INSIGHTS-JOURNAL OF
HEALTH AND REHABILITATION

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

ASSESSING EMERGENCY ROOM NURSES' AWARENESS OF NOVEL TREATMENTS AND EMERGING INNOVATIONS IN ANAPHYLAXIS MANAGEMENT

Original Research

Kehkashan Shabir*[1], Imtiaz Ramzan[2], Husna Najeeb[2] , Muhammad Danish*[1], Rubina Haider[1], Arooba Fatima[1], Muhammad Bilal Hussain[3], Farrukh Jamal[4]

[1]Department of Nursing, Shahida Islam Medical Complex, Bahawalpur Road, 100M Lodhran, Punjab, Pakistan.

[2]Department of Nursing, Choudhary Pervaiz Elahi Institute of Cardiology Multan, Punjab Pakistan.

[3]Department of Nursing, Fatima Memorial Hospital, Lahore, Pakistan.

[4]Department of Statistics, Faculty of Science, University of Tabuk, Tabuk, Saudi Arabia.

Corresponding Author: Kehkashan Shabir, Department of Nursing, Shahida Islam Medical Complex, Bahawalpur Road, 100M Lodhran, Punjab, Pakistan, shabirkehkashan08@gmail.com

Muhammad Danish, Department of Nursing, Shahida Islam Medical Complex, Bahawalpur Road, 100M Lodhran, Punjab, Pakistan, hmdanishaltaf2000@gmail.com

Acknowledgement: The authors acknowledge the cooperation of all emergency room nurses who participated in this study.

Conflict of Interest: None

Grant Support & Financial Support: None

ABSTRACT

Background: Anaphylaxis is an acute, potentially fatal systemic hypersensitivity reaction that requires rapid recognition and immediate treatment to prevent severe morbidity or mortality. Emergency room nurses play a pivotal role in early identification and timely management; however, international evidence suggests persistent gaps in knowledge regarding diagnostic criteria, epinephrine administration, and post-treatment monitoring. Inadequate awareness of updated guidelines and emerging therapeutic options may compromise patient safety, particularly in high-pressure emergency settings.

Objective: To assess the level of awareness and knowledge among emergency room nurses regarding updated definitions, evidence-based management protocols, and novel treatments for anaphylaxis, and to evaluate how this awareness may influence clinical practice.

Methods: A descriptive cross-sectional study was conducted among 60 emergency room nurses working in tertiary care hospitals of Bahawalpur. Participants were recruited using non-probability convenience sampling. Data were collected through a structured, self-administered, closed-ended questionnaire designed to assess demographic characteristics, clinical exposure, knowledge of anaphylaxis recognition, epinephrine use, complications, and awareness of emerging therapies. Data were analyzed using SPSS version 27, applying descriptive statistics including frequencies and percentages.

Results: Among the participants, 66.7% correctly identified anaphylaxis as a life-threatening condition, while 33.3% demonstrated incorrect or uncertain understanding. Epinephrine was recognized as the first-line treatment by 58.3% of nurses; however, only 31.7% correctly identified the recommended intramuscular dose and route. A substantial proportion (85.0%) incorrectly believed that a single dose of epinephrine is always sufficient. Awareness of biphasic anaphylaxis was limited, with only 18.3% identifying it as a serious delayed complication. Knowledge of novel treatment approaches was moderate, and 70.0% expressed interest in further training, despite reported limitations in access to updated therapies and educational resources.

Conclusion: Emergency room nurses demonstrated moderate overall awareness of anaphylaxis management, but critical deficiencies were evident in epinephrine dosing, recognition of delayed complications, and familiarity with emerging therapies. Strengthening continuous professional education and improving access to updated, evidence-based guidelines are essential to enhance emergency care quality and patient safety.

Keywords: Anaphylaxis, Epinephrine, Evidence-Based Practice, Emergency Nursing, Patient Safety, Therapeutics, Treatment Outcome.

