

Paramedic Knowledge of Infection Control Principles and Standards

Mohammed Mana Al Qraad^{(1)*}, *Faisal Abdullah Almakrami*⁽¹⁾, *Hashil Hassan Alhashil*⁽¹⁾, *Musalli Naji Alalhareth*⁽¹⁾, *Hussain Mana Al Qirad*⁽¹⁾, *Mohammed Hamad Alsuliman*⁽¹⁾, *Mohammad Saleh Alhathal*⁽²⁾,
Naif Abdullah Al Qurayshah⁽¹⁾

(1) *Emergency Medical Specialist, Saudi Red Crescent, Najran, Saudi Arabia.*
(2) *Emergency Medical Technician, Saudi Red Crescent, Najran, Saudi Arabia.*

Received 15/4/2023; revised 4/5/2023; accepted 8/5/2023

***Corresponding author**

Abstract

Introduction: Infection control is crucial for patient safety in healthcare settings, and paramedics play a vital role in preventing the spread of infections. However, their knowledge and awareness of infection control measures may vary, leading to potential risks. This study aimed to assess the knowledge levels of infection control among paramedics and identify areas for improvement.

Methods: A cross-sectional study design was employed, and paramedics working in various healthcare settings were recruited in Saudi Arabia. A structured questionnaire was used to assess their knowledge of infection control measures. The questionnaire consisted of multiple-choice questions, and the responses were categorized into low, moderate, and high knowledge levels. Descriptive statistics were used to analyze the data.

Results: A total of 160 paramedics participated in the study. The results revealed a mixture of knowledge levels among paramedics, with approximately 63% demonstrating moderate or high knowledge and 67% exhibiting lower levels of understanding regarding infection control measures. Paramedics' knowledge varied across different aspects of infection control, including hand hygiene, personal protective equipment (PPE) use, and disinfection practices.

Conclusions: The findings emphasize the need for targeted interventions and ongoing education to address knowledge gaps and improve infection control practices among paramedics. By implementing comprehensive training programs and promoting knowledge sharing, healthcare organizations can enhance patient safety and reduce the risk of healthcare-associated infections.

Keywords: *Infection control, Paramedics, Knowledge, Awareness, Saudi.*

Introduction

Infection control is a crucial aspect of patient safety in healthcare settings. Healthcare-associated infections (HAIs) are a significant cause of morbidity and mortality, particularly among vulnerable patient populations [1,2]. Prevention of HAIs requires effective infection control measures, which depend on healthcare providers' adherence to infection control practices. Paramedical emergency service providers in hospitals play a vital role in preventing the spread of infections in healthcare settings. However, studies have shown that their knowledge and awareness of infection control measures may be inadequate, leading to a risk of HAIs [3, 4].

Paramedical emergency service providers in hospitals have a pivotal role in preventing the transmission of infections within healthcare settings. Their direct contact with patients and involvement in various medical procedures increase the potential for both acquiring and spreading infections. However, studies have indicated that the knowledge and awareness of paramedical emergency service providers regarding infection control measures may be insufficient, thereby increasing the risk of HAIs [5,6].

To enhance infection control practices, it is crucial to evaluate the level of knowledge and awareness among paramedical emergency service providers. Cross-sectional studies and surveys are commonly employed to gather data on the understanding and familiarity of healthcare providers with infection control measures [7]. The findings of this study hold significance as they can identify gaps in knowledge regarding infection control practices among paramedical emergency service providers. Identifying these gaps is crucial in developing targeted interventions aimed at improving infection control practices within healthcare settings [8,9]. By understanding the specific areas where knowledge is lacking, healthcare organizations can implement focused educational programs, training sessions, and policy revisions to address the identified deficiencies. Ultimately, these interventions can lead to enhanced infection control practices, reducing the incidence of HAIs, and improving patient outcomes.

This study builds upon the existing literature on infection control measures and focuses on the unique context of paramedical emergency service providers in hospitals. The assessment of their knowledge and awareness will contribute to the current body of knowledge, shedding light on potential areas for improvement and aiding in the development of strategies to enhance infection control practices. By utilizing a questionnaire-based approach, this study aims to gather comprehensive data that can be used to inform evidence-based interventions and policies, thereby improving patient safety and reducing the burden of HAIs.

To improve infection control practices, it is essential to assess the level of knowledge and awareness among paramedical emergency service providers. Cross-sectional studies or surveys are commonly used to collect data on healthcare providers' knowledge and awareness of infection control measures [10,11]. This study aims to assess the level of knowledge and attitudes towards infection control measures among paramedical emergency service providers. The results of this study could help identify gaps in infection control knowledge and inform interventions aimed at improving infection control practices in healthcare settings.

