Original Article

Assessing the knowledge of emergency respiratory diseases among clinical-years medical students in Saudi universities of the Western Region

Afnan M. Alhawsawi[1], Bayan F. Alzahrani[1], Noura R. Alotaibi[1], Raghad A. Alamer[1], Rataj A. Alharbi[2], Reem Y. lotf[3], Tanveer N. Khan[4], Hadeel A. Khadawardi[5]

[1]Medical student, Faculty of Medicine, Umm Al-Qura University, Makkah, KSA. [2]Medical student, Faculty of Medicine, Jeddah University, Jeddah, KSA. [3]Medical student, Faculty of Medicine, Suliman Al rajhi University, Bukayriyah, KSA. [4]College of Medicine and Surgery, Batterjee Medical College, Jeddah, KSA. [5]Assistant professor at Internal Medicine Department, Faculty of Medicine, Umm Al-Qura University, Makkah, KSA.

ABSTRACT

Background: This study assessed the knowledge and preparedness of clinical-year medical students in the Western Region of Saudi Arabia regarding respiratory emergencies. The objective was to evaluate their understanding of critical respiratory conditions and identify gaps in education that may hinder effective patient management. By highlighting deficiencies in training, the study aimed to support the development of improved educational strategies to better equip future physicians for respiratory crises.

Methods: A cross-sectional design was used, involving fourth- to sixth-year medical students from various Saudi universities. A structured digital questionnaire evaluated their knowledge on the recognition, diagnosis, investigation, and management of respiratory emergencies, including acute exacerbations of COPD, asthma, pulmonary embolism, chest trauma, and respiratory failure. Pre-clinical students, those studying abroad, and non-medical students were excluded. Data were analyzed using descriptive and inferential statistics, with knowledge levels classified on a three-point scale.

Results: The findings revealed that while students generally recognized clinical signs and symptoms of conditions such as pulmonary embolism and acute respiratory failure, there were significant gaps in their understanding of appropriate diagnostic and initial management strategies. Certain demographic factors, including marital status, were associated with variations in knowledge levels.

Conclusion: The study highlighted a concerning lack of preparedness among clinical-year students in handling respiratory emergencies, despite a high level of theoretical awareness. These findings underline the urgent need to strengthen medical curricula with focused education and practical training on respiratory emergency management to ensure competent and effective future physicians.

Keywords: Respiratory diseases, Emergencies, Medical students, Clinical-years, Western Saudi Arabia.

Introduction

Respiratory failure is identified as one of the five crucial conditions within the "First Hour Quintet," which requires immediate recognition and management [1,2].

Respiratory diseases are a leading cause of morbidity and mortality worldwide, accounting for millions of premature deaths annually [3].

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Address for correspondence: Afnan Mousa Alhawsawi, Medical student, Faculty of Medicine, Umm Al-Qura University, Makkah, KSA.
E-mail: Afnanmousah@gmail.com

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Medical students are responsible for addressing global health challenges and for developing medical services. They can offer fresh, youthful insights, conduct research more effectively, and enhance the global health workforce during urgent situations [4,5]. However, the primary responsibility of medical students is to become competent physicians. Their main focus should be medical education, gaining medical knowledge, and improving hand skills. Straying from this path could negatively impact student performance and healthcare systems [6]. Given the high prevalence and significant impact of respiratory diseases, there is growing concern regarding the level of knowledge and preparedness among medical students regarding handling emergency respiratory cases [7]. A study conducted by Lindskou et al. underscored the necessity of properly educating healthcare professionals on respiratory emergencies to improve patient outcomes [8]. Existing literature, especially in the context of Saudi Arabia, shows a notable deficiency in studies assessing medical students' knowledge and understanding of the acute management of respiratory emergencies [7]. This study sought to identify gaps in knowledge that may affect effective patient care by evaluating their understanding of the recognition and management of acute respiratory emergencies. So, this study aimed to assess the knowledge of emergency respiratory diseases among clinical-year medical students in universities in the Western Saudi Region.

