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Medical Students' Perceptions, Self-Confidence, and Willingness to Handle In-Flight Medical Emergencies: A Cross-Sectional Study

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Abstract

As air travel rebounds in the post-COVID-19 period, in-flight medical emergencies (IMEs) are anticipated to become more frequent. Despite this, there is limited research assessing the readiness of health profession students to respond to such situations. This study aimed to evaluate medical students' knowledge, confidence, and willingness to assist in an IME within their internship program. A cross-sectional design was employed using an online, self-administered questionnaire distributed to medical students at two Saudi Arabian medical colleges. The survey consisted of three sections: sociodemographic information, knowledge of aviation medicine (10 questions), confidence (7 questions), and willingness (4 questions) to respond to IMEs. Associations between knowledge levels and independent variables were assessed using odds ratios (OR) and 95% confidence intervals (95% CI). Confidence and willingness responses were measured using a 5-point Likert scale. The results revealed that 61.4% of participants demonstrated insufficient knowledge for managing an IME. Attendance in life support courses did not significantly affect knowledge levels (60.4% vs. 66.7%, P > 0.99). The only factor associated with higher knowledge was flying at least twice a year [OR = 1.89 (95% CI = 1.14–3.17), P = 0.02]. Regarding willingness, 93.3% of students scored low, 6.3% moderate, and 0.8% high. Confidence scores were similarly low for 86.3%, moderate for 12.2%, and high for 1.5% of participants. Attendance in life support courses did not influence confidence or willingness scores. Despite the majority of students having previously completed life support training, most lacked adequate knowledge, confidence, and willingness to respond to IMEs. These findings highlight the critical need for targeted education on in-flight medical emergencies and their specific challenges before students enter their mandatory 7th-year internship.

Keywords: Medical education, Aviation Medicine, First Responder, Emergency Medicine

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Introduction

Global air travel nearly doubled over the decade preceding the COVID-19 pandemic, rising from 2.25 billion

passengers in 2009 to 4.46 billion in 2019, with an average annual growth rate of 7.1% [1]. This surge in air travel underscores the importance of being prepared for in-flight medical emergencies (IMEs). IMEs occur at an estimated rate of 18.2 events per million passengers, with an overall mortality rate of 0.21 per million [2]. As the aviation sector recovers from the 60% drop in passenger numbers in 2020 due to COVID-19—a decline projected by the International Air Transport Association (IATA) to rebound beyond pre-pandemic levels by 2024 [1, 3]—the frequency of IMEs is expected to rise accordingly [4, 5].

Most IMEs involve relatively minor issues such as dizziness, headaches, syncope, nausea or vomiting, shortness of breath, and injuries or burns [6, 7]. While airline cabin crews are trained to manage these incidents, studies suggest that only about one-third of IMEs are resolved without the intervention of a healthcare professional on board [6, 7]. Physicians are the most frequent volunteers responding to crew requests for medical assistance, accounting for 48.1% of responses, while nurses, emergency medical personnel, and other healthcare providers contribute 28.2% [4]. The physiological stresses of air travel, combined with spatial and resource limitations, make IMEs uniquely challenging, even for experienced healthcare professionals [8–12]. Additionally, concerns about medicolegal liability can discourage physicians from intervening [13].

Medical students, as future healthcare providers, may also encounter IMEs during their careers. Katzer *et al.* [14] reported that approximately one in five senior medical students had experienced an in-flight medical emergency. Because in-flight physiology, epidemiology, legal considerations, and available resources for healthcare responders are not typically covered in medical curricula, IMEs can be particularly intimidating, leaving students with limited confidence and competence to provide adequate care [14]. Supporting this, a previous study found that only 11.5% of primary care physicians felt confident providing medical assistance during an IME [11].

Although few studies have evaluated medical students' preparedness at different stages of training, results consistently show that they often feel underprepared and possess insufficient knowledge to manage IMEs effectively [13, 14]. This study, therefore, aimed to assess medical students' knowledge, confidence, and willingness to respond to IMEs at two large medical colleges in western Saudi Arabia.

