge evaluations to examine both comfort and knowledge. The sponsoring medical schools’ institutional review boards approved this study as exempt from written consent. As such, researchers used verbal consent for enrollment of all participants.

We distributed the survey to a convenience sample of fourth-year medical students during scheduled class meetings at two medical schools in the U.S., the University of California, Irvine School of Medicine and the University of California, San Francisco School of Medicine. All full-time students in their fourth year of medical education attending the sponsoring medical schools were eligible for inclusion. Prior to participating, students received a mass email containing the study information sheet, and a copy was available during the day of the survey administration. Investigators administered surveys in a break room and lecture hall and collected them in a confidential manner. Completion of the survey was completely optional, and researchers collected no identifying data in the survey.

The primary outcome was descriptive analysis of the

survey data, including mean scores of questions on knowledge and self-assessment of competency for in-flight emergencies. The survey consisted of a demographic section with questions that assessed age, gender, year of training, previous healthcare training such as emergency medical technician-basic, previous employment as a healthcare provider, previous training for in-flight emergencies, possession of a pilot’s license, and whether they had been aboard an aircraft during an in-flight medical emergency. The survey contained a section to measure perceived confidence and comfort level of students in responding to in-flight medical emergencies with questions using a 5-point Likert scale. The third section of the survey involved 10 fund-of-knowledge questions (Table 1). These questions addressed flight physiology, common in-flight medical emergencies, and logistical considerations when managing in-flight medical emergencies. They were independently reviewed and approved by a former airline medical director, who is an expert in ground-based medical command of in-flight medical emergencies and currently works in the ground-based medical advisory industry. This expert is not a coauthor of this paper.

We calculated descriptive statistics for the demographic questions, responses to the self-assessment questions, and scores of the fund of knowledge questions using a commercially available spreadsheet program (Microsoft Excel 2011, Microsoft Corp., Redmond, WA).

## RESULTS

The survey was distributed to 304 fourth-year medical students, 126 from one medical school and 178 from the other. Two hundred thirty-two (76%) students filled out and returned the survey instrument, and 229 (75%) completed all of the subjective and objective questions. Three students indicated that they were third-year medical students. These were excluded from analysis. The majority (54%) of respondents were female, with a mean age of 27 years. Demographic responses to the survey indicated that the vast majority (85%) of respondents had taken a basic life support course, but only a minority (12%) had previously worked as a healthcare provider. A minority of respondents reported previous training on flight physiology or in-flight emergencies (11%). Although 21% of responders had previously been on an aircraft during a medical emergency, only 10% of those (2% of the total sample) had helped manage an in-flight medical emergency. The baseline mean response to each in-flight self-assessment question was less than three, corresponding to disagreement or strong disagreement with statements of comfort with in-flight medical emergencies (Table 2). The mean responses for whether the students felt confident in their ability to respond to general medical emergencies was greater than the mean response to their ability to respond to in-flight medical emergencies ( $p < 0.0005$ ).

The answers to the initial fund-of-knowledge questions yielded a mean correct percentage of 64% (range of 10%-

100%, median of 60%, 95% CI of 62.1%-65.9%). The most commonly missed question was “With respect to the enhanced medical kit, flight crew members are required to...” (28% correct). The question most frequently answered correctly was “U.S. flight crews are all trained in the use of

**Table 1.** Fund-of-knowledge questions related to in-flight emergencies, with correct answers starred.

Question	Percent answered correctly (%)
1. The percentage of oxygen in the atmosphere decreases as your altitude or elevation increases. True <span style="float:right">False*</span>	31
2. The humidity in cabin air on a commercial airline flight is typically relatively _____ when compared to typical ground level building interiors. a. Low* <span style="float:right">b. High</span>	87
3. Commercial airplane cabins are typically pressurized to an altitude of _____ a. Sea level b. 2,000 feet c. 8,000 feet* d. 15,000 feet e. Not pressurized	31
4. The most common in-flight medical emergency is. a. Stroke b. Myocardial Infarction c. Seizures d. Vasovagal (syncope, fainting, dizziness)*	86
5. Licensed physicians are required to respond to in-flight medical emergencies on domestic US flights. True <span style="float:right">False*</span>	62
6. All of the following equipment is required by the FAA as part of the enhanced emergency kit, EXCEPT (Choose only one). a. Laryngoscope* b. Inhaled bronchodilator c. Epinephrine 1:10,000 d. Aspirin e. Nitroglycerin	85
7. US Flight crews are all trained in the use of the automated external defibrillator. True* <span style="float:right">False</span>	94
8. With respect to the enhanced medical kit, flight crew members are required to. a. Take it out only on request* b. Always take it out c. Always open it d. Know the indications of its medications	28
9. Who has the final say on whether the plane will be diverted because of an in-flight medical emergency? a. the responding physician b. the pilot in charge (captain)* c. the patient d. Ground based medical control	52
10. Only a minority of in-flight medical emergencies result in the diversion of the plane. True* <span style="float:right">False</span>	85

