

**UNIVERSITY OF GHANA  
COLLEGE OF HEALTH SCIENCES**

**AVAILABILITY AND READINESS OF HOSPITALS FOR EMERGENCY TRAUMA  
CARE DELIVERY: A CASE STUDY OF NSAWAM GOVERNMENT HOSPITAL**

**BY**

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**THIS DISSERTATION IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON  
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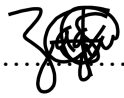
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## DECLARATION

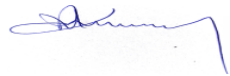
I declare that apart from references to other people's work which I have duly acknowledged, this dissertation is my own work produced from research under supervision. This work has not been submitted to any institution for any degree award.

  
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## **DEDICATION**

To my parents: Tony and Ruth

The wind beneath my sail!



### **ACKNOWLEDGEMENT**

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## -LIST OF ABBREVIATIONS

|       |   |                                                    |
|-------|---|----------------------------------------------------|
| A & E | - | Accident and Emergency Unit                        |
| ER    | - | Emergency Room                                     |
| GETC  | - | Guidelines for Emergency Trauma Care               |
| HIC   | - | High Income Country                                |
| KNUST | - | Kwame Nkrumah University of Science and Technology |
| KATH  | - | Komfo Anokye Teaching Hospital                     |
| LMIC  | - | Lower Middle-Income Country                        |
| NGH   | - | Nsawam Government Hospital                         |
| SARA  | - | Service Availability and Readiness Assessment      |
| WHO   | - | World Health Organisation                          |

## ABSTRACT

**Background :** Globally, injuries and violence are issues of public health concern with burden disproportionately borne by Lower/Lower-Middle Income Countries. Public health strategies to mitigate this problem border on injury prevention and the provision of efficient emergency trauma care and surgical systems. Ghana has a high burden of trauma, however trauma care systems are not as organized as the standards required. District hospitals are the main providers equipped to provide emergency trauma care at the primary level.

**Objective:** This study was therefore conducted to assess the availability and readiness of the hospitals for trauma emergency care services comprising of emergency room, surgical, and blood transfusion services, with a case study of Nsawam Government Hospital.

**Methods:** A cross-sectional descriptive design was used with structured questionnaires adapted from World Health Organization's (WHO) Service Availability and Readiness Assessment (SARA) tool and the WHO's Guidelines for Essential Trauma Care. The checklists were administered to 36 staff members of the Emergency Department of the hospital, and then 8 purposively selected administrative staff of other units that provided services to trauma patients. Simple descriptive analysis was done. The availability ratings of physical resources needed in the Accident and Emergency Unit were analysed by generating median values from a four-point Likert scale (from 0-3). The factors influencing resources availability were analysed using frequencies and percentages of responses while the readiness scores of the hospital for emergency trauma surgical care were analysed using the mean availability of all items needed for a specific service, expressed as a percentage.

**Results:** Forty-four respondents were interviewed: Nine were involved in managerial roles, with remainder being different cadre of Emergency room staff (13 Physician Assistants, 16 General Nurses and 6 Medical Officers). Nsawam Government Hospital offered both emergency room services, minor and major trauma surgeries as well as blood transfusion services. Circulatory medicines, general surgery and basic airway equipment had the highest median availability rates of 3 (adequate) each. In the Emergency room, essential low-cost equipment for advanced airway had median rating of 0 (absent) while neurosurgical care, chest tubes with underwater seal and electronic cardiac monitors had median availability ratings of 1 (inadequate) each. The readiness score for hospital emergency room services was 71% while that for minor and major trauma surgery was 90% and 95% respectively. Blood transfusion and basic amenities had readiness scores of 87.5% and 85.7% respectively. These least readiness score obtained in the emergency room was influenced by low scores for tracer indicators for advanced imaging and advanced airway in the Emergency Unit. Factors contributing to low availability of equipment were associated with the absence of the equipment, staffing, stock-outs, user-fees and equipment breakdown.

**Conclusion:** This study concludes that the availability of trauma emergency care in Nsawam Government Hospital was high, and the readiness scores of the hospital for surgery and blood transfusion was higher compared to Emergency Room services. Unreliable availability of advanced airway devices and advanced imaging contributed to lower readiness for Emergency Room services. Hence, managerial strategies to improve the availability of essential low-cost items in the Emergency Department and to strengthen the referral system are recommended.

## **Chapter 1**

### **INTRODUCTION**

#### **1.1 Background to the Study**

Globally, injuries and violence are the leading cause of death within the male gender and among young people aged 5-29 years. The rates of death are higher in Lower and Lower-Middle Income Countries (LMICs) and amongst the poor (World Health Organization, 2018, 2021). The socioeconomic impact of injuries is great because of the high distribution among working age groups (World Health Organization, 2021). Injury prevention is a key strategy to reducing the burden of disease, but when injury occurs, the prognosis of the trauma patient is related to the quality of emergency care received post-injury (Mock et al., 2012), whether pre-hospital or in-hospital emergency care (World Health Organization, 2018, 2021).

Emergency medical care is “care for conditions that require rapid intervention to avoid death or disability”(Hirshon et al., 2013). It comprises both pre-hospital and in-hospital care. Among people with low access to health care or suboptimal health-seeking behaviours, the emergency health system becomes the first point of contact with a formal healthcare system, as healthcare is sought only when one is injured or critically ill (Reynolds et al., 2017). Trauma emergency care within a hospital is a surgical subspecialty, and it focuses on delivering care to injured patients, i.e., injury recognition and urgent resuscitation in the emergency room, and offering minor or major surgery, and blood transfusion services to patients where indicated.

Unlike High Income Countries, Lower and Middle Income Countries (LMICs) have many deficiencies in the Emergency Medical Systems(EMS) for the injured (Edem et al., 2019) contributing to higher mortality rates. But a large fraction of trauma-related deaths in these countries could be prevented with a context-specific trauma system strengthening (Yeboah et al.,

2014). Mock, et. al (2012) also noted that, 34-38% of lives in LMICs would be saved if trauma system strengthening was done. Evidence from developed countries further supports the fact that proper organisation of trauma care systems leads to reductions in injury-related mortalities (Hanche-Olsen, Alemu, Viste, Wisborg & Hansen, 2012).

Prior to the year 2003, Ghana lacked a formal emergency medical system, and its health system rather prioritised a primary preventive healthcare delivery (Yiadom et al., 2018). However, following the May 9<sup>th</sup>, 2001 disaster resulting from stampede at the Accra Sports Stadium, and the rising burden of injuries and other acute illness thereafter, the need for a robust emergency health system was brought to the forefront. This led to the formation of the National Ambulance Service in 2004 (Banin et al., 2020; Yiadom et al., 2018; Zakariah et al., 2017 ). Since then, Ghana's EMS has chalked several successes including local postgraduate training for doctors and nurses in emergency medicine, and trauma/orthopaedics, drone-facilitated emergency response, One Constituency/One Ambulance programme and district capacity building for obstetric emergency care (Japiong et al., 2016; Osei-Ampofo et al., 2013; Yiadom et al., 2018; Zakariah et al., 2017). These vast investments and initiatives have contributed to the continuous growth of the EMS in the country.

In LMICs like Ghana, the primary health care system plays an influential role in determining the outcomes of trauma cases (Stewart et al., 2017) . Particularly in rural areas in Ghana, district hospitals are the main players in the EMS, receiving trauma patients referred from lower centres. These facilities are typically staffed by general practitioners and nurse anaesthetists, and with about 50-100 beds, they are equipped to provide basic surgical and emergency care(Japiong et al., 2016; Stewart et al., 2017; Zakariah et al., 2017). In spite of the different degrees of resource challenges faced within these facilities, the availability and readiness of each individual low-level

healthcare facility to offer emergency care to an injured patient is still very important to reduce the incidence of preventable deaths.

Nsawam Government Hospital (NGH) is a district hospital within the Nsawam-Adoagyiri Municipality. It is located in close proximity to the major highway (N6 Highway) which links Greater Accra Region to the eastern and the northern parts of the country. This highway has been labelled “accident prone” (Ghana News Agency, 2021). The municipality itself is a well-situated gap-town, with roads that link three regions - Greater Accra, Eastern and Central regions, and also connecting them to northern parts of the country. The Nsawam Government Hospital, however, is more than one-hour-drive away from the closest second level or tertiary health facility. Thus, it becomes a prime first level facility attending to emergencies that arise in its vicinity. As was reported by the mass media, there was a fatal Road Traffic Accident (RTA) in Nsawam business area on 7<sup>th</sup> of February 2022, in which a large cement trailer truck ran into several taxis, pedestrians and property. This resulted in a mass casualty that left five people dead, and several others injured. Nsawam Government Hospital was instrumental in providing emergency trauma care services to these victims (MyJoyOnline.com, 2022; The Herald, 2022). Death following trauma is trimodal- it is dependent on the time lifesaving trauma emergency care is received and the quality of services provided. Although not all trauma-related deaths are preventable, optimal and prompt emergency treatment obtained within the golden hour (first 60 minutes after injury) prevents early and late deaths which would occur between minutes to days following injury (Abhilash & Sivanandan, 2020). Prior to this accident, and even after, no studies have ascertained the readiness of Nsawam Government Hospital to offer immediate and optimal emergency trauma care to avoid preventable deaths.



The WHO's Guidelines for Essential Trauma Care (GETC) provides a health facility with guidelines on the minimum standards of inputs and processes required to ensure quality trauma systems giving resources constraints (Mock, Lormand, Goosen, Joshipura & Peden, 2004). This has been used for several studies on facility-based trauma care. Service Availability and Readiness Assessment (SARA) tools designed by the World Health Organisation (WHO) and United States Agency for International Development (USAID) have been used to assess and continuously monitor the availability of physical and human resources, as well as the capacity of health facilities to utilise these resources to provide both general and specific health services by generating and computing indicator scores (World Health Organisation-United States Agency for International Development, 2015). The aim of the study therefore was to assess the availability and readiness for emergency trauma care (comprising emergency room, surgery and blood transfusion services) in Nsawam Government Hospital using afore mentioned tools.

## **1.2. Problem Statement**

According to the World Health Organization (2021), globally, about 4.4 million people die every year from injury-related causes including Road Traffic Accidents (RTA), suicide and violence against oneself and others, falls, burns and poisoning. This figure is higher than the combined global mortalities from malaria, tuberculosis and HIV/AIDS (Oteng et al., 2019; World Health Organization, 2014; Zaidi et al., 2019). Most of these deaths are preventable if quality emergency trauma care was available and designated facilities are ready to provide care. According to World Health Organization (2021), 90% of these injury-related deaths occur in Lower-Middle-Income Countries (LMICs) like Ghana, due to deficiencies in trauma health systems and patient factors (Japiong et al., 2016; Zaidi et al., 2019). The implications of the statistics are dire.

Ghana is currently facing a triple burden of disease from injuries, infections and non-communicable diseases (Yiadom et al., 2018). The country has a developing Emergency Medical System (EMS) (Osei-Ampofo et al., 2013; Zakariah et al., 2017), within which there are challenges in accessing trauma care (Blankson, Amoako, Odei-Ansong & Lartey, 2019). In Ghana, hospital-based trauma emergency care is organised at all levels of health care delivery except primary health care centres (health centres, Community-based Health Planning Services (CHPS compounds) (Japiong et al., 2016; Stewart et al., 2015). This makes district/first-level hospitals (especially those in rural areas) key players in trauma service provision.

Some previous studies have shown that trauma patients referred to higher centres (secondary and tertiary facilities) from first-level hospitals reportedly had higher mortality rates as compared to patients with similar injuries in developed countries (Oteng et al., 2019). Patients in developed countries often presented to tertiary facilities after significant delays and suboptimal resuscitation at the district hospitals (Japiong et al., 2016; Oteng et al., 2019). Edem et al. (2019) and Whitaker et al. (2020) explain that, delays in receiving trauma care are caused by facility-level challenges in resource base, making prompt diagnosis, providing injury treatment and or facilitating referrals. Overall, these challenges can be classified into problems with trauma service availability (the physical presence of human resources and physical resources) and facility's readiness (capacity to utilise available resources, i.e., essential medicines, diagnosing technology, trauma-specific training, staffing, trauma guidelines, and basic hospital amenities). Ideally, injured patients presenting to a hospital's emergency department have varied medical needs and this determines the emergency trauma services provided. Emergency trauma services ranging from urgent resuscitation received in the emergency room, to minor or major surgical procedures and blood transfusion generally ought to be delivered promptly once indicated.

In a district hospital like Nsawam Government Hospital, there has been a progressive increase in the proportion of trauma patients presenting to the Accident and Emergency (A&E) Department. The hospital's facility records showed that, the incidence of trauma attendance had increased from 7.2% of all Emergency Room attendance in 2013, to approximately 24% in 2021. This steady rise in demand for trauma care would require a matching increase in the supply of resource base for trauma care delivery.

In a health facility, provision of a specific service can be measured by the availability and service specific readiness for the service. In the case of trauma emergency care service delivery, service availability is seen in the physical presence of an emergency unit in the hospital with designated hospital emergency room infrastructure, the presence of the different cadres of health workers trained to offer emergency services. The availability of a service is needed before a health system can provide emergency care to injured patients.

### **1.3 Conceptual Framework**

Service readiness describes the capacity of the facility to use available resources for trauma care. Trauma service readiness is seen in terms of composite mean availabilities of staffing and training in emergency trauma surgical care, medicines and commodities, functioning diagnostics, essential equipment and blood transfusion services in the health facilities. General hospital basic amenities are also important in the provision of trauma care. The basic amenities considered are utility and communication services, ambulance service for referrals, infection control and hospital general infrastructure). In the absence of these factors (i.e., Health workforce, health infrastructure and basic amenities, resources for emergency, surgical and blood transfusion services), the facility cannot provide any quality service successfully. In the absence of an optimal hospital-based trauma care, there would be high rate of preventable deaths and disability among trauma patients.

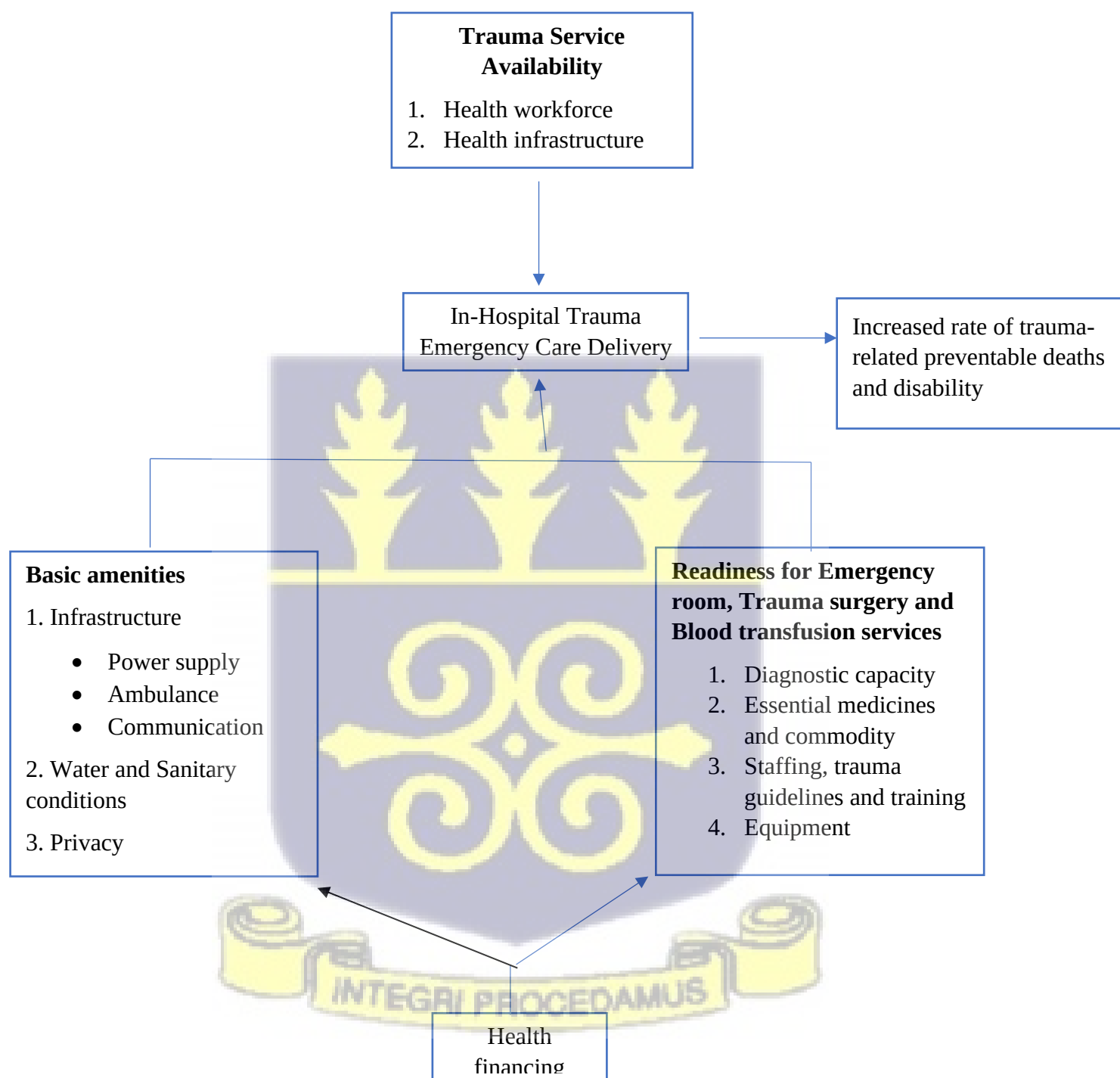


Figure 1 : Conceptual Framework of the Availability and Readiness of Hospitals for Emergency Trauma Care Service Delivery (author's construct from literature review)

#### 1.4 Justification

District hospitals play a vital role in provision of emergency trauma services in Ghana. Delays in receiving care at this first-level negatively impact the survival of trauma patients even after they

have been referred to receive tertiary care. Emergency service delivery is dependent on the availability of physical and skilled human resources, and the ability to utilise available resources to provide care. The health facility records in Nsawam Government Hospital have shown a gradual increase in trauma cases presenting to the Emergency Unit from 2013-2021. The facility is also located in close proximity to the accident prone N6 highway. No study has however described the availability of trauma care resources in this district hospital, the readiness of hospital to provide care or the factors which determine the level of availability of emergency care. By assessing the trauma service availability and readiness of the case study facility (Nsawam Government Hospital), health managers within the hospital and the Ghana Health Service District Directorate would be provided with availability and readiness scores for trauma care. This may further guide trauma systems strengthening within the district. In the absence of a good district level trauma care service, there would be an increase in the burden of trauma on secondary and tertiary hospitals, and this would affect patient prognosis and overall health system negatively.

### **1.5. Objectives of the study**

The objectives of the study have been grouped into general and specific objectives as below.

#### **1.5.1. General Objective**

To assess the availability and readiness for emergency trauma care comprising emergency room, surgical and blood transfusion services in Nsawam Government Hospital.

#### **1.5.2. Research Questions**

The research questions for this study are stated below.

1. What are the availability ratings of physical resources needed for the provision of emergency trauma care in Nsawam Government Hospital?
2. What are the factors influencing availability of physical resources for the provision of emergency trauma care in Nsawam Government Hospital?