Materials and Methods

Conceptual framework

The Saudi Medical Education Directives (SaudiMED) framework, introduced in 2009 by the Deanery of Saudi Medical Colleges, aligns with global trends toward competency-based medical education [15]. It outlines the essential clinical, procedural, and professional competencies that medical students should achieve before commencing their mandatory 7th-year internship [15, 16]. While the SaudiMED framework addresses common clinical scenarios relevant to IMEs—such as syncope, lightheadedness, abnormal respiration, chest pain, arrhythmias, and abdominal pain [5]—as well as skills like patient assessment, first aid, basic cardiac life support, and burn care, it does not explicitly cover these competencies in the context of the unique challenges posed by in-flight emergencies. These include understanding the roles of medical volunteers and cabin crew during an IME.

Ho *et al.* [17] emphasized that doctors and medical students must first evaluate their own competencies and physical and mental readiness before providing in-flight care. If deemed competent, the healthcare provider should identify themselves to the crew, communicate their scope of practice, and establish their duty of care and legal responsibilities. Students should clarify that they can only assist in a limited capacity, collaborate with crew members, obtain patient consent, and maintain thorough documentation. While the pilot retains ultimate authority over flight diversion, the medical volunteer's role is to support the crew, understand the in-flight environment and available resources, and, if diversion occurs, help coordinate with ground personnel for smooth patient handover. Hu and Smith [18] also highlight that personal legal risk is minimal unless negligence occurs, and volunteers should provide care with confidence.

To investigate whether the competencies outlined by the SaudiMED framework equip students with sufficient knowledge, confidence, and willingness to assist during IMEs, we designed a multicenter survey. The study specifically examined how well students are prepared to perform their roles as medical volunteers in alignment with the considerations described by Ho *et al.* [17] and Hu and Smith [18].

Study setting

Saudi Arabia's higher education system has historically been led by public universities, typically with one major institution per city. In recent years, the growth of private colleges has diversified options, particularly in Jeddah. For this research, we focused on two institutions: King Abdulaziz University, the city's sole public medical school, and Batterjee Medical College, the largest private medical college in the area, where the authors are primarily employed.

Study population

This study targeted medical students undertaking their 7th-year mandatory general internship, a requirement for graduation in Saudi Arabia. Participants were recruited using a convenience sampling strategy.

Survey method

A multicenter, cross-sectional survey was conducted online between June and December 2022. The questionnaire was divided into three domains: sociodemographic details (eight items), knowledge of aviation medicine (ten items), confidence (seven items), and willingness (four items) to respond to in-flight medical emergencies (IMEs).

The survey was designed after a thorough review of relevant literature, adapting elements from previous studies [11, 13, 14]. The first section captured demographic and background information, including age, gender, university type, frequency of air travel, completion of basic life support (BLS) or advanced cardiac life support (ACLS) courses, prior exposure to IMEs, and completion of an emergency medicine rotation. The knowledge section contained ten questions—two multiple-choice and eight true/false—covering four key areas: aviation pathophysiology (three items), epidemiology (two items), availability of equipment and onboard resources (two items), and medicolegal obligations (three items). The confidence and willingness sections assessed students' readiness to provide care through statements such as, "My medical education has equipped me with sufficient knowledge and skills to assist in a medical emergency," and "I would introduce myself as a medical intern and offer help during an in-flight medical emergency."

Pilot testing

To ensure content and face validity, the survey was reviewed by three independent physician experts with experience in emergency and academic medicine (acknowledged in the paper). A pilot test was then conducted with twenty students not included in the main study, in accordance with Hertzog's guideline that twenty participants per group are sufficient for pilot studies [19]. Cronbach's alpha measured internal consistency, yielding 0.899 for confidence and 0.721 for willingness. These results indicate acceptable reliability (values > 0.7 are adequate), while values above 0.9 can signal redundancy [20, 21]. The instrument demonstrated strong internal consistency and low redundancy, and no substantial revisions were required for the main survey.

Data collection

The final questionnaire was hosted on Google Forms and distributed to students at both institutions. The survey link was shared via multiple channels, including WhatsApp groups and email lists, to encourage broad participation. Technical restrictions ensured that each participant could submit the survey only once, preventing duplicate responses.