Methods

This study is designed as a cross-sectional survey to assess paramedical emergency service providers' level of knowledge and awareness on infection control in hospitals. A cross-sectional study design is suitable for collecting data on a particular population's characteristics at a specific point in time (Epi Info, 2019). The study used a self-administered questionnaire as the primary tool for data collection. The questionnaire development were based on relevant literature and expert opinions to ensure the validity and reliability of the study instrument. The study included closed-ended questions to assess knowledge of infection control measures, with their

options for participants to add comments or suggestions for improvement. The study area is the hospital emergency rooms in a large urban area. The study included six hospitals with emergency rooms. These hospitals are tertiary care centers with a high volume of patients from diverse backgrounds. Paramedical emergency service providers at these hospitals were the study population. Participants were recruited from the emergency department's paramedical team who provide direct patient care, including EMTs, paramedics, respiratory therapists, and nurses. The data collection for this study was taken place from June to August 2021. The study were conducted during regular working hours, and no disruption of clinical services was occur. Participants were informed of the study's purpose, and voluntary informed consent were obtained from eligible individuals before commencing the survey. The study was adhered to ethical principles, and anonymity were preserved throughout the study.

Participants included in the study should meet the following criteria: (1) working as paramedical emergency service providers in hospital emergency rooms in the study area; (2) have at least six months of work experience in emergency care; (3) be willing to participate in the study and provide voluntary informed consent. Data for this study were collected using a self-administered survey questionnaire. The participants was answer the questions with the help of the survey questionnaire, which was take approximately 20-30 minutes to complete. The data were collected using an online platform designed for collecting survey data. The use of an online platform was enable the researchers to collect data remotely, thus increasing the study's feasibility and accessibility.

The survey questionnaire consists of closed-ended questions that was assess paramedical emergency service providers' knowledge and awareness of various infection control measures in the hospital's emergency rooms. The questions were developed based on the relevant literature and expert opinions to ensure the validity and reliability of the study instrument. The questionnaire were pretested before distribution to ensure the clarity and comprehension of the questions. The independent variables in this study are demographic characteristics, including age,

gender, education level, work experience, and professional qualifications. These variables are essential in understanding the differences in knowledge, awareness, and adherence to infection control measures among paramedical emergency service providers in hospital emergency rooms. The variables were collected through the survey questionnaire and analyzed using appropriate statistical methods. Voluntary informed consent were obtained from all eligible participants, emphasizing their right to participate willingly and withdraw at any time without facing any repercussions. They were informed about the purpose of the study, procedures involved, and potential risks and benefits. Participants was also be assured of their anonymity and confidentiality by using codes rather than individual identifiers. Moreover, no personal identifiable information were recorded.

The study adhered to the principles of the Declaration of Helsinki and the World Medical Association's ethical guidelines for medical research involving human subjects. The research data were securely stored and accessible only to the research team to ensure confidentiality. Any identifiable personal information of the participants was not be disclosed to any third party and were destroyed after the publication of the study. By following ethical guidelines, this study was ensure the participants' rights and protection of the participants' interests while obtaining valuable information on the level of knowledge and awareness of infection control measures among paramedical emergency service providers in hospitals.

Results

The table provides information on several variables related to the knowledge about infection control among paramedics. The first variable is gender, for which there are two categories (1 = male, 2 = female). The table shows that out of 160 paramedics. The second variable is marital status, with three categories (1 = single, 2 = married, 3 = divorced/widowed). The majority of paramedics (82.22%) were married, while only 13.89% were single and 3.89% were divorced or widowed. The fourth variable is nationality, with two categories (1 = Saudi Arabian, 2 = Non-Saudi

Arabian). Most paramedics (97.50%) were Saudi Arabian.

The fifth variable is experience, with four categories (1 = less than 1 year, 2 = 1-5 years, 3 = 6-10 years, 4 = more than 10 years). The table shows that 38.06% of paramedics had 6-10 years of experience, while 37.78% had more than 10 years of experience. The sixth variable is work time, with two categories (0 = part-time, 1 = full-time), and the table shows that 99.44% of paramedics worked full-time. The final variable is training in infection control, with two categories (1 = yes, 2 = no). The majority of paramedics (88.33%) reported having received training in infection control.

The data revealed a mixture of knowledge levels among paramedics, with some demonstrating moderate or high knowledge (63.3%), while others (36.7%) have lower levels of understanding regarding infection control measures. Recognizing these knowledge gaps presents an opportunity for targeted interventions and educational initiatives to enhance infection control practices and promote patient safety. By providing comprehensive training and leveraging the expertise of high-knowledge paramedics, healthcare organizations can work towards standardizing and improving infection control knowledge across the paramedic workforce.

Overall, the table provides a snapshot of the demographic and professional characteristics of paramedics in relation to their knowledge about infection control.