3. What is the readiness score for emergency room services in Nsawam Government Hospital?
4. What is the readiness score for trauma surgical services in Nsawam Government Hospital?
5. What is the readiness score for blood transfusion services in Nsawam Government Hospital?

### **1.5.3. Specific Objectives**

The specific objectives of this study are as stated below

1. To determine the availability ratings of physical resources for emergency trauma care services in Nsawam Government Hospital.
2. To investigate the factors influencing availability of physical resources for provision of emergency trauma care in Nsawam Government Hospital.
3. To determine the readiness score for emergency room care in Nsawam Government Hospital.
4. To determine the readiness score for trauma surgical care in Nsawam Government Hospital.
5. To determine the readiness score for blood transfusion services in Nsawam Government Hospital.

### **1.6. Outline of the dissertation**

This dissertation reports on the availability and readiness of Nsawam Government Hospital to offer emergency trauma care to injured patients reporting to the Accident and Emergency Unit in six chapters. The introduction, literature review and methodology are presented in chapters 1, 2 and 3 respectively. Chapter 4 contains the results of the study, while Chapter

5 discusses the results obtained. In Chapter 6, recommendations and conclusions based on results obtained are made.



## **Chapter 2**

### **LITERATURE REVIEW**

#### **2.1. Introduction**

This chapter reviews literature relevant to the topic under study and the objectives of the study. It provides information on service availability and readiness, essential trauma care, as well as the factors affecting availability of trauma resources.

#### **2.2 Trauma Care Services**

##### **2.21 Trauma epidemiology: Mortality and morbidity from trauma**

The World Health Organisation (2021) explains that, trauma causing injuries are an important cause of morbidity and mortality globally. The causes range from intentional to unintentional factors and include Road Traffic Accidents (RTA), suicide and violence against oneself and others, falls, burns and poisoning. Vehicular accidents are the leading cause of injury-related deaths among all age groups globally accounting for one out of every three trauma related death. About 8% of all deaths are caused by traumatic injury (World Health Organization, 2018, 2021). For every trauma related death recorded, about 10 to 50 other people are left permanently disabled (Yiadom et al., 2018). The subsequent care of trauma victims with non-fatal injuries is shared by emergency departments, general or specialist outpatient clinics, rehabilitation facilities and even mental healthcare practices (World Health Organization, 2021).

##### **2.22 Essential emergency care in trauma**

Emergency care for trauma patients comprises prehospital care (care offered at the trauma scene, and enroute to the hospital) as well as in-hospital care. For every injured patient, depending on the degree of severity of injury, in-hospital trauma emergency care comprised emergency room care, minor and or major trauma surgery, and or blood transfusion. Mortality is dependent on the



promptness and quality of emergency care received. There are disparities in trauma patient outcomes in high income countries compared to low/ middle income countries. This difference in survival rates has been attributed to better, more expensive equipment and technology on one hand, but to a larger extent on the improvement in trauma care organisation and planning in higher income countries (Edem et al., 2019; Yeboah et al., 2014).

Recognizing the role of a functional healthcare system in survival post-injury, the World Health Organisation in 2004 issued a framework- Guidelines for Essential Trauma Care(GETC)- that would provide minimum acceptable (essential) standards and resources for the management of patients with trauma-related injury (Ntakiyiruta et al., 2016; Stewart et al., 2015, 2016). The GETC developed by Essential Trauma Care Project focuses on the availability of inputs(staffing and training) as well as physical resources (infrastructure, equipment and supplies) needed for facility-based trauma care delivery (Mock et al., 2004). Based on this, the GETC provides guidelines that define low-cost minimal (i.e., cost-effective, reasonable and feasible) standards for improving trauma care that can be achieved in all parts of the world, and that are sufficient to meet the needs of any trauma patient (Debas et al., 2015).

The Guidelines for Essential Trauma Care manual categorizes health facilities based on the level of staffing present, and then it assigns standards for trauma care for each category. The categories of health facilities are as follows:

1. Basic facilities

Frequently, basic facilities are the first point of call for trauma patients especially in countries with no formal EMS. They are primary health care facilities headed by Physician Assistants, Nurses or Village Health Workers; or doctors providing outpatient services only.

2. Hospitals staffed by general practitioners.

These facilities include hospitals without a full-time specialist doctor (particularly General Surgeon). They may or may not have a surgical theatre. They are staffed by General Practitioners or Medical Assistants who have been trained to perform certain operations. District hospitals in Africa and Primary Health Centres in India fall under this category.

3. Hospital staffed by specialists

Hospitals in this category have at least a General Surgeon, but may have other specialists as well. They would have surgical theatres. Hospitals in this category include Regional Hospitals in Africa, Community Health Centres or District Hospitals in India or General Hospitals in Latin America.

4. Tertiary Care Hospitals

Hospitals in this category have a wide range of specialists and subspecialties. They are usually the highest level of health care within a country.

In setting the standards for inputs and physical resources, the Guidelines for Essential Trauma Care assigns priorities to each item based on the category of the hospital explained below.

1. Essential resources

Any item designated as “Essential” (E) should be assured at stated health facility level including facilities which are severely deprived. Also, these resources could be provided with minimal increase in spending.

2. Desirable resources.

Items designated as “D” for a particular level of health system increase the probability of success of trauma care.

3. Possibly Required resources

Advanced resources designated as “possibly required” (PR) are present at lower levels of health systems in order to improve access to trauma resources. Trauma treatment capacities are shifted to lower levels with poor access trauma care.

#### 4. Irrelevant resources

Resources designated as “irrelevant” (I) are not expected to be present at that given health care level. For instance, capnography and mechanical ventilator are irrelevant trauma resources at the level of the basic hospital, but they become desirable at high level health facilities.

### 2.3 Service Availability and Readiness Assessments

The World Health Organization (WHO) in partnership with the United States Agency for International Development (USAID) developed the Service Availability and Readiness (SARA) survey to assess and subsequently monitor health facilities and their capacity to deliver a given service. It measures services based on a set of tracer and composite indicators for a health care delivery (World Health Organisation-United States Agency for International Development, 2015). It has three primary areas: service availability, general service readiness, and service specific readiness. This focuses on the availability and readiness with respect to emergency trauma services.

#### 2.3.1 Availability of emergency trauma services

Service availability is defined by the physical presence of human and physical resources for the provision of a health service, and aspects of utilization of service by the community. It excludes more complex factors that determine utilization. The tracer indicators that are measured under service availability are health infrastructure, health workforce and service utilization. The overall

score is usually computed for the number of health facilities within a unit of health administration. (World Health Organisation-United States Agency for International Development, 2015).

### **2.3.2 Readiness for emergency room, trauma surgery and blood transfusion**

Readiness measures the ability of the health facility to use the resources it has to provide relevant care: either general care or specific- service care. This is assessed by the physical presence of tracer indicators in four domains: staff and training, equipment, diagnostics and commodities. Service Readiness can be computed using the SARA methodology for either a single facility , or multiple facilities in a given catchment area (World Health Organisation-United States Agency for International Development, 2015; Zaidi et al., 2019). The latter method computes readiness by facility and this may be employed in a case study of a single facility (World Health Organisation-United States Agency for International Development, 2015, p118).

This section discusses the four main domains by which readiness is assessed in the context of emergency trauma service delivery.

#### **2.3.2.1 Staffing**

This section discusses the skilled human resources staffing trauma care delivery centres and the factors affecting availability of the health workforce. A wide range of cadres of health workers are needed for the successful organization of trauma care. They include but not limited to doctors, physician assistants, nurses, trauma surgical specialists, emergency physicians and nurses, nurse anaesthetist and anaesthesiologists. Most district hospitals in Ghana however are staffed by medical doctors (general practitioners) and nurse anaesthetist who offer limited emergency trauma surgical care (Hanche-Olsen et al., 2012; Japiong et al., 2016). In fact, Gyedu et al.(2020) demonstrated an unmet need for trauma operative care in Ghana, especially in the rural areas. District hospitals performed majority of all surgeries in the Ghana. However, only 38% of these

procedures were trauma-related surgeries, with 37% of these being done by non-surgeons (Gyedu et al., 2020). Meanwhile, the capacity of a first level facility to perform essential trauma operations/ resuscitations contributes to survival of injured victims and even quality of life after recovery from injury.

Training of health workers in trauma emergency care is very essential in building the hospital's capacity and improving its readiness for trauma care delivery. At the facility level, scheduled in-service trauma care training of health workers involved in trauma care delivery is necessary to ensure readiness for trauma care. Continuous professional training programmes in trauma care have contributed to a reduction in treatment delays and preventable deaths in several parts of the world (Berndtson et al., 2019; Edem et al., 2019; Stewart et al., 2015). Programmes which provide in-service training for other trauma services support staff also should not be left out as they have proved very advantageous. For instance continuous professional training of Biomedical Engineers have the advantage of prolonging lifespan of equipment used in trauma care and ought to be included (Stewart et al., 2015). Currently, Ghana's policy on continuous training health workers on emergency care insists on a set of training courses in emergency care programmes for all core staff (basic and advanced life support courses) and non-core staff (basic life support courses). It mandates the hospital management to ensure this training takes place at selected centres and to also ensure re-certification of staff every three years. Staff are to have training also in quality assurance and customer care (Ministry of Health, 2011).

Historically, there have been programmes in the country like the annual university-led, continuing education program for injury care (1996-2011) which targeted rural hospitals' health workers and provided skills in essential trauma care practices in low resource settings. It was organised by the Kwame Nkrumah University of Science and Technology (KNUST) and participants were

sponsored by Ministry of Health and District Health Services (Stewart et al., 2016). When evaluated, trainees demonstrated good retention of trauma care knowledge(Japiong et al., 2016; Mock et al., 2004). Sadly, this course in trauma care was dissolved due to challenges with financing the programme(Stewart et al., 2016). Currently, other courses like the Advanced Trauma Life Support (ATLS) have been useful in providing trauma continuing professional development in LMICs (Berndtson, Morna, Debrah & Coimbra, 2019). Unfortunately, the ATLS is prohibitively expensive in LMICs and in the context of marked resource limitations, it may not be an ideal teaching tool.

Several institutions have also been set up to oversee/provide training into emergency care. For instance, the Komfo Anokye Teaching Hospital (KATH) provides specialty training in Emergency Medicine and Emergency Nursing. A Paramedic Emergency Care Training School has also been established to train Emergency Medical Technicians for prehospital care (Banin, Bonney, Osei-Ampofo, Oduro & Donkor, 2020). The Ghana College of Physicians and Surgeons (GCPS) is another important institution in health workforce capacity building. This college oversees the residency training of doctors in specialty fields of General surgery, trauma and orthopaedics surgery all over Ghana.

#### **2.3.2.2. Guidelines**

Guidelines for trauma care are a set of protocol which are standardized and evidenced based, and if followed by the health workers, have potential to ensure quality care and better patient outcomes(Baker et al., 2013). In Ghana, the National Policy and Guidelines for Hospital Accident and Emergency services has been in existence since 2011(Ministry of Health, 2011). It contains guidelines for infrastructure, equipment, medicines, human resource, referrals, health information, triaging, quality control and funding. Though a national guideline exists, there is the need for

facilities to have a similar written down formal guideline for local care of injured patients. This has the advantage of improving overall patient care (Firew et al., 2022).

Among the guidelines relevant for trauma care are triaging guidelines. Triage is done to provide ranking based on the level of injury severity in trauma patients (Banin et al., 2020). In regions with resource constraints like LMICs, the South African Triage Scale (SATS) is the preferred triaging tool used as it helps the practitioner optimise the use of scarce resources among patients based on the severity (Gyedu et al., 2016). Triage has been shown to reduce waiting times and shorten physician intervention times thereby leading to a reduction in mortality (Rominski et al., 2017; Dalwai et al., 2014).

In 2011, the Ministry of Health (MOH) recommended the use of the Triage Scale (TS) an adopted version of SATS for triaging in Ghanaian hospitals (MOH, 2011). This tool uses a colour coding system to classify patients and the urgency of their conditions using certain parameters. The MOH explains that, there should also be a dedicated area for triaging within the emergency unit (Gyedu et al., 2016; Ministry of Health, 2011). In Ghana, a study showed that in about 187 district hospitals, patient triaging was organised by General Practitioners and nurses (Gyedu et al., 2016). Nurse-led triaging was practiced in bigger hospitals like KATH in Ghana, and in other parts of the world (Rominski et al., 2017). Irrespective of the staff who does the triaging, the results of using SATS for triaging have been shown to be more reliable when conducted by providers who had received intentional triage training (Gyedu et al., 2016). Thus, training in triaging is mandated for all core staff of the emergency units in Ghana (Ministry of Health, 2011).

### **2.3.2.3 Equipment and diagnostics**

Medical technology and equipment are essential inputs needed to ensure safe and efficient delivery of quality in-hospital trauma services. Technology used in trauma care ranges from radiology and



laboratory diagnostics to other equipment like airway/breathing equipment, circulation, equipment, splints, and monitoring devices used for physical examination, resuscitation and treatment. Unlike High Income Countries (HICs), access to modern medical technology is limited in LMICs: basic emergency equipment was comparatively more available than advanced technology. This is corroborated by results from a study in Tanzania (Baker et al., 2013). In Ethiopia, a study even showed low availability of both basic and advanced emergency care equipment (Firew et al., 2022). In the case of Ghana, between 2004 and 2014, a serial assessment of trauma care capacities of selected hospitals in Ghana had showed some improvement in the availability of equipment for urgent care for injured patient (Stewart et al., 2016). However, a single facility case study conducted by Japiong et al. (2016) observed that, devices used in the management of the airway and breathing as well as Personal Protective Equipment (PPE) in a second -level hospital in Accra, Ghana had low availability ratings. According to this study, laboratory diagnostics were mostly available but at levels below the recommended standards proposed by World Health Organisation (WHO) and Ghana Health Service (GHS).

The level of availability of medical technology is influenced by several factors key among them are the cost involved, and availability of support infrastructure and skill to ensure optimal functioning of such equipment (Stewart et al., 2015, 2016).

On the matter of cost of equipment/diagnostics, there is a misconception that all emergency and critical care equipment are comparatively more expensive and sophisticated than those required in other medical disciplines. When these equipment were physically present also, there were problems with affordability limiting patients' access to care. Oteng et al. (2019) found that in a Ghanaian tertiary hospital, some diagnostic equipment like Computerized Tomography (CT) scans were not utilised for patient unless reimbursement was assured. Though some equipment required



in trauma surgery may be costly to the health system and patient, contrary to the earlier assertion, there are some basic and inexpensive equipment which are essential and can be used to provide quality standard care in hospitals (Baker et al., 2013). Depending on the grade of the hospital, only minimal financial investment would be needed to ensure standards of trauma emergency care are met.

Aside the problem of economic cost of equipment to the health system, Stewart et al.(2016) highlighted the role of vertical programmes in influencing the availability of trauma equipment saying “although relatively successful for disease-specific interventions and providing some broader benefits, vertical programmes may channel resources away from other pressing public health dilemmas, like injury control” (Stewart et al., 2016 p.169). This may explain why some expensive technology like mechanical ventilators, radiology diagnostics, and or arterial blood gas equipment, which were not supported by vertical programmes were likely to be unavailable. Other equipment like ultrasounds (supported by obstetric programmes) useful in trauma care are likely to be more available in the hospital, but not within the trauma emergency unit.

In terms of readiness for use, the presence or absence of trained personnel with skill to use equipment also affects the availability of the product . Some equipment may be available in a facility, but may be difficult to use as either their operating language were not understood by local staff or their reagents were not locally available (Stewart et al., 2015). Apart from this, every equipment needs to have appropriate support services to ensure optimal function, but if the services are not available, the equipment will soon become unusable. This includes skills for operations, cleaning, repair and maintenance. The facility’s medical technology and engineering human resource base are very valuable in this regard (Edem et al., 2019; Stewart et al., 2015, 2017). The correct cleaning and processing of an equipment is able to preserve the shelf-life of the equipment

and prevent the spread of infections within the hospital setting. This in the long run improves efficiency and effectiveness of the equipment in providing emergency trauma surgical care. The unreliable availability of equipment is a cause of delays in receiving trauma care (Edem et al., 2019; Whitaker et al., 2020) resulting in preventable deaths (Oteng et al., 2019).

#### **2.3.2.4 Essential Medicines and Commodities**

For optimal functioning of a health system, there ought to be equitable access to quality and effective essential commodities and medicines (WHO, 2007).

Essential medicines are those medications that “satisfy the priority of health care needs of a population. They are selected with due regard to disease prevalence and public health relevance, evidence of efficacy and safety and comparative cost effectiveness”(World Health Organization(WHO), 2021). Ghana has a country specific essential medicines list. Out of these, there are recommended essential medicines with for emergency trauma care delivery, and other medications essential for general outpatient purposes. These medicines range from intravenous fluids and blood products for resuscitation, to medicines for trauma surgery and anaesthesia. Procurement and stock management influences the availability of essential medicines for trauma (Japiong et al., 2016; Stewart et al., 2015). Majority of district and regional hospitals in LMICs have medicines for basic care but not advanced care (Firew et al., 2022). Baker et al (2013) observed that, drugs for basic emergency care were available but those for advanced care were mostly not in stock in Tanzania. Apart from procurement challenges, affordability of medicines also affects access. Strategies like KATH Drug Pack Policy has led to improvement in access to essential medicines to the patient (Banin et al., 2020; Stewart et al., 2015).

Blood and blood products capabilities are an important aspect of essential medicines with respect to emergency trauma services capacity. Stewart et al. (2016) used a serial assessment of the

capacity of hospitals in Ghana to offer trauma care over a period of time was done, and found that availability of blood services in district hospitals had increased over a period of about 10yrs. In fact, this service was more likely to be available than some equipment for basic airway management and breathing. This is because blood product processing and supply have been an essential part of some key donor funded vertical programmes for obstetric emergency care and Human Immunodeficiency Virus (HIV).

The World Health Organisation (WHO) recommends a formal blood bank in a hospital as ideal in order to ensure reliable availability of this essential product. However, when not possible, the facility should have the capacity for “immediate donation and administration of fresh whole blood” (Mock et al., 2004 p. 25). Always, the facility should have the capacity to ensure safety of blood product and a safe transfusion process. This entails ensuring that the blood has been screened for blood borne viruses particularly Hepatitis B and C, Human Immunodeficient Virus (HIV). Also, clinicians ought to be trained in how to safely prescribe and administer blood products to the trauma patient as well as to monitor patient for response during transfusion process managing adverse blood transfusion events should they arise (Mock et al., 2004).

## **2.4. Basic Hospital Amenities**

The basic hospital amenities required for emergency trauma care include emergency transportation, communication infrastructure, power source, water and sanitation and hygiene services.

### **2.4.1 Emergency Transportation**

According to the National Referral Policy Guideline (2012), transportation of a patient to and from a health facility was to be done with “a suitably equipped ambulance or whatever other appropriate

means of transportation was available”(Ministry of Health, 2012 p.11). Two parallel ambulance systems exist in Ghana. They are the National Ambulance Service (NAS) and Facility-Based Ambulance System (FBAS). The NAS is the country’s formal institution, with nationwide coverage, responsible for prehospital care and facilitating interhospital transfers. Their ambulances are stocked and staffed by Emergency Medicine Technicians (EMT). The FBAS is operated by hospital. Patients in FBAS are accompanied by a general nurse (who is not prehospital care provider) during referrals (Mould-Millman et al., 2014).