Data analysis

The study focused on three main outcomes: medical students' knowledge, confidence, and willingness to intervene during an in-flight medical emergency (IME). Categorical data were summarized using counts and percentages, whereas continuous measures were expressed as means with standard deviations (SD).

For the knowledge assessment, participants' correct responses across the ten questions were ranked from highest to lowest. Domain-specific scores were calculated by averaging the percentage of correct answers within each domain. To explore the impact of prior training, odds ratios (ORs) with 95% confidence intervals (95% CI) were calculated to compare students who had completed BLS or ACLS courses with those who had not. Statistical significance was determined using Fisher's exact test, with $P < 0.05$ considered significant.

Knowledge levels were further dichotomized into 'adequate' and 'inadequate,' with a score of 60% or higher classified as adequate, consistent with conventional academic pass thresholds.

Confidence and willingness to respond to IMEs were measured using a 5-point Likert scale ranging from 0 (strongly disagree) to 4 (strongly agree). Total scores were computed by summing individual item scores, resulting in a maximum of 28 points for confidence and 16 points for willingness. Scores were then categorized as 'low' (< 70%), 'moderate' (70%–89%), or 'high' (≥ 90%), following prior research benchmarks [13, 22]. Subgroup comparisons between students with and without BLS/ACLS training were performed using a two-way ANOVA, with P-values greater than 0.05 considered non-significant. Cronbach's alpha was also calculated for the main survey to confirm internal consistency, in line with the pilot study.

All analyses were conducted using SPSS version 17.0 (SPSS Inc., Chicago, IL, USA).

Ethics

Ethical clearance was obtained from the Institutional Review Board (IRB) of Batterjee Medical College, Jeddah, Saudi Arabia (Reference No. RES-2022-0028). Participants provided informed consent at the beginning of the survey, and confidentiality of responses was strictly maintained.

Results

A total of 394 medical interns completed the survey, comprising 117 males and 277 females, with a median age of 23 years (interquartile range 22–24 years). About one-third of respondents attended a public university, and 81% reported a GPA between 3.75 and 5.0. Over half of the students (53.2%) indicated they travel by air at least once per year, and 14.2% had encountered an IME firsthand. While most participants (84%) had previously attended

life support courses such as BLS or ACLS, fewer than half (40.4%) had completed an emergency medicine rotation. Further demographic and academic characteristics are summarized in **Table 1**.

Table 1. Demographic and academic profile of participating medical students (n = 394)

Characteristic	Category	Number (n)	Percentage (%)
Gender	Female	277	70.3%
	Male	117	29.7%
Type of medical school	Public	261	66.2%
	Private	133	33.8%
GPA	2.00–2.74	6	1.5%
	2.75–3.74	69	17.5%
	3.75–4.49	160	40.6%
	4.50–5.00	159	40.4%
Air travel frequency	Less than once per year	184	46.7%
	Once per year	105	26.6%
	Two or more times per year	105	26.6%
Previous IME experience	Yes	56	14.2%
	No	338	85.8%
Life support course attendance	Yes	331	84.0%
	No	63	16.0%
Completion of emergency medicine rotation	Yes	159	40.4%
	No	235	59.6%

Knowledge of medical care during an in-flight medical emergency

The proportion of students providing correct answers for each knowledge question is summarized in Table 2. When the responses were grouped by domain, the highest level of accuracy was observed for questions related to equipment and support systems, with 77% of participants answering correctly. This was followed by aviation pathophysiology (53.6%), medicolegal responsibilities (39.9%), and the epidemiology of IMEs (35.8%) **(Table 2)**.

In a subgroup analysis examining the impact of life support training, attendance in BLS or ACLS courses was significantly associated with correct responses for only one specific question: Q10, which assessed knowledge of legal risk for physicians providing in-flight assistance. Participants who had attended life support courses were 1.8 times more likely to answer correctly [OR = 1.8; 95% CI = 1.04–3.1; P = 0.04] **(Table 2)**.