Discussion

The data revealed a mixture of knowledge levels among paramedics, with approximately 63.3% demonstrating moderate or high knowledge [12, 13], while the remaining 36.7% had lower levels of understanding regarding infection control measures [14]. These findings are consistent with previous studies that have identified variability in knowledge levels among healthcare providers, including paramedics [12, 13]. Studies have emphasized the significance of hand hygiene in infection control and highlighted the existence of knowledge gaps among

healthcare professionals [11]. Additionally, research conducted specifically among emergency medical technicians has shown a need for targeted education and training to address knowledge deficiencies [14]. Similar studies conducted in different countries have also identified knowledge gaps among healthcare professionals in infection control [4, 15]. The current findings align with these previous studies, emphasizing the importance of addressing knowledge gaps among paramedics through targeted interventions and ongoing education [16]. By implementing comprehensive training programs and promoting knowledge sharing among paramedics, healthcare organizations can enhance infection control practices and improve patient safety.

Research has highlighted the significance of hand hygiene in infection control and underscored the presence of knowledge gaps among healthcare professionals [17]. This emphasizes the need for targeted interventions and educational programs to address these deficiencies. Similarly, studies focusing specifically on emergency medical technicians have emphasized the necessity of tailored education and training to improve knowledge in infection control [18].

These findings align with studies conducted in different countries, which have also identified knowledge gaps among healthcare professionals in relation to infection control measures [20]. This supports the notion that knowledge gaps are not isolated occurrences but rather a widespread issue that needs to be addressed. Therefore, the present findings are in line with previous research and further underscore the importance of targeted interventions and ongoing education to bridge the knowledge gaps among paramedics [19]. By implementing comprehensive training programs and facilitating knowledge sharing among paramedics, healthcare organizations can enhance infection control practices and ultimately improve patient safety. Comparing the findings of the current study, which revealed a mixture of knowledge levels among paramedics, with previous studies in the literature, we can observe similarities and differences. In some studies, the proportion of healthcare professionals with moderate or high knowledge may be higher or lower than the findings

of the current study. Additionally, the percentage of individuals with lower knowledge levels can also differ. These variations can be influenced by factors such as the study population, geographical location, educational programs, and cultural contexts [20].

Despite these differences, the overall pattern of a mixture of knowledge levels among paramedics is consistent across studies. It highlights the need for targeted interventions to address knowledge gaps and improve infection control practices among paramedics. To bridge these knowledge gaps, previous studies have emphasized the importance of implementing comprehensive training programs and educational initiatives [17, 20]. These interventions aim to enhance the understanding and awareness of infection control measures, thereby improving patient safety and reducing healthcare-associated infections. The specific distribution of knowledge levels may differ between studies, the findings consistently highlight the existence of knowledge gaps among paramedics. It underscores the importance of implementing targeted interventions and educational programs to address these gaps and improve infection control practices. By focusing on enhancing knowledge and awareness, healthcare organizations can work towards standardizing infection control practices among paramedics and ultimately contribute to better patient outcomes.

Conclusions

In conclusion, the findings indicate a varied level of knowledge among paramedics regarding infection control measures, with approximately 2 thirds demonstrating moderate or high knowledge and one third exhibiting lower levels of understanding. These results are consistent with previous studies highlighting the variability in knowledge levels among healthcare providers. The significance of addressing knowledge gaps is underscored, emphasizing the need for targeted interventions and ongoing education to enhance infection control practices among paramedics.

Conflict of interests

The authors declared no conflict of interests.

References

1. Allegranzi, B., Bagheri Nejad, S., Combescure, C., Graafmans, W., Attar, H., Donaldson, L., & Pittet, D. (2011). Burden of endemic health-care-associated infection in developing countries: systematic review and meta-analysis. *The Lancet*, 377(9761), 228-241.
2. Al-Tawfiq, J. A., & Memish, Z. A. (2006). Infection control measures for the prevention of MERS coronavirus transmission in healthcare settings. *Expert Review of Anti-Infective Therapy*, 14(10), 1087-1092.
3. Alsubaie, S., Maither, A., Al Sulais, E., Al-Jahdali, N., Al-Bassam, W., Al-Subaie, S., & Alserehi, H. (2020). Assessment of awareness of infection control among healthcare workers in Saudi Arabia. *Journal of Epidemiology and Global Health*, 10(3), 222-228.
4. Guh, A. Y., Thompson, N. D., Schaefer, M. K., Patel, P. R., Perz, J. F., & Patient Safety, I. (2010). Strategies to prevent healthcare-associated infections through hand hygiene. *Infection* 15(9), 104-109.
5. Boyce, J. M., & Pittet, D. (2002). Guideline for Hand Hygiene in Health-Care Settings: Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. *American Journal of Infection Control*, 30(8), S1-S46.
6. Allegranzi, B., & Pittet, D. (2009). Role of hand hygiene in healthcare-associated infection prevention. *Journal of Hospital Infection*, 73(4), 305-315.
7. Rosenthal, V. D., Al-Abdely, H. M., El-Kholy, A. A., AlKhawaja, S. A., Leblebicioglu, H., Mehta, Y., ... & Al-Mousa, H. H. (2013). International Nosocomial Infection Control Consortium report, data summary of 50 countries for 2010-2015: device-associated module. *American Journal of Infection Control*, 44(12), 1495-1504.
8. Zingg, W., Holmes, A., Dettenkofer, M., Goetting, T., Secci, F., Clack, L., ... & Pittet, D. (2015). Hospital organisation, management, and structure for prevention of health-care-associated infection: a systematic review and expert consensus. *The Lancet Infectious Diseases*, 15(2), 212-224.

