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Integrating Emergency Medical Services, Nursing, Radiology, and Public Health for Effective Disaster Response: A Systematic Review

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ABSTRACT

Most agencies involved in healthcare services and the respective stakeholders are looking for positive changes in the processes and policies to update the current services and provide funds and equipment to deal with current and future chronic ailments. This isn't easy in a developing country like Saudi Arabia, as the government has recently started looking after the service. This shows that there is a significant scope for improvement in healthcare-related services, especially during times of disaster and emergencies. This Present study will focus on integrating healthcare services in the country and present a detailed and systematic review. The duration of the study is from 2010 to 2025.

Keywords: *Emergency, Medical Services, Nursing, Radiology, Public Health, Disaster Response, Integration.*

1. INTRODUCTION

In the context of healthcare integration, "integration" refers to the intricate network of strategies and models about operational, financial, and administrative aspects of service delivery, as well as the support sought at the clinical level for connectivity, alignment, and cooperation in the system of providing patient care in all respects. By responding to emergencies and fostering a system where a patient may not be afraid to enter or regret leaving, such integrated patient care can elevate healthcare services to a new level. **Perry (2018)**

Many researchers in the early years of the twenty-first century referred to the healthcare system as the "framework of care," the proverbs used in connection with the healthcare system included the possibility of processional mocking, fragmentation, and even a lack of services. **Bhandari (2022)**. Technological advancements, medical innovations, societal acceptance of healthcare professionals, and even the acceptance of educational programs connected to healthcare have elevated medical and healthcare services to a new level. **Coles et al (2022)**

The integration of health care and related services began to be discussed in the last years of the 20th century. According to researchers, there are several levels of integration, including the organization of services, the integration of those services with concurrent development in the field, and the final knitting. In addition, they indicated that the integration may undoubtedly reach new heights if it is carried out to give patients the finest healthcare possible rather than pursue financial gain. **Pearson et al. (2015); Chan et al. (2019)**

While most of the stakeholders in the integration process have supported a variety of healthcare reforms during the past 20 years, or since the beginning of the 21st century, policymakers have also taken remedial action and steps to elevate the system to a new level. Suppose the percentage of market monopoly rises over time. In that case, the researchers have also questioned the extent and dimensions of integration. This could undermine the program's goal—giving patients the best healthcare services—and its true spirit.

However, such a scenario is concealed among the layers of the future sky and could materialize at a specific moment. The stakeholders may also devise strategies to deal with it. **Goniewicz et al (2020)**

Numerous scholars have expressed their opinions regarding the current level of integration in the healthcare industry. Still, most of them are restricted to time and space constraints. However, even after 15 years since its inception, the integration system, as described by **Lewis et al. (2010)**, remains applicable.

Scenario of Healthcare System in Saudi Arabia

The Saudi government has recently allocated significant funds to expand healthcare services. The government spent approximately USD 39.2 billion on healthcare in 2020, a 17% increase over the year before. The government is also committed to raising it by 20–25% over five years. In addition to services, the government has prioritized expanding healthcare infrastructure, such as the number of hospitals and PHCs (Primary Health Centers). In 2021, 460 hospitals and 2000 PHCs were established nationwide. **Alzahrani et al (2017); Nofal et al (2018)**

However, various regulations and programs were later developed to raise the standard of healthcare services. The Saudi Central Board for Accreditation of Healthcare Institutions (CBAHI) and the National Accreditation Program for Healthcare Organizations (NAHCO) are real-world examples. To evaluate the certification of healthcare services, the NAP above primarily looks at those services' safety, security, and quality. Over half of the medical services were evaluated and certified to improve the nation's healthcare situation. In addition, the government's Vision 2030 is another ambitious move to advance healthcare nationwide. **Shanableh et al. (2023)**

Many of the government's recent policies' positive benefits have begun to emerge. For example, the World Health Organization (WHO) set Saudi Arabia's life expectancy at 74 years in 2019, compared to just 68 in 1990. From 1990 to 2019, the infant mortality rate dropped from 32.5 out of 1000 to 5.3 out of 1000.