Methods

This study used a cross-sectional observational design to evaluate clinical-year medical students' knowledge of emergency respiratory disease management. Data were gathered via an online survey targeting students across various Saudi universities in the Western Region.

Study Population and Sampling: The target population included all clinical-year medical students (4th, 5th, and 6th year students) from multiple universities in the Western Region of Saudi Arabia. Students in their initial years of medical studies and those studying outside Saudi universities or in fields other than medicine were excluded. The survey was distributed across social media channels to maximize participation and ensure representation from different universities.

Data Collection: A systematic digital questionnaire was created using Google Forms to collect the data. The questionnaire assessed sociodemographic characteristics, including sex, marital status, university, and academic year. In addition to the knowledge assessment, awareness, investigation, and management of emergency respiratory diseases (including acute respiratory failure, anaphylactic laryngeal edema, asthma/chronic obstructive pulmonary disease (COPD) exacerbation, pulmonary embolism, pneumonia, and chest trauma). The survey items were crafted following a thorough review of the relevant literature with a similar concept. The survey was designed to be comprehensible to all students, with clarity for understanding and answering accurately. An introductory message was attached to inform participants of the study's objective and ensure confidentiality. The participation was optional. The questionnaire comprised 40 questions and was organized into nine sections. The first section focused on obtaining consent from the participants and gathering information regarding their medical training year. The second section addressed sociodemographic data. The third section assessed the participants' knowledge of emergency respiratory diseases. The fourth and fifth sections were dedicated to acute respiratory failure and anaphylactic laryngeal edema, respectively. The sixth section examines asthma and COPD. The seventh section pertained to pulmonary embolism, while the eighth focused on pneumonia. Finally, the ninth section addressed chest trauma. In total, 1,010 responses were received. In order to guarantee the validity and reliability of the questionnaire, three experts examined the items in connection with the study objectives to evaluate its content validity across all domains; the evaluation was first carried out independently, and then items that required discussion were thoroughly discussed until a consensus was reached. All recommended changes were made to improve the validity of the questionnaire, culminating in the final format used in the current study, which demonstrated high reliability as estimated by Cronbach's alpha coefficient, which produced a scale value of 0.75.

Outcome Measures: The primary outcome was the knowledge level of the clinical-year medical students regarding emergency respiratory disease management. Secondary outcomes included the identification of familiarity with specific emergency respiratory conditions and competency to perform initial management for each respiratory emergency. Ethical approval was approved by the Institutional Review Board of Umm Al-Qura University (approval no. HAPO-02-K-012-2023-10-1776). All responses were anonymized, and data were stored securely with limited access to the research team to ensure compliance with confidentiality standards.

Data Analysis: The responses were entered into SPSS Version 20 for statistical analysis. Descriptive

statistics, such as means and frequency distributions, were computed for the demographic factors and knowledge scores. To analyze group differences (e.g., sex or academic year), Chi-squared tests were performed with a significance level of $p < 0.05$. Responses were evaluated using a three-point Likert scale to measure the awareness level of each disease-related question: low (1.00–1.67), medium (1.68–2.34), and high (2.35–3.00).

Results

Through this study, we aimed to identify the demographic characteristics of the participants, as well as to assess clinical-year medical students' knowledge of emergency respiratory diseases management. This was based on the medical students' competence in identifying selected acute respiratory cases, including signs and symptoms, initial investigations, and interventions.

Baseline characteristics: A total of 1010 medical students completed the questionnaire; 873 students met the criteria for knowledge assessment, and 137 students were excluded because they were in the non-clinical year of medical school. Baseline demographic and academic characteristics are summarized in (Table 1). Among the included participants, 336 (33%) were in their sixth year of medical education. The majority of the students were single, 834 (83%), and Saudi, 787 (78%). Many students were enrolled in government universities, 624 (62%). Most of the students had a respiratory disease course, 819 (81%), as a subject in their university curriculum.

