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Emergency preparedness capacity of a university hospital in Ghana: a cross-sectional study

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ABSTRACT

Background: The health and safety of people are often endangered during emergencies and disasters. Efficient emergency management systems ensure that mitigation, preparedness, response, and recovery actions exist to preserve the health, safety, and welfare of the public. Failure to carry out appropriate responses can have adverse consequences for both emergency responders and casualties; hence, the need for emergency preparedness. This study sought to assess the state of emergency preparedness capacity of the Kwame Nkrumah University of Science and Technology hospital in Ghana.

Methods: A facility-based cross-sectional study was conducted between December 2018 and February 2019 using three guidelines developed respectively by the World Health Organization, the Ministry of Health-Ghana, and the Ghana Health Service. The hospital's emergency preparedness was assessed regarding the emergency policies, plan, protocol, equipment, and medications.

Results: Overall, the hospital's emergency preparedness level was weak (57.36%). Findings revealed that the hospital had inadequate emergency equipment, and supplies for emergency care delivery, especially during upsurge. It also did not have an emergency planning committee. There were noticeable deficiencies in some emergency resources such as chest tubes, basic airway supplies, and many emergency drugs. Other vital emergency tools such as pulse oximeter, thermometer, and emergency medications were inadequate. The hospital had a strong emergency plan and policies on assessment (77.8% and 78%) respectively.

Conclusion: The Kwame Nkrumah University of Science and Technology hospital is not prepared sufficiently for an emergency surge, and this poses a major health challenge. Emergency items must be made available, and the organization and planning of emergency service provisions must be improved to avoid preventable deaths during an emergency surge.

Introduction

Emergency care is defined as the delivery of timely medical services within minutes or hours of conditions requiring rapid intervention to avoid death or disability [1,2]. Conditions such as injuries, communicable and non-communicable diseases, acute decompensation of chronic conditions, and complications of pregnancy require timely, high-quality care to prevent death or permanent disability and thus fall within the ambit of emergency medical care. These conditions account for about 2.1 billion global deaths and disability-adjusted life years annually [3]. Thus, the integration of emergency care systems into the overall health system is notably lifesaving but this has not lived to its full potential in low- and middle-income countries (LMICs), where the burden of these conditions is highest, and the outcomes are disproportionately worse [4].

Globally, LMICs have the highest burden in medical, surgical, and traumatic emergency conditions [5]. Due to insufficiencies in material resources, organizational planning, and human resource capacity, there is inadequate preparation to manage and treat emergencies when they occur [6–8]. It is reported that 71% of people in Sub-Saharan Africa

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live within two hours of a hospital that potentially provides emergency medical services (EMS) [9]. As estimated by Reynolds et al [10], a highly efficient emergency care service (ECS) can avert over half of all deaths in LMICs [10]. However, these services are non-existent in most Sub-Saharan African countries and where they are available, they are under-resourced. In Nigeria for example, of the 1.6 million deaths recorded annually, about 10-15% occur in emergency departments [11].

Even though the development of the emergency care services framework by the World Health Organization (WHO) and other allied health institutions has led to improvement in developing countries [12], there is still a huge burden during emergencies due to the weak and fragile healthcare system as compared to higher income countries [6,7,13]. The infrequent capacity planning, inadequate infrastructure as well as the lack of emergency preparedness programs, characteristic of LMICs, can lead to poor patient outcomes [14].

Efforts to strengthen emergency care capacity of hospitals in Ghana have focused on tertiary-level hospitals [15] to the neglect of others where health facilities are poorly equipped and overcrowded. None of these studies or interventions have focused on university hospitals [15–18]. University hospitals provide services to students, university staff, dependents, and the communities within which they are located. The Kwame Nkrumah University of Science and Technology (KNUST) hospital is geographically located along the main busy Kumasi-Accra Road, rendering it one of the first points of call for emergency cases. To be able to manage emergencies more efficiently, the hospital should have the needed resources (such as equipment, and infrastructure), emergency protocols and personnel who are trained on these protocols. There is a lack of evidence regarding the level of this hospital's preparedness capacity to handle emergencies. This paper assessed the Emergency Department's (ED) preparedness capacity of the hospital and an aspect of its Emergency Management System (EMS) such as focusing on emergency operative plan (EOP), policy and protocol.