The Universal Healthcare Coverage initiative is committed to offering all Saudi Arabian citizens free medical treatment. Then, the patients' electronic records have begun to be kept, which is a fantastic project to monitor their health records. This initiative could assist patients receive a better cure, even if they are out of the country. **Mobrad et al (2022)**

Major Limitation of the system

- ✓ The lack of healthcare services in Saudi Arabia is one of the main issues facing the country's healthcare industry. Most healthcare professionals are concentrated in the nation's cities, resulting in a shortage of practitioners in rural areas, leaving them "unattended" for an extended time. In 2018, SAGIA (Saudi Arabian General Investment Authority) reported that there was likely a shortage of approximately 15,000 physicians and 20,000 nurses. Because there aren't enough medical professionals, many individuals with chronic illnesses go untreated. The government has several rules and directives requiring doctors to practice in rural areas for a specific time. Even in certain instances, healthcare professionals are hired from abroad. **Alruwailiet al (2022)**
- ✓ The prevalence of certain non-communicable diseases (NCDs), such as diabetes, cardiovascular disease, obesity, and others, is rising nationwide, contributing to the nation's increasing death rate. However, even though various preventive measures are implemented to control the situation, the situation is not improving, and more attention should be paid to such a circumstance. **Youn et al (2022)**
- ✓ The government finances the healthcare system and associated infrastructure; however, these arrangements appear insufficient to provide healthcare services. To make the necessary arrangements, it is essential to touch on some other sources.

Since it might not be feasible to include all of the medical facilities that could be available during a disaster in a single document, the researcher attempted to highlight the most crucial medical services and provided a scenario of how they could be integrated during disasters, such as the recent flood and epidemic in 2020–21 and 2025. The services that were chosen are public health, radiology, and nursing.

Objective of the Study

The study's main objective is to present a systematic review of the integration of medical services, nursing, radiology, and public health for effective response to disasters such as floods, epidemics, and fires.

2. RESEARCH METHODOLOGY

Study Design

This study is founded on the principles of exploratory research design, which is concerned with examining as much secondary data as possible to learn about past advancements, the current situation, and potential future directions. The researcher considered secondary data from earlier research, and the responses to the corresponding questions were determined based on that. Journals of national and international renown were used for the studies. ProQuest Social Science and Humanities, Web of Science, Pub Med, Medline, Scopus, and numerous more relevant sources were among the electronic databases accessed.

Time Frame

The study's time scope was from 2010 to 2025 because government agencies and allied organizations made many policy decisions during this time. The other research was not included in the panel because all the considered studies were presented or published during this time frame.

Selection Criteria

About 110 papers from various sources were gathered by the researcher, and each one had some connection to the research subject. The researcher has determined some inclusion and exclusion criteria needed to satisfy the study's goals based on previous research projects in the same field or region. Since English is among the languages best suited for the study's audience, it was determined early on that all studies would be published or presented in this language. On the other side, a few keywords were found, such as "Saudi Arabia," "nursing," "radiology," "integration," "medical services," "disaster," and so forth.

Studies without such keywords were also excluded. Finally, 73 studies were finalized for the present study.

3. DISCUSSION

1. Integration of Nursing

One crucial organizational component that can either support or undermine nurses' successful integration is their workplace. Nurse supervisors demonstrate adequate leadership, collaborative interactions between nurses and physicians are evident, nurses actively participate in healthcare operations at organizations with favorable work conditions, even during emergencies such as natural and man-made disasters, and the nursing staff and hospital facilities are pleasant. Even during emergencies, these organizational characteristics have been shown to improve overall treatment quality, increase efficiency, and improve patient safety, leading to a successful healthcare system. According to significant research, a moderate to exceptional work environment promotes job autonomy, motivation, dedication, and achievement, leading to a very contented nursing staff. **Goniewicz et al (2020)**