Often, injured patients were more likely to be transported in an ambulance than the non-injured patients. Several studies in Ghana, however, have noted high rate of non-ambulance use in transporting emergency patients to hospital from scenes of injury or carrying out interfacility transfers. There were usually prepayments required before ambulance transport of patients. This and other barriers to accessing ambulance services, and low severity of cases were postulated as factors contributing to non-ambulance use (Mould-Millman et al., 2014; Stewart et al., 2017).

#### **2.4.2 Communication infrastructure**

Communication is an important factor in general in health systems performance, particularly in its referral and health informatics processes.

In terms of referrals, effective communication is essential in preventing delays in reaching care and receiving care (Edem et al., 2019; Whitaker et al., 2020). At the prehospital level for instance, challenges with communication may be between onlookers at the scene/ ambulance and receiving hospital. Khudadad et al. (2020) cited that, the unavailability of a communication system that would allow remote clinical advising as a challenge facing the delivery of quality prehospital trauma care. At the facility level, challenges may be in interfacility communications for referrals. Referral of a patient to a facility ought to be facilitated through early inter-facility communication

by telephone, email, fax or radio before actual transfer of patient (Minsitry of Health, 2012; Stewart et al., 2017). Details communicated to the receiving facility should include patient biodata, chief complaints, examination and findings, investigations, diagnosis and treatment as well as day/time of referral (Minsitry of Health, 2012).

In terms of health information, presence of adequate communication infrastructure (like computers) and reliable internet and network connectivity is an essential input for health services delivery (Mensah et al., 2022). The Ghana's Ministry of Health proposes that all facilities adopt its standard data collection tools at the Emergency to collect data including biodata (Ministry of Health, 2011). The 2010 Ghana National eHealth Strategy was adopted to implement electronic medical record system in all major hospitals in the country (Abdul-Fatawu & Adam, 2020).

In terms of trauma systems, health informatics is needed in formation of trauma registry which contains separate local data of all trauma cases (Hanche-Olsen et al., 2012). The advantage of a trauma registry is that it allows opportunity for accurate recording of mechanism of injury, severity of injury and procedures required by patients in trauma care, and thus providing reliable information for future use in trauma care audit, evaluation and health planning. However, such registries are cost intensive and require some specialized human resource base to maintain quality of data. For many LMICs, ensuring this is a challenge. Ghana, as a case study, has no organised national trauma registry, rather, regional population-based or institutional trauma registries have been cited in literature (Banin et al., 2020; Gyedu et al., 2020). Inefficient record keeping and filing systems have been the bane affecting retrospective analysis of trauma care in some facility based studies in Ghana (Blankson et al., 2019; Oteng et al., 2019). Unfortunately, Ghana's District Health Information Management System (DHIMS) which is an electronic system used by health managers

to monitor key performance indicators (Abdul-Fatawu & Adam, 2020) did not include indicators for trauma (Stewart et al., 2017).

### **2.4.3. Power Source**

Energy is strongly linked to health and healthcare delivery. Access to energy by health facilities is essential in ensuring universal health coverage. The presence of electricity has been linked to reduction in some health indicators like child mortality in parts of Africa. A reliable source of energy is needed to run vaccine centres, and other medical technologies in health care provision (Fofana, Liechty, Marcus & Vilbert, 2022). About 60% of health facilities in Sub-Saharan Africa lack access to electric power supply. In several cases, facilities that are connected to the power grid receive an erratic supply of electricity characterized by frequent power outages (Fofana et al., 2022). Off-the-grid power sources become suitable alternatives for power in case there was a cut in the primary power supply. Diesel powered generators or rarely renewable sources of electricity like solar energy are used in Ghanaian health facilities as secondary sources of energy (Chaaroui et al., 2021).

### **2.4.4. Water, Sanitation and Hygiene (WASH) Services**

Water, Sanitation and Hygiene (WASH) Services are essential to ensure delivery of quality healthcare services. The lack of WASH facilities in a health facility increases the risk of spread of infections, and lowers client satisfaction with care delivered (Kanyangarara, Allen, Jiwani & Fuente, 2021). In LMICs, about 50% of health facilities lack pipe borne water, 33% have no improved toilets, 39% lack adequate safe waste disposal and 39% lack soap for handwashing (Cronk & Bartram, 2018). The level of WASH infrastructure needs of a health facility/ department depends on the services rendered for instance in managing infectious disease or conducting surgeries.

However by 2030, the United Nations Sustainable Development Goals targets the availability of all basic WASH services in all healthcare facilities (CDC, 2020). The basic standard for water supply in a health facility is that “water should be available from an improved source on the premises. Improved sources of water include piped water, boreholes or tube wells, protected dug wells, protected springs, rainwater and packaged or delivered water” (World Health Organization and the United Nations Children’s Fund, 2019 p.2). Other basic WASH facilities include hand functioning hygiene facilities present at points of care and within five meters of toilets; segregation of hospital waste into 3 bins (general, infectious, and highly infectious) with safe treatment and disposal of infectious waste and sharps. In terms of toilet sanitation facilities, WHO and UNICEF advocate for improved facilities which would separate human faecal matter from human contact. i.e., flush and pour flush toilets connecting to sewers, septic tanks or pit latrines, dry pit latrines with slabs, and composting toilets. Also, staff engaged in cleaning the hospital environment should be trained and should be guided by a set of protocols (World Health Organization and the United Nations Children’s Fund, 2019).

All these facilities when available and if protocols for use are adhered to by staff, Infection Prevention and Control (IPC) would be attained.

#### **2.4.5. Privacy**

Privacy is an ethical code of conduct/right within the patient’s charter in which the healthcare provider has the responsibility of honouring. According to the Collins Dictionary, privacy means being able to carry out activities without other people seeing (Harper Collins, n.d.). The SARA assesses for privacy in terms of visual and auditory, where the patients’ details are not seen or heard by other individuals who have not been granted permission (through patient’s consent) (World Health Organisation-United States Agency for International Development, 2015). From



the Ghanaian Patients' Charter, the patient has the right to privacy during “consultations, examination and treatment”, and any attempt to use patient's information/ records for the purpose of teaching should not be carried out without the patient's concern (Nyaho Medical Center, 2018).

## **2.5. Financing for Trauma Emergencies**

This section discusses financing trauma emergency care delivery. The Policy and Guidelines for Accident and Emergency Services in Ghana provides that all patients presenting to the emergency unit have the right to receive quality care, without request for any payment within the first 48 hours on admission (Ministry of Health, 2011). This is irrespective of their National Health Insurance Scheme (NHIS) subscription status (Norman, Aikins, Binka & Nyarko, 2012; Stewart et al., 2021). The Government of Ghana, Health Insurance agencies and special taxes (including the emergency services tax) were designated as sources of funding for this policy. The goal of this policy is to improve access to quality emergency services and eliminate catastrophic health spending leading to poverty (World Health Organisation, 2007).

On the ground however, this policy is not being implemented. Stewart et.al (2021) conducted a study among injured children in the KATH, the NHIS was shown to offer some financial risk protection only in insured patients who were not severely injured. Out-of-pocket payments were not eliminated with NHIS subscriptions, severely injured patients generally had Catastrophic Health Expenditures (CHE) irrespective of insurance status. Many hospitals transferred costs of emergency care to patients irrespective of insurance cover (Stewart et al., 2021). But some facilities also have mechanisms in place to bear such costs. Norman et al (2012) indicated that, facilities reported offering free treatment to mass trauma patients in a study in the Central Region of Ghana. The KATH had a Red Stamp Policy that allowed practitioners to carry out required diagnostics on emergency patients irrespective of patients' ability to pay (Banin et al., 2020).



The NHIS facility reimbursements (which are usually paid late) are pegged at fixed rates for all government facilities irrespective of geographical location and differences in supply and procurement chain, and the cost of health service delivered. It relies on a low tax base for funding its disproportionately wider net of subscribers. In response to the infrequent re-imbursements, many public health facilities are forced to rely on funds pooled from the smaller proportion of patients who are uninsured, Internally Generated Funds (IGF) and cost minimization strategies. Consequently, there are frequent stockouts of goods, supplies are purchased on credit at exorbitant prices (set by suppliers in anticipation of future cedi depreciation), and servicing of equipment or training of staff are delayed (Stewart et al., 2015, 2016).

## 2.6. Summary

A lot of factors cause trauma related injuries. These factors, which include Road Traffic Accidents (RTA), suicide and violence against oneself and others, falls, burns and poisoning, are key to morbidity and mortality globally. Of all the factors, vehicular accidents are the leading causes of injury-related death among all age.

Trauma related injuries require emergency care which comprises pre-hospital care (care offered at the trauma scene, and enroute to the hospital) as well as in-hospital care. In order to satisfactorily treat trauma patients, the WHO has developed Guidelines for Essential Trauma Care (GETC). These guidelines represent the minimal standards of physical resources (equipment, diagnostics and essential medicines) required per level of health facility, in order to provide emergency trauma care.

In addition to the GETC, WHO and USAID have developed the SARA (Service Availability and Readiness Assessments) tool for assessing and monitoring of health facilities and their capacity to deliver a given service. This evaluates the physical presence of services evidence by present

workforce and trauma infrastructure. It also assesses the ability of the facility to use available resources using four domains of service-specific readiness: staffing and guidelines, equipment, essential medicine and diagnostics. Other relevant general hospital resources necessary for trauma care delivery include amenities like Sanitation and Hygiene (WASH) Services, effective transportation and communication infrastructure. These resources ought to be readily available when desired and must be functional to prevent delays in reaching care and receiving care.



## **Chapter 3**

### **METHODS**

#### **3.1 Introduction**

This chapter contains methods used in data collection and analysis for this research. The sections covered under this chapter include: study design, study area and population, inclusion and exclusion criteria, sampling strategies, data collection and analysis, quality assurance and ethical considerations for data collection.

#### **3.2 Study Design**

The study design applied was a quantitative observational cross-sectional study conducted from September 2022 to October 2022. The observation cross-sectional study design allows the researcher to obtain data on both outcome and exposure at the same time without any prior application of an intervention. This was also chosen because it was relatively inexpensive and less time consuming to conduct as compared to other study designs (Setia, 2016).

#### **3.3 Study Area**

The study area was the Nsawam Government Hospital of the Ghana Health Service. Presented below is the description of the study area.

##### **3.3.1 Geography**

Nsawam Government Hospital is found within the newly created Nsawam-Adoagyiri Municipality in the Eastern Region of Ghana, specifically in Nsawam. The municipality is located in the South-Eastern part of the Eastern Region, about 34.3km from Accra. It is bordered by Ga West and East Municipalities to the south, Akuapem South District to the north, Ayensuano District to the north-west and Upper West Akim District to the south-west (Ghana Statistical Service, 2014). Nsawam,

the municipal capital is found along the Accra-Kumasi Highway (N6). This is an accident-prone highway which is one of the major highways linking southern Ghana to the northern regions (Ghana News Agency, 2021).

### **3.3.2 Demography and economic status**

According to the 2010 Population and Housing Census, the Nsawam Adoagyiri Municipality had an estimated population of 86,000 , with a growth rate at 1.6% per annum and sex ratio of 98.8. The district spans over an estimated land area of about 175 square kilometres. About 60.9% of the municipality's population are between the ages of 15-64 years. Out of this figure, 66.5% are economically active. According to the Ghana Statistical Service, majority of this group (92.7%) are employed, with the most dominant occupation for both sexes being sales and services (Ghana Statistical Service, 2014)

### **3.3.3 Healthcare provision**

Within the Nsawam-Adoagyiri Municipality are five CHPS compounds, six health centres, two faith-based hospitals and three private hospitals. Additionally, the municipality boasts of an Orthopaedic Centre where among other services, the fitting of prosthesis is offered. The Nsawam Government Hospital (NGH) is the main first level referral centre for all these primary health facilities. It has a 7-bed 24hr Accident and Emergency Unit (A&E) , procedure room and separate wards for longer term care for surgical patients. At the emergency room (A&E), all emergencies are primarily managed except for obstetric/gynaecological emergencies (which are managed in a different ward). The hospital has an operating theatre with 2 operating rooms (Eastern Regional Co-ordinating Council, n.d.; Nsawam Government Hospital, n.d.) and a minor theatre to provide minor and major trauma surgical care. Minor surgical services refer to surgeries that can be conducted under local anaesthesia and do not require a sterile surgical theatre or a specialist

surgeon. Major surgical services are surgical services which are generally conducted by specialist surgeons, requiring both resources for minor surgeries, and additional physical and human resources for anaesthesia (World Health Organisation, 2017).

In Nsawam Government Hospital, the patients with injuries first present to the Accident and Emergency (A&E) Unit where they are resuscitated and then they are either transferred to the hospital surgical ward, the major /minor surgical theatres for operative procedures, referred to higher centres, or discharged to go home.

### **3.4 Study population**

The study population was the staff of the Accident and Emergency (A&E) Unit (including one nurse manager of the Emergency Department) and personnel who were heads of units /in-charges involved in hospital operations in Nsawam Government Hospital relevant to trauma care.

#### **3.4.1. Inclusion criteria**

Staff of Nsawam Government Hospital who worked within the Accident and Emergency Unit or whose work involved the direct or indirect care for trauma patients in the hospital or general hospital administrative duties were included in study.

#### **3.4.2. Exclusion criteria**

Staff of Nsawam Government Hospital who worked within the Accident and Emergency Unit or whose work involved the direct or indirect care for trauma patients in the Hospital or general hospital administrative duties, but who were away on work leave at the time of study or who refused to participate were excluded from study.

### **3.5. Sampling strategies**

This section presents the methods applied to sample participants in the study

### **3.5.1. Sample size determination**

The sample size for the study was 44. This comprised 36 out of the 50 staff providing services in the Accident and Emergency Unit (including one deputy nurse manager) during the period of the study, who gave their consent to participate in the study. Also 8 participants were purposively selected as they were the heads of departments/in-charges whose work was directly or indirectly related to trauma surgical care. These were Medical Superintendent, heads of nursing care for the theatre ward, nurse anaesthetist in-charge, General Surgeon, hospital information technology personnel, heads of laboratory, biomedical and imaging departments.

### **3.5.2. Sampling methods**

The sampling method employed in the study are purposive sampling with total enumerative sampling. This section presents a description of methods applied.

#### **3.5.2 Purposive sampling method**

Purposive sampling was done to sample members of hospital administration and heads/ in-charges of units relevant to trauma care. Purposive sampling is a non-probability sampling method that seeks to obtain data from participants who are most knowledgeable about the subject matter (Etikan, Musa, & Alkassim, 2016). This sampling method was applied to obtain data from persons who were most knowledgeable about trauma emergency surgical care in Nsawam Government Hospital. This sampling strategy was chosen because this method was recommended for use by the WHO SARA methodology manual for calculating readiness scores (World Health Organisation-United States Agency for International Development, 2015). Thus, the heads of departments/in-charges who played leadership roles in units relevant to trauma care delivery were recruited. The Medical Superintendent, hospital information technology personnel, nurse anaesthetist, nursing head of emergency and theatre wards, General Surgeon, head of laboratory,

biomedical and imaging departments were the key informants listed to be sampled. All these personnel listed gave their consent to be participants in the study.

### 3.5.3 Total enumerative sampling

A total enumerative sampling was also taken of all staff who worked in the Accident and Emergency Unit in Nsawam Government Hospital. This is a type of non-probability purposive sampling in which all units within a given population who share the same characteristics are sampled. This method was employed when the sample size is small and defined by a peculiar character (Laerd Dissertation, 2012). Total enumerative sampling was done to obtain direct data from all staff members of the emergency department who worked daily to provide surgical trauma care in Nsawam.

### 3.6 Study Variables

The variables measured in the study were availability and readiness for emergency trauma care in Nsawam Government Hospital. These were dependent on variables which are tracer indicators categorised under the following: basic hospital infrastructure (general service readiness), essential medicines and commodities, blood services, diagnostics, equipment, and staffing and guidelines.

Table 3.1: Operational Definitions

| Variable List                                   | Operational definition                                                                                                                                                                                                                                             | Scale of measurement | Type of variable |
|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------------|
| Availability of emergency Trauma care           | Physical availability of physical and human resources for trauma care. Expressed as a rating.                                                                                                                                                                      | Interval             | Discrete         |
| Readiness for emergency trauma care             | Mean availability of the tracer indicators for physical and human resources needed to be physically present to deliver in-hospital emergency room care, minor trauma surgical care and major trauma surgical care, blood transfusion services. Expressed as scores | Ratio                | Continuous       |
| 1. Guidelines on emergency trauma care policies | Observed nationally adapted guidelines on trauma care , triage policies, appropriate use of blood and safe blood transfusion.                                                                                                                                      | Nominal              | Categorical      |
| 2. Staff trained in emergency trauma care       | At least one staff member trained in aspects of emergency trauma care, appropriate use of blood and safe blood transfusion in the last three years.                                                                                                                | Nominal              | Categorical      |

|                                           |                                                                                                                                                                                                                                                                                                                                               |         |             |
|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------|
| 3. Essential medicines and commodities    | Observed availability of medications relevant to trauma surgical care in stock in service area with at least one valid.<br>Reported sufficiency of blood as no interruption in blood availability in last three months, with blood obtained from national/regional blood bank/other sources but screened for blood borne viruses              | Nominal | Categorical |
| 4. Equipment                              | Observed availability and reported functionality of equipment relevant to the provision of surgical care and blood storage in the facility                                                                                                                                                                                                    | Nominal | Categorical |
| 5. Diagnostic facility                    | Observed availability (on-site either in lab or service area) and reported functionality of equipment and reagent needed to conduct the onsite tests for haemoglobin, electrolytes, blood gases, blood grouping and crossmatching, and trauma imaging. Focused Assessment with Sonography in Trauma-FAST should be present in emergency unit. | Nominal | Categorical |
| <b>6. Basic Amenities</b>                 |                                                                                                                                                                                                                                                                                                                                               |         |             |
| 6.i. Dedicated trauma beds                | Observed dedicated trauma beds                                                                                                                                                                                                                                                                                                                | Nominal | Categorical |
| 6.ii Communication equipment              | Reported availability of functioning communication equipment. Excludes private cell phones (unless facility pays for cost of calls) and payphones outside facility.                                                                                                                                                                           | Nominal | Categorical |
| 6.iii Computer with email/internet access | Reported availability of a functioning computer with email/internet access on day of survey.                                                                                                                                                                                                                                                  | Nominal | Categorical |
| 6.iv Emergency Transportation             | A functioning vehicle with fuel that is routinely available for emergencies is reported as available. Or, access to emergency vehicle at a site in close proximity to hospital.                                                                                                                                                               | Nominal | Categorical |
| 6.v Improved water source                 | Observed availability of improved water sources within the facility or in the grounds of the hospital.                                                                                                                                                                                                                                        | Nominal | Categorical |
| 6.vi Auditory and visual privacy          | Observed availability of a private/ screened off room for emergency consultations, which provides both visual and auditory privacy.                                                                                                                                                                                                           | Nominal | Categorical |
| 6.vii Power                               | Reported availability of electricity at least for lighting and communication during normal working hours, obtained from any source of power.                                                                                                                                                                                                  | Nominal | Categorical |

### 3.7. Data Collection

Quantitative data was collected using questionnaires from the adapted tools explained below.