Table 2. Knowledge about in-flight medical emergencies of medical students (n = 394)

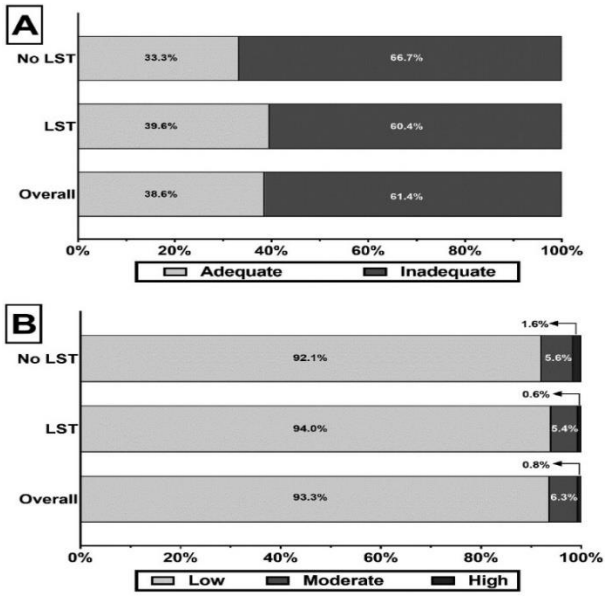
	Overall				Life support training				No life support training				OR	P
	N	%CR	Rank	%DCR	N	%CR	Rank	%DCR	N	%CR	Rank	%DCR	(95%C)	
Aviation Pathophysiology														
Q1: Airplane cabins are generally pressurized to approximate conditions found at sea level.	97	24.6%	9		80	24.2%	9		17	5.1%	8		0.86 (0.48–1.57)	0.63
Q2: At cruising altitude, the cabin air contains a reduced oxygen partial pressure, which can lead to mild hypoxia even in otherwise healthy passengers				53.6%				53.7%				10.2%	1.04	
	278	70.6%	2		234	70.7%	2		44	13.3%	2		(0.57–1.88)	0.88
		65.7%	4		219	66.2%	5		40	12.1%	3		1.12	0.67

Q3: Gases within body cavities may increase in volume by approximately 30% due to the reduced cabin pressure experienced during flight	259											(0.63–1.95)	
Epidemiology													
Q4: The medical emergency that occurs most frequently on flights	91	23.1%	10		78	23.6%	10		13	3.9%	10	1.19 (0.62–2.34)	0.74
Q5: Most in-flight medical emergencies result in the aircraft being diverted to the closest medical facility	191	48.5%	6	35.8%	156	47.1%	6	35.4%	35	10.6%	5	7.3%	0.71 (0.41–1.21)	0.27
Equipment availability/support system													
Q6: Flight attendants receive training in basic life support	341	86.5%	1		290	87.6%	1		51	15.4%	1		1.66 (0.84–3.36)	0.16
Q7: The majority of airlines offer in-flight medical support through consultation with physicians on the ground during medical emergencies.	266	67.5%	3	77.0%	226	68.3%	3	78.0%	40	12.1%	3	13.8%	1.24 (0.7–2.16)	0.47
Medicolegal responsibilities													
Q8: Physicians have a legal obligation to identify themselves during an in-flight medical emergency.	102	25.9%	8	39.9%	85	25.7%	8	40.3%	17	5.1%	8	7.2%	0.94 (0.5–1.69)	0.88
		29.7%	7		95	28.7%	7		22	6.6%	7		0.75	0.37

Q9: Who typically decides whether an airplane should be diverted to the nearest hospital in the event of an in-flight medical emergency?	117											(0.43–1.31)	
Q10: Providing medical aid as a qualified physician carries minimal legal risk and is endorsed by aviation medicine specialists	253	64.2%	5	220	66.5%	4	33	10%	6	1.8	(1.04–3.1)		0.04

$\%_{CR}$ = percentage of participants with correct answers to the question, and $\%_{DCR}$ = percentage of correct answers in the domain.