**Table 2.** Mean response to self-assessment questions.

Self-assessment questions	Mean response (1-strongly disagree 2-disagree 3-neither agree nor disagree 4-agree 5-strongly agree) (95% CI)
My medical education has given me adequate knowledge and skill to render assistance during a medical emergency.	3.34 (3.21-3.47)
My medical education has given me adequate knowledge and skill to render assistance during an in-flight medical emergency.	2.68 (2.54-2.82)
I have an adequate understanding of what medical supplies are required on commercial airplanes.	1.78 (1.65-1.91)
I have an adequate understanding of the level of training of commercial air crew in managing in-flight medical emergencies.	1.59 (1.48-1.70)
I have an adequate understanding of the manner in which the air crew, ground based medical control, and the on board volunteer healthcare provider work together to manage an in-flight medical emergency.	1.66 (1.55-1.77)
I would currently feel confident responding to an in-flight medical emergency.	2.19 (2.06-2.32)
I would currently provide competent care while responding to an in-flight medical emergency.	2.26 (2.14-2.38)

the automated external defibrillator” (94% correct). When analyzing the subgroup of participants that had previously worked as a healthcare provider the mean correct percentage for the fund-of-knowledge questions was not significantly different compared to all respondents at 63% (CI of 57.9%-68.1%) vs. 64% (CI of 62.1%-65.9). Those who had worked as healthcare providers also exhibited a baseline response less than three for all the in-flight self-assessment questions, similar to those participants without prior experience working as healthcare providers.

**DISCUSSION**

Education addressing logistics and environmental considerations for managing in-flight medical emergencies is not a required component of medical school curriculum in the U.S. This is despite the fact that any physician who travels by

air may be asked to render care in such a situation. Our study indicates that approximately one in five medical students have already been on a flight with a potential medical emergency. Our results also confirmed that medical students, even in their final year of training, do not feel confident or competent in the management of in-flight medical emergencies. The participants' responses to both subjective and objective questions indicated that they were not sufficiently capable of responding during in-flight medical emergencies.

These results build on the limited available previous research. When compared to the only other known publication on discrete medical student training in this specific topic, our study demonstrates that a lack of perceived competence and knowledge exists consistently among senior medical students at more than one medical school.<sup>12</sup> The need for this knowledge base by practicing physicians can be further inferred by several review articles and case reports on in-flight medical emergencies.<sup>1,2,4,5-10</sup> In addition, the literature has demonstrated that discrete simulation training improves response to medical emergencies.<sup>15,16</sup> Given these findings, medical schools should consider ways to include material on the subject within their curricula.

## LIMITATIONS

Our study has several limitations. First, response performance to in-flight medical emergencies is challenging to measure and Likert scale questions may not capture actual student perception of competency levels. Although Likert scales may incur central tendency bias, such bias would likely falsely elevate students' confidence ratings, since the most common responses to the self-assessment questions corresponded to disagree or strongly disagree. Likert scales supply results that are similar to those of traditional formats of measurement.<sup>17</sup> Second, our study used multiple-choice questions to evaluate the topic-specific fund of knowledge. We attempted to find questions on the topic with existing external validation, but were unable to. As the process of creating validated questions alone would have been much more complex than the design of this study, we moved forward with that limitation. Although the fund-of-knowledge questions were not externally validated, we attempted to select questions that addressed key concepts of in-flight medical emergencies. Additionally, these questions were vetted by an expert in providing online medical command during these events. Third, while successful performance on these objective questions is expected for individuals with appropriate expertise, it is by no means sufficient to demonstrate an adequate understanding and performance of the required skills during actual in-flight medical emergencies. Fourth, as with any convenience sample, the potential for bias exists. This was mitigated by including a study population that was both homogenous and advanced in training (senior medical students), and by administering the survey in person during scheduled activities that involve the entire class, not certain sub segments. Two separate universities were involved to reduce the bias from

any one institution, with an adequate overall response rate. The use of only two universities may not result in a national representation of curricular preparedness and curricular need, but did function at decreasing the bias that may occur when looking at only one school.

It is not entirely clear why three of the 235 responders indicated that they were third-year medical students, as the surveys were administered at functions attended solely by fourth-year medical students. These students might have circled the third-year indicator in error or they may have been third-year medical students who chose to attend the activity.

## CONCLUSION

This multicenter study demonstrates that fourth-year medical students do not feel adequately prepared to respond to in-flight medical emergencies and may have sub-optimal knowledge in this area of medicine. A training gap likely exists in the U.S. medical school curriculum to address the response to and management of in-flight medical emergencies aboard commercial aircraft. This study provides an initial step in identifying and potentially improving a deficiency in current medical education.

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*Conflicts of Interest:* By the WestJEM article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. The authors disclosed none.

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