- i. A 45-item abridged WHO Guideline for Essential Trauma Care was used as a checklist for availability of equipment and technology (Adapted from Japiong et al (2016) and Stewart et al (2015)). This was a four-point Likert scale used to assess the availability ratings of trauma specific equipment/services available in the Accident & Emergency Unit. Studies from which this scale was adapted did not



report on its psychometric properties. This scale had seven subsections, and each section represented key resuscitation principles required in caring for an injured patient. The questions under each subsection probed into the availability of equipment in the emergency room for performing a specific initial care for injured. The subsections are as follows: airway, breathing, circulation, diagnostics, surgery, extremity injury , and brain and spinal cord injury.

- ii. Service Availability and Readiness Assessment (SARA) methodology core instrument for WHO was adapted to assess service availability and readiness adapted for emergency trauma surgical care (World Health Organisation-United States Agency for International Development, 2015). From the SARA methodology, questionnaires were adopted to probe into the available trauma surgical procedures conducted in the facility (Section 1). The questionnaire also assessed readiness for minor and major surgical services, emergency room services, blood bank services and basic hospital amenities respectively by measuring specific tracer indicators which were grouped into domains of care. This part of the questionnaire was in 6 different sections based on the domains of care: Section 2 and 3 investigated the domain of staffing and guidelines, and equipment for trauma care. Section 4 probed into diagnostic facility for trauma care, while Section 5 probes into essential medicines and commodities. Section 6 and 7 were used to evaluate all indicators for blood transfusion services and basic hospital amenities respectively. Each section was administered to the head of department/in-charge of unit providing the service in the Surgical Theatre or Emergency Unit.

Data collection with the above instruments was conducted between September and October, 2022. All staff who work in the Accident and Emergency Unit were recruited to complete the adapted Guidelines for Essential Trauma Care questionnaire which sought to assess availability ratings of trauma equipment and services. Direct observation was used to corroborate and confirm availability of all physical resources which were rated as always available ( score of 3). Respondents were asked to provide reasons to explain why a lower score(<3) was assigned to a particular resource in the emergency room.

For the adopted SARA questionnaire, each section was administered to the head of department/in-charge of unit providing specific service (i.e, minor and major surgery, blood transfusion, emergency room care, hospital basic amenities) in the Surgical Theatre or Emergency Unit or Hospital Administration.

### **3.8 Quality assurance**

Quality assurance in this context relates to the steps that were put in place to ensure data accuracy quality and reducing biases. These include training research assistants, supervising data entry and data analysis.

#### **3.8.1 Training of research assistants**

Two research assistants who were physician assistants collected data for this study. The training lasted for about an hour and 30minutes as these were physician assistants with previous knowledge of data collection of this nature. They were trained on the data collection instruments, sampling criteria, ethical issues and the informed consent process. Data was cleaned prior to analysis .

#### **3.8.2 Pretesting**

The structured questionnaires were pretested in Acres Medical Centre, a private medical centre in Accra. Questionnaires were administered to health personnel who performed roles related to

emergency trauma care. They were Medical Doctor and Family Physician, Laboratory Personnel in-charge, and General Nurse in-charge of the facility. Pretesting helped the researcher restructure the final questionnaire used in the data collection.

### 3.8.3 Validity and reliability

Validity measures the level to which the scales used measure the actual/real value of the concept under study (Goforth, 2015). The scales used are valid as the variables included in study measure the concept of availability as recommended by the Guidelines for Essential Trauma Care by WHO, as well as service-specific readiness as established by WHO Methodology for Service Availability and Readiness Assessments (Mock, 2004; World Health Organisation-United States Agency for International Development, 2015). The formation of these guidelines by WHO were evidence based, utilising expert consultation in the field of trauma surgery as well as monitoring and evaluation of hospital services.

Reliability of the study was assured by calculating the Cronbach's alpha of the 45-item Likert scale used. Cronbach alpha is assessing the "strength of consistency" of a given scale in measuring a given concept. It is calculated using the formula as stated below:

$$\alpha = \frac{N\bar{c}}{\bar{v} + (N - 1)\bar{c}}$$

where N is the number of scale items

c refers to the average of all covariances between items

v refers to the average variance of each item

Results from applying formula should range from 0 to 1: the minimum coefficients recommended are between 0.65 and 0.8, with scores greater than 0.95 suggesting redundancy. Following literature review, no studies utilising these similar scales were found to have reported on this alpha

co-efficient for reliability. However, after applying scale to data used in this study, the alpha coefficient calculated for the Likert scale was 0.89, thus suggesting high reliability of the scale (Goforth, 2015).

### **3.9 Data management and analysis**

#### **Data entry and processing**

The data was coded and entered into Microsoft Excel 2016, and cleaned to ensure that all data entered were accurate and in an organised format for analysis. The data was then exported to Stata IC v 16.

#### **Data analysis**

Analysis was done using Stat IC v 16, and then simple descriptive analysis was done. Availability ratings of physical resources needed in the Accident and Emergency Unit were analysed using the median of a four-point Likert scale (0-3). The factors influencing trauma resource availability were represented by frequencies and percentages of responses. Readiness scores of the hospital for emergency trauma surgical care services were calculated as the mean availability of all items needed for a specific service, expressed as a percentage.

#### **3.9.1 Assessing availability ratings for trauma physical resources within Nsawam Government Hospital**

Objective 1 was analysed using descriptive statistics. First, 36 respondents who were all staff of the Accident and Emergency Unit were asked about the degree to which selected equipment/items for trauma emergencies were reliably available within the facility. For this items /equipment, WHO's Guidelines for Essential Trauma Care, had originally classified them into essential (E), desirable (D), and possibly required (PR) based on their recommended levels of availability. "Essential" (E) items per a given facility level are the basic items that should be commonly

available within the given facility, even in low economic settings. The “desirable” (D) items if present would increase overhead cost of the facility, however, its presence improves outcome of trauma patient. “Probably required” (PR) resources were those trauma resources which may be shifted to lower levels in order to increase availability of resources.

In this study, respondents were to rank availabilities of individual items on a Likert scale, as either:

0—Absent, but should be present;

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 needed.

Direct observation was used to confirm reliable availability of items scored as 3. The availability of equipment for trauma care was investigated by calculating median scores for each equipment/item. Score of 0-2 were considered low availability. A score of 3 was considered satisfactory availability.

### **3.9.2 Identifying factors that determine the level of availability of trauma resources**

The second objective was to investigate factors which determined the availability/supply of items identified as having unreliable/low availability (score of 0-2). Respondents (i.e., staff of the Accident and Emergency Unit) were asked to provide reasons that accounted for the low availability scores (0-2) where this was assigned. The possible factors highlighted included equipment absence, human resource shortages, stock-outs, user fees restricting access and faulty equipment. Respondents could assign more than one reason to explain unavailability. Similar factors were described for groups of items that performed functions synergistic in nature. These

reasons for unavailability were described as a percentage of all total responses for each item, as well as groups of equipment/item.

### **-3.9.3. Assessing the readiness scores of emergency services, surgical care and blood transfusion services**

Service readiness was defined as the mean availability of all tracer indicators recommended by SARA as important for the provision of the specified service (Iverson et al., 2020). To assess service readiness for emergency care, the WHO methodology for calculating readiness scores by facilities was applied (dissertation methodology is described on Page 42) (World Health Organisation-United States Agency for International Development, 2015, p118). Readiness for emergency services, major and minor surgery and blood transfusion were assessed as these services were all needed to provide trauma emergency care. The eight managers working in other units relevant to trauma care, and the deputy nurse manager of the Emergency Unit of Nsawam Government Hospital were interviewed and they responded to different sections of the SARA questionnaire. Their responses were used in generating scores for SARA, as they were considered most knowledgeable in services provided by the units they headed (Table 3.2).

Table 3.2: Respondents of SARA Questionnaires

| SARA Questionnaire                                                           | Respondents                                                                                                                                 |
|------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| SARA questionnaire for Emergency Service*                                    | Nurse in-charge of Emergency, Personnel In-charge of Laboratory service, Personnel In-charge of Medical Imaging department, General Surgeon |
| SARA questionnaire for Minor Trauma Surgery, and available surgical services | General Surgeon                                                                                                                             |
| SARA questionnaire for Major Trauma Surgery, Infection Control Precautions*  | Anaesthetists in-charge, General Surgeon, Theatre Ward In-charge                                                                            |
| SARA questionnaire for basic hospital amenities*                             | Information Technology Personnel, Medical Superintendent                                                                                    |
| SARA questionnaire for blood transfusion services                            | Blood Bank in-charge                                                                                                                        |

- Respondents responded to different parts of questionnaire based the role played in trauma care.

Readiness was defined in four domains: equipment, diagnostic capacity, staffing and training, and essential medicines. Each domain had a number of tracer items which respondents (head of relevant department/ in-charge of units) were required to score (Table 3.3). The tracer indicators for minor and major surgery as well as blood transfusion are recommended by the original WHO SARA methodology (Table 3.3 and Table 3.1). The tracer indicators for emergency services were adapted from a SARA survey conducted in Libya by the World Health Organization (World Health Organization, 2017). For reliability, the checklists were administered to heads/unit in-charges and direct observation was used to confirm availability where applicable.

For each variable/tracer indicator of a domain, a value of 1 was assigned if the service or equipment was available and functioning, and 0 was assigned if it was unavailable or available but non-functional. Answers reported as “don’t know” were treated as missing data.

For each domain, an index score was calculated as a mean score of all tracer items expressed as a percentage. If a domain had 6 tracer items, and 4 out of these 6 indices were available and functioning, then the domain score was  $4 \times 100 / 6$  (The domain score will be 66.67%. This means that the facility had only 66.67% of items/resources required to deliver services in the domain in question). The final readiness score for a particular service in a facility was then calculated as a mean score of all the individual domains for that service.

Table 3.3: Number of tracer indicators for readiness domains for each service needed in trauma emergency care.

| Domain<br>Service                         | Number of tracer indicators per domain |                            |                  |                    |
|-------------------------------------------|----------------------------------------|----------------------------|------------------|--------------------|
|                                           | Training and Guidelines Domain         | Essential Medicines Domain | Equipment Domain | Diagnostics Domain |
| Hospital Accident and Emergency Room care | 5                                      | 2                          | 18               | 7                  |
| Minor trauma surgery                      | 3                                      | 6                          | 4                | 0                  |
| Major trauma surgery                      | 4                                      | 9                          | 19               | 0                  |
| Blood transfusion                         | 2                                      | 2                          | 1                | 2                  |



### **3.10 Ethical considerations**

#### **3.10.1 Institutional and ethical approval**

##### **Ethical Clearance**

Ethical approval (GHS/RDD/ERC/Admin/App/22/329) was obtained from the Ethical Review Committee of Ghana Health Service (GHS-ERC) (APPENDIX II: ETHICAL APPROVAL CERTIFICATE).

##### **Permission from study site**

Permission was also sought from the Eastern Regional Ghana Health Service Directorate and Nsawam Government Hospital before the start of the study.

#### **3.10.2 Consenting Process**

Informed consent forms were administered to each individual to obtain consent prior to recruiting them into study. All respondents were included in the study only after obtaining verbal consent and agreeing to a written informed consent bearing their names after the objectives of the study were explained. Participation in study was only on voluntary basis.

#### **3.10.3 Voluntary withdrawal**

Recruited respondents were informed that they were at liberty to withdraw their participation in the study at any point in the research without facing any penalty whatsoever

#### **3.10.4 Confidentiality and privacy**

Hospital administration and study participants were assured of confidentiality, the safety and appropriate usage of data. The interviewer used identification numbers to represent each participant instead of their names to ensure anonymity. Also, they were assured that the



information obtained during the interview would not to be shared with any third party. Data obtained would be used solely for the purposes of this study.

### **3.10.5 Risks and Discomforts**

There were minimal risks in partaking in the study. The only discomfort was with time spent in answering questionnaire (respondents spent 15minutes to 40minutes in answering questions depending on the role they played in providing trauma emergency).

### **3.10.6 Benefits**

Participants did not gain any direct benefit from the study. However, the findings of this study would be made available to Emergency Department and hospital administration of Nsawam Government Hospital as well as the Ghana Health Service. This would be instrumental in providing evidence for trauma systems strengthening in Nsawam Government Hospital and may promote dialogues between key stakeholders in efforts to improve injury survival especially in rural parts of Ghana. Also, results would be presented at conferences and in peer-review journals to inform practice in health systems strengthening.

### **3.10.7 Compensation/Payment**

No compensation was paid to participants of this study other than a word of appreciation.

### **3.10.8 Conflict of interest**

The Principal Investigator has no conflict of interest in this study. The study is solely for academic purposes and it is of public health importance.

### **3.10.9 Summary**

The study was conducted at the Nsawam Government Hospital of the Ghana Health Service which is located in the Nsawam-Adoagyiri Municipality in the Eastern Region of Ghana.

The Nsawam Government Hospital (NGH) is the main first level referral centre for all the primary health facilities within the municipality and its environs. It has an operating theatre with two operating rooms and a 7-bed 24hr Accident and Emergency Unit where initial urgent care for all trauma emergencies are primarily managed.

Purposive sampling and total enumerative sampling methods were used for the collection of data. The dependent variables for the study were availability and readiness for emergency trauma services and the independent variables were tracer indicators categorised under basic hospital infrastructure , essential medicines and commodities, blood services, diagnostics, equipment, staffing and guidelines.

Quantitative data was collected using questionnaires adapted from the WHO Guidelines for Essential Trauma Care and SARA core instrument. Selected members of hospital administration and heads of departments/ service delivery were recruited to complete different parts of the adapted SARA guideline based on their expertise. All staff who worked in the Accident and Emergency Unit were recruited to complete the adapted Guidelines for Essential Trauma Care questionnaire which sought to assess availability ratings of trauma equipment and services. Direct observation was used to corroborate and confirm availability of all physical resources which were rated as always available. The questionnaire was administered after pretesting and the sample size for the study was forty-four.

The data collected was coded and entered into Microsoft Excel 2016, and cleaned. Analysis was done using STATA IC v 16, and then simple descriptive analysis was done. Availability ratings of physical resources needed in the Accident and Emergency Unit were analysed using the median of a four-point Likert scale (0-3). The factors influencing trauma resource availability were represented by frequencies and percentages of responses. Readiness scores of the hospital for

emergency trauma surgical care services were calculated as the mean availability of all items needed for a specific service, expressed as a percentage.

The following chapter would discuss the results obtained from the data analysis described.



## Chapter 4

### RESULTS

#### 4.1 Introduction

This chapter presents the findings of the study conducted to assess the availability and readiness of Nsawam Government Hospital to provide emergency trauma surgical care to injured victims.

#### 4.2 Background Characteristics of Respondents who participated in the study

In all, 44 respondents were recruited into the study; out of this 36 of them were staff of the Accident and Emergency Unit directly involved in the provision of trauma emergency care while eight (General Surgeon, Medical Superintendent, Deputy Laboratory In-Charge, Technical Officer in charge of the Imaging Unit, officer-in-charge of the Blood Bank, Information Technology (IT) Personnel and Theatre Ward-in charge) worked in other sections of the hospital (Table 4.1).

Table 4.1: Distribution of Staff Interviewed

| Cadre of Staff Interviewed                      | Number    |
|-------------------------------------------------|-----------|
| <b>A&amp;E Staff</b>                            |           |
| Physician Assistants                            | 13        |
| General Nurses                                  | 16        |
| Medical Officers                                | 6         |
| Deputy Nurse Manager of A&E Ward                | 1         |
| <b>Staff of other Units</b>                     |           |
| General Surgeon                                 | 1         |
| Managers of other units involved in trauma care | 7         |
| <b>Total</b>                                    | <b>44</b> |

On the whole however, the hospital's human resources who offered trauma emergency service delivery comprised of 1 General Surgeon and 5 Nurse Anaesthetists. There were 6 General Medical Officers, and 18 Physician Assistants (interns) who were on the emergency room roster to offer emergency care. There was no Emergency Specialist / Trauma Surgeon on staff roll.

#### 4.2 Perceived Availability Ratings for Trauma Resources

Thirty-six staff of the Accident and Emergency Department (including the Emergency Ward Deputy Nurse Manager) were asked to grade availability of WHO recommended trauma resources as 0(absent), 1 (inadequate), 2 (partially adequate), 3 (adequate).

Overall, all items under Circulatory Medicines for trauma emergency, basic airway and general surgery were reliably available with a score of 3 (Table 4.2). On the other hand, physical equipment/resources for advanced airway (rated as 0) and neurosurgical care (rated as 1) as well as chest tubes with underwater drainage (rated as 1) had lower mean availability scores. For the availability of diagnostic resource in Nsawam Government Hospital, essential haemoglobin testing, and x-ray services were highly available each with ratings of 3. Electronic cardiac monitors and electrolyte testing capacity were desirable items/service but they were present and had scores of 1 and 3 respectively (Table 4.2). The Cronbach's alpha of the Likert scale used was 0.89.

Table 4.2: Perceived Availability Ratings of Equipment in Nsawam Government Hospital Accident and Emergency Unit by Staff of the Emergency Unit

| Equipment/ Service                       | WHO expected rating | Median Nsawam Government Hospital Staff rating |
|------------------------------------------|---------------------|------------------------------------------------|
| Basic Airway                             |                     |                                                |
| Nasal or oral airway                     | E                   | 3                                              |
| Suction Pump                             | E                   | 3                                              |
| Advanced Airway                          |                     |                                                |
| Laryngoscope                             | E                   | 0                                              |
| Endotracheal Tube                        | E                   | 0                                              |
| Overall rating for -Airway equipment     |                     | 2                                              |
| Breathing                                |                     |                                                |
| Stethoscope                              | E                   | 3                                              |
| Oxygen supply                            | E                   | 3                                              |
| Nasal prongs                             | E                   | 3                                              |
| Face mask                                | E                   | 3                                              |
| Chest tubes and water seal               | E                   | 1                                              |
| Bag valve mask                           | E                   | 3                                              |
| Mechanical ventilator                    | D                   | 0                                              |
| Overall rating for Breathing equipment   |                     | 2                                              |
| Circulation Essential Medicines          |                     |                                                |
| Intravenous set                          | E                   | 3                                              |
| Blood transfusion capacity               | E                   | 3                                              |
| Overall rating for Circulation medicines |                     | 3                                              |
| Circulation Equipment                    |                     |                                                |

|                                                  |           |   |
|--------------------------------------------------|-----------|---|
| Clock or watch with second hand                  | <i>E</i>  | 3 |
| Urinary catheter                                 | <i>E</i>  | 3 |
| Electronic Cardiac Monitoring                    | <i>D</i>  | 1 |
| Overall rating for Circulation equipment         |           | 3 |
| <i>Diagnostics</i>                               |           |   |
| Haemoglobin testing                              | <i>E</i>  | 3 |
| Electrolyte testing                              | <i>D</i>  | 3 |
| Arterial Blood Gas testing                       | <i>D</i>  | 0 |
| Xray                                             | <i>E</i>  | 3 |
| Portable Xray                                    | <i>D</i>  | 0 |
| FAST                                             | <i>D</i>  | 0 |
| CT Scan                                          | <i>D</i>  | 0 |
| Overall rating for Diagnostic capacity           |           | 2 |
| <i>General Surgery</i>                           |           |   |
| Basic General Surgery                            | <i>E</i>  | 3 |
| Major General Surgery                            | <i>E</i>  | 3 |
| Skin Graft                                       | <i>E</i>  | 2 |
| Overall rating for General Surgical Procedures   |           | 3 |
| <i>Orthopaedic care for extremity injury</i>     |           |   |
| Skin/skeletal traction                           | <i>E</i>  | 3 |
| Internal fixation                                | <i>E</i>  | 0 |
| External fixation                                | <i>E</i>  | 0 |
| Prosthetics for amputees                         | <i>D</i>  | 0 |
| Image intensification                            | <i>D</i>  | 0 |
| Overall rating of resources for Extremity injury |           | 2 |
| <i>Neurosurgical care</i>                        |           |   |
| Cervical Collar                                  | <i>E</i>  | 2 |
| Backboard                                        | <i>E</i>  | 1 |
| Major neurosurgery                               | <i>PR</i> | 0 |
| ICP Monitoring                                   | <i>D</i>  | 0 |
| Overall rating for neurosurgical care equipment  |           | 1 |

Adapted from WHO Guidelines for Essential Trauma care where E(Essential), D(Desirable), PR (Probably Required). Availability ratings assigned by staff of A&E Unit were 0(absent), 1(inadequate), 2(partially adequate), 3(adequate). Numbers in cells above represent median ratings.