Respiratory emergency knowledge: The overall assessment of the respiratory disease emergency knowledge level is shown in (Table 2). Students showed a high level of awareness in identifying all domains of respiratory emergencies. However, they demonstrated low knowledge of managing each emergency regarding ordering initial investigations and initiating initial interventions. Demographic and academic characteristics did not significantly affect knowledge levels. However, there was an exception for marital status, which showed a significant difference from the level of respiratory disease awareness, p-value less than 0.05. Among participating students, the following respiratory emergencies were identified (Table 3): acute respiratory failure, 69.60%; chest trauma, 68.8%; pulmonary embolism, 67.0%; asthma/COPD exacerbation, 65.0%; anaphylactic laryngeal edema, 60.6%; and pneumonia, 25.4%. In the detailed knowledge assessment of acute respiratory failure emergencies (Table 4), 68.3% of the students chose the inability to speak in a complete sentence as a sign and symptom, 54.3% chose to order arterial blood gas (ABG) as an initial investigation, and 70.5% chose to assess airway, breathing, and circulation as an initial intervention. Secondary knowledge assessment of anaphylactic laryngeal edema (Table 5) 71.29% of the students identified airway obstruction with respiratory stridors and cyanosis as signs and symptoms; 48.9% identified clinical assessment as an initial investigation , and 54.2 % identified intramuscular epinephrine as an initial intervention. While assessing signs and symptoms of asthma/COPD exacerbation (Table 6), 69.60% of the students chose shortness of breath. Regarding initial investigation and initial intervention, only 18.3% chose to order ABG and 60.6% chose short-acting bronchodilators, respectively. Furthermore, while assessing knowledge of pulmonary embolism emergency (Table 7), 69.9% of students answered shortness of breath as a sign and symptom, only 30.5% answered CT pulmonary angiography as an initial investigation, and 54.9% answered thrombolytic therapy as an initial intervention. The participants' answers for the emergency identification and management of pneumonia and chest trauma, including pneumothorax and hemothorax, are summarized (Table 8).

Discussion

This study provides valuable insights into knowledge gaps among clinical-year medical students regarding the management of emergent respiratory diseases. The current study's results have scarcely been explored in the literature, particularly in the western region of Saudi Arabia. Although significant research has been conducted on general medical education and the management of respiratory conditions, few studies have focused on assessing medical students' competence in managing respiratory emergencies. While the results demonstrated a generally acceptable understanding of fundamental respiratory emergencies, there were areas where students showed deficiencies, particularly in recognizing the urgency of certain diseases and identifying appropriate diagnostic interventions. These gaps in knowledge may influence decision making and, in turn, patient outcomes, underscoring the importance of targeted improvements in medical education.

General Knowledge of Respiratory Emergencies: The majority of students in this study were able to identify key respiratory emergencies requiring immediate intervention, such as acute respiratory failure, anaphylactic laryngeal edema, and asthma/chronic obstructive pulmonary disease (COPD) exacerbations.

Table 1: Personal and academic baseline characteristics.

		Count	Column N %
Are you a medical student in the clinical- year (4th, 5th, 6th)?	No	137	14%
	Yes	873	86%
What is your medical-year of study?	4th	272	26%
	5th	265	26%
	6th	336	33%
	Excluded	137	14%
What is your gender?	Male	331	33%
	Female	542	54%
	Excluded	137	14%
What is your marital status?	Single	834	83%
	Married	32	3%
	Divorced	2	0,2%
	Widowed	5	0,5%
	Excluded	137	14%
What is your nationality?	Saudi	787	78%
	Not Saudi	86	9%
	Excluded	137	14%
Where is your university type?	Governmental university	624	62%
	Funded university	239	24%
	Excluded	147	15%
What is the name of your university?	Al Rayyan colleges	60	6%
	Batterjee Medical College	117	12%
	Ibn Sina Medical College	64	6%
	King Saud bin Abdulaziz University	75	8%
	King Abdulaziz University	52	5%
	Taibah University	206	20%
	Taif University	77	8%
	Umm Al Qura University	167	16%
	University of Jeddah	44	4%
	Other	148	15%
Did you study respiratory diseases (chest) course?	No	54	5%
	yes	819	81%

	Excluded	137	14%
Did you attend workshops, lectures, and training about emergent respiratory diseases?	no	222	22%
	yes	651	64%
	Excluded	137	14%
Family history of respiratory disease?	None	452	45%
	First-degree	266	26%
	Second-degree	122	12%
	Others	33	3%
	Excluded	137	14%
Do you have been diagnosed with a respiratory disease?	no	679	67%
	yes	194	19%
	Excluded	137	14%

Table 2: Means and standard deviations of respiratory disease emergency surveys.