INTRODUCTION

Anaphylaxis is a severe, acute, and potentially fatal systemic hypersensitivity reaction characterized by rapid onset and multisystem involvement. It results from the sudden release of inflammatory mediators, including histamine, leukotrienes, and cytokines, from sensitized mast cells and basophils coated with immunoglobulin E, culminating in a type I hypersensitivity reaction (1). The condition primarily affects the cardiovascular, respiratory, cutaneous, and gastrointestinal systems and may rapidly progress to anaphylactic shock if not promptly recognized and managed (2). Despite advances in allergy science and emergency medicine, anaphylaxis continues to pose a significant clinical challenge due to its unpredictable presentation and the need for immediate, decisive intervention. Globally, the burden of anaphylaxis is increasing, with incidence rates reported between 50 and 112 cases per 100,000 population and an estimated lifetime prevalence ranging from 0.3% to 5.1% (2,3). In developed countries, prevalence estimates range from 1.6% to 5.1%, and anaphylaxis accounts for up to 0.26% of all hospital admissions, underscoring its growing public health relevance (4). A substantial proportion of cases are classified as idiopathic anaphylaxis, where no clear trigger can be identified; these cases constitute approximately 6.5% to 35% of all presentations and are more frequently observed in middle-aged individuals (3). This rising trend, coupled with diagnostic uncertainty in idiopathic cases, amplifies the need for heightened clinical awareness and preparedness among frontline healthcare providers.

Anaphylaxis awareness refers to the level of understanding regarding its triggers, early signs and symptoms, and evidence-based management strategies (5). Early recognition is the cornerstone of effective treatment, particularly in emergency settings where delays or errors in management can lead to severe morbidity or mortality. Nurses working in emergency departments are often the first healthcare professionals to assess and initiate care for patients presenting with acute allergic reactions, placing them in a pivotal role in anaphylaxis outcomes. However, multiple studies have highlighted concerning gaps in knowledge and clinical judgment related to anaphylaxis among nursing professionals. Evidence indicates that a large proportion of nurses misidentify anaphylactic shock or select inappropriate medications, reflecting deficiencies in both diagnostic accuracy and therapeutic decision-making (1,6). Similar findings have been reported across diverse healthcare systems, where nurses demonstrated low overall knowledge scores in anaphylaxis prevention and management, emphasizing a persistent and widespread educational gap (7). These deficiencies are not limited to nursing staff alone; studies involving physicians and other healthcare professionals have also reported suboptimal knowledge of epinephrine dosing, underutilization of epinephrine auto-injectors, and inconsistent adherence to international anaphylaxis guidelines (8,9). Nevertheless, comparative analyses consistently show that nurses, particularly those in high-pressure emergency environments, exhibit greater gaps in practical management skills despite positive attitudes toward patient care (10). Alarmingly, such gaps persist even though anaphylaxis is routinely included in undergraduate and postgraduate nursing curricula, suggesting that traditional educational approaches may be insufficient to ensure long-term competence and clinical readiness (11).

The problem is further compounded in regions where public and professional awareness of anaphylaxis remains limited. While studies from Western countries report ongoing challenges in anaphylaxis recognition and management, there is a notable scarcity of data from the Middle East and South Asia, despite rising rates of food allergies and allergic diseases in these regions (12). The limited regional evidence restricts the development of context-specific training programs and delays the integration of updated international guidelines into local emergency care protocols. Given the life-threatening nature of anaphylaxis and the rapid evolution of treatment strategies, including updated diagnostic criteria, refined epinephrine administration protocols, and innovations in supportive care, it is critical to assess whether emergency department nurses remain adequately informed of current best practices. Understanding their level of awareness regarding novel treatments and recent advances is essential, as insufficient knowledge may translate into delayed or suboptimal care, directly affecting patient outcomes in emergency settings (13,14). Therefore, this study is designed to evaluate the level of awareness and knowledge among emergency room nurses regarding contemporary definitions, treatment guidelines, and emerging innovations in anaphylaxis management, and to explore how this awareness influences clinical practice and patient outcomes. By identifying existing knowledge gaps, the study aims to provide a rational basis for targeted educational interventions and training programs that can enhance emergency nursing practice and improve the safety and effectiveness of anaphylaxis management.