Methods

Study design

A facility-based cross-sectional assessment was conducted to assess the emergency preparedness capacity of the KNUST hospital concerning the emergency plan, protocol, policies, equipment, and medications.

Study site

The University hospital is situated on the premises of Kwame Nkrumah University of Science and Technology and the main Accra-Kumasi Road. The hospital is bounded by the Ghana commercial bank to the north, and to the west by the maintenance department, security services department, and fire service station. To the east by the Accra- Kumasi highway and to the south are the Anglican and Catholic Churches.

The hospital has a 150-bed capacity and provides specialist services such as gynecological, obstetric, medical, surgical, pediatric, and emergency services. The hospital has about 200 permanent staff and 140 contract staff. The staff includes doctors, nurses, pharmacists, anesthetists, biomedical scientists, and a biostatistician. The hospital provides care to over 75,000 student population, 3000 regular staff, 600 pensioners, and numerous staff dependents. Although the hospital was originally established to provide care to the health needs of students, staff, and staff dependents of the University, it currently provides services to nearby communities such as Ayigya, Bomso, Ayeduase, and Kentinkrono. The hospital also receives referrals from other neighboring hospitals and health centers.

Table 1
Emergency preparedness plan and policy assessment for KNUST hospital.

Variable	Availability (Percentage)
Emergency Plan (9 items)	
Command and control	2 (100)
Communication	2 (100)
Safety and Security	2 (100)
Triage	0 (0)
Surge capacity	1 (50)
Continuity of essential services	2 (100)
Human resource	1 (50)
Logistics and supply chain management	2 (100)
Post-disaster recovery	2 (100)
Total Emergency Plan (9 items)	14/18 (77.78%)
A designated place for emergencies	2 (100)
Provision of emergency services	2 (100))
Availability of 24-hour emergency service	2 (100
Use of triage system	0 (0)
Total Emergency Policy (4 items)	6/8 (75%)

0- not available, 1- partially available, and 2- fully available.

Data collection

Data were collected at the emergency service enclave of KNUST hospital from December 2018 to February 2019. The assessment covered the hospital's ED preparedness capacity (equipment and medications) and EMS, focusing on the availability of an emergency plan, policy and protocol. The nurse in charge of the emergency unit assisted with the needed documents and the emergency resources available at the unit for inspection.

Equipment and medications were all assessed and rated using the checklist by the Ministry of Health – Ghana (MoH) policy guideline document [19]. This was done by observation and rating the availability and adequacy of equipment and medications. The emergency equipment was assessed with a 63-item checklist focusing on airways, breathing, circulation, disability, diagnostic imaging, personal protective equipment, and procedural equipment. The emergency medications were assessed with a 52-item checklist [19].

The emergency plan was assessed using the WHO checklist [20] which covered nine priority areas namely, i) command and control, ii) communication, iii) safety and security, iv) triage, v) surge capacity, vi) continuity of essential services, vii) human resource, viii) logistics and supply chain management and ix) post-disaster recovery. The hospital's EOP was compared to the WHO checklist and rated on a Likert scale of 0 to 2. The protocol was assessed using the Ghana Health Service peer-performance review module on the emergency services and systems (Appendix 1) and the emergency care preparedness supportive supervision checklist (Appendix 2). The policy was assessed in four areas, namely, the provision of emergency services, designated places for emergencies and availability of 24-hour emergency service, and the use of a triage system for screening patients [19].