Questions		Number of answers			Level of awareness	Gender	Marital status	Nationality
		one answer	two answers	three answers or more				
Which of the following respiratory diseases is considered an emergency (rapid intervention should be taken immediately)? (Choose all correct)	Ni	77	25	771	**high**	0.92	0.00	0.48
	%	8.8%	2.9%	88.3%				
What are the signs and symptoms of acute respiratory failure that require emergency medical intervention? (Choose all correct)	Ni	76	144	653	**high**	0.45	0.23	0.57
	%	8.7%	16.5%	74.8%				
What is the initial investigation for acute respiratory failure?	Ni	873	0	0	**low**	/	/	/
	%	100%	0.0%	0.0%				
What is the initial intervention for acute respiratory failure?	Ni	873	0	0	**low**	/	/	/
	%	100%	0.0%	0.0%				
What are the signs and symptoms of anaphylactic laryngeal edema that require emergency medical intervention? (Choose all correct)	Ni	124	229	520	**high**	0.44	0.06	0.35
	%	14,2%	26.2%	59.6%				
What is the initial investigation for anaphylactic laryngeal edema?	Ni	873	0	0	**low**	/	/	/
	%	100%	0.0%	0.0%				
	Ni	873	0	0	**low**	/	/	/

What is the initial intervention for anaphylactic laryngeal edema?	%	100%	0.0%	0.0%				
What are the signs and symptoms of Asthma/COPD exacerbation that require emergency medical intervention? (Choose all correct)	Ni	93	130	650	**high**	0.24	0.00	0.85
	%	10,7%	14.9%	74.5%				
What is the initial investigation for Asthma/COPD exacerbation?	Ni	873	0	0	**low**	/	/	/
	%	100%	0.0%	0.0%				
What is the initial intervention for Asthma / COPD exacerbation?	Ni	873	0	0	**low**	/	/	/
	%	100%	0.0%	0.0%				
What are the signs and symptoms of pulmonary embolism that require emergency medical intervention? (Choose all correct)	Ni	83	196	594	**high**	0.41	0.04	0.42
	%	9,5%	22.5%	68.0%				
What is the initial investigation for pulmonary embolism?	Ni	873	0	0	**low**	/	/	/
	%	100%	0.0%	0.0%				
What is the initial intervention for emergency pulmonary embolism with hemodynamic instability?	Ni	873	0	0	**low**	/	/	/
	%	100%	0.0%	0.0%				
What are the signs and symptoms of pneumonia that require emergency medical intervention? (Choose all correct)	Ni	75	120	678	**high**	0.29	0.00	0.80
	%	8,6%	13.7%	77.7%				
What is the initial investigation for pneumonia?	Ni	873	0	0	**low**	/	/	/
	%	100%	0.0%	0.0%				
What is the initial intervention for pneumonia?	Ni	873	0	0	**low**	/	/	/
	%	100%	0.0%	0.0%				
What are the signs and symptoms of pneumothorax and hemothorax post -chest trauma that require emergency medical intervention? (Choose all correct)	Ni	87	165	621	**high**	0.56	0.02	0.15
	%	10,0%	18.9%	71.1%				
What is the initial investigation for pneumothorax and hemothorax emergency situations?	Ni	873	0	0	**low**	/	/	/
	%	100%	0.0%	0.0%				

What is the initial intervention for pneumothorax and hemothorax in an emergency?	Ni	873	0	0	**low**	/	/	/
	%	100,0%	0.0%	0.0%				
mean and Std.dev	**Level of awareness**				**low**	0.69	0.00	0.40

Std.dev: Stander deviation

Table 3: Respiratory disease emergencies.