A total of 61.4% of participants demonstrated insufficient knowledge for managing care during an in-flight medical emergency (IME) (P = 0.0224; **Figure 1A**). Although participants who had completed life support training showed a higher proportion of adequate knowledge compared to those who had not (39.6% vs. 33.3%), this difference did not reach statistical significance (P > 0.99; **Figure 1A**).



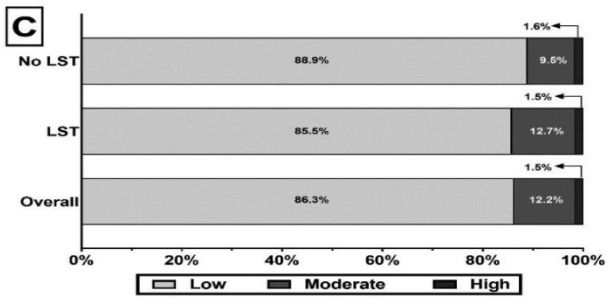


Figure 1. Survey participants' proportions showing (A) sufficient knowledge, (B) confidence, and (C) willingness to respond during an in-flight medical emergency. LST = Life support courses

The analysis revealed that only participants who flew at least twice annually had significantly higher odds of possessing adequate knowledge [OR = 1.89 (95% CI = 1.14–3.17), P = 0.02]. No statistically meaningful associations were found between adequate knowledge and factors such as gender, type of medical school, GPA, age, prior exposure to an IME, participation in life support training, or completion of an emergency medicine rotation **(Table 3)**.

Table 3. Association between demographic/academic characteristics of medical students and their level of knowledge about in-flight medical emergencies (IME)

Variables	Knowledge level[§]	OR (95%CI)	P

		Inadequate (n = 289)		Adequate (n = 171)			
		N	%	N	%		
Gender	Male	76	65%	41	35%	(Ref)	
	Female	166	59.9%	111	40.1%	1.24 (0.8–1.92)	0.37
Type of medical school	Public	160	61.3%	101	38.7%	(Ref)	
	Private	82	61.7%	51	38.3%	1.02 (0.66–1.55)	> 0.99
GPA	2.00−2.74	5	83.3%	1	16.7%	(Ref)	
	2.75−3.74	42	60.9%	27	39.1%	0.31 (0.03–2.58)	0.4
	3.75−4.49	94	58.8%	66	41.3%	0.28 (0.02–2.17)	0.4
	4.5−5.00	101	63.5%	58	36.5%	0.35 (0.03–2.66)	0.42
Age (years)	20	18	60%	12	40%	(Ref)	
	21	33	70.2%	14	29.8%	1.57 (0.59–4.17)	0.46
	22	38	61.3%	24	38.7%	1.06 (0.44–2.64)	> 0.99
	23	45	53.6%	39	46.4%	0.77 (0.35–1.75)	0.67
	24	52	63.4%	30	36.6%	1.16 (0.51–2.69)	0.83
	25	24	55.8%	19	44.2%	0.84 (0.32–2.12)	0.81
	26	8	61.5%	5	38.5%	1.07 (0.27–3.92)	> 0.99
	27	10	71.4%	4	28.6%	1.67 (0.44–5.65)	0.52
	28	6	75%	2	25%	2 (0.37–10.85)	0.68
	29	2	100%	0	0%	Inf (0.28-Inf)	0.52
	30	2	66.7%	1	33.3%	1.33 (0.14–20.76)	> 0.99
	>30	4	66.7%	2	33.3%	1.33 (0.26–7.81)	> 0.10
Air travel frequency	< 1 time per year	107	58.2%	77	41.8%	(Ref)	
	One time per year	59	56.2%	46	43.8%	0.92 (0.57–1.51)	0.8
	≥ 2 times per year	76	72.4%	29	27.6%	1.89 (1.14–3.17)	0.02
Previous IME experience	Yes	32	57.1%	24	42.9%	(Ref)	
	No	210	62.1%	128	37.9%	1.23 (0.69–2.15)	0.55
Life support course attendance	Yes	200	60.4%	131	39.6%	(Ref)	
	No	42	66.7%	21	33.3%	1.31 (0.75–2.26)	0.4
Completion of emergency medicine rotation	Yes	90	56.6%	69	43.4%	(Ref)	
	No	152	64.7%	83	35.3%	1.4 (0.92–2.14)	0.11

[§]Achieving ≥ 60% of correct answers in the knowledge domain was considered "adequate," mirroring the usual acceptable pass rate in academia.