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

METHODS

A cross-sectional descriptive study design was employed to assess the level of awareness and knowledge among emergency room nurses regarding novel treatments and innovations in the management of anaphylaxis at a single point in time. This design was selected because it allowed efficient data collection within a limited timeframe, facilitated the assessment of multiple variables simultaneously, and was appropriate for estimating knowledge levels and practice-related patterns in a clinical workforce. The study was conducted in the emergency departments of selected hospitals in Bahawalpur over a six-month period following approval of the research synopsis. The study population comprised registered staff nurses working in emergency units. A total of 60 nurses were enrolled, with the sample size calculated using the Cochrane formula ($Z = 1.64$, $P = 0.3333$, $d = 0.1$, margin of error = 10%), resulting in a final sample size of 60 participants. A non-probability convenience sampling technique was used to recruit eligible participants based on their availability during the data collection period. Nurses who were actively working in the emergency department and had a minimum of six months of emergency room experience were included to ensure adequate clinical exposure to acute allergic emergencies, while those with less than six months of ER experience or those not present during the data collection period were excluded. Data were collected using a structured, self-administered, closed-ended questionnaire developed after a review of relevant literature. The instrument was designed to evaluate nurses' knowledge, awareness, attitudes, and perceptions regarding current definitions of anaphylaxis, established management guidelines, and emerging or novel treatment approaches. The questionnaire also included items related to demographic and professional characteristics to explore potential associations between background variables and knowledge levels. Prior to administration, the purpose of the study was explained to all participants, and written informed consent was obtained to ensure voluntary participation. Confidentiality and anonymity were maintained throughout the study by assigning codes rather than using personal identifiers. Ethical approval for the study was obtained from the relevant institutional ethical review committee prior to data collection. All procedures were conducted in accordance with ethical principles for research involving human participants, including respect for autonomy, confidentiality, and the right to withdraw at any stage without penalty. Data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS) version 27. Descriptive statistics, including frequencies and percentages, were used to summarize demographic variables and levels of awareness and knowledge related to anaphylaxis management. Inferential statistical analyses were also applied to examine associations and trends between demographic characteristics and familiarity with novel anaphylaxis treatments, forming the analytical basis for interpretation of findings.

RESULTS

A total of 60 emergency room nurses participated in the study, all of whom were directly involved in frontline emergency care. The majority were emergency nurses (66.7%), followed by charge nurses (21.7%) and registered nurses (11.7%). With respect to professional experience, half of the participants had six months of emergency care experience (50.0%), while 36.7% reported 1-5 years of experience. A smaller proportion had less than one year of experience (11.7%), and only one participant (1.7%) reported experience slightly exceeding six months. Formal training in anaphylaxis management within the past five years was reported by 63.3% of nurses, whereas 36.7% had not received any recent structured training. Exposure to anaphylaxis cases varied considerably. Nearly half of the respondents (45.0%) reported encountering anaphylaxis frequently, defined as more than six cases per year. Occasional exposure (3-6 cases per year) was reported by 26.7%, while 16.7% encountered such cases rarely (1-2 times per year). A smaller group (11.7%) reported exposure to anaphylaxis on an almost daily basis, indicating that a substantial proportion of nurses had regular clinical contact with this life-threatening condition. Regarding fundamental knowledge, 66.7% of participants correctly identified anaphylaxis as a severe, life-threatening allergic reaction. However, 23.3% incorrectly perceived it as a mild allergic reaction, and 10.0% were either uncertain or misclassified it as a chronic allergic condition. When asked about common causes of anaphylaxis, medications were most frequently identified (61.7%), followed by food allergens (45.0%), latex exposure (20.0%), blood transfusions (16.7%), and insect stings (10.0%). In terms of symptom recognition, swelling of the lips, tongue, or throat was the most commonly recognized manifestation (71.7%), followed by shortness of breath (63.3%) and skin manifestations such as rash or urticaria (55.0%). Notably, only 20.0% of nurses correctly identified hypotension as a major clinical feature of anaphylaxis.