### 4.3 Factors contributing to low availability of equipment for emergency and trauma care

For the equipment and services which had low availability scores in Table 4.2, staff were asked to provide reasons which could explain the low availability of this physical resource.

The absence of an equipment meant that the equipment had never been physically available or present within the hospital premises. This was the most common reason attributed to the low availability of mechanical ventilators (14, 63.6%), diagnostic equipment (16, 65.0%), prosthetics for amputees (9, 36.0%), image intensification (21, 75.0%), intracranial pressure monitoring (18,

60.0%), and backboard (14, 66.7%) among respondents ( 4.3). On inspection however, the facility had acquired a new portable x-ray device, however, this equipment was within the radiology department yet to be opened. The older portable x-ray device could not be moved to the Emergency Unit because the unit had no lead shielding equipment installed to protect other patients from harmful x-rays while in use. Ultrasonography was available also, but at scheduled times in the Obstetric and Gynaecological department mainly for this cohort of patients and not in the Accident & Emergency Unit. This created a mismatch in the availability of these diagnostic resources.

The shortage in the supply of skilled health-workers was frequently mentioned as causing low availability of overall neurosurgical and orthopaedic care (48.3% and 40.0% of responses respectively) ( 4.3). Majority of responses (40.7%) from the staff of the Emergency Unit also indicated low availability of staff skilled to use advanced airway equipment in the Emergency Room . The emergency unit had electronic cardiac monitors but these were broken down according to 85.7% (18) of responses. User fees restricted access to and timely availability of chest tubes and underwater seal drainage equipment (16, 66.7%) as well as cervical collars (15, 71.4%), hence their suboptimal availability. These user-fees had to be paid to external vendors since they were not usually stocked by the hospital. Generally, the hospital had breathing equipment stocked however, according to about 80.0% (12) of responses, there were not enough units available to meet demands .

**TABLE 4.3: FACTORS CONTRIBUTING TO DEFICIENCIES IN RESOURCES FOR TRAUMA CARE AT NSAWAM GOVERNMENT HOSPITAL**

| Equipment/ Item with low availability scores   | Equipment absence (%) | Breakdown (%) | Staffing shortage (%) | Training (%) | Lack of supplies/reagent (%) | Stockout/ Insufficient quantities (%) | User fees (%) | Don't know (%) | Service not seen in facility (%) |
|------------------------------------------------|-----------------------|---------------|-----------------------|--------------|------------------------------|---------------------------------------|---------------|----------------|----------------------------------|
| <i>Airway</i>                                  |                       |               |                       |              |                              |                                       |               |                |                                  |
| Laryngoscope (n=25)                            | 76.00                 |               |                       |              |                              | 12.00                                 |               | 12.00          |                                  |
| Endotracheal Tube (n=26)                       | 76.92                 | 3.85          |                       |              |                              | 3.85                                  |               | 15.38          |                                  |
| Overall Airway equipment (n=28)                | 33.33                 | 21.88         | 40.74                 |              |                              |                                       |               |                |                                  |
| <i>Breathing</i>                               |                       |               |                       |              |                              |                                       |               |                |                                  |
| Chest tubes and water seal (n=24)              | 20.83                 |               |                       | 4.17         | 4.17                         |                                       | 66.67         | 4.17           |                                  |
| Mechanical ventilator (n=22)                   | 63.63                 | 13.64         |                       | 4.55         | 4.55                         | 13.64                                 |               |                |                                  |
| Overall Breathing equipment (n=17)             | 11.76                 | 11.76         |                       |              |                              | 70.59                                 |               | 5.88           |                                  |
| <i>Circulatory Equipment</i>                   |                       |               |                       |              |                              |                                       |               |                |                                  |
| Electronic Cardiac Monitoring (n=21)           | 9.52                  | 85.71         |                       |              |                              |                                       |               | 4.76           |                                  |
| <i>Diagnostics</i>                             |                       |               |                       |              |                              |                                       |               |                |                                  |
| Arterial Blood Gas (n=25)                      | 44.00                 |               | 4.00                  |              | 20.00                        | 4.00                                  |               | 28.00          |                                  |
| Portable Xray (n=32)                           | 68.75                 |               | 3.13                  | 3.13         |                              |                                       |               | 25.00          |                                  |
| FAST (n=33)                                    | 87.87                 |               |                       | 3.03         |                              | 3.03                                  |               | 6.06           |                                  |
| CT Scan (n=30)                                 | 80.00                 |               | 3.33                  |              |                              |                                       |               | 16.67          |                                  |
| Overall diagnostic capacity (n=25)             | 65.00                 | 5.00          |                       |              |                              | 30.00                                 |               |                |                                  |
| <i>General Surgery</i>                         |                       |               |                       |              |                              |                                       |               |                |                                  |
| Skin Graft (n=18)                              |                       |               | 16.67                 | 27.7         | 16.6                         |                                       |               | 38             |                                  |
| <i>Orthopaedic care for extremity injuries</i> |                       |               |                       |              |                              |                                       |               |                |                                  |
| Internal fixation                              | 17.39                 |               | 34.78                 |              | 4.35                         |                                       |               | 17.39          | 26.09                            |
| External fixation (n=23)                       | 17.39                 |               | 30.43                 |              |                              |                                       | 4.35          | 17.39          | 30.43                            |
| Prosthetics for amputees (n=25)                | 36.00                 |               | 28.00                 |              |                              |                                       |               | 12.00          | 24.00                            |
| Image intensification (n=28)                   | 75.00                 |               | 17.86                 |              |                              |                                       |               | 7.14           |                                  |
| Overall orthopaedic care (n=20)                | 35.00                 |               | 40.00                 | 5.00         |                              | 5.00                                  | 5.00          | 10.00          |                                  |
| <i>Neurosurgical care</i>                      |                       |               |                       |              |                              |                                       |               |                |                                  |
| Cervical Collar (n=21)                         | 14.28                 |               |                       |              |                              | 4.76                                  | 71.43         | 9.52           |                                  |
| Backboard (n=21)                               | 66.67                 |               |                       |              |                              |                                       | 19.05         | 14.29          |                                  |
| Basic neurosurgery (n=32)                      | 19.35                 |               | 41.95                 | 6.45         |                              |                                       |               | 9.67           | 22.58                            |
| Major neurosurgery (n=29)                      | 13.79                 |               | 44.83                 | 6.9          |                              |                                       |               | 10.34          | 24.14                            |
| ICP Monitoring (n=30)                          | 60.00                 |               | 13.33                 | 3.33         |                              |                                       |               | 10.00          | 13.33                            |
| Overall Neurosurgical care (n=29)              | 20.69                 | 10.34         | 48.28                 | 10.34        |                              |                                       |               | 3.45           | 6.90                             |



#### 4.4 Service Readiness

Nsawam Government Hospital was assessed for its readiness for trauma surgical care using adapted structured questionnaires from WHO's Service Availability and Readiness Assessment (SARA). The readiness for in-hospital emergency room services was calculated as the mean availability of all tracer indicators under the following domains: equipment (44.4%), diagnostics (43.0 %), essential medicines (100%), staffing and guidelines (100%) (Table 4.4 1)

Table 4.4 1: Readiness Score for Trauma In-hospital Emergency Room Services of Nsawam Government Hospital

| HOSPITAL TRAUMA EMERGENCY ROOM SERVICE     | READINESS SCORE(%)  |
|--------------------------------------------|---------------------|
| Guidelines for:                            |                     |
| Trauma emergencies                         | 1 (100)             |
| Triaging <sup>c</sup>                      | 1(100)              |
| Staff trained in:                          |                     |
| Trauma surgery                             | 1 (100)             |
| Trauma course in last 3 years              | 1(100)              |
| <i>Domain Readiness Score</i>              | <i>1(100)</i>       |
| Equipment                                  |                     |
| Stethoscope                                | 1(100)              |
| Oxygen                                     | 1(100)              |
| Suction apparatus                          | 1(100)              |
| Chest tube with underwater drainage        | 0(0)                |
| Laryngoscope handle and blade (Adult)      | 0(0)                |
| Laryngoscope handle and blade(paediatrics) | 0(0)                |
| Endotracheal tube-adult                    | 0(0)                |
| Endotracheal tube- paediatrics             | 0(0)                |
| Oropharyngeal or nasopharyngeal airway     | 0(0)                |
| Pulse oximeter                             | 1(100)              |
| Resuscitator bag and mask-adult            | 1(100)              |
| Resuscitator bag and mask-paediatric       | 1(100)              |
| Magills forceps-adult                      | 0(0)                |
| Magills forceps-paediatric                 | 0(0)                |
| Suction Apparatus                          | 1(100)              |
| Clock with second hand                     | 1(100)              |
| Cervical collar <sup>a</sup>               | 0 (0)               |
| Backboard <sup>b</sup>                     | 0 (0)               |
| <i>Domain Readiness score</i>              | <i>0.444 (44.4)</i> |
| Essential Medicines                        |                     |
| Intravenous infusion set                   | 1 (100)             |
| Crystalloid infusion                       | 1(100)              |
| <i>Domain Readiness Score</i>              | <i>1(100)</i>       |

|                                                         |                 |
|---------------------------------------------------------|-----------------|
| Diagnostics                                             |                 |
| Xray                                                    | 1(100)          |
| Portable X-ray                                          | 0               |
| FAST                                                    | 0               |
| CT Scan                                                 | 0               |
| Haemoglobin testing                                     | 1(100)          |
| Electrolyte testing                                     | 1(100)          |
| Arterial Blood Gas testing                              | 0(0)            |
| <i>Domain Readiness Score</i>                           | <i>0.43(43)</i> |
| Service Readiness Score for Hospital trauma emergencies | 0.71(71.00)     |

<sup>a b c</sup> These indicators for emergency services not considered originally within tool used by World Health Organisation, (2017), however included following literature review.

Readiness for emergency care was defined as the presence of tracer indicators important for providing in-hospital trauma emergency care services.

The service readiness score is defined as the mean availability of service-specific tracer items within across four domains: staffing and guidelines, equipment, essential medicines and diagnostics.

The overall readiness to provide trauma emergency room services in the Accident & Emergency Unit was 71.0% (Table 4.4 1).

The following minor surgical procedures were available at Nsawam Government Hospital: wound debridement, suturing, closed reduction of dislocated joint, chest tube insertion, acute burn management, and cricothyroidotomy. Readiness for minor surgery was calculated as the mean availability of tracer indicators (representing physical and human resources) required in the provision of minor surgery within Nsawam Government Hospital. The tracer indicators were scored under the following domains: staffing and guidelines (100%), equipment (100%), essential medicines (71%) (Table 4.4 2).

In Nsawam Government Hospital, the major trauma surgery services available were exploratory laparotomy, amputation, external fixation, skin grafting. These were offered within the main surgical theatre of the hospital. Readiness for major surgery (i.e., the availability of tracer indicators required in the provision of advanced anaesthesia and major surgical procedures) was

scored under the following domains: staffing and guidelines (100%), equipment (84.0%), essential medicines (100%) (Table 4.4 3).

The readiness scores for major surgical care and minor surgical care were 95% (Table 4.4 3) and 90% (Table 4.4 2) respectively. These scores were influenced by low scores assigned for essential equipment under major surgery, and for essential medicines needed for minor surgeries.

Table 4.4 2: : Readiness Score for Minor Trauma Surgery in Main Surgical Theatre

| MINOR TRAUMA SURGERY                             | READINESS SCORE(%) |
|--------------------------------------------------|--------------------|
| Guidelines for:                                  |                    |
| Trauma emergencies                               | 1(100)             |
| Staff trained in:                                |                    |
| Trauma surgery                                   | 1(100)             |
| Trauma course in last 3 years                    | 1(100)             |
| Domain Readiness Score                           | 1(100)             |
| Equipment                                        |                    |
| Torniquet                                        | 1(100)             |
| Retractor                                        | 1(100)             |
| Surgical scissors                                | 1(100)             |
| Stylet                                           | 1(100)             |
| Domain Readiness Score                           | 1(100)             |
| Essential Medicines                              |                    |
| Skin disinfectant                                | 1(100)             |
| Suture material                                  | 1(100)             |
| Ketamine injection                               | 1(100)             |
| Lidocaine                                        | 1(100)             |
| Splints for extremities                          | 1(100)             |
| Material for cast                                | 0 (0)              |
| Domain Readiness Score                           | 0.71(71)           |
| Overall readiness score for minor trauma surgery | 0.90 (90)          |

Readiness for minor trauma surgery was defined as the presence of tracer indicators important for providing in-hospital minor trauma surgery services.

The service readiness score is defined as the mean availability of service-specific tracer items within across three domains: staffing and guidelines, equipment and essential medicines.

Table 4.4 3: Readiness Score for Major Trauma Surgery in Main Surgical Theatre

| MAJOR TRAUMA SURGERY                            | READINESS SCORE (%) |
|-------------------------------------------------|---------------------|
| Guidelines for:                                 |                     |
| Trauma emergencies                              | 1 (100)             |
| Staff trained in:                               |                     |
| Trauma surgery                                  | 1 (100)             |
| Anaesthesia                                     | 1 (100)             |
| Trauma course in last 3 years                   | 1(100)              |
| <i>Domain Readiness Score</i>                   | <i>1(100)</i>       |
| Equipment                                       |                     |
| Anaesthesia machine with tubings and connectors | 1(100)              |
| Stethoscope                                     | 1(100)              |
| Oxygen cylinder                                 | 1(100)              |
| Flowmeter for oxygen therapy                    | 1(100)              |
| Oxygen delivery apparatus                       | 1(100)              |
| Resuscitator bag and mask-adult                 | 1(100)              |
| Resuscitator bag and mask-paediatric            | 1(100)              |
| Magills forceps-adult                           | 0(0)                |
| Magills forceps-paediatric                      | 0(0)                |
| Nasogastric tubes                               | 1(100)              |
| Oropharyngeal or Nasopharyngeal airway          | 1(100)              |
| Laryngoscope handle and blade-adult             | 1(100)              |
| Laryngoscope handle and blade -paediatric       | 1(100)              |
| Laryngoscope handle and blade -neonate          | 1(100)              |
| Endotracheal tube- adult                        | 1(100)              |
| Endotracheal tube- paediatric                   | 1(100)              |
| Endotracheal tube -neonate                      | 0(0)                |
| Spinal needle                                   | 1(100)              |
| Suction Apparatus                               | 1(100)              |
| <i>Domain Readiness score</i>                   | <i>0.84 (84)</i>    |
| Essential Medicines                             |                     |
| Thiopental powder                               | 1(100)              |
| Suxamethonium bromide(powder)                   | 1(100)              |
| Atropine (injectable)                           | 1(100)              |
| Halothane (inhalation)                          | 1(100)              |
| Bupivacaine (injectable)                        | 1(100)              |
| Diazepam (injectable)                           | 1(100)              |
| Lidocaine 5% (heavy spinal solution)            | 1(100)              |
| Epinephrine(injectable)                         | 1(100)              |
| Ephedrine (injectable)                          | 1(100)              |
| <i>Domain Readiness Score</i>                   | <i>1 (100)</i>      |
| Overall Readiness for major trauma surgery      | 0.95 (95)           |

Readiness for major trauma surgery was defined as the presence of tracer indicators important for major trauma surgery services.

The service readiness score is defined as the mean availability of service-specific tracer items within across three domains: staffing and guidelines, equipment and essential medicines.

The readiness of Nsawam Government Hospital to provide blood transfusion services were assessed and the readiness score obtained was 87.50 % (Table 4.4 4). This low score was attributed to blood supply sufficiency, where the blood bank always had blood products of all blood groups always available for patient use.

Table 4.4 4: Readiness Score for Blood Transfusion Services in Nsawam Government Hospital

| <b>Blood transfusion services</b>                            | <b>Readiness Scores (%)</b> |
|--------------------------------------------------------------|-----------------------------|
| Staffing and guidelines                                      |                             |
| Guidelines for appropriate use of blood and safe transfusion | 1 (100)                     |
| Trained staff                                                | 1(100)                      |
| <i>Domain readiness score</i>                                | 1(100)                      |
| Equipment                                                    |                             |
| Blood storage refrigerator                                   | 1(100)                      |
| <i>Domain readiness score</i>                                | 1(100)                      |
| Diagnostics                                                  |                             |
| Blood typing                                                 | 1 (100)                     |
| Crossmatch testing                                           | 1 (100)                     |
| <i>Domain readiness score</i>                                | 1(100)                      |
| Essential Medicine and commodities                           |                             |
| Blood supply sufficiency                                     | 0(0)                        |
| Blood supply safety                                          | 1(100)                      |
| <i>Domain readiness score</i>                                | 0.5 (50)                    |
| <b>Readiness score for blood transfusion</b>                 | <b>0.875 (87.5)</b>         |

Readiness for blood transfusion was defined as the presence of tracer indicators important for blood transfusion services.

The service readiness score is defined as the mean availability of service-specific tracer items within across four domains: staffing and guidelines, equipment, diagnostics and essential medicines.

The basic hospital amenities necessary for trauma care provision were assessed by determining the facility's readiness score. Low scores for visual and auditory privacy contributed to the low overall readiness scores of 85.7% (Table 4.4 5).

Table 4.4 5: Readiness Score for Basic Hospital Amenities\*

| Basic Amenities                              | Readiness Score (%) |
|----------------------------------------------|---------------------|
| Improved water source inside facility        | 1(100)              |
| Visual or auditory privacy for consultations | 0(0)                |
| Client Latrine                               | 1(100)              |
| Communication equipment                      | 1(100)              |
| Emergency transport                          | 1(100)              |
| Power supply                                 | 1(100)              |
| Computers with internet and email access     | 1(100)              |
| Readiness score for Basic Amenities          | 0.857 (85.7)        |

Readiness for basic hospital amenities defined as the presence of tracer indicators important for major trauma surgery services.

\*In original SARA methodology tool, basic hospital amenities are a domain under General Hospital readiness (World Health Organisation-United States Agency for International Development, 2015).

The domain readiness score is defined as the mean availability of domain-specific tracer items within across three domains: staffing and guidelines, equipment and essential medicines.