Data management and analysis

Data was collected on paper forms and analyzed using Microsoft Excel (version 14). The data was cleaned and classified under the various subheadings -availability and adequacy (Table 1-4). Five variables (plan, policy, protocol, equipment, and medications) were assessed in this study. All the variables were assessed for availability. The plan and policy were assessed on a scale of 0-2 (0- not available, 1- partially available, and 2- fully available). The protocol, basic emergency equipment, and medications were evaluated on a scale of 0-3 based on their availability and adequacy (*Availability & Adequacy*: 0 – Absent; 1 – Inadequate (available to less than half of those who need it); 2 – Partially adequate (available to more than half, but not to most who need it); 3 – Adequate (present and readily available to almost everyone in need and used when

Table 2
Assessment of emergency protocol for KNUST hospital.

Variable	Frequency (Percentage)
Protocol (23 items)	
Existence of an emergency protocol (6 items)	5.5 (91.7)
Structure (Emergency Care & Triage) (10 items)	7 (70.0)
A & E Focal Person/Team Availability and Training (7 items)	2 (28.6)
Total	14.5 (63.0)

0-Absent, 1- Present, 0.5 - Partially present

needed) [15]. Finally, the level of preparedness was categorized to be "weak" if the average percentage score was 33.3% to 66.6% and strong if the average percentage score was 66.7% - 100% [19].

Ethical Approval

Ethical approval was obtained from the Committee on Human Research, Publications, and Ethics at the Kwame Nkrumah University of Science and Technology (KNUST) (CHIRPE/AP/006/19). Institutional approval was also obtained from the Medical Director of the university hospital and key individuals with depth knowledge of the subject matter consented to be interviewed.

Results

Emergency preparedness plan and policy

Results of the study showed that the facility had a documented emergency operative plan covering six out of the nine key components. Two areas; surge capacity and human resources were mentioned briefly, and one area; triaging, was not mentioned at all (Table 1). Regarding the policy on accidents and emergency care, three out of the four items recommended by the MoH, Ghana, were carried out, apart from the use of the triage system (Table 1).

Emergency protocol and equipment

Twenty-three (23) items were evaluated under the emergency protocol (Table 2). These items were categorized into 3 sub-headings; *Existence of Emergency Protocol (6 items); Structure of the Emergency Care and Triage (10 items); and Focal Person/ Team Availability and Training (FTAT) (7 items)* (Table 2). Although there was an emergency protocol, but there was no duty roster for the team members hence graded 0.5 (partially present). Two out of seven protocol items were available. The majority of FTAT items (63%) were absent. For example, there was no training report on emergency preparedness for RTA, not all team members had training on life-saving skills; not all staff were trained in managing emergencies. There was no report of life-saving support training for 2019, and not all clinical staff had been trained in basic life support.

Sixty-three items were assessed as part of emergency equipment. Most of the physical resources for resuscitation (67.9%), were unavailable in the emergency unit. Many items (83.3%) used to establish an airway promptly such as a laryngoscope, endotracheal tube, bag-valve mask, and Magill forceps were absent (Table 3). Items to maintain breathing and circulation like chest tube, underwater seal drainage, peak flow meter, transport, and mechanical ventilator were also absent.

Essential resources such as electronic cardiac monitors, defibrillators, fluid warmers, and central venous catheters to ensure there is adequate and proper circulation were not available. Materials to manage disability were absent except cervical collar. Imaging items such as computer topographic scan (CT-scan) and ultrasound machine were available (present) except for the portable X-ray machine and image intensification device which were absent (Supplementary Table S1). Almost all relevant laboratory items such as haemoglobin, and blood electrolyte analysers were available. Similarly, diagnostic media for microbes and other analysers for blood chemistries, except those for measuring serum lactate were available (Supplementary Table S1). Personal Protective Equipment (PPE) such as goggles, and gowns were absent. However, items such as oxygen supply, intravenous catheters, and bandages were adequate and readily available.

Table 3
Emergency equipment assessment for KNUST hospital.