Knowledge related to treatment and management demonstrated important gaps. Epinephrine was correctly identified as the first-line treatment by 58.3% of respondents, while others selected corticosteroids (20.0%), antihistamines (15.0%), or intravenous fluids (6.7%). Only 31.7% correctly identified the recommended intramuscular dose of epinephrine (0.3-0.5 mg), whereas 35.0% incorrectly selected the intravenous route, 28.3% chose the subcutaneous route, and 5.0% selected nebulized administration. Furthermore, a large majority

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

(85.0%) believed that a single dose of epinephrine was always sufficient, reflecting limited awareness of the need for repeat dosing in certain clinical scenarios. Awareness of complications and recent advances was comparatively low. Only 18.3% of nurses recognized biphasic anaphylactic reactions as a serious delayed complication. Awareness of novel or emerging treatment options was moderate overall (63.3%). Intranasal epinephrine was the most frequently recognized novel therapy (45.0%), followed by sublingual epinephrine formulations (28.3%) and monoclonal antibodies (10.0%). Very few participants identified newer auto-injector devices (5.0%), while 11.7% reported no awareness of any novel treatments. Self-reported confidence varied across different aspects of care. Very high confidence in recognizing anaphylaxis symptoms was reported by 38.3% of nurses, while 40.0% felt somewhat confident in distinguishing anaphylaxis from other allergic reactions. Confidence in administering epinephrine was reported as very high by 41.7% of participants. The most frequently cited barriers to adopting novel treatments included lack of awareness (46.7%), high cost (21.7%), and institutional or regulatory restrictions (20.0%), with safety or efficacy concerns reported by 11.7%. In terms of educational needs, preferred training modalities included online courses or webinars (26.7%), hands-on workshops (25.0%), case-based learning (23.3%), and simulation-based training (23.3%). The majority of respondents (70.0%) indicated that additional training on novel anaphylaxis treatments would positively influence their clinical practice. Preferred frequency of updates was annual (40.0%), followed by every 2-3 years (31.7%), or only when new guidelines are released (25.0%), while a small proportion (3.3%) felt no further training was required.

Table 1: Demographic and Professional Characteristics of Emergency Room Nurses (n = 60)

Variable	Category	Frequency (n)	Percent (%)
Job Role	Emergency Nurse	40	66.7
	Charge Nurse (CN)	13	21.7
	Registered Nurse (RN)	7	11.7
	Total	60	100.0
Years of Emergency Experience	6 months	30	50.0
	1-5 years	22	36.7
	<1 year	7	11.7
	>6 months	1	1.7
Formal Training on Anaphylaxis (past 5 years)	Yes	38	63.3
	No	22	36.7

Table 2: Frequency of Encountering Anaphylaxis Cases

Frequency of Encounters	Frequency (n)	Percent (%)
Rarely (1-2 times/year)	10	16.7
Occasionally (3-6 times/year)	16	26.7
Frequently (>6 times/year)	27	45.0
Almost daily	7	11.7
Total	60	100.0

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

Table 3: Knowledge of Anaphylaxis Definition and Common Causes among Emergency Room Nurses (n = 60)

Variable	Category	Frequency (n)	Percent (%)
Understanding of Anaphylaxis Definition	Severe, life-threatening allergic reaction	40	66.7
	Mild allergic reaction	14	23.3
	Chronic allergic condition	3	5.0
	Not sure	3	5.0
Common Causes of Anaphylaxis (Multiple response)	Medications (e.g., antibiotics, NSAIDs)	37	61.7
	Food allergens	27	45.0
	Latex exposure	12	20.0
	Blood transfusions	10	16.7
	Insect stings	6	10.0

Table 4: Knowledge of Epinephrine Administration and Dosage

Variable	Response Option	Frequency (n)	Percent (%)
First-Line Treatment	Epinephrine	35	58.3
	Corticosteroids	12	20.0
	Antihistamines	9	15.0
	IV Fluids	4	6.7
Recommended Dose and Route	IM, 0.3-0.5 mg	19	31.7
	IV, 0.1 mg	21	35.0
	Subcutaneous, 0.3 mg	17	28.3
	Nebulized, 1 mg	3	5.0

Table 5: Awareness of Novel Anaphylaxis Treatments

Novel Treatment Type	Selected by (n)	Percent (%)
Intranasal epinephrine	27	45.0
Sublingual epinephrine	17	28.3
Monoclonal antibodies	6	10.0
New auto-injector devices	3	5.0
None	7	11.7

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

Table 6: Barriers to Adopting Novel Anaphylaxis Treatments

Barrier	Frequency (n)	Percent (%)
Lack of awareness	28	46.7
High cost	13	21.7
Regulatory/policy restrictions	12	20.0
Safety or efficacy concerns	7	11.7