Which of the following respiratory diseases is considered an emergency (rapid intervention should be taken immediately)? (Choose all correct)	**No.**	**%**
Acute respiratory failure	703	69.60%
Anaphylactic laryngeal edema	612	60.6%
Asthma/COPD exacerbation	656	65.0%
Chest trauma (pneumothorax, hemothorax)	695	68.8%
Interstitial Lung Disease	97	9.6%
Lung cancer	138	13.7%
Pulmonary embolism	677	67.0%
Pneumonia	257	25.4%
Solitary Pulmonary Nodule	112	11.1%

Table 4: Knowledge level of acute respiratory failure emergency.

What are the signs and symptoms of acute respiratory failure that require emergency medical intervention? (Choose all correct)	**No.**	**%**
Central or peripheral cyanosis	720	71.29%
Inability to speak in complete sentences	690	68.3%
Labored breathing	558	55.2%
A crackling sound in the lungs	359	35.5%
Coughing	254	25.1%
Headaches	152	15.0%
What is the initial investigation for acute respiratory failure?		
ABG analysis	548	54.3%
Chest CT scan	153	15.1%
FeNo Test	39	3.9%
Peak flow rate	133	13.2%
What is the initial intervention for acute respiratory failure?		
Give intravenous fluids	24	2.4%
Start antibiotics	50	5.0%
Start by assessing airway, breathing, and circulation (ABG) with O2 therapy	712	70.5%
Systemic corticosteroids	87	8.6%

Table 5: Knowledge level of anaphylactic laryngeal edema emergency.

What are the signs and symptoms of anaphylactic laryngeal edema that require emergency medical intervention?	**No.**	%
Airway obstruction which presents with inspiratory stridor and cyanosis	720	71.29%
Muffled voice	502	49.7%
Wheezing	336	33.3%
Collapse and unconsciousness	558	55.2%
Cough	227	22.5%
Fever	169	16.7%
What is the initial investigation for anaphylactic laryngeal edema?		
ABG analysis	93	9.2%
CBC and inflammatory markers	124	12.3%
Chest X-ray	162	16.0%
clinical diagnosis	494	48.9%
What is the initial intervention for anaphylactic laryngeal edema?		
Antibiotics	87	8.6%
Antihistamine	139	13.8%
Bolus IV fluids	100	9.9%
Intramuscular (IM) injection of epinephrine	547	54.2%

Table 6: Knowledge level of Asthma/COPD exacerbation emergency.

What are the signs and symptoms of Asthma/COPD exacerbation that require emergency medical intervention?	**No.**	**%**
Shortness of breath	703	69.60%
Tight or heavy chest pain	633	62.7%
Wheezing	596	59.0%
Increased cough	517	51.2%
Fever	148	14.7%
Sore throat	116	11.5%
Headache	135	13.4%
What is the initial investigation for Asthma/COPD exacerbation?		
ABG Analysis	185	18.3%
Chest CT	59	5.8%
Chest x-ray	149	14.8%
No answer	137	13.6%
Spirometry	480	47.5%
What is the initial intervention for Asthma / COPD exacerbation?		
Antibiotics	16	1.6%
Inhaled corticosteroids	195	19.3%
Mechanical ventilation	50	5.0%
Short-acting inhaled Î²2 agonist and anticholinergic bronchodilators	612	60.6%

Table 7: Knowledge level of pulmonary embolism emergency.

What are the signs and symptoms of pulmonary embolism that require emergency medical intervention?	No.	%
Shortness of breath	706	69.90%
Wheezing	257	25.4%
Anxiety	188	18.6%
Chest pain	696	68.9%
Hemoptysis	572	56.6%
Fever	189	18.7%
What is the initial investigation for pulmonary embolism?		
CBC	32	3.2%
Chest x-ray	132	13.1%
Computerized tomography pulmonary angiogram (CTPA)	310	30.5%
D-Dimer	399	39.5%
What is the initial intervention for emergency pulmonary embolism with hemodynamic instability?		
Antibiotics	91	9.0%
Antiplatelets	83	8.2%
Supportive management	145	14.4%
Thrombolytic therapy	554	54.9%

Table 8: Knowledge level of pneumonia, pneumothorax and hemothorax post chest trauma emergency.