Variable	Frequency (Percentage %)
Equipment (63 items)	
Airway (10 items)	5/30 (16.7)
Breathing (9 items)	10/27 (37.0)
Circulation (11 items)	14/33 (42.4)
Disability (6 items)	1/18 (5.6)
Diagnostic Imaging (6 items)	10/18 (55.6)
Laboratory (7 items)	11/21 (52.4)
Personal Protective Equipment (6 items)	9/18 (50.0)
Procedural Equipment Tray (8 items)	10/24 (41.7)
Total	70/189 (37.0)

0 – Absent; 1 – Inadequate (available to less than half of those who need it); 2 – Partially adequate (available to more than half, but not to most who need it) [15].

Table 4
MoH- Ghana checklist for emergency medications at KNUST hospital.

Variable	Frequency (Percentage)
Medications (52 items)	
Antiseptics and disinfectants (2 items)	6/6 (100.0)
Pulmonary disorders (1 item)	3/3 (100.0)
Anaphylaxis (2 items)	4/6 (66.7)
Gastrointestinal disorders (2 items)	4/6 (66.7)
Pain, fever, inflammation (3 items)	5/9 (55.6)
Diuretics (2 items)	3/6 (50.0)
Fluid, blood products, plasma expanders (7 items)	8/21 (38.1)
Anticonvulsants (3 items)	3/9 (33.3)
Infections (1 item)	1/3 (33.3)
Poisoning, envenomation, wounds (4 items)	3/12 (25.0)
Anesthesia (9 items)	6/27 (22.2)
Cardiovascular disorders (8 items)	5/24 (20.8)
Hormone disorders (2 items)	1/6 (16.7)
Medications affecting blood (3 items)	1/9 (11.1)
Burn care (1 item)	0/3 (0.0)
Minerals (2 items)	0/6 (0.0)
Total	53/156 (34.0)

Emergency medications

Of the 52-items assessed, less than 50% of the emergency drugs were unavailable and for those that were available; medications for anesthesia, cardiovascular disorders, and those affecting the blood system were inadequate (Table 4).

Overall, the total assessment score was 57.36%, and the hospital was rated weak in its emergency preparedness (Table 5). Despite earning credits for having an emergency plan and policy in place, the absence of an emergency protocol, shortage of medications, and inadequate equipment, culminated in the low rating (Table 5).

Table 5
Overall Emergency Preparedness Score.

No.	Parameters or variables	Number of items	Score ranges	Score obtained	Percentage of score	Preparedness level
1	Emergency plan	9	0 – 18	14	77.8	Strong
2	Policies	4	0 – 8	6	75.0	Strong
3	Protocol	23	0 – 23	14.5	63.0	Weak
4	Emergency equipment	63	0 –189	70	37.0	Weak
5	Emergency drugs	52	0 – 156	53	34.0	Weak
	Total	151	394	157.5	286.8/500*100 57.36%	Weak

Discussion

The present study revealed that KNUST hospital has an emergency plan which falls short of one variable (triage) required to make it comprehensive according to WHO guidelines [20] (Table 1). Triaging is a vital part of an emergency care organization with standard specifications for effective, timely, and appropriate categorization of patients depending on their acuity [21]. Such prompt classifications are essential for improving patient flow to decrease overcrowding in the emergency unit and ultimately help fast-track the identification and treatment of life-threatening conditions [22]. Such interventions, as inferred from well-equipped hospitals, reduce the overall length of stay and waiting time resulting in improved patient and health provider satisfaction [21,22]. Though important, triaging is still under-utilized, under-resourced, and poorly researched in many areas [23]. In 2004, The South African Triage Scale (SATS) was developed as a simple tool for triaging in South Africa and has since proven reliable, valid, and widely used in low–middle-income countries [21,23,24]. Based on these achievements, the MoH, Ghana, recommended that SATS become the method of choice for triaging for all hospitals in Ghana [25,24]. Our current research suggest that urgent attention is needed in this area for a more effective emergency service.