Confidence and willingness to provide medical care during an IME

The survey items assessing confidence and willingness demonstrated good internal consistency, with Cronbach's alpha values of 0.91 and 0.74, respectively, which were similar to those observed in the pilot study, suggesting the questionnaire was reliable and free from excessive redundancy.

Across the entire participant group, the majority exhibited low willingness to assist during an IME (93.3%), while 6.3% showed moderate willingness, and only 0.8% reported high willingness **(Figure 1B)**. Confidence levels followed a similar pattern: 86.3% of participants had low confidence, 12.2% moderate confidence, and just 1.5% high confidence **(Figure 1C)**. Attendance at life support courses did not significantly influence the distribution of low, moderate, or high confidence or willingness scores.

Only 40.9% of participants agreed or strongly agreed that their medical training adequately prepared them to handle an IME, and even fewer (24.4%) felt confident in their ability to respond. Likewise, 38.3% expressed willingness to identify themselves and assist during an IME, while 49% reported concerns regarding potential medicolegal consequences of providing care in such situations. Predictably, a large majority (72.1%) disagreed or strongly disagreed with the statement that additional training in managing IMEs was unnecessary. The mean Likert-scale responses for individual items evaluating confidence and willingness to provide medical assistance during an IME are summarized in **Figure 2**.

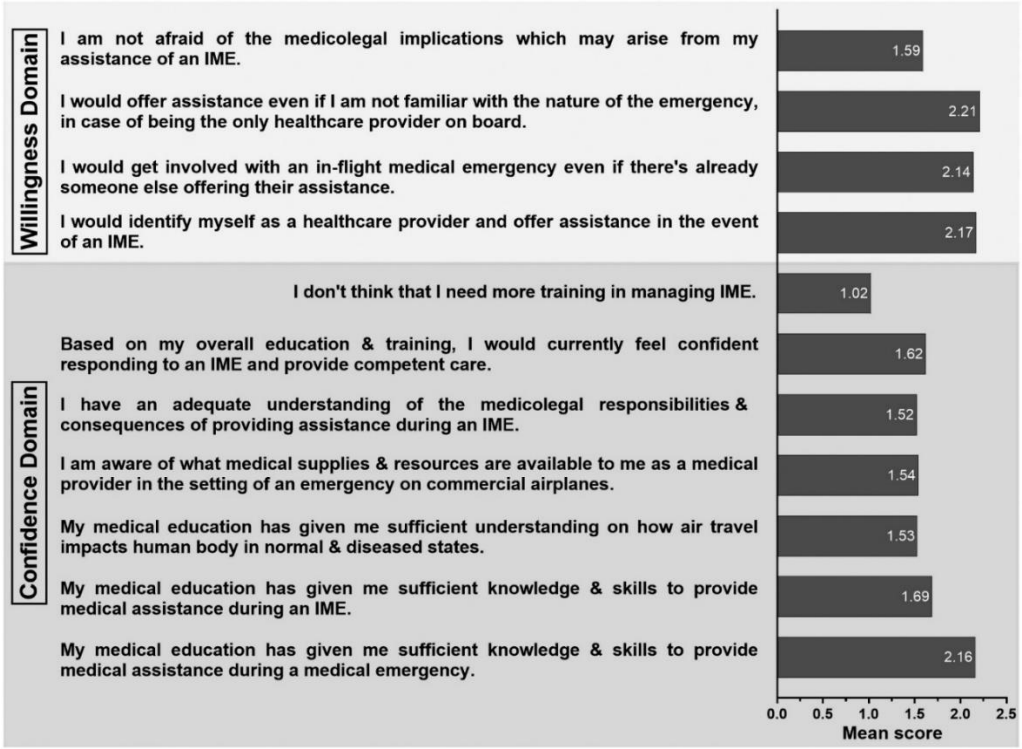


Figure 2. Average Likert-scale ratings for seven questions assessing participants' confidence and four questions evaluating their willingness to provide medical assistance during an IME

