

Knowledge, Attitudes and Practices of Radiologists and Paramedics Towards Accident and Emergency Preparedness and the Role of Biomedical Engineering in Prehospital Emergencies

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Abstracts

Purpose: The purposes of this study were to assess the knowledge, attitude, and practice of radiologists and paramedics regarding accident and emergency preparedness in hospitals in the southern region of the Kingdom of Saudi Arabia and how to improve their role. **Materials and methods:** This was a descriptive, cross-sectional online survey that was carried out among radiologists and paramedics in the Kingdom of Saudi Arabia. A self-structured, close-ended questionnaire that was administered that consisted of 19 questions was included. The questionnaire validity and reliability were evaluated for vetting and remarks. The questions were circulated through Google Forms, and it was circulated among the study participants through online mode. The data were collected systematically, and SPSS Statistics version 26.0 was used for data analysis **Results:** There were 139 responses, (77 specialist's radiology and 62 paramedics) participated in the study through Google Forms. In the study group, 84 (61.4%) were know the main steps for emergency response in major emergencies (p-value 0.000). Among the 19 questions used to assess the KAP, 12 questions were significant with a p-value less than 0.05. More than 72.6% agree the Management must be adequately prepared when emergencies and accidents occur. The respondents' attitude toward emergency preparedness was generally positive, Only a minority, that is, 43 (30.9%) of the respondents think it is possible for cooperation between radiologists and paramedics to interpret emergency cases and develop treatment plans in the emergency department. **Conclusion:** The level of knowledge was satisfactory among the radiologists and paramedics with a neutral level of attitudes, practice and knowledge regarding disaster preparedness. Follow-up research is essential to maximize the preparedness of the accident and emergency department.

Keywords: emergency department, radiologists, paramedics, knowledge, attitude, practice.

Introduction

The accident and emergency department, also referred to as an emergency room, is a medical facility that specializes in providing immediate and acute medical care to patients who arrive without prior warning [1]. Emergency care is provided during the first hours after the onset of an acute medical condition, such as a heart attack, accident injuries, complications during childbirth, or any health problem that arises acutely and poses a threat to life [2].

Emergency medical response is one of the most important challenges that healthcare teams face in ensuring the provision of high-quality and timely care to patients in critical cases. Success in this field depends greatly on smooth collaboration between various healthcare professionals, including Emergency Medical Services (EMS) technicians, radiologists, and paramedics [3,4]. This multidisciplinary collaboration plays a crucial role in meeting the complex needs of patients during emergencies and accidents [5]. By integrating diverse expertise, healthcare teams can achieve comprehensive, integrated care, contributing to improved patient outcomes and increasing the effectiveness of the overall emergency medical response.

For radiologists, competence is the ability to quickly and accurately interpret radiological images, such as fractures, internal injuries, or neurological abnormalities, which is instrumental in guiding immediate interventions, treatment decisions, and patient outcomes in emergency situations [6,7]. On the other hand, paramedics are considered the front line in responding to emergency situations, requiring knowledge and skill for emergency medical care and procedures [8]. Paramedics' rapid decision-making and application of protocols are essential in the management of time-sensitive emergencies such as cardiac arrests, trauma incidents, and severe respiratory distress [9,10].

The attitudes of radiologists and paramedics toward emergency preparedness are equally important. So that it promotes positive attitudes and cooperation for a smooth response to emergency situations [11]. Furthermore, they must maintain a high level of preparedness, and stay up to date with the latest protocols and technological advances to enhance their effectiveness during crises.

Biomedical Engineering is the rising field in medical science by involving the knowledge of biology and medicine in combination with the principals of engineering to develop devices and procedures which can solve the greatest number of medical and health related problems in this modern world. Therefore, the overall applications of BME are medical imaging, artificial organs, biomaterials, tissue engineering, neural engineering [18].

Thus, the objective of this study is to assess the knowledge, attitudes, and practices of radiologists and paramedics regarding accident and emergency preparedness. Understanding their preparedness levels, training needs, and perceived barriers can inform targeted interventions and policies aimed at strengthening comprehensive emergency response capabilities.