Table 7: Preferred Methods of Training and Frequency of Updates

Training Method	Selected by (n)	Percent (%)
Online courses/webinars	16	26.7
Hands-on workshops	15	25.0
Case-based learning	14	23.3
Simulation-based training	14	23.3
Interactive mobile apps	1	1.7
Preferred Frequency of Updates	Frequency (n)	Percent (%)
Annually	24	40.0
Every 2-3 years	19	31.7
Only when new guidelines emerge	15	25.0
No further training needed	2	3.3

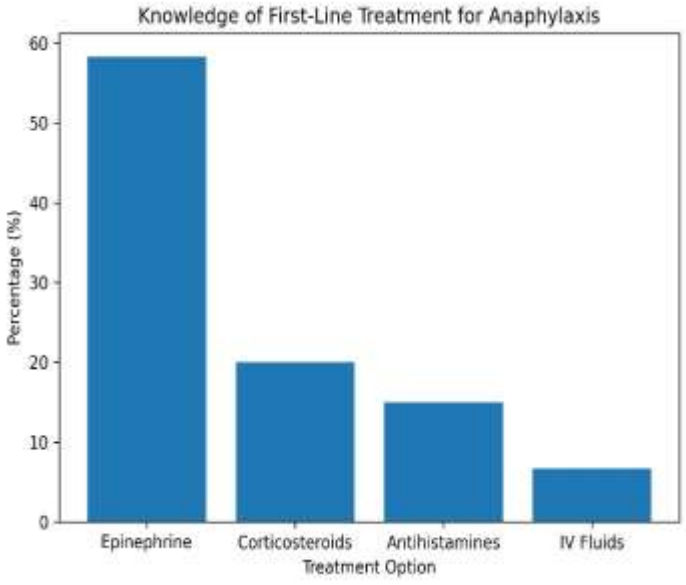

Figure 1 Knowledge of First-Lin Treatment for Anaphylaxis

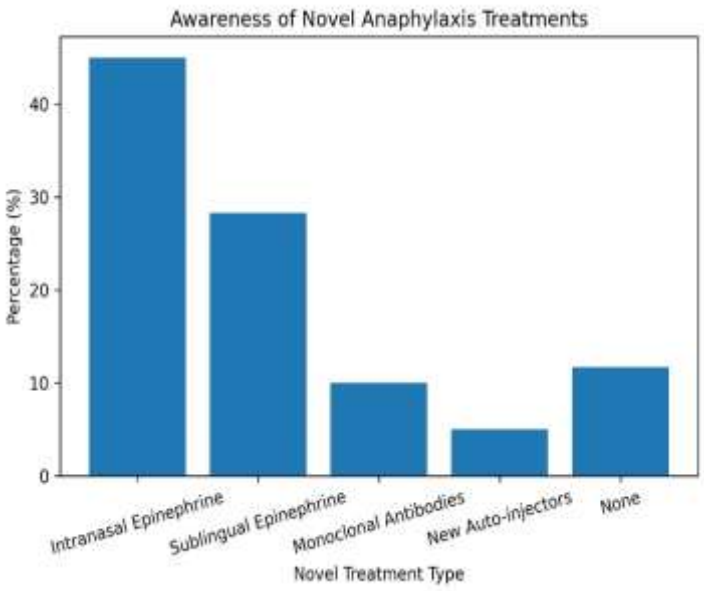

Figure 1 Awareness of Novel Anaphylaxis Treatments

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

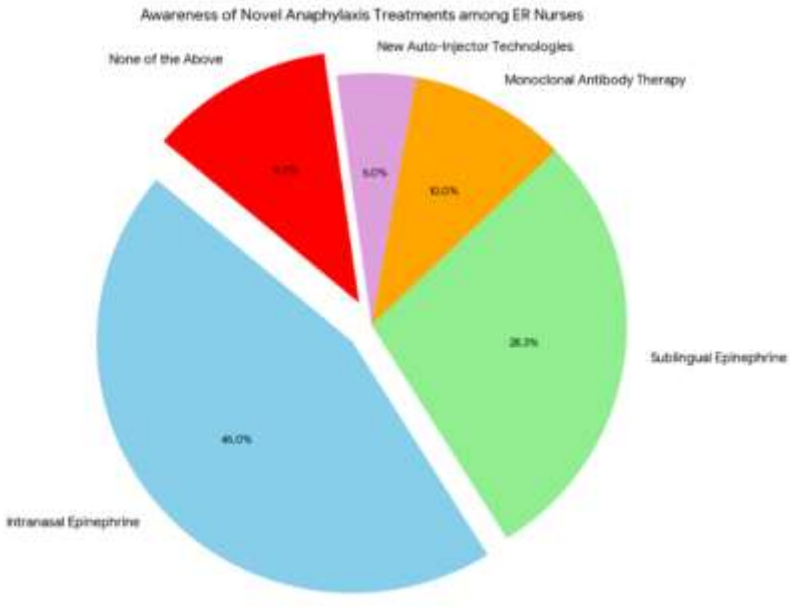

Figure 2 Awareness of Novel Anaphylaxis Treatments Among ER Nurses

DISCUSSION

This cross-sectional study provided an overview of the current level of awareness and preparedness among emergency room nurses regarding the recognition and management of anaphylaxis, with particular emphasis on updated guidelines and emerging treatment options. The findings demonstrated a moderate level of general awareness; however, critical deficiencies were evident in areas that are central to patient survival during anaphylactic emergencies. These results reinforce ongoing concerns reported in the literature that, despite routine exposure to acute care settings, gaps in both foundational knowledge and advanced clinical decision-making persist among frontline nursing staff (15,16). Accurate and early recognition of anaphylaxis is the cornerstone of effective management, yet only two-thirds of participants correctly identified anaphylaxis as a life-threatening condition. This finding aligns with previous evidence showing that incomplete understanding of the definition and severity of anaphylaxis remains common among healthcare professionals, particularly nurses working in high-pressure environments (17). Misclassification of anaphylaxis as a mild or chronic condition may delay escalation of care and compromise patient outcomes. The observed knowledge gap at this fundamental level suggests that core emergency concepts may not be sufficiently reinforced through continuing professional education. Deficiencies were more pronounced in relation to treatment protocols, particularly epinephrine administration. Although more than half of the nurses identified epinephrine as the first-line therapy, fewer than one-third correctly recognized the recommended intramuscular dose and route, and the majority believed that a single dose is invariably sufficient. These misconceptions are clinically significant, as current guidelines emphasize