Discussion

The findings of this study indicate that medical students in Saudi Arabia exhibit low confidence and a limited willingness to intervene during an IME, which likely stems from a lack of knowledge about IMEs. Although participants who traveled by air at least twice a year were more likely to achieve adequate knowledge scores, no significant associations were found between knowledge levels and factors such as medical school type, GPA, prior experience with an IME, attendance at life support courses, or completion of an emergency medicine rotation. This suggests a broader systemic gap. Notably, the current Saudi medical curriculum does not require instruction on air travel physiology, operational logistics, clinical approaches, or medicolegal considerations relevant to IME management. While some students may pursue postgraduate training in emergency medicine—which has previously been linked to higher confidence and willingness in responding to IMEs—many are likely to choose other specialties that do not adequately prepare them for these scenarios [13, 23].

Given that approximately 70% of participants reported feeling unprepared to assist during an IME, there is a clear need for targeted training programs. Several initiatives have recently been implemented to educate medical students on emergency response. For example, Christiana Care Health System's Department of Emergency Medicine introduced a simulation-based program for third- and fourth-year students that emphasized onboard medical resources and patient management, which improved IME-related knowledge scores [24]. Similarly, the 'First Five Minutes' program at Case Western Reserve University School of Medicine trained students as first responders by covering scene safety, patient assessment, airway management, BLS/CPR, and hemorrhage control [25]. However, this program was not specifically tailored to IME scenarios, and its acceptability, feasibility, and effectiveness remain unreported.

More extensive IME-focused training programs have been described for emergency medicine residents, which could be adapted for senior medical students under the SaudiMED framework and the National Commission for Academic Accreditation and Assessment (NCAAA) guidelines [16]. For instance, Vanderbilt University Medical Center implemented a hands-on simulation for residents that emphasized role identification, resource utilization, and patient assessment during IMEs, which participants rated highly for enhancing preparedness [26]. At Ohio State University Wexner Medical Center, a simulation training using a grounded Boeing 737 included five scenario-based simulations (anaphylaxis, shockable rhythm arrest, pulmonary embolism-induced syncope, anterior epistaxis, and an agitated passenger) and three discussion modules (aeromedical considerations, medicolegal issues, and decompression sickness) for emergency and internal medicine residents [27]. This program improved both medical knowledge, particularly ACLS skills, and self-assessed competence [27].

In addition, digital tools for decision-making during IMEs have emerged. A randomized trial demonstrated that non-emergency residents using the airRx mobile app were more likely to complete checklists correctly [28]. However, simulations revealed that tasks such as cardiac and pulmonary exams or vital signs measurements took longer when using the app [28]. Similar delays have been observed among medical students in other domains, such as tobacco cessation counseling [29]. Educational podcasts, such as the Curbsiders Internal Medicine Podcast, also provide IME-focused learning resources [30].

The impact of this program on improving clinical skills among participants has not yet been documented. Additionally, these training initiatives tend to only minimally address—or sometimes omit entirely—the medicolegal considerations of in-flight medical emergencies (IMEs), a concern noted by over half of our study respondents. IMEs raise specific legal issues for health professions students who wish to provide care. For instance, questions of jurisdiction often arise because IMEs can occur over international waters or within airspace subject to different national laws, complicating the legal responsibilities of medical responders. Furthermore, legislation varies regarding the legal protections offered to volunteers providing emergency assistance to strangers. In countries such as the United States, the United Kingdom, and Canada, physicians responding to IMEs are generally safeguarded under Good Samaritan laws [31–33].

In contrast, nations like France, Germany, and Denmark have adopted mandatory 'duty to help' statutes [34]. As a result, volunteers must navigate differing legal frameworks depending on the flight's location and the passengers' and crew's nationalities [35]. Unsurprisingly, physicians who are well-informed about these laws are more likely to offer assistance during an IME [31]. In Saudi Arabia, our review found no published guidelines or official statements from professional associations addressing IMEs.