Materials and Methods

Study Design:

A cross-sectional study was conducted to assess the knowledge, attitudes, and practices of radiologists and paramedics regarding accident and emergency preparedness in hospitals in the southern region of the Kingdom of Saudi Arabia, from June to July 2024. A self-administered survey was used to collect data from all specialist's radiology and paramedics in the emergency department.

Study participants and Sample size:

A convenience sample was used to include all the participants as identified from the list of employees available with the hospital administration. The selection of the emergency department specialist's radiology and paramedics was based on their upfront role in responding to an emergency. The study included staff who have more than one year of experience at the study site. Staff who were in vacations or pulled out into emergency department were excluded

Questionnaire

A web-based questionnaire was the primary research instrument. The instrument was adapted from a previous study and modified to suit the objectives of this study [11,12]. The questionnaire comprised four sections consisting of 19 questions was framed, where the first included demographic data with five items. The remaining 14 questions were used to assess the knowledge, attitude, and practices, each with 6, 5, and 3 items, respectively. Literature review was the primary source of secondary data since the researcher compared the primary data findings with those of previous scholars on a similar topic. The final questionnaire underwent a face validity assessment to ensure the effectiveness of the questions in aligning with the study's objectives.

Data Collection:

Data will be collected through structured questionnaires distributed electronically to participants From June to July 2024.

Data Analysis:

Statistical analysis was carried out using the Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA), version 26. Frequencies and percentages were obtained for the categorical variables, while mean and standard deviation (SD) were calculated for the scale variables. The chi-square test was used to assess the association between the categorical variables and the outcome. A p-value less than 0.05 was considered significant.

Result

1.1. demographics of the participants

A total of 139 responses from dental students and dental professionals were collected. About 75 (54%) were within the age group 30 years. Among the study groups, 96 (69.1%) were males and

370 (46%) were males. About 77 (55.4%) specialist's radiology and 62 (44.6%) paramedics were included in the study. 80 (57.6%) participants had a professional experience of less than 5 years, while 75 (54.0%) participants were found to have more than 2 years of professional service at hospital.

Table 1.demographic traits of participants (n=139)

Characteristics	Frequency	Percent (%)
Gender		
Male	96	69.1%
Female	43	30.9%
Age		
≤ 30 years	75	54.0%
≥ 30 years	64	%46.0
Occupational		
specialist's radiology	77	%55.4
paramedics	62	%44.6
Years of professional experience		
≤ 5 years	80	%57.6
≥ 5 years	59	%42.4
Years of professional service in hospitals		
≤ 2 years	64	%46.0
≥ 2 years	75	%54.0

1.2. knowledge, attitudes, and practices of dentists of radiologists and paramedics towards accident and emergency preparedness.

Table 2 summarizes the participants' knowledge, attitudes, and practices of radiologists and paramedics towards accident and emergency preparedness. The study revealed several key findings. 84 (61.4%) were know the main steps for emergency response in major emergencies, while the remaining 55(39.6%) were not know with a significant p value of 0.000. About 63(45.3%) know how to use emergency medical devices and equipment correctly, 54 (38.8%) said no, and 22(15.8%) answered I don't know (p value 0.001). Of the participants, interpreting and analyzing radiographs in the emergency department is important for dealing with emergency cases 65 (46.8%) agreed, 39 (28.0%) said no, 35 (25.2) answered I don't know (p value 0.000). About 73 (52.5%) agreed that cooperation between radiologists and paramedics help improve response procedures for treating emergency cases, 21 (15.1%) disagreed, and 45 (32.4%) answered as don't know (p-value 0.008). About 76 (55.0%) Do You have knowledge of the medical protocols necessary to deal with emergency cases and incidents in the emergency department, 24 (17%) said no, and 39(28%) answered I don't know (p value 0.008).