prompt intramuscular epinephrine with repeat dosing when necessary to prevent progression to refractory shock or fatal outcomes (18,19). Similar trends have been reported in previous studies, where inappropriate dosing, incorrect routes of administration, and overreliance on adjunctive therapies such as antihistamines or corticosteroids were common (20). The continued prioritization of these secondary agents over epinephrine reflects outdated practice patterns that may persist in the absence of regular guideline updates and skills-based training.

Another notable finding was the limited awareness of biphasic anaphylaxis, a potentially severe delayed reaction that can occur after apparent symptom resolution. Recognition of this complication was strikingly low, despite its clinical relevance for patient observation and disposition decisions. This under-recognition has also been documented in prior research and highlights a broader challenge in anticipating delayed or atypical presentations of anaphylaxis in emergency settings (21). Failure to identify biphasic reactions may lead to premature discharge and increased risk of morbidity. Encouragingly, most participants expressed interest in learning about novel therapies, including alternative epinephrine delivery systems and biologic agents. This openness to professional development represents

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

an important strength and suggests readiness for targeted educational interventions. However, reported barriers such as limited availability of newer treatments, high costs, and institutional or regulatory constraints indicate that knowledge deficits are compounded by systemic limitations. Addressing these challenges requires not only individual-level education but also institutional commitment to updating protocols, ensuring access to essential medications, and integrating evidence-based innovations into routine practice. Comparisons with international studies revealed that these findings are not unique to the local context. Research conducted in diverse healthcare systems has similarly demonstrated moderate overall knowledge but insufficient competency in pharmacological management and emergency response execution (12,22). Consistent associations between higher knowledge levels and greater clinical experience or recent training further underscore the importance of continuous professional development as a determinant of preparedness. Structured, recurring training programs that emphasize practical skills, dosing accuracy, and scenario-based learning have been advocated as effective strategies to bridge these gaps (23).