Liability is another important concern. Health professions students may face legal responsibility if they act beyond their training or inadvertently harm a patient. This issue is particularly relevant, as our study found that students were often willing to assist during IMEs despite having insufficient knowledge and confidence. While willingness can stem from altruistic intentions, acting alone without understanding one's limitations can be hazardous.

Future IME training programs should therefore not only cover medicolegal and liability topics but also familiarize students with airline procedures for managing medical emergencies and liaising with ground-based medical personnel [36, 37]. Students must understand the practical constraints of in-flight care, such as limited space, equipment, and resources [9, 38]. They may need to adapt their clinical practices to the unique aircraft environment, prioritizing interventions according to patient severity and available resources while considering potential legal and ethical ramifications [31, 39]. IMEs also necessitate collaboration with non-medical personnel, including pilots, cabin crew, ground staff, and possibly other passengers. Hence, students should be trained to work effectively in these multidisciplinary teams to deliver appropriate care and ensure smooth transfer to a medical facility upon landing.

Medical and health professions schools can integrate IME training into the curriculum either as a dedicated module or within existing courses such as emergency medicine or critical care. High-fidelity simulations that replicate aircraft environments allow students to practice clinical skills and decision-making in realistic scenarios [40]. Schools may also promote experiential learning through volunteering opportunities on flights or observing aviation medicine specialists. Such simulation and experiential approaches can enhance students' competence, self-efficacy, and readiness to respond, while reducing anxiety and stress associated with IMEs [41, 42]. However, barriers such as already dense curricula and low prioritization of the topic may hinder the widespread incorporation of IME training into medical education [43–45].

Limitations

This study has several limitations that may affect the generalizability of its findings. The participant sample was a convenience cohort, skewed toward female students and those enrolled in public medical schools, which could produce different results if a more diverse population were included. Additionally, the use of true/false questions may have allowed for random guessing, potentially influencing the accuracy of responses. Although we attempted to minimize this bias by providing clear instructions and emphasizing careful completion, the possibility of guessing remains a limitation.

A more critical limitation is that the survey instrument was evaluated only for face and content validity, as well as internal consistency, without assessment of construct or external validity. As noted in previous research [14], there is currently no externally validated questionnaire designed to assess senior medical students' knowledge, confidence, and willingness to respond to in-flight medical emergencies (IMEs). To address this, we developed a conceptual framework and adapted questions from prior studies [13, 14], prioritizing items that capture essential IME-related concepts.

Developing a fully validated survey instrument is a complex process that goes beyond the scope of this study. Our primary goal was to provide preliminary evidence

indicating that current medical curricula do not adequately prepare students to respond to IMEs. To date, only three studies have examined medical students' knowledge in this context, all suggesting insufficient preparedness [14, 24, 40]. Evidence regarding students' confidence and willingness to respond remains unreported. The accumulating findings from cross-sectional research, including this study, along with acknowledgment of the issue by experts in critical care, aviation medicine, and emergency medicine [46, 47], as well as by medical students themselves [48], highlight the need to develop externally validated tools to assess knowledge, confidence, and willingness comprehensively.

Given the global nature of air travel, such instruments should be internationally adaptable, particularly with respect to variations in medicolegal frameworks, such as Good Samaritan laws. This would enable comparisons of student preparedness across countries and ultimately support efforts to standardize IME training programs worldwide.

Until such validated instruments are available, the results of this study should be interpreted with caution and considered primarily as hypothesis-generating.

Conclusion

Our findings align with the limited prior research, which indicates a notable gap in knowledge, confidence, and willingness among health profession students to manage in-flight medical emergencies (IMEs). Despite more than 80% of participants having completed life support courses, most students still demonstrated insufficient preparedness to respond effectively to emergencies. These results highlight the critical need to incorporate IME-focused training into medical education before students begin their seventh-year mandatory general internship.

Managing IMEs can be complex and demanding, often placing medical students in situations where they may serve as the sole healthcare provider. Therefore, we strongly recommend that medical schools familiarize students with IMEs and the specific challenges they present, ensuring better readiness for real-life scenarios.

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