What are the signs and symptoms of pneumonia that require emergency medical intervention?	No.	%
Fever	513	50.79%
Cough	445	44.1%
Shortness of breath	576	57.0%
Urea > 7 mmol/L	518	51.3%
Confusion	480	47.5%
Hypotension	445	44.1%
What is the initial investigation for pneumonia?		
CBC	99	9.8%
Chest CT scan	91	9.0%
Chest x-ray	592	58.6%
Pulmonary function test	91	9.0%
What is the initial intervention for pneumonia?		
Antibiotics	640	63.4%
Corticosteroids	93	9.2%
IV fluids	118	11.7%
Paracetamol	22	2.2%

What are the signs and symptoms of pneumothorax and hemothorax post chest trauma that require emergency medical intervention?		
Hemoptysis	448	44.36%
Chest pain	612	60.6%
Shortness of breath	604	59.8%
Chest contusion	522	51.7%
Stridor	305	30.2%
A crackling sound in the lungs	376	37.2%
What is the initial investigation for pneumothorax and hemothorax in emergency situations?		
Chest CT scan	73	7.2%
Chest X-ray	499	49.4%
Clinical diagnosis	301	29.8%
What is the initial intervention for pneumothorax and hemothorax in an emergency?		
Apply occlusive dressing	46	4.6%
Antibiotics	69	6.8%
IV fluids	84	8.3%
Pleural space drainage, i.e. needle decompression/chest tube insertion	674	66.7%

they particularly have a high level of awareness of acute respiratory failure, as 69.6% of them could recognize its symptoms, and this level of awareness aligns with global clinical guidelines in which respiratory failure is treated as one of the most critical emergencies [9]. This suggests that the basic principles of emergency medicine pertaining to recognizing life-threatening respiratory conditions are well understood by a significant proportion of students in the western region. Even the students' awareness of pulmonary embolism (67%) and chest trauma (68.8%) reflects a fairly sound understanding of these conditions, which are associated with high morbidity and mortality if not managed appropriately [10]. However, it is notable that a small minority of students (25.4%) identified pneumonia as an emergency condition. This is concerning, given that severe cases of pneumonia can lead to respiratory failure and sepsis, making timely intervention for the disease critical [11]. This reflects a misconception that pneumonia is a lingering condition and is safely managed as an outpatient rather than the possibility that it could present as an acute emergency that requires immediate intervention to prevent sepsis, particularly in vulnerable populations such as elderly or immunocompromised patients. Pneumonia is the leading cause of acute respiratory distress syndrome [12,13].

Diagnosis and Investigations: Gaps in diagnostic knowledge were evident, as only approximately half (54%) of students understood the importance of arterial blood gas (ABG) analysis in cases of acute respiratory failure. ABG remains a cornerstone for assessing respiratory emergencies and providing critical information on a patient's oxygenation and acid-base status [14]. Since a considerable proportion of students selected incorrect tests, this shows that even if the basics of diagnostics are understood by over half, there is still a need to reinforce the importance of using appropriate testing in acute settings. Given that only 18.3 % correctly identified ABG as a principal investigation for asthma/COPD exacerbations, this represents a significant knowledge gap since ABG is an essential test for assessing obstructive airway disease severity and early recognition of type II respiratory failure. [15]. Understanding the need for ordering ABG with an accurate interpretation of ABG is vital in both emergent respiratory conditions. This highlights a deficiency in hands-on training and clinical exposure for managing asthma/COPD exacerbation.

Furthermore, not only did just 39.5% correctly identify D-dimer as a screening tool for pulmonary embolism (PE), but the majority failed to identify computed tomography pulmonary angiogram (CTPA) as the gold standard for confirming the diagnosis. This sharply contrasts the findings of a study conducted in Poland by Urbanek et al., who reported that 66% of students in their sample correctly identified CTPA as an appropriate diagnostic tool [16]. This discrepancy clarifies a gap in the current teaching curricula, highlighting the urgent need to improve clinical knowledge to choose and order precise diagnostic tests for high-risk respiratory conditions. Since pulmonary embolism is an emergency that can lead to hemodynamic instability and cardiac arrest if not promptly identified and treated, the ability to rapidly confirm diagnosis through an appropriate imaging modality is vital.