#### 4.5. Summary

In this chapter, the findings from the study were espoused. Forty-four staff of Nsawam Government Hospital were recruited into study. Out of this figure, 36 responded to adapted questionnaire for availability of essential trauma care, while the remaining eight were interviewed on facility readiness to provide care.

Availability ratings were scored for trauma resources in a Likert scale. Items under circulatory medicine, basic airway supplies and general surgery had a high mean score of 3. The other items with low mean availability ratings were queried to investigate factors contributing to low scores. Generally, factors were leading to low availability were equipment absence, break down and insufficient supplies. Readiness scores calculated for minor (90%) and major surgery (95%) as well as blood transfusion services (87.5%) were high, compared to the readiness score for services rendered in the emergency room. The next few chapters would discuss the findings of this study and propose recommendations to the problem analysed.

## **Chapter 5**

### **DISCUSSION**

#### **5.1 Introduction**

From the results, it was found that Nsawam Government Hospital had skilled human resources (i.e. General Surgeon) for providing trauma emergency surgical care, as well as other staff who had received training in trauma surgery and trauma emergency guidelines. It was also found that, the hospital provided all the Bellwether surgeries relevant to trauma emergencies. The hospital had available essential medicines needed for fluid resuscitation and blood transfusion services, with varying availabilities of equipment for resuscitation. These factors influenced the service readiness scores for emergency trauma care delivery. This section discusses the findings of the study.

#### **5.2 Availability ratings for physical resources for provision of emergency trauma care**

The results of the study showed that, there were higher availability ratings for physical resources for major general surgery in Nsawam Government Hospital as compared to the availability ratings in other first level hospitals assessed in the study by Stewart et al (2015). However, lower availability ratings were recorded for physical resources for overall orthopaedic and neurosurgical services and for securing an advanced airway. According to the WHO, general orthopaedic and neurosurgical services are desirable (D) services for a district hospital like Nsawam Government Hospital. This means that adding these services would come at a higher additional cost to the hospital, although the services would be instrumental in improving trauma patient outcomes (Mock et al., 2004; Debas et al., 2015). Patients of Nsawam Government Hospital with severe fractures requiring internal fixation, orthopaedic implants, prosthetics and neurosurgical procedures therefore are referred to higher centres after resuscitation as the hospital did not provide these



advanced surgeries. Similar findings in the availability of physical resources for surgical care were described by Spiegel et al. (2015) who demonstrated relatively low availability ratings of items for orthopaedic procedures in first level hospitals in LMICs. In fact, Stewart et al. (2015) survey in Ghana had showed that, major surgical procedures (comprising neck exploration, exploratory laparotomy, major amputation) and orthopaedic surgeries had relatively lower availability ratings. Now between 2014-2015, the national rate for performance of advanced orthopaedic operations (i.e., Open Reduction and Internal Fixation-ORIF) was 74% compared with neurosurgical operations (i.e., craniotomy) rate of 5.9%. The causes of these low national operations rates, especially in face of high incidence of neurosurgical injuries i.e., traumatic brain injuries are myriad ranging from neurosurgical physical resource challenges at higher centres, to high mortality of injured patients requiring neurosurgical care prior to their arrival at referral facilities (Gyedu et al., 2020; Kamal et al., 2016; Stewart et al., 2016). By addressing the challenge of low availability ratings of neurosurgery equipment, supply of services would match demand on a national level. Meanwhile, the overall cost-effectiveness of introducing the physical resources for these desirable (D) surgical services in-house at Nsawam Government Hospital would require further studying.

In Nsawam Government Hospital, essential medicines needed for fluid resuscitation as well as blood transfusion had high availability ratings as compared to other inputs. Similar findings were seen in studies that assessed trauma care capacities in Ghanaian hospitals at different levels (Stewart et al., 2016). Contributing to this high availability of blood and intravenous fluid is the presence of vertical programmes within the health system targeting comprehensive obstetric care which also requires physical resources for blood transfusion. Although these largely funded vertical programmes primarily targeted the reduction in maternal mortality rates, trauma surgical



care has also benefitted from the increased access to donor blood/blood banks. (Stewart et al., 2015, 2016). Strengthening the system for acute injury management within Nsawam Government Hospital would in a feedback loop, lead to the improvement of the hospital's readiness for other emergency and surgical conditions.

### **5.3 Readiness score for emergency room services in Nsawam Government Hospital**

When the Emergency Department was assessed for its readiness to attend to injured patients, a lower score of 71% was obtained because of low access to advanced diagnostic facilities (43%) and advanced airway devices (44%). This means that, the facility's Emergency Unit had a mean availability of 71% out of all the tracer indicators assessed for emergency room services. The advanced airway devices however were reliably available within the surgical theatre of the hospital (Table 4.4 3). A study amongst health facilities in the Northern part of Ghana found low availabilities of trauma surgical items in the Emergency Room as compared to the surgical theatre (Tabiri et al., 2015). The WHO Guidelines for Essential Trauma Care in response to this recommended that it was important for the Emergency Department to have similar availabilities of advanced airway equipment (Mock et al., 2004).

For district hospitals in Ghana, a review by Jumbam et al. (2022) described a lack in the consistent access to imaging technologies. Nsawam Government Hospital's trauma surgical patients had access to in-house essential x-ray services. However, patients requiring advanced imaging resources (which are labelled as desirable by WHO) had to be referred. This indirectly emphasizes the need for a robust referral system which allow patient's requiring these advanced services to have timely access to them, thus preventing delays and avoidable deaths.

#### 5.4 Readiness scores for trauma surgical services in Nsawam Government Hospital

In terms of surgical service readiness, Nsawam Government Hospital had higher readiness scores for major surgery (95.0%) as compared to that for minor surgeries (90%). This means that, 95% of tracer indicators for major surgery were present and functioning, as compared to 90% of minor surgical tracer indicators. The key domains influencing these scores were domains for essential medicines and equipment. The hospital had reliable availability of anaesthetic essential medications (major surgery) as compared to medications for splinting fractures (minor surgery). Also, some breathing equipment for major surgery were unavailable in the surgical theatre. The higher readiness scores for major trauma surgery are likely related to the availability of all three Bellwether surgical services on offer in Nsawam Government Hospital.

Bellwether surgeries are essential surgical services which “are cost-effective, address a substantial burden of surgical conditions” and can be reliably provided on a global scale in spite of the nation’s income (Debas et al., 2015). O’Neill et al. (2016) found that the performance of three Bellwether Surgeries - Caesarean Sections, Laparotomy and Treatment for Open Fractures – can be used as a benchmark to measure available essential surgical care at first-level hospitals. These three standard procedures should be available at every hospital to enable that facility meet the essential surgical need of the population it serves, and thereby influence readiness for surgical services. Clients requiring more advanced services beyond these Bellwether procedures ought to be referred to higher centres (O’Neill et al., 2016). Of these three Bellwether procedures mentioned, only laparotomy and open fracture management (i.e., wound debridement, skin traction and external fixation) are relevant in emergency injury care. In the case of Nsawam Government Hospital, perhaps the demand on the additional Bellwether surgical service which is unrelated to trauma care, i.e., Caesarean Section Surgeries influenced the readiness scores for major trauma surgery services. This is because, Nsawam Government Hospital offers Caesarean Delivery in

Comprehensive Obstetric and Neonatal Care (CEMONC) policy. The facility conducts about 500 deliveries monthly (Nursing and Midwifery Council of Ghana, 2021) making an annual delivery rate estimated at 6000 deliveries. A significant proportion of these deliveries would require surgical care under anaesthesia in order to reduce maternal and neonatal mortality. Since equipment and essential medications for both major trauma and obstetric surgeries are similar, we are likely seeing a feedback improvement in readiness for major surgical care (Stewart et al., 2015, 2016).

Beyond Nsawam Government Hospital and on a much larger scale however, there is a high unmet national need for trauma surgical care. Gyedu, et al. (2020) argue that, Ghana's population has an annual trauma surgical operation rate of 134/100,000 population, equivalent to trauma surgical met need of only about 12%. Contributing to this relatively high unmet need are challenges with pre-hospital care, and inadequate resources for in-hospital trauma care. Now of all the trauma surgeries performed in this country, only 38% of them were performed in district hospitals (Gyedu et al., 2020). Gyedu et al. (2020) also observed that, district hospitals in Ghana which had a Surgeon permanently employed performed about two-thirds of all district-level trauma operations as compared to hospitals without a surgeon provider. This calls into question the readiness for trauma surgery in district hospitals. Most district hospitals in Ghana were staffed by only General Practitioners (non-Surgeons) and Nurse Anaesthetists with limited surgical capabilities - largely wound management (Japiong et al., 2016). This obviously would influence their individual level of emergency trauma service readiness. In this study however, results from readiness scores for both minor and major trauma surgery in Nsawam Government Hospital showed that the hospital had the skilled human resources for providing trauma surgical care: i.e., at least one General Surgeon and Nurse Anaesthetists. There was also at least one emergency unit staff who had

received training in trauma surgery, trauma emergency guidelines (Advanced Trauma Life Support- ATLS) and or triaging in last 3 years as recommended by the Ghana Accident and Emergency Services Policies and Guidelines (Ministry of Health, 2011). The presence of staff with these aforementioned skillsets increases the capacity of the hospital to offer emergency trauma surgical care, hence the readiness scores for minor and major surgery services obtained from the study.

### **5.5 Readiness scores for blood transfusion services in Nsawam Government Hospital**

Readiness scores for blood transfusion services were 87.5%, meaning the blood bank had available about 87.5% out of all tracer indicators assessed. The reduction in the readiness score was contributed by low scores for blood supply sufficiency. It was reported that there had been some interruption in the availability of blood in the last three months, however, the study did not ascertain the extent to which this was experienced: i.e., whether it was in relation to some specific donor blood groups, or all donor blood groups. This would require further studies in the future.

### **5.6 Hospital basic amenities**

The hospital had some infrastructure needed in referral services as well as other basic amenities for its operations. The Nsawam Government Hospital has an Accident and Emergency Unit with the following amenities available: communication equipment, emergency vehicle for transportation and electricity. These aforelisted are important resources in facilitating referrals. The National Referral Policy Guideline stipulates that patient interhospital transfers were done in appropriate emergency vehicle (Ministry of Health, 2012 p.11), and the Nsawam Government Hospital had the capacity to do this. Communication infrastructure to facilitate referrals were also highlighted as important (Minsitry of Health, 2012; Stewart et al., 2017). There was also access to reliable electricity supply within the last 7 days (at the time of data collection), client toilet

facilities and improved water supply. These utilities, if always reliably supplied, facilitate the provision of emergency trauma care, the performance of surgeries and the prolongation of the lifespan of hospital diagnostic and therapeutic equipment (World Health Organisation, 2016). A readiness score of 87.5% was obtained, with low scores recorded for tracer indicator for patient privacy during patient consultations at the Emergency Room. The Ghana Health Service's Patients' Charter advocates that every patient enjoys this right to privacy and confidentiality, and as such several strategies need to be implemented to ensure this right is not breached (Ghana Health Service, 2002). In the case of Nsawam Government Hospital, low-cost engineering solutions which can modify the emergency unit to provide privacy to patients during consultations ought to be explored and implemented. Training of health workers to ensure this right is upheld is key.

#### **5.7. Factors contributing to availability of equipment/items for trauma care.**

The study sought to find out the factors which influenced the availability of resources for trauma care. It was found that in Nsawam Government Hospital, the most common factors were related to equipment absence, frequent stockouts (insufficient stock to match demand), user-fees restricting access, shortage of skilled health workers, and breakdown of apparatus. When a resource is absent or unavailable, improvised resources are used and these may not always provide best outcome desired. This section discusses the above listed factors

##### **5.7.1. Equipment Absence**

At Nsawam Government Hospital, results obtained showed that, laryngoscopes (76.0%), endotracheal tube (76.9%) (both equipment for advanced airway), mechanical ventilators (63.6%) were absent (i.e., never been present) at the Emergency Unit, although the same devices were present within the surgical theatre. Another study in selected hospitals including district hospitals in the Northern belt of Ghana found similar disparity in availability of resources (i.e., surgical

theatre compared with emergency department) (Tabiri et. al., 2015). In Nsawam Hospital, one other major factor influencing low availability of these advanced items was the shortage in skilled health workforce to use above equipment in the Emergency Unit. Other studies have shown that equipment needed for advanced care during resuscitations were less available in most district and regional hospitals in LMICs as compared to basic equipment for emergency care (Firew et al., 2022; World Health Organisation, 2016). The WHO advocates for the development of local capacity within developing countries to produce and maintain more “frugal technology” for use in these parts (World Health Organisation, 2016).

#### 5.7.2. Prepayment for Trauma Emergency Care

The chest tube with underwater seal drainage and cervical collars were the essential items whose availability was restricted because fees were required by external vendors prior to usage. Similar findings of low availability ratings were made in other studies in Ghana (Stewart et al., 2015, 2016). Out of pocket payment for healthcare is associated with increased likelihood of catastrophic health expenditures (WHO, 2007).. The National Health Insurance Scheme (NHIS) ideally exempts all emergency patients from paying for healthcare irrespective of their subscription status (Norman et al., 2012; Stewart et al., 2021). If this policy were being implemented fully, then user fees should not have restricted availability of any item required for emergency trauma care. Also, equipping the local industry to manufacture the same equipment using standard scientific principle would potentially lower cost and improve overall item availability (Shah et al., 2015).

#### 5.7.3. Procurement and Stock Management.

About 70% of responses obtained showed that generally, breathing equipment were available but their quantities did not always match supply. The problem of resource mismatching was noted in the fact that resources like the portable x-ray machine was available in the hospital, however there



were no protective equipment to allow its full use in the Emergency Department. Also, the hospital had an ultrasound unit which had limited availability at certain times of the day, and was used for Obstetric and Gynaecological cases. The electronic cardiac monitors were installed within the Accident and Emergency Unit, but they had limited availability because some of their connecting probes were non-functional. Similar findings of stockouts and resource mismatches were made in a study which assessed the root causes of unavailable medical equipment in India (Shah et al., 2015). An improvement in procurement and stock management practices has the potential of increasing product availability. From a study that surveyed about 40 district hospitals in Ghana, the factors found to contribute to frequent stockouts included long and inflexible processing times, shortages of supplies at the Government's Medical Stores (this was the main supplier of hospital items), delayed National Health Insurance reimbursements and unreliable open market suppliers (Stewart et al., 2015). Shah et al. (2015) suggest that, resource mismatches could be resolved through better planning, training of staff to have the skill to fully use existing resources, as well as strengthen local biomedical engineering capacity for timely maintenance and repair of equipment.

#### 5.7. 4. Human resource challenges

In spite of the hospital being able to provide essential emergency and trauma care, human resource shortages were highlighted by Emergency Room staff as contributing to low availability ratings given for equipment for neurosurgery and orthopaedics services as well as the advanced airway equipment. The former two are desirable services, but the advanced airway placement is an essential/basic service at the Emergency Department. Given the that the Nsawam General Hospital has only one trained Specialist Surgeon, strategies should be put in place to build capacity to provide basic services. The presence however of permanently employed Medical Officers and a General Surgeon working within the Emergency Unit at Nsawam Government Hospital offers an opportunity for training and intentional supervision leading to task-sharing, where the non-

Surgeon Medical Officers are trained to perform minor but essential surgical operations as well as some major trauma surgeries. Also, it presents an opportunity for mentoring Medical Officers in order for them to take up specialties where needs exist. Aside the above, from results obtained, it was found that Nsawam Government Hospital had mainly Physician Assistant (PAs) interns on the monthly schedule of the Emergency Unit, who were working under the supervision of Medical Doctors in the Emergency Unit. Similar to what is discussed by Hanche-Olsen et al (2012), these Physician Assistants were mainly rotated through the different disciplines of medicine within the hospital. Even though this provides an opportunity for capacity building for these personnel, the presence of more permanent and higher-level personnel manning unit on a daily basis would be desired for quality of care. With the human resources available, the hospital needs to invest in training in trauma emergency care and retraining of medical doctors on call at the emergency unit to ensure good supervision and oversight at the unit. Nsawam Government Hospital would benefit from constant in-service training of already existing clinical staff to be more adept at recognising and providing initial urgent care. The output of these skilled human resources at Nsawam Government Hospital should improve the met need for trauma surgical care within the catchment area (Gyedu et al., 2020).

#### 5.8. Summary

This chapter discusses the main findings of the research in relation to the specific objectives and the research questions. The study found that although on the average Ghana has an unmet need for trauma surgical operation of about 88%, the Nsawam Government Hospital has some physical and human resources who make it possible for the hospital to achieve a high level of care for trauma and emergency patients.

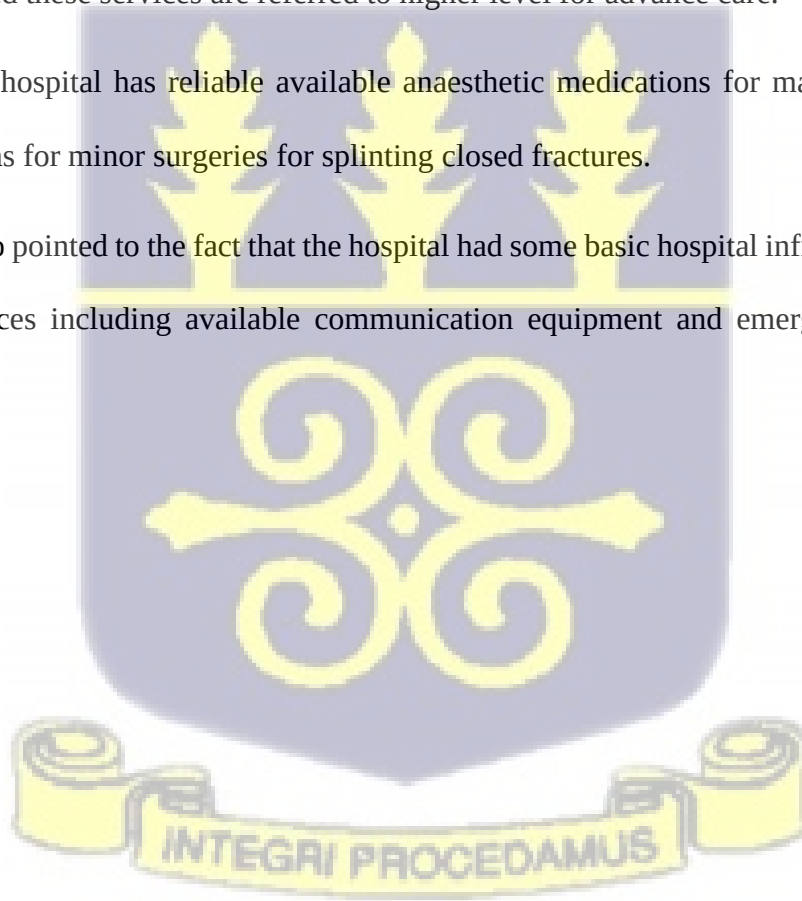


The key available human resources include General Surgeons, Medical Officers and Nurse Anaesthetists, General Nurses. The hospital lacks orthopaedic and neurosurgical surgeons.

With regard to physical resources, the hospital has the wherewithal to conduct all the Bellwether surgeries, and carry out fluid resuscitation and blood transfusion, but lacks advanced airway equipment as well as internal fixation devices, orthopaedic implants and prosthetics. Hence, patients who need these services are referred to higher level for advance care.