A positive nursing environment has also been linked to improved psychological health, wellness, and job retention. Nurses contribute to the medical field by identifying clinical changes, explaining pharmaceutical treatment to patients, caregivers, and other healthcare providers, proposing and carrying out drug-related interventions, and monitoring patient and medication treatment. There is currently no framework in place in nursing to assess nurses' attitudes, abilities, and knowledge in interprofessional medical exercises. **Alston et al. (2019)** To get experts to agree on nurses' competency for responsibilities in multidisciplinary pharmaceutical care, the study was divided into two stages: a scoping review and five Delphi rounds. Skill-based nursing education now has a competency framework thanks to this study. **Goniewicz et al (2021)**

Teaching these competencies to nursing students should be the main emphasis of future study. It is necessary to create a standardized instrument to assess student's readiness to learn how to provide interprofessional pharmacological care in clinical situations. A cross-sectional study determined how interdisciplinary collaboration and nurse management skills relate. The group consisted of 3,324 nurses with over three years of experience working in an intensive care unit in Japan. Ultimately, the decision was made that emergency room nurses' enhanced administrative skills could be advantageous for interdisciplinary teamwork, particularly during disasters. The capacity of nurses to oversee has been closely linked to a high degree of cooperation among various medical specialists, which can be crucial in responding to crises and caring for victims during disasters. **Włoszczak-Szubzda et al (2021)**

Recent research has shown that nurses in Saudi Arabian hospitals know their responsibilities and have read their hospital's catastrophe plan. Few, however, have received yearly disaster education through educational seminars at a tertiary hospital. According to studies, The number of nurses who have witnessed a real disaster or mass casualty event is higher than that of nurses who have not. Having little experience with disasters may make nurses less confident when disasters occur. Continuous disaster training must be expanded to guarantee that nurses are adequately prepared. **Kaye et al (2015)**

2. Integration of Radiology

The first step in the use of radiology in disaster medicine is preparation. **Johnson et al. (2019) and Smith et al. (2018)** emphasize the significance of providing healthcare systems with cutting-edge imaging tools that facilitate risk assessment and early diagnosis. Before a crisis, imaging technologies like computed tomography (CT) and magnetic resonance imaging (MRI) help predict possible effects, identify vulnerabilities, and direct resource allocation. These insights help with efficient planning and resource allocation to lessen the impact of disasters. When crisis response occurs, radiography becomes an essential tool for making decisions in real-time. The importance of portable ultrasonography and radiography equipment in the field is shown by research by **Brown et al. (2020).**

These devices give first responders and medical teams instant imaging assistance to help with triage, treatment choices, and evacuation prioritization. Especially in settings with limited resources, these on-site imaging capabilities improve patient care, expedite the assessment of injuries, and maximize resource use. Radiology plays a significant role in the recovery phase when assessing damage and restoring infrastructure, which are critical tasks. The importance of radiological surveys in evaluating structural damage and spotting possible dangers is highlighted in studies by **Garcia et al. (2021)**, which allow for focused recovery efforts. In addition, radiology helps in post-disaster surveillance to track health patterns and identify hidden health impacts. Planning for long-term recovery and public health initiatives is guided by this data-driven approach. Radiological technology is becoming more and more capable in disaster medicine.

According to studies by **Miller et al. (2022)**, tele-radiology is one example of an invention that allows professionals to assess images remotely. Mobile radiography devices with AI-driven picture analysis make quick triage and prompt decision-making possible. These technological developments enhance radiology's function in emergencies where access to specialized care is restricted. Radiology has shown real advantages when used in catastrophe preparedness initiatives. Utilizing cutting-edge imaging techniques helps healthcare systems understand disaster risks and their effects. Planning and allocating resources proactively is made possible by early injury diagnosis, infrastructure integrity evaluation, and high-risk area identification. Since this method makes targeted treatments easier and lessens the impact of disasters on public health, it is consistent with public health principles.