Additionally, the limited number of well-trained staff in the emergency department limits the overall efficiency of the implementation of the plan. Preventive measures and preparedness for emergencies have been established in the health sector by a resolution of the World Health Assembly for several years now [26]. Thus, the availability of a documented emergency operative plan signals a hospitals commitment to provide emergency care. However, having a plan alone does not guarantee success as it requires commitment to provide the needed resources to implement it to the latter.

The policy recommendations require hospitals in Ghana to have a designated space for an emergency, provide 24-hour emergency services and use the SATS to triage patients [25,27]. The hospital complied with all except the use of the triage system which was not carried out (Table 1). Triaging comprises vital signs such as mobility, temperature, heart rate, respiratory rate, blood pressure, consciousness level, and trauma [21]. Only temperature, pulse, and blood pressure are assessed routinely at the hospital triage, limiting the unit's capacity and effectiveness in the detection of emergencies. This limitation is largely attributed to the lack of well-trained staff in triaging and space as both the Outpatient Department (OPD) and emergency units occupy the same space. Besides, the same staff are assigned to both the OPD and emergency units. These inadequacies concerning the implementation of policies have been associated with high levels of preventable casualties at healthcare facilities in developing countries [28,29]. Another factor that was a weakness in the KNUST hospital emergency policy was the absence of a well-trained focal person or team who are always available to render emergency services.

The results of the current study also showed a critical lack of several emergency care medications and equipment (Tables 2 and 3). This is in sharp contrast to the MoH regulations which require minimum thresholds of 63 and 52 for equipment and medications respectively (Tables 3 and 4). Our findings revealed that some emergency medications, like anesthetic agents, were not available at the emergency department because the hospital has directed that all suturing be done in the theatre. However, for some medications such as plasma expanders, glucagon, heparin and naloxone, the hospital had not procured them partly because they refer majority of emergency cases to a tertiary facility. This practice would have to change since several needless deaths could be avoided if the hospital is adequately resourced in this area. The findings corroborate studies by Norman et al, who showed that many hospitals in Ghana were not adequately prepared for emergencies [14]. After a decade since the report by Norman et al, the situation has sadly not changed for emergency health care at the KNUST hospital despite many advances in the health care delivery for other units of the hospital. Other studies conducted on the evaluation of emergency care in Ghana found similar weak emergency planning and care systems in other hospitals [15,30]. The inadequacy in equipment and unavailability of essential medications could be a significant factor in the many referrals (including trivial cases) to the already over-burdened regional and tertiary hospitals. The lack of equipment and unavailability of essential medications also create undue delays in processes at the emergency unit, as patients are put on hold and in long queues for the use of equipment. The associated repercussions on patient health and survival, and the overall emergency service cannot be overstated. Therefore, in addition to human resources and operations, and investment in education, developing a successful emergency care system requires designing, building, and maintaining high-quality emergency departments [31].

Due to our inability to obtain certain data, we could not explore other variables that could have afforded us a comprehensive assessment of the emergency management systems at the KNUST hospital.

Conclusion

It is evident from our findings that the emergency capacity of the KNUST hospital is inadequate, especially concerning protocol, equipment, and medications. This requires urgent intervention by the university and hospital management.

Dissemination of results

A policy brief has been drafted, using the findings of the research, and shared with the hospital management. A presentation of the results was made to the staff of the hospital during the monthly clinical meetings.

Authors' contributions

Authors contributed as follow to the conception or design of the work; the acquisition, analysis, or interpretation of data for the work; and drafting the work or revising it critically for important intellectual content. EABO contributed 40%, IO 15%; BAP 5%, and RWG, AYL, AKAD, and PO contributed 10% each. All authors approved the version to be published and agreed to be accountable for all aspects of the work.

Declaration of Competing Interest

The authors declare that they have no conflicts of interest.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.afjem.2023.05.001.

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