In addition, the hospital has reliable available anaesthetic medications for major surgeries, but lacks medications for minor surgeries for splinting closed fractures.

The analysis also pointed to the fact that the hospital had some basic hospital infrastructure needed in referral services including available communication equipment and emergency vehicle for transportation.



## Chapter 6

### SUMMARY, CONCLUSION AND RECOMMENDATIONS

#### 6.0 Introduction

This chapter presents the conclusions on the findings from the study at it relates to the research objectives. It also provides the recommendations for the study.

#### 6.1 Summary of the study

The main objective for this study is to assess the availability and readiness for emergency trauma care in Nsawam Government Hospital. A purposive sampling method was applied to obtain data from persons who were most knowledgeable in trauma emergency surgical care. In addition, a total enumerative sampling was done to obtain direct data from all staff members of the emergency department who worked daily to provide surgical trauma care in the Hospital. The tools which were used for data collection include the abridged WHO Guideline for Essential Trauma Care, the WHO's Service Availability and Readiness Assessment (SARA) tool. The SARA methodology made it possible for questionnaires for assessing minor and major surgical services, emergency services, blood services and basic hospital amenities to be adapted to evaluate readiness for emergency trauma care.

In order to analyse the data, the information gathered was coded and entered into Microsoft Excel 2016, and cleaned. The analysis was done using STATA IC v 16, and then simple descriptive analysis was done. The availability ratings of physical resources needed in the Accident and Emergency Unit were analysed using the median of a four-point Likert scale (0-3). The Cronbach alpha calculated for this scale was 0.89. The factors influencing trauma resource availability were represented by frequencies and percentages of responses. The readiness scores of the hospital for emergency trauma surgical care services were calculated as the mean availability of all items needed for a specific service, expressed as a percentage.

After the analysis, it was found that the Nsawam Government Hospital had some of the skilled human resources for providing trauma surgical care including General Surgeons, Medical Officers, Nurse Anaesthetists and General Nurses; some of whom had received training in trauma surgery and trauma emergency guidelines.

It was also found that all the Bellwether surgeries relevant in emergency trauma care delivery were available in Hospital, and the hospital also had a high level of readiness for the provision of trauma surgeries. In addition, the hospital has in place the essential medicines needed for fluid resuscitation and blood transfusion, but with varying availability of equipment for resuscitation. The hospital, however, lacks advanced airway equipment, advanced imaging equipment as well as internal fixation devices, orthopaedic implants and prosthetics.

## **6.2 Conclusion of the study**

This section presents the conclusion of the study based on the specific objectives below.

### **6.2.1 Availability ratings of physical resources for emergency trauma care services**

Majority of essential low-cost items for trauma emergency care in Nsawam Government Hospital (NGH) have satisfactory availability ratings (score of 3) among staff of the Accident and Emergency Unit. Items for circulation (medicines), basic airway equipment and General Surgery have the highest ratings for availability, while essential items for advanced airway management (endotracheal tube, laryngoscope) are considered the least available (score of 0) to clients within the Emergency Room.

### **6.2.2. Factors influencing availability of resources for providing emergency trauma care**

The factors influencing the availability of essential low-cost resources in Nsawam Government Hospital (NGH) are categorized mainly into challenges with procurement and stock management, financing healthcare, equipment absence and human resource shortages. These factors accounted

for the low availabilities of essential items/services which scored availability ratings lower than 3. It is important to strengthen management practices to ensure reliable supply of essential items, and to explore systems that would facilitate transfer and referral of patients requiring access to expensive and more advanced trauma resources or services.

### **6.2.3 Readiness of Nsawam Government Hospital for emergency room care.**

For all trauma emergency services provided, the Nsawam Government Hospital has relatively lower readiness scores for hospital emergency room care (71%). Thus, trauma patients visiting the emergency room at the time of the study would not have had certain life-saving services reliably available to them for their use. This may lower the probability of survival from injuries sustained from trauma, given that, the Emergency Room is frequently the first facility to provide services to the injured

### **6.2.4 Readiness of Nsawam Government Hospital for trauma surgical care.**

The readiness scores for trauma emergency surgical care in Nsawam Government Hospital was highest for conducting major trauma surgeries as the facility had high availability of anaesthesia essential medicines which are required for these procedures. The facility had a readiness score of 95% and 90% for major and minor trauma surgeries respectively. The hospital needs to ensure continuous provision of all tracer indicators for surgery.

### **6.2.5 Readiness of Nsawam Government Hospital for blood transfusion services**

Nsawam Government Hospital had readiness scores for blood transfusion services of about 87.5%. The score obtained was influenced by low score for blood supply sufficiency. Strategies in stock management as well as coordinating of blood donations should be implemented at the lab to ensure consistent supply of blood

### **6.3 Recommendations of the study**

From the findings of this study, in this section, the recommendations for key stakeholders in trauma emergency care delivery are presented below.

#### **6.3.1 Ministry of Health/Ghana Health Service**

The government should develop local industries to manufacture essential trauma surgical equipment in the country instead of relying on importation of these equipment. Local manufacturing of equipment has the potential to improve item availability, reduce cost involved in purchase of items, as well as increase access to experts for frequent maintenance and repair. Thus, policies geared towards building local capacity for biomedical engineering using locally available material, but standard scientific reasoning should be implemented.

#### **6.3.2 Management of Nsawam Government Hospital**

The Management of Nsawam Government Hospital should institute interventions that would be focused on improving the following management challenges: forecasting and planning, procurement and supply, and stock management. These interventions would not only ensure better stock levels of all equipment at all times, but would also prevent situations where there is a mismatch between available resources, supporting infrastructure and the needs of injured patients. These interventions would require multidisciplinary efforts in order to achieve reliable supply of equipment.

Aside this, with regard to the challenge of staffing, regular on-the-job training for at least all emergency staff should be organised by the Management of Nsawam Government Hospital, to ensure that these workers are well equipped to offer trauma surgical care. This would further improve the readiness of the hospital for emergency care.

### **6.3.3 Health Workers/Emergency Health Workers**

Health workers within Nsawam Government Hospital are encouraged to keep abreast with policies and practices regarding trauma surgeries and emergencies. This would enable them deliver high quality services with the resources available and overall improve patient post-injury survival.

### **6.4. Limitations to the study**

The study had a cross-sectional design and thus, the availability of resources in the hospital may vary with changes in time. Availability ratings assigned to each item or service within the Emergency unit were subjective, as there could have been under-reporting of availability of these services, or over-reporting in order to exaggerate needs of facility in order to gain attention. Also, some questions demanded recall for response, hence recall bias. Efforts were made in reducing these biases by sampling scores from different cadres of staff who managed and or provided the services related to trauma emergency care. Corroborative information was obtained from the heads of departments or unit in-charges using the SARA methodology. Direct inspection was used to confirm availability of the resource where applicable. The assumption was made that once the equipment was readily available, the staff knew how to use them for trauma care unless categorically stated otherwise. The scope of this study did not include assessing for competent utilization of resources or the referral system. Future research may focus on this and also on applying methodology on across facilities, and even applying a qualitative approach to support/further explain the quantitative findings.

Despite these limitations, the study made use of recommended standard WHO tools for surgical care, i.e., WHO SARA methodology and Guidelines for Essential Trauma Care. The WHO SARA framework and methodology was used which allows for subsequent comparison of data across facilities, regions and even countries (Spiegel et al., 2017; Iverson et al., 2020). Findings from this

study are therefore applicable to Nsawam Government Hospitals, but may be generalized only to hospitals similar in structure and functioning to the facility under study.

### **6.5 Recommendations for future research**

Prior to this study, no previous study had been done to assess the readiness of health facilities in Ghana to deliver emergency trauma care. Since service availability and readiness change with time, it is essential that periodic assessments are made in Nsawam Government Hospital to monitor and evaluate the hospital's progress. This study also recommends research on the availability of trauma surgical resources and the readiness of the hospitals within Nsawam Government Hospital's referral network be conducted. The study should also further assess the referral system, as this also plays a role in the outcome of trauma surgical patients.

A study analysing the economic costs and the National Health Insurance Scheme as it relates to emergency care is needed to reassess the accessibility/utilisation of the benefit package (i.e., free healthcare for all patients requiring emergency care who present at the Emergency Room) by patients requiring emergency trauma care in Nsawam Government Hospital. Also, there is the need to explore other financing mechanisms that would improve access to trauma emergency care in Nsawam Government Hospital.



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## APPENDIX I: QUESTIONNAIRE

Respondent ID

|  |  |  |
|--|--|--|
|  |  |  |
|--|--|--|

**SCHOOL OF PUBLIC HEALTH**

**UNIVERSITY OF GHANA, LEGON**

**Title of Project: Availability and readiness for emergency trauma care: A case study of Nsawam Government Hospital**

Date of Interview: \_\_\_\_ / \_\_\_\_ / 2022

### **Consent Form**

Hello Sir/ Madam, my name is **Dr Angela Woode**, a student at the School of Public Health, University of Ghana, Legon reading **Masters in Public Health (MPH)**. I am conducting this study on the **availability and readiness for the provision emergency trauma care in Nsawam Government Hospital**. The purpose of this research is to evaluate the capacity of Nsawam Government Hospital to offer emergency care to trauma or injured patients, by assessing availability and functionality of key resources. There is no risk associated with this study. However, some questions may require researcher to observe presence of resource and this may require some added time. The questionnaire may be completed in a maximum of 40minutes. I would like to assure you that any information you provide will be strictly confidential; and will be used only for the purposes of this research and never be used against you.

Your participation is voluntary, and you may stop the interview at any time.

Do I have your permission to continue? Yes ☐ No ☐



**SECTION A: AVAILABILITY OF EMERGENCY TRAUMA CARE**

|                                                                                                                                                                                                                                  |                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                             |                          |                          |                          |                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ASK TO BE SHOWN THE ACCIDENT AND EMERGENCY UNIT IN THE FACILITY WHERE TRAUMA SERVICES ARE PROVIDED. FIND STAFF WHO WORK WITHIN THIS UNIT. INTRODUCE YOURSELF, EXPLAIN THE PURPOSE OF THE SURVEY AND ASK THE FOLLOWING QUESTIONS. |                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                             |                          |                          |                          |                                                                                                                                                                                                                                                                                                       |
| Please indicate your professional cadre. <span style="border: 1px solid black; display: inline-block; width: 200px; height: 30px; vertical-align: middle;"></span>                                                               |                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                             |                          |                          |                          |                                                                                                                                                                                                                                                                                                       |
|                                                                                                                                                                                                                                  | Please tell me if this facility has these equipment or services, and rate its level availability on scale of 0-3. For equipment/services with low availability (0-2), please assign reason for unavailability. | Availability Ratings.<br>0—Absent, but should be present;<br>1—Inadequate, available to less than half of those who need it;<br>2—Partially adequate, available to more than half, but not to most who need it;<br>3—Adequate, present, and readily available to almost everyone in need and used when needed.<br><b>(PLEASE TICK ✓ APPROPRIATE COLUMN)</b> |                          |                          |                          | Reason assigned for availability score of 0-2<br>1-equipment absence<br>2-broken<br>3 – personnel shortage<br>4- lack of training<br>5 – lack of reagent/supplies<br>6 – stockout, insufficient quantity<br>7 – user fees necessary<br><b>(YOU MAY CHOOSE MORE THAN ONE REASON FOR EACH QUESTION)</b> |
|                                                                                                                                                                                                                                  |                                                                                                                                                                                                                | Absent                                                                                                                                                                                                                                                                                                                                                      | Inadequate               | Partially adequate       | Adequate                 |                                                                                                                                                                                                                                                                                                       |
| 1.0                                                                                                                                                                                                                              | <b>Airway</b>                                                                                                                                                                                                  | <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                                                                                                                                                                                                                                                                       |
| 1.1                                                                                                                                                                                                                              | <b>Basic equipment</b>                                                                                                                                                                                         | <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                                                                                                                                                                                                                                                                       |
| 1.11                                                                                                                                                                                                                             | Nasal or oral airway                                                                                                                                                                                           | <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                                                                                                                                                                                                                                                                       |
| 1.12                                                                                                                                                                                                                             | Suction pump                                                                                                                                                                                                   | <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                                                                                                                                                                                                                                                                       |
| 1.2                                                                                                                                                                                                                              | <b>Advanced equipment</b>                                                                                                                                                                                      | <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                                                                                                                                                                                                                                                                       |
| 1.21                                                                                                                                                                                                                             | Laryngoscope                                                                                                                                                                                                   | <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                                                                                                                                                                                                                                                                       |
| 1.22                                                                                                                                                                                                                             | Endo tracheal tube                                                                                                                                                                                             | <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                                                                                                                                                                                                                                                                       |
| 1.23                                                                                                                                                                                                                             | <b>Overall, how would you rate availability of airway equipment?</b>                                                                                                                                           | <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                                                                                                                                                                                                                                                                       |
| 2.0                                                                                                                                                                                                                              | <b>Breathing Equipment</b>                                                                                                                                                                                     | <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                                                                                                                                                                                                                                                                       |
| 2.1                                                                                                                                                                                                                              | Stethoscope                                                                                                                                                                                                    | <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                                                                                                                                                                                                                                                                       |
| 2.2                                                                                                                                                                                                                              | Oxygen supply                                                                                                                                                                                                  | <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                                                                                                                                                                                                                                                                       |
| 2.3                                                                                                                                                                                                                              | Nasal prongs                                                                                                                                                                                                   | <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                                                                                                                                                                                                                                                                       |
| 2.4                                                                                                                                                                                                                              | Face mask                                                                                                                                                                                                      | <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                                                                                                                                                                                                                                                                       |
| 2.4                                                                                                                                                                                                                              | Chest tubes and water seal                                                                                                                                                                                     | <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                                                                                                                                                                                                                                                                       |
| 2.5                                                                                                                                                                                                                              | Bag-valve-mask                                                                                                                                                                                                 | <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                                                                                                                                                                                                                                                                       |
| 2.6                                                                                                                                                                                                                              | Mechanical ventilator                                                                                                                                                                                          | <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                                                                                                                                                                                                                                                                       |
| 2.7                                                                                                                                                                                                                              | <b>Overall, how would you rate availability of breathing equipment?</b>                                                                                                                                        | <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                                                                                                                                                                                                                                                                       |

|      |                                                                                  |                          |                          |                          |                          |  |
|------|----------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--|
|      |                                                                                  |                          |                          |                          |                          |  |
| 3.0  | <b>Circulation</b>                                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 3.1  | <b>Essential medicines</b>                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 3.11 | Intravenous infusion set                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 3.12 | Blood transfusion capacity                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 3.13 | Overall, what level of availability rating would you assign essential medicines? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 3.2  | <b>Equipment</b>                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 3.21 | Clock or watch with second hand                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 3.22 | Urinary catheter                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 3.23 | Electronic Cardiac monitoring                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 3.24 | <b>Overall, how would you rate availability of circulatory equipment?</b>        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 4.0  | <b>Diagnostics</b>                                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 4.1  | <b>Laboratory</b>                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 4.11 | Haemoglobin                                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 4.12 | Electrolytes                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 4.13 | Arterial blood gas, lactate                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 4.2  | <b>Imaging</b>                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 4.21 | X-rays                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 4.22 | Portable X-rays                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 4.23 | Focused Assessment with Sonography in Trauma (FAST)                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 4.24 | CT Scan                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 4.25 | <b>Overall, how would you rate availability of diagnostic equipment?</b>         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 5.0  | <b>Surgery</b>                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 5.1  | Basic General surgery <sup>a</sup>                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 5.2  | Major General surgery <sup>b</sup>                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 5.3  | Vascular repair                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 5.4  | Skin grafting                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |

|      |                                                                                                   |                          |                          |                          |                          |  |
|------|---------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--|
| 5.5  | <b>Overall, how would you rate availability of surgery service?</b>                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 6.0  | <b>Extremity Injury</b>                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 6.1  | Skin/skeletal traction                                                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 6.2  | Internal fixation                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 6.3  | External fixation                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 6.4  | Prosthetics for amputees                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 6.5  | Image intensification                                                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 6.6  | <b>Overall, how would you rate availability of services for managing extremity injury?</b>        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 7.0  | <b>Brain and spinal injury</b>                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 7.1  | <b>Spine immobilization Equipment</b>                                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 7.11 | Cervical collar                                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 7.12 | Backboard                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 7.2  | Basic neurosurgery <sup>c</sup>                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 7.3  | Major neurosurgery                                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 7.4  | ICP monitoring                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| 7.5  | <b>Overall, how would you rate availability of services for managing brain and spinal injury?</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |

Items are only counted as present (i.e., rating 1–3, see text) or absent (i.e., rating 0, see text).