About 76 (54.7 %) agreed that need to know emergency (accident) operational plans (p=0.1). 101 (72.6%) agreed that Management must be adequately prepared when emergencies and accidents occur (p=0.08). 90 (64.7%) agree that Potential hazards that are likely to cause accidents and emergencies should be identified and dealt with, compared to 21(15.2%) who said no, and 28 (20.1%) who said they did not know (p=0.000). Most respondents, 105 (75.5%) think the emergency operational plan needs to be updated regular (p=0.003), and 94 (67.6%) agree that Emergency simulations should occur frequently in a hospital setting (p=0.00).

Among the professionals', 71 (50.9%) taking courses to improve your knowledge regarding dealing with emergency situations ($p= 0.13$). about 66 (47.5%) they don't have a personal plan for action in the event of an accident or emergency ($p= 0.008$). 43 (30.9%) agreed that think that cooperation between radiologists and paramedics to interpret emergency cases and develop treatment plans in the emergency department, 85(61.2%) said no, and 11 (7.9%) answered I don't know (p value 0.00).

Table 2. knowledge, attitudes, and practices of radiologists and paramedics towards accident and emergency preparedness (n=139)

Characteristics	Responses			P value
	yes	no	Don't know	
Knowledge				
Do you know the main steps for emergency response in major emergencies?	84 (61.4%)	37 (26.6%)	18 (12.9%)	0
Do you know how to use emergency medical devices and equipment correctly?	63 (45.3%)	54 (38.8%)	22 (15.8%)	0.001
Do you think that interpreting and analyzing radiographs in the emergency department is important for dealing with emergency cases?	65 (46.8%)	39 (28%)	35 (25.2%)	0
Does cooperation between radiologists and paramedics help improve response procedures for treating emergency cases?	73 (52.5%)	21 (15.1%)	45 (32.4%)	0.5
Do You have knowledge of the medical protocols necessary to deal with emergency cases and incidents in the emergency department	76 (55.0%)	24 (17.0%)	39 (28.0%)	0.008
Do you think that ongoing training should be provided to all emergency department staff?	99 (71.2%)	22 (15.8%)	18 (13%)	0.00
Attitude				
I don't need to know emergency (accident) operational plans.	38 (27.3%)	76 (54.7%)	25 (18%)	0.1
Management must be adequately prepared when emergencies and accidents occur.	101 (72.6%)	13 (9.4%)	25 (18%)	0.08
Potential hazards that are likely to cause accidents and emergencies should be identified and dealt with	90 (64.7%)	21 (15.2%)	28 (20.1%)	0.00
Training is essential for all emergency department staff	59 (42.4%)	35 (25.2%)	45 (32.4%)	0.002
The emergency operational plan needs to be updated regularly.	105 (75.5%)	25 (18%)	9 (6.5%)	0.003
Emergency simulations should occur frequently in a hospital setting	94 (67.6%)	21 (15.1%)	24 (17.3)	0.00
Practice				
Are you keen on taking courses to improve your knowledge regarding dealing with emergency situations?	71 (50.9%)	45 (32.3%)	23 (16.8%)	0.13
Do you have a personal plan for action in the event of an accident or emergency?	52 (37.4%)	66 (47.5%)	21 (15.1%)	0.008
Do you think it is possible for cooperation between radiologists and paramedics to interpret emergency cases and develop treatment plans in the emergency department?	43 (30.9%)	85 (61.2%)	11 (7.9%)	0.00