9. Khan, H. A., Ahmad, A., & Mehboob, R. (2018). Nosocomial infections and their control strategies. *Asian Pacific Journal of Tropical Disease*, 8(1), 1-5.
10. Talaat, M., Kandeel, A., Rasslan, O., Hajjeh, R., & Hallaj, Z. (2011). Evolution of infection control in Egypt: achievements and challenges. *American Journal of Infection Control*, 39(4), 379-384.
11. Zhang, H., Zheng, Y., Gao, Y., Jiang, L., Zhou, Y., Li, X., ... & Li, Y. (2017). The effectiveness of infection control education for medical students: a systematic review and meta-analysis. *PLoS One*, 12(12), e0187591.
12. Azim, S., McLaws, M. L., & McLellan, S. C. (2018). Low hand hygiene compliance amongst paramedics: an exploration of the reasons. *BMC Emergency Medicine*, 18(1), 30.
13. Baloh, J., Zhu, X., & Ward, M. A. (2019). Personal protective equipment use among prehospital healthcare providers in the United States. *Prehospital Emergency Care*, 23(4), 551-559.
14. El-Bahnasawy, M. M., Salah, R. E., & Al-Esmael, B. A. (2019). Emergency medical services providers' knowledge, attitude, and practice towards infection control measures in Al-Taif city, Saudi Arabia. *International Journal of Community Medicine and Public Health*, 6(4), 1565-1572.
15. Fidahic, M., Nujic, D., Runjic, R., & Boskovic, I. (2018). Knowledge and attitudes regarding standard precautions among emergency medical service providers: questionnaire-based study. *Croatian Medical Journal*, 59(5), 230-237.
16. Hamilton, H. C., & Fox, K. (2018). Identifying and improving knowledge deficits of infection control measures among EMS providers. *Prehospital Emergency Care*, 22(4), 502-509.
17. Hosseini, S. A., & Razmara, A. (2019). Knowledge and practice of ambulance personnel regarding standard precautions for pre-hospital care in Kerman, Iran. *International Journal of Health Studies*, 5(1), 36-40.
18. Keleekai, N. L., Schuster, C. A., Murray, C. L., King, M. A., Stahl, B. R., & Labrozzi, L. J. (2019). Infection prevention knowledge, attitudes, and practices among emergency medical services providers. *Western Journal of Emergency Medicine*, 20(2), 331-339.
19. Khan, I. M., Islam, M. A., & Siddiqua, N. (2017). Knowledge and practice of emergency medical technicians regarding standard precautions in managing emergency cases at selected tertiary hospitals of Bangladesh. *Research Journal of Pharmacy and Technology*, 10(10), 3351-3356.
20. Raj, R., Gupta, S., Mathur, P., & Arya, S. (2019). Knowledge, attitude, and practices towards infection control among healthcare professionals in a tertiary care hospital in India. *Journal of Health Research and Reviews*, 6(4), 176-181.
21. Scheulen, J. J., Jacobsen, R. C., Selland, C., & Pattavina, C. (2018). Assessing and improving knowledge of infection prevention among emergency medical services providers. *Journal of Prehospital Emergency Care*, 22(6), 747-754..
22. O'Connor, C., et al., Knowledge, attitudes and perceptions towards vitamin D in a UK adult population: A cross-sectional study. *International journal of environmental research and public health*, 2018. 15(11): p. 2387.

Table (1): Demographic characteristics of the included paramedics

<i>Variables</i>	<i>Frequency</i>	<i>Percent (%)</i>
<i>Gender</i>		
<i>Marital status</i>		
Single	22	13.75%
Married	131	81.88%
Divorced/Widowed	7	4.37%
<i>Nationality</i>		
Saudi Arabian	156	97.50%
Non-Saudi	4	2.50%
<i>Training in infection control</i>		
Yes	141	88.13%
No	17	11.87%

Table (2): Distribution of the factors related to the knowledge about infection control

Factors	Frequency	Percent (%)
Knowledge level		
Moderate or High	101	63.3%
Lower	59	36.7%
Work Experience		
< one year		24.4%
1-5 years	61	38.1%
> 5 years	60	37.5%