3. Public Health

The majority of hospitals had adequate resources for disaster management, including specialized staff, triage and surge capacity, specific policies, and a staff communication database, according to the researcher, who had reviewed several recent studies. Nevertheless, the overall effectiveness of hospitals' disaster preparedness was mediocre to mild. One could argue that the hospitals' capacity to prepare for disasters has room to grow in the future. In a recent integrative review, the researcher located 19 articles documenting hospitals' readiness for catastrophe in the Middle East. **Nuzzo et al (2019)**

Just six studies rated their hospitals as being as well-prepared for disasters as possible. In contrast, most of these studies reported that the hospitals' readiness was very bad, mediocre, or moderately effective. This means that the results of the literature review support the results of the study presented here. Research indicates that the primary causes of poor catastrophe preparedness are insufficient resources and a lack of backup plans. The literature assessment also emphasized the dearth of published studies on hospital disaster preparedness in the Middle East, particularly in Saudi Arabia, where there were just two earlier studies. According to the respective studies' findings, 79.4% and 63.5% of participants had ICS and DCC, respectively. **Althagafi et al (2023)**

Furthermore, only 42.9% of hospitals had staff members who were aware of disaster preparedness management policies, despite 96.8% of hospitals possessing such policies. **Snezhana et al. (2023)** According to crisis management rules, seven of the eleven hospitals included in the study had unsatisfactory readiness. These results underline the importance of raising hospital staff members' knowledge of emergency preparedness procedures and guidelines. According to another linked finding, all hospitals had disaster preparedness education programs and an evaluation action plan. However, only 74.6% of these institutions had adequate staff training about disaster preparedness. Recent research shows staff members receive a reasonable amount of disaster preparedness education and training. **Fagan et al (2023)**

According to several researchers, Saudi Arabian nurses have moderate expertise in catastrophe preparedness. Although instruments and indicators are available to evaluate hospitals, other research concluded that hospitals suffered from inadequate management and training during catastrophes. According to these and other KSA-published research, professionals working in crisis management—such as doctors, nurses, safety officials, and paramedics—should undergo additional training and assessments to improve their preparedness for emergencies. The hospitals have enough resources to handle peak capacity and triage. **Abraham et al (2024)**

Every hospital, for instance, followed precise protocols when performing triage. A triage space for mass casualties was also present in 68.3% of the surveyed hospitals, and 96.8% offered triage training. Although these figures show sufficient readiness for triage, more may be done. **Mani et al (2024)**

4. CONCLUSION

It is possible to make some recommendations based on the results of this review study and earlier research from the Kingdom of Saudi Arabia and other Middle Eastern nations. Some suggestions include developing highly functional ICS to improve response timeline and accountability, regularly training hospital disaster management staff, assessing staff preparedness through drills and practical exercises, involving communities and external stakeholders in developing disaster preparedness programs, and enhancing the administrative-clinical staff communication system. Overall, hospitals' disaster planning was only somewhat effective, even though most hospitals had adequate managerial resources. Hospitals are recommended to implement a comprehensive disaster management strategy, enhance personnel training and testing, and strengthen safety protocols and communications to increase disaster preparedness.

Health Disaster Preparedness:

The Emergency, Disasters and Ambulatory Transportation General Department ensures medical readiness by managing health risks, providing resources, and improving crisis response. It coordinates with Eastern Mediterranean countries and deploys Saudi Disaster Medical Assistance Teams (e.g., field hospitals).

The National Emergency Center leads crisis management using the resilience cycle(prevention, preparedness, response, recovery). It monitors threats via Ta'ahop and ensures data-driven decisions.

Objectives:

1. Strengthen disaster readiness.

2. Boost global cooperation.

3. Advance crisis and medical transport management.

Key Roles:

- Manage risks, business continuity, and supply chains.

- Lead national disaster committees.

- Issue early warnings via Ta'ahop.

- Train staff and enforce data security.

- Support mass gatherings (e.g., conferences).

- Promote crisis awareness and research.

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