The study possessed several strengths, including its focus on emergency room nurses who are directly involved in acute patient care and its emphasis on emerging treatments, an area that remains underexplored in regional research. Nonetheless, certain limitations must be acknowledged. The relatively small sample size and use of non-probability convenience sampling limited the generalizability of the findings. Restriction of the study to hospitals within a single city may not reflect variations in knowledge across different regions or healthcare settings. Additionally, reliance on self-administered questionnaires introduced the possibility of response bias, as reported knowledge may not accurately reflect actual clinical practice. Future research should incorporate larger, multi-center samples and employ mixed-method approaches, including direct observation or simulation-based assessments, to better evaluate clinical competence. Longitudinal designs may also be valuable in assessing the impact of targeted training interventions on knowledge retention and patient outcomes. Expanding the scope to include measurable clinical indicators, such as time to epinephrine administration or adherence to observation protocols, would further strengthen the evidence base. Overall, the findings highlighted critical knowledge gaps in the recognition and management of anaphylaxis among emergency room nurses, particularly regarding epinephrine use, delayed reactions, and newer therapeutic options. Addressing these gaps through standardized training, institutional support, and alignment with international guidelines has the potential to significantly improve emergency care quality and patient safety in anaphylactic emergencies.

CONCLUSION

This study concluded that emergency room nurses in Bahawalpur demonstrated a moderate level of awareness regarding the identification and management of anaphylaxis; however, clinically important gaps persist that may compromise timely and effective care. While general recognition of anaphylaxis and its urgency was evident, deficiencies were apparent in critical aspects of management, particularly accurate epinephrine administration, recognition of delayed or biphasic reactions, and adherence to current evidence-based treatment priorities. Misconceptions surrounding the role of adjunctive therapies and limited familiarity with emerging treatment options further highlighted the need for systematic educational reinforcement. Importantly, the strong willingness among nurses to engage in additional training reflects a valuable opportunity to strengthen emergency preparedness through structured, guideline-driven education and institutional support. Addressing these gaps through regular competency-based training, improved access to updated protocols, and integration of novel therapies into clinical practice has the potential to significantly enhance patient safety and outcomes in anaphylactic emergencies.

AUTHOR CONTRIBUTIONS

Author	Contribution
Kehkashan Shabir*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Imtiaz Ramzan	Substantial Contribution to study design, acquisition and interpretation of Data Has given Final Approval of the version to be published

Author	Contribution
Husna Najeeb	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Muhammad Danish*	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Rubina Haider	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Arooba Fatima	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Muhammad Bilal Hussain	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Farrukh Jamal	Critical Review and Manuscript Writing Has given Final Approval of the version to be published

REFERENCES

1. Alanazy, A., Boodai, R. S., Alhulaybi, B. I., Alraihan, A. I., Almulhim, R. A., Almulhim, B. F., Rajappan, S. K., Alruwaili, A., & Alanazi, A. (2024). Awareness of anaphylaxis among public in Al-Ahsa City of Saudi Arabia: A cross-sectional study. PloS one, 19(12), e0315722.

2. Alsaleem, H. N., Almuzaini, A. S., Aldakheel, F. N., Almuhaisni, R., Alsharekh, N. A., Alharkan, M. K., Aldakhil, L. N., s Aljudayi, A., Alkhalifah, K. A., & Altuwaiyan, A. F. (2024). Knowledge and Preparedness of Physicians in Relation to Anaphylaxis at Primary Healthcare Centers in Al-Qassim, Saudi Arabia. Cureus, 16(3).

3. Arga, M., Topal, E., Yılmaz, S., Erdemli, P. C., Bıçakcı, K., & Bakırtaş, A. (2021). Healthcare workersknowledge level regarding anaphylaxis and usage of epinephrine auto-injectors. The Turkish journal of pediatrics, 63(3), 372-383.

4. Cimen, S. S., & Sayili, S. B. (2022). Level of knowledge among healthcare professionals regarding anaphylaxis. Asia Pacific Allergy, 12(4), e41.

5. Dharmaratne, C., & Dahanayaka, N. (2023). Knowledge on anaphylaxis, its associated factors and self-perceived confidence on its management among medical officers attached to the Teaching Hospital Karapitiya. Galle Medical Journal, 28(3).