Discussion

Emergency department workers, such as radiologists and paramedics, are on the front line of dealing with emergency cases. However, their responsibilities multiply many times during emergencies and incidents at hospital sites. High competence and appropriate skills combined with realistic capabilities are essential to save human lives and enhance human health in emergency situations. This study aims to assess the knowledge, attitudes, and practices of radiologists and paramedics regarding accident and emergency preparedness. Overall, radiologists and paramedics revealed a satisfactory level of knowledge in disaster preparedness. Most of the participants expressed their positive attitude towards accident and emergency preparedness management, and (n=105; 75.5%) of them agreed that the emergency operational plan needs to be updated regularly. The emergency department may have to work on updating the operational plan and sharing it with emergency department staff so that they are ready to deal with any emergency. Only 21 (15.1%) participants disagreed to the need of frequent Emergency simulations in the hospital. Corrigan et al. conducted a study at an Australian urban trauma center, surveying 140 respondents. They found that 83 participants (59.3%) had received prior training in disaster management, 53 (37.9%) had participated in disaster simulation drills, and 18 (12.9%) had direct experience in managing disasters [13]. The study highlighted that those with training and simulation experience felt more prepared to handle such events compared to those without such experience. The conduct of a drill in the emergency department may increase the knowledge and continually improve its practice in Emergency preparedness. In this study, participants were found to be adequately aware of emergency situations, while they were less familiar with know about emergency (accident) operational plans. Ogedegbe et al. emphasized the critical role of disaster preparedness training for healthcare providers [14]. Overall, radiologists' and paramedics' knowledge of response/preparedness activities in the event of a large-scale emergency incident was found to be statistically significant. The study findings also highlight the need to implement additional educational programs in emergency preparedness regarding accident emergency preparedness literacy, and the need for accident emergency preparedness education and training is well recognized in the literature [7,12,14].

Initiatives aimed at developing and training the workforce play a crucial role in promoting interdisciplinary cooperation. Continuing education and training programs should be designed to provide health care professionals with the knowledge, skills, and attitudes necessary to work effectively in multidisciplinary teams [15]. In addition, multidisciplinary research partnerships should be encouraged to explore innovative approaches to delivering emergency medical care. Joint research endeavors can play a role in addressing gaps in knowledge, evaluating the effectiveness of multidisciplinary interventions, and identifying best practices to improve patient outcomes in emergency settings [16].

Biomedical engineering is a relatively new science in the academic field. Its development has allowed to introduce technology in medical applications, especially through clinical simulation. The high-fidelity mannequins with physiological response are a clear exponent. They are used both for the acquisition of students of both basic and advanced skills, as well as training when working in multidisciplinary teams. In a second phase these same mannequins are used for a first evaluation of the students before their clinical practices thanks to the approach of clinical

cases. Currently, holograms and other technological means are used to study in depth the physiology and physiopathology, as well as the anatomy, of the human body. The postgraduate training of health personnel working in emergency medical services has the following objectives: first, to provide individual, specialized training in the field of emergency; Another aim is the continuous training of health teams, and a third objective would be to form high-performance teams [6]. For this, not only do we have the clinical simulation, we also have augmented virtual reality, immersive virtual reality, CAVE's, [7] etc. That they give us a great methodological variety for the learning of the emergency team students the student can repeat as many times as he wishes until he has acquired skills, non-technical skills or simply having the immersive experience in the emergency field. For this, it is necessary to and medical emergency situations teams with engineers and health specialists about teaching and medical emergency situations. Teams that complement each other and mark the difference, in a transdisciplinary way, between current and future training. At the moment we live a very productive moment in this sense. It innovates in products present in ambulances, such as the "Smart BenchTM", platform that allows to know the real weight of any patient, facilitating the calculation of pharmaceutical doses, fluids, etc. reducing human error or devices traditionally anchored to the hospital environment, such as the CT scanner housed inside an ambulance to detect stroke immediately and effectively, thanks to the technical advances of biomedical engineering . Many other examples could be cited. The most important one is to provide the mobile units with technical means to be able to obtain the trace ability of the decisions made during the emergency to increase the safety of our patients and thus their survival[18].

One limitation of this study is that reliance on self-reported data may introduce response bias and limit the generalizability of the results. Future research should aim to mitigate these limitations through larger sample sizes, randomized study designs, and objective outcome measures.

Conclusions

The current study showed that the level of knowledge among radiologists and paramedics regarding disaster preparedness was satisfactory, but attitudes and practices were average. This indicates an urgent need to improve our emergency response to be compatible with current requirements for emergency healthcare around the world. To enhance the knowledge, attitudes and practices of health professionals in the studied and other hospitals. Accordingly, the study recommends the need to obtain basic education on emergency response for all employees, especially those involved in emergency management, and to develop and implement emergency plans and drills regularly to enhance their readiness to deal with such situations.

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