Intervention and Management: The current study demonstrated that an adequate number of students (70.5%) correctly identified securing the airway and stabilizing the patient as the initial intervention for acute respiratory failure, reflecting a good grasp of resuscitation principles [17]. Simultaneously, the study revealed the need to improve students' knowledge regarding prompt interventions and management approaches for other respiratory disease emergencies. There were severe deficiencies in recognizing the correct interventions for other conditions. Only 60.6 % of students knew that short-acting bronchodilators are mandatory to reverse acute bronchospasm in asthma/COPD exacerbations [18,19,20]. Early implementation of known guidelines for the management of asthma and COPD exacerbation is crucial to prevent deterioration of clinical status and to minimize the risk of intensive care unit admission. Respiratory viral infections are common among communities, especially in winter, and remain the predominant cause of asthma and COPD exacerbation. Although death from asthma is rare, poor management of exacerbations prolongs hospital admission and morbidity [21]. Furthermore, many students failed to identify the correct first-line treatment for conditions such as anaphylactic laryngeal edema, with only 54.2% having chosen intramuscular epinephrine. Epinephrine is the most critical intervention in anaphylactic management, as it can rapidly reverse airway obstruction and prevent cardiovascular collapse. This gap highlights the need for more rigorous training to recognize and manage life-threatening allergic reactions [22]. In other settings, similar gaps in treatment knowledge have been documented, such as Drupad et al. reported that only 56.9% in their study were able to determine the emergency intervention for anaphylaxis, a finding consistent with the results of our study [23]. These deficiencies underscore the importance of integrating practical hands-on training into medical curricula to ensure that students are adequately prepared for real-life emergencies.

Implications for Medical Education: The findings of this study have significant implications for medical education. Although students generally demonstrate a basic level of competence in respiratory emergencies, the gaps in diagnostic and therapeutic knowledge suggest that current training may not adequately prepare them for real-world clinical scenarios. Given that the students in our sample were in their clinical-years, such deficiencies could have resulted in delayed diagnosis and inappropriate management of critical cases, leading to adverse patient outcomes. One plausible explanation for these gaps could be overreliance on theoretical knowledge without sufficient practical exposure. As simulation-based learning has been shown to improve clinical decision-making and readiness for emergencies, it could be more widely integrated into the medical curriculum to bridge this gap [24]. Emergency medicine workshops, which 64% of the students from our sample had attended, could be further expanded and made a compulsory component of clinical training. Okuda et al. found that case-based discussions and hands-on simulations for high-stakes emergencies could ensure that students were prepared to effectively manage such conditions in real-life settings [25]. Moreover, our study highlights the importance of incorporating more clinical exposure to infectious respiratory diseases such as pneumonia. Given the global burden of infectious diseases, especially in developing countries, medical students must be adept at recognizing and treating such conditions in an acute setting [23]. Curricula should emphasize the vital role of early diagnosis and intervention in infectious respiratory emergencies, including determination of appropriate diagnostic tools and evidence-based treatment protocols.

Limitations: This study has several limitations. First, it used a self-report questionnaire to induce response bias and overstate the knowledge levels. Second, the sample was limited to clinical-year medical students from specific Saudi universities, restricting its applicability to other areas or academic levels. Third, the cross-sectional design provides a snapshot of knowledge without examining changes over time or

following specific treatments. Finally, actual abilities to address respiratory emergencies were not assessed; thus, they may not reflect real-world capabilities. Future studies should include longitudinal and hands-on assessments to address these limitations.

Conclusion

Clinically year medical students in Saudi Arabia have demonstrated a generally acceptable understanding of fundamental respiratory disease emergencies. However, notable deficiencies were observed, particularly in recognizing the urgency of certain conditions and identifying appropriate diagnostic and management interventions. It is recommended to enhance the knowledge and understanding of clinical-year medical students regarding acute management of respiratory emergencies through targeted educational interventions and practical training.

Conflict of Interest

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