6. El-Sayed, Z. A., El-Owaidy, R., Hussein, S. M., Hossam, D., El-Sawi, I. H., Adel, A., Almalky, M., Elshebiny, E., Ismaeel, A. Y., & Osman, N. S. (2021). Physicians' knowledge and practice concerning diagnosis and management of anaphylaxis: The situation in Egypt. African Journal of Emergency Medicine, 11(4), 464-470.

7. González-Díaz, S. N., Villarreal-González, R. V., Fuentes-Lara, E. I., del Rocío Salinas-Díaz, M., de Lira-Quezada, C. E., Macouzet-Sánchez, C., Macías-Weinmann, A., Guzmán-Avilán, R. I., & García-Campa, M. (2021). Knowledge of healthcare providers in the management of anaphylaxis. World Allergy Organization Journal, 14(11), 100599.

8. Noh, Y., & Lee, I. (2021). A mixed-methods approach-based study of anaphylaxis awareness and educational needs among nursing students. International Journal of Environmental Research and Public Health, 18(17), 9280.

9. Phan, D., Nguyen, T., Do, H., & Dau, T. (2024). Assessing Knowledge of Vietnamese Nurses about Prevention and Treatment of Anaphylaxis: A Cross-Sectional Study. International Journal of Public Health Asia Pacific, 105-116.

10. Casale TB, Wang J, Oppenheimer J, Nowak-Wegrzyn A. Acute At-Home Management of Anaphylaxis: 911: What Is the Emergency? J Allergy Clin Immunol Pract. 2022;10(9):2274-9.

11. Motosue MS, Li JT, Campbell RL. Anaphylaxis: Epidemiology and Differential Diagnosis. Immunol Allergy Clin North Am. 2022;42(1):13-25.

12. Gorham NP. Anaphylaxis:: After the Emergency Department. Emerg Med Clin North Am. 2022;40(1):33-7.

13. Shaker M, Abrams EM, Sublett JW. Contextual community epinephrine prescribing: Is more always better? Ann Allergy Asthma Immunol. 2023;131(2):176-84.

14. Acquisto NM, Bodkin RP, Vabishchevich Y, Falkowski MW, Tuttle SC, Jones CM, et al. Epinephrine autoinjector prescribing following anaphylaxis presentation to the emergency department. Allergy Asthma Proc. 2023;44(4):283-90.

15. Krajewski GS, Krajewski T. Evaluation and Management of Food Allergies in the Emergency Department. Immunol Allergy Clin North Am. 2023;43(3):491-501.

16. Gabrielli S, Clarke AE, Morris J, Gravel J, Lim R, Chan ES, et al. Fruit-Induced Anaphylaxis: Clinical Presentation and Management. J Allergy Clin Immunol Pract. 2021;9(7):2825-30.e2.

17. Wallace DV. Knowledge gaps in the diagnosis and management of anaphylaxis. Ann Allergy Asthma Immunol. 2023;131(2):151-69.

18. Zeke A, Sudhir A. Management of allergic reactions and anaphylaxis in the emergency department. Emerg Med Pract. 2022;24(7):1-24.

19. Hong B, Merrill KA, Golding MA, Simons E, Ben-Shoshan M, Protudjer JLP. Prehospital epinephrine administration for treating anaphylaxis among those with comorbid asthma: A scoping review. Ann Allergy Asthma Immunol. 2023;131(1):69-74.e1.

20. Lowing D, Chung S, Luk J, Dingeldein L. Prehospital Epinephrine Use in Pediatric Anaphylaxis by Emergency Medical Services. Pediatr Emerg Care. 2022;38(8):367-71.

21. Dribin TE, Sampson HA, Zhang Y, Boyd S, Zhang N, Michelson KA, et al. Timing of repeat epinephrine to inform paediatric anaphylaxis observation periods: a retrospective cohort study. Lancet Child Adolesc Health. 2025;9(7):484-96.

22. Ducharme L, Gabrielli S, Clarke AE, Morris J, Gravel J, Lim R, et al. Tree nut-induced anaphylaxis in Canadian emergency departments: Rate, clinical characteristics, and management. Ann Allergy Asthma Immunol. 2022;129(3):335-41.

23. Dribin TE, Waserman S, Turner PJ. Who Needs Epinephrine? Anaphylaxis, Autoinjectors, and Parachutes. J Allergy Clin Immunol Pract. 2023;11(4):1036-46.