FAST Focused Assessment with Sonography for Trauma, CT Computed Tomography, ICP: Intracranial Pressure

a Basic general surgery—wound debridement, B1 % total body surface area burn excision, digital amputation, surgical airway

b Major general surgery—neck exploration, exploratory laparotomy, major amputation

c Basic neurosurgery—burr hole, treatment of open depressed skull fracture

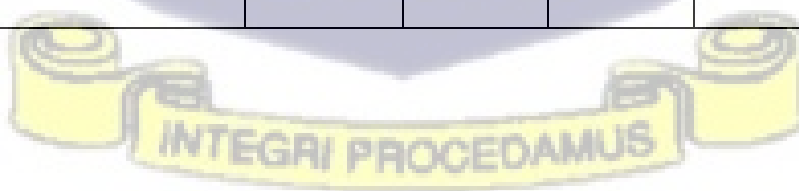
**SECTION B: READINESS FOR EMERGENCY TRAUMA SERVICES DELIVERY**

| 1. EMERGENCY TRAUMA SURGERY SERVICES                                                                                                                                                                                                                |                                                                                                                     |                          |                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
|                                                                                                                                                                                                                                                     | Question                                                                                                            | Result                   | Data collection notes    |
| Please indicate role you play in trauma service delivery                                                                                                                                                                                            |                                                                                                                     | <input type="text"/>     |                          |
|                                                                                                                                                                                                                                                     | Does facility offer any services for emergency trauma care?                                                         | YES.....1<br>NO.....2    | Interview response       |
|                                                                                                                                                                                                                                                     | Does this facility have dedicated beds for trauma patients?                                                         | YES.....1<br>NO.....2    | Interview response       |
| Ask to be shown the location in the facility where trauma services are provided. Find the person most knowledgeable about surgical services in the facility. Introduce yourself, explain the purpose of the survey and ask the following questions. |                                                                                                                     |                          |                          |
| 1.0                                                                                                                                                                                                                                                 | Trauma Surgery Service:<br>Please tell me if this facility provides the following services (PLEASE ANSWER BY TICK✓) | YES                      | NO                       |
| 1.1                                                                                                                                                                                                                                                 | Chest tube insertion                                                                                                | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.2                                                                                                                                                                                                                                                 | Suturing                                                                                                            | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.3                                                                                                                                                                                                                                                 | Wound debridement                                                                                                   | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.4                                                                                                                                                                                                                                                 | Acute burn management                                                                                               | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.5                                                                                                                                                                                                                                                 | Cricothyroidotomy                                                                                                   | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.6                                                                                                                                                                                                                                                 | Tracheostomy                                                                                                        | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.7                                                                                                                                                                                                                                                 | Amputation                                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.8                                                                                                                                                                                                                                                 | Exploratory laparotomy                                                                                              | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.9                                                                                                                                                                                                                                                 | Neck exploration                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.10                                                                                                                                                                                                                                                | Vascular repair                                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.11                                                                                                                                                                                                                                                | Skin grafting                                                                                                       | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.12                                                                                                                                                                                                                                                | Closed repair dislocated joint                                                                                      | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.13                                                                                                                                                                                                                                                | Skin/skeletal traction                                                                                              | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.14                                                                                                                                                                                                                                                | Open reduction and fixation for fracture                                                                            | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.15                                                                                                                                                                                                                                                | External fixation                                                                                                   | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.16                                                                                                                                                                                                                                                | Prosthetics for amputees                                                                                            | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.17                                                                                                                                                                                                                                                | Image intensification                                                                                               | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.18                                                                                                                                                                                                                                                | Basic neurosurgery                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.19                                                                                                                                                                                                                                                | Major neurosurgery                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> |

| 2. STAFFING AND GUIDELINES                               |                                                                                                                                                                                                                                      |                                                                         |                      |
|----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|----------------------|
| Please indicate role you play in trauma service delivery |                                                                                                                                                                                                                                      | <div style="border: 1px solid black; height: 20px; width: 100%;"></div> |                      |
| 2.1                                                      | Guidelines for trauma emergency care                                                                                                                                                                                                 | YES, OBSERVED.....1<br>YES, REPORTED NOT SEEN .....2<br>NO .....3       | Observe guidelines   |
| 2.11                                                     | Triage Guidelines                                                                                                                                                                                                                    | YES, OBSERVED.....1<br>YES, REPORTED NOT SEEN .....2<br>NO .....3       | Observe guidelines   |
| 2.2                                                      | Does this facility have a staff member trained in trauma surgery present at the facility or on call 24hr a day (including weekends and on public holidays)                                                                           | YES.....1<br>NO.....2                                                   | Interview response   |
| 2.22                                                     | Have you any staff trained in trauma emergency care?                                                                                                                                                                                 | YES.....1<br>NO.....2                                                   |                      |
| 2.23                                                     | Have you or any provider of trauma services received training in recommended trauma courses in last 3 yrs.<br><br>(Recommended courses=Advanced Trauma Life Support and, Triaging)                                                   | YES.....1<br>NO.....2                                                   | Interviewer response |
| 2.24                                                     | Does this facility have a staff member trained in anaesthesia (nurse, clinical officer, general physician, surgeon, or anaesthesiologist) present in the facility or on call 24hrs a day (including weekends and on public holidays) | YES.....1<br>NO.....2                                                   | Interview response   |

| 3. EQUIPMENT                                             |                                                                                                                                                |                          |                          |                          |                          |                          |                          |
|----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Please indicate role you play in trauma service delivery |                                                                                                                                                |                          |                          |                          |                          |                          |                          |
|                                                          | Please tell me if the following trauma equipment and supplies are available and functional in this facility today. <b>ASK TO SEE THE ITEMS</b> | A) AVAILABLE             |                          |                          | B) FUNCTIONING           |                          |                          |
|                                                          |                                                                                                                                                | Observed                 | Reported not seen        | Not available            | Yes                      | No                       | Don't know               |
| 1.0                                                      | <b>Airway Basic equipment</b>                                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.1                                                      | Nasal or oral airway                                                                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.2                                                      | Suction device (manual or foot pump)                                                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.3.1                                                    | Laryngoscope handle and blade-adult                                                                                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.3.2                                                    | Laryngoscope handle and blade-paediatric                                                                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.3.3                                                    | Laryngoscope handle and blade-neonatal                                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.4.1                                                    | Endotracheal tube neonatal (uncuffed size<3)                                                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.4.2                                                    | Endotracheal tube paediatric (uncuffed size 3.0-5.0)                                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.4.3                                                    | Endotracheal tube adult (cuffed size 5.5-9.0)                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.5.1                                                    | Magills forceps(adult)                                                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.5.2                                                    | Magills forceps(paediatric)                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.6                                                      | Stylet                                                                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.0                                                      | <b>Breathing Equipment</b>                                                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.1                                                      | Stethoscope                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.2.1                                                    | Oxygen concentrators                                                                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.2.2                                                    | Oxygen cylinders                                                                                                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.23                                                     | Central oxygen supply                                                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.24                                                     | Flowmeter for oxygen therapy with humidification                                                                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

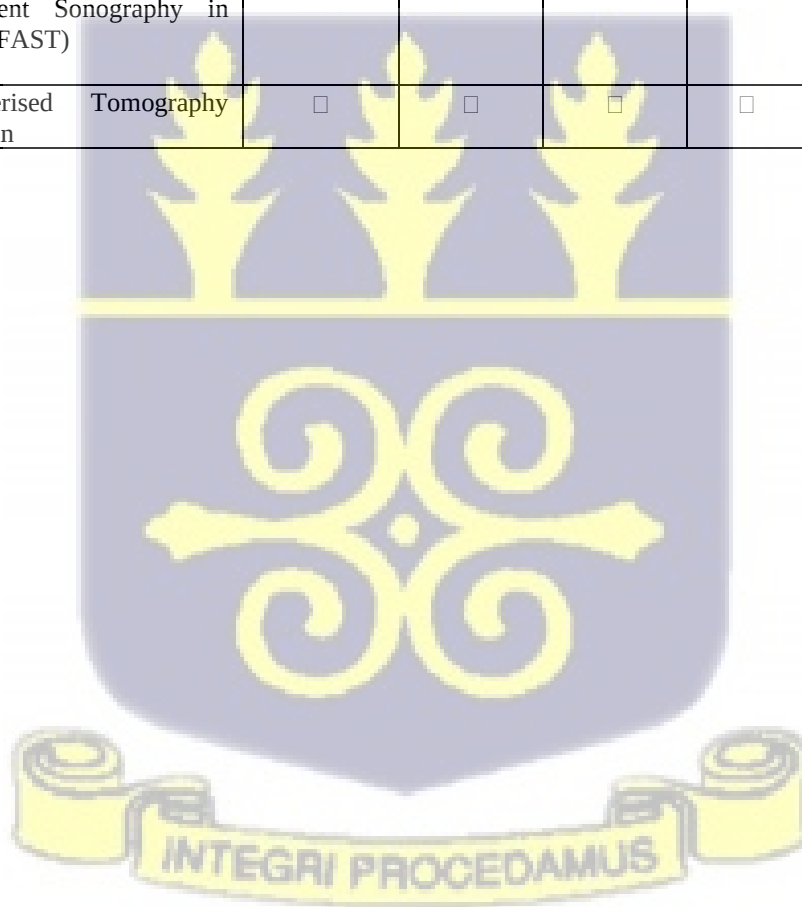
|       |                                                                                  |                          |                          |                          |                          |                          |                          |
|-------|----------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 2.25  | Oxygen delivery apparatus (key connecting tubes and mask/nasal prongs)           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.26  | At any time during the past 3 months has oxygen been unavailable for any reason? | YES.....1<br>NO.....2    |                          |                          |                          |                          |                          |
| 2.3   | Chest tubes and water seal                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.4   | Pulse oximetry                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.5.1 | Bag-valve-mask- adult                                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.5.2 | Bag-valve-mask- paediatric                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.6   | Mechanical ventilator                                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3.0   | <b>Equipment for Circulation</b>                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3.1   | Intravenous infusion set                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3.2   | Clock or watch with second hand                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3.3   | Nasogastric tubes                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3.4   | Tourniquet                                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3.5   | Retractor                                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3.6   | Surgical scissors                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.0   | <b>Disability Spine Equipment immobilization</b>                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.1   | Cervical collar                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.2   | Backboard                                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |





| 4: DIAGNOSTIC FACILITY                                                                                                                                                                                           |                                                                                                                             |                          |                          |                          |                          |                          |                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Ask to be shown the main laboratory or location in the facility where most testing is done to start data collection. Introduce yourself and explain the purpose of the survey, then ask the following questions. |                                                                                                                             |                          |                          |                          |                          |                          |                          |
| Please indicate role you play in trauma service delivery                                                                                                                                                         |                                                                                                                             |                          |                          | <div></div>              |                          |                          |                          |
| 1                                                                                                                                                                                                                | Does this facility conduct any diagnostic testing including any rapid diagnostic testing?                                   | YES.....1<br>NO.....2    |                          |                          |                          |                          |                          |
|                                                                                                                                                                                                                  | <b>Does this facility conduct the following onsite or offsite</b>                                                           | YES, ONSITE              | YES, OFFSITE             | DON'T CONDUCT THE TEST   |                          |                          |                          |
| 1.1                                                                                                                                                                                                              | Haemoglobin                                                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                          |                          |                          |
| 1.2                                                                                                                                                                                                              | Serum creatinine testing                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                          |                          |                          |
| 1.3                                                                                                                                                                                                              | Other renal function testing(such as electrolytes urea nitrogen)                                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                          |                          |                          |
| 1.4                                                                                                                                                                                                              | Arterial blood gas                                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                          |                          |                          |
| 2.0                                                                                                                                                                                                              | Please tell me if the following equipment items and reagents are available and functional today. <b>ASK TO SEE THE ITEM</b> | A) AVAILABLE             |                          |                          | B) FUNCTIONING           |                          |                          |
|                                                                                                                                                                                                                  |                                                                                                                             | OBSERVED                 | REPORTED NOT SEEN        | NOT AVAILABLE            | YES                      | NO                       | DON'T KNOW               |
| 2.1                                                                                                                                                                                                              | Colorimeter/haemoglobinometer                                                                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.2                                                                                                                                                                                                              | Haematology analyser                                                                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.3                                                                                                                                                                                                              | HemoCue                                                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.4                                                                                                                                                                                                              | Biochemistry analyser                                                                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.5                                                                                                                                                                                                              | Centrifuge                                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.6                                                                                                                                                                                                              | Specific assay kits-renal function test                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.7                                                                                                                                                                                                              | Arterial blood gas analyser                                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.8                                                                                                                                                                                                              | Blood gas assay kits                                                                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.9                                                                                                                                                                                                              | Does this facility perform diagnostic x-rays, ultrasound, or computerized tomography?                                       | YES.....1<br>NO.....2    |                          |                          |                          |                          |                          |

| 3.0 | Please tell me if the following imaging equipment items are available and functional today.<br><b>ASK TO SEE THE ITEMS</b> | A) AVAILABLE             |                          |                          | B) FUNCTIONING           |                          |                          |
|-----|----------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|     |                                                                                                                            | Observed                 | Reported not seen        | Not Available            | Yes                      | No                       | Don't Know               |
| 3.1 | X-rays machine                                                                                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3.2 | Portable X-rays machine                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3.3 | Equipment for Focused Assessment Sonography in Trauma(FAST)                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3.4 | Computerised Tomography (CT) Scan                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |



## 5. ESSENTIAL MEDICINES AND COMMODITIES

Ask to be shown the location in the facility where surgical services are provided. Find the person most knowledgeable about surgical services in the facility. Introduce yourself, explain the purpose of the survey and ask the following questions.

Please indicate role you play in trauma service delivery

|     | Please tell me if any of the following materials or medicines are available in this service site today.<br>I would like to see those that are available. CHECK TO SEE IF AT LEAST ONE OF EACH MATERIAL/MEDICINE IS VALID (NOT EXPIRED) | OBSERVED AVAILABLE          |                          |                                          | NOT OBSERVED              |                          |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--------------------------|------------------------------------------|---------------------------|--------------------------|
|     |                                                                                                                                                                                                                                        | AT<br>LEAST<br>ONE<br>VALID | AVAILABLE<br>NON- VALID  | REPORTED<br>AVAILABLE<br>BUT NOT<br>SEEN | NOT<br>AVAILABLE<br>TODAY | NEVER<br>AVAILABLE       |
| 1   | Fluid for resuscitation                                                                                                                                                                                                                |                             |                          |                                          |                           |                          |
| 1.1 | Ringers Lactate                                                                                                                                                                                                                        | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/>                 | <input type="checkbox"/>  | <input type="checkbox"/> |
| 1.2 | Isotonic saline                                                                                                                                                                                                                        | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/>                 | <input type="checkbox"/>  | <input type="checkbox"/> |
| 1.3 | O-Negative whole blood                                                                                                                                                                                                                 |                             |                          |                                          |                           |                          |
| 2.  | Suture material (any type)                                                                                                                                                                                                             | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/>                 | <input type="checkbox"/>  | <input type="checkbox"/> |
| 3.  | Skin disinfectant                                                                                                                                                                                                                      | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/>                 | <input type="checkbox"/>  | <input type="checkbox"/> |
| 4.  | Ketamine(injection)                                                                                                                                                                                                                    | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/>                 | <input type="checkbox"/>  | <input type="checkbox"/> |
| 5.  | Lidocaine 1% or 2% anaesthesia                                                                                                                                                                                                         | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/>                 | <input type="checkbox"/>  | <input type="checkbox"/> |
| 6.  | Splints for extremities                                                                                                                                                                                                                | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/>                 | <input type="checkbox"/>  | <input type="checkbox"/> |
| 7.  | Materials for cast                                                                                                                                                                                                                     | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/>                 | <input type="checkbox"/>  | <input type="checkbox"/> |
| 8.  | Diazepam (injection)                                                                                                                                                                                                                   | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/>                 | <input type="checkbox"/>  | <input type="checkbox"/> |
| 9   | Thiopental powder                                                                                                                                                                                                                      | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/>                 | <input type="checkbox"/>  | <input type="checkbox"/> |
| 10  | Suxamethonium bromide (powder)                                                                                                                                                                                                         | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/>                 | <input type="checkbox"/>  | <input type="checkbox"/> |
| 11  | Atropine (injectable)                                                                                                                                                                                                                  | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/>                 | <input type="checkbox"/>  | <input type="checkbox"/> |
| 12  | Halothane(inhalation)                                                                                                                                                                                                                  | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/>                 | <input type="checkbox"/>  | <input type="checkbox"/> |
| 13  | Bupivacaine (injectable)                                                                                                                                                                                                               | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/>                 | <input type="checkbox"/>  | <input type="checkbox"/> |
| 14  | Diazepam(injectable)                                                                                                                                                                                                                   | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/>                 | <input type="checkbox"/>  | <input type="checkbox"/> |
| 15  | Lidocaine 5%                                                                                                                                                                                                                           | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/>                 | <input type="checkbox"/>  | <input type="checkbox"/> |
| 16  | Epinephrine (injectable)                                                                                                                                                                                                               | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/>                 | <input type="checkbox"/>  | <input type="checkbox"/> |
| 17  | Ephedrine (injectable)                                                                                                                                                                                                                 | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/>                 | <input type="checkbox"/>  | <input type="checkbox"/> |

| 6. BLOOD TRANSFUSION SERVICES |                                                                                                                                                                                                                                                                                                                |                          |                          |                          |                          |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|                               | Questions                                                                                                                                                                                                                                                                                                      | Results                  |                          | Skip                     |                          |
| 1                             | Does this facility offer blood transfusion services                                                                                                                                                                                                                                                            | YES ..... 1 NO..... 2    |                          |                          |                          |
|                               | Ask to be shown the location in the facility where blood is collected, processed, tested, stored, or handled prior to transfusion. Find the person most knowledgeable about blood transfusion services in the facility. Introduce yourself, explain the purpose of the survey and ask the following questions. |                          |                          |                          |                          |
|                               | Please indicate role you play in trauma service delivery                                                                                                                                                                                                                                                       |                          | <input type="text"/>     |                          |                          |
| 1.1                           | Have there been any interruptions in blood availability during the past 3 months?                                                                                                                                                                                                                              | YES ..... 1 NO..... 2    |                          |                          |                          |
| 1.2                           | Does this facility obtain blood from a national or regional blood centre?                                                                                                                                                                                                                                      | YES ..... 1 NO..... 2    |                          |                          |                          |
| 1.3                           | Does this facility obtain ANY blood from sources other than the national or regional blood centre?                                                                                                                                                                                                             | YES ..... 1 NO..... 2    |                          |                          |                          |
| 1.4                           | Does any place in this facility do blood screening for infectious diseases prior to transfusion?                                                                                                                                                                                                               | YES ..... 1 NO..... 2    |                          | 1.6                      |                          |
| 1.5                           | Please tell me if the blood that is transfused in the facility is "always", "sometimes", "rarely", or "never" screened for any of the following infectious diseases.                                                                                                                                           | ALWAYS                   | SOMETIMES                | RARELY                   | NEVER                    |
| 1.5.1                         | HIV                                                                                                                                                                                                                                                                                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.5.2                         | Syphilis                                                                                                                                                                                                                                                                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.5.3                         | Hepatitis B                                                                                                                                                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.5.4                         | Hepatitis C                                                                                                                                                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

|       |                                                                                                                                                                                                                       |                                                                                                                                           |                                          |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| 1.6   | Does this facility have a refrigerator available and functioning in this service area for the storage of blood?                                                                                                       | AVAILABLE AND FUNCTIONAL....1<br><br>AVAILABLE NOT FUNCTIONAL....2 AVAILABLE<br>DON'T KNOW IF FUNCTIONING .....<br>3 NOT AVAILABLE..... 4 | If No go<br>to<br><br>1.7                |
| 1.6.1 | Is the temperature of the refrigerator monitored at least once every 24 hours? <b>IF YES: PLEASE ASK TO SEE THE LOG USED TO RECORD THE TEMPERATURE</b>                                                                | YES, LOG OBSERVED.....1<br><br>YES, LOG REPORTED NOT SEEN .....2<br><br>NO .....3                                                         | If No go<br>to<br><br>1.7                |
| 1.6.2 | Has the temperature log been completed for the last 30 days? <b>PLEASE REVIEW LOG AND CHECK FOR COMPLETENESS (TEMPERATURE RECORDED AT LEAST ONCE EVERY 24 HOURS DURING THE LAST 30 DAYS)</b>                          | YES ..... 1<br>PARTIALLY.....2<br>..... 3                                                                                                 | YES,<br>NO<br><br><br>If No go<br>to 1.7 |
| 1.6.3 | Has the temperature been out of the range 2 to 6 °C inclusive in the last 30 days? <b>PLEASE CHECK THE TEMPERATURE RECORD AND VERIFY THE TEMPERATURE FOR THE LAST 30 WORKING DAYS IN ORDER TO ANSWER THE QUESTION</b> | OBSERVED IN RANGE..... 1 REPORTED IN<br>RANGE BUT NOT SEEN ..... 2<br><br>OUT OF RANGE ..... 3 RECORD NOT<br>AVAILABLE..... 4             |                                          |
| 1.7   | Do you have any guidelines on the appropriate use of blood and safe transfusion practices? <b>IF AVAILABLE, ASK TO SEE THE DOCUMENT</b>                                                                               | YES, OBSERVED..... 1 YES,<br>REPORTED NOT SEEN.....2<br>NO..... 3                                                                         |                                          |

|      |                                                                                                                                                                |                          |                          |                          |                          |                          |                          |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 1.\  | Have any provider(s) of blood transfusion services received any training in the appropriate use of blood and safe transfusion practices in the last two years? | YES .....1<br>.....2     | NO                       |                          |                          |                          |                          |
| 1.9  | Does this facility conduct the following blood group serology tests onsite or offsite                                                                          | Yes, Onsite              | Yes, Offsite             | Don't Conduct the Test   |                          |                          |                          |
| 1.91 | ABO blood grouping testing                                                                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                          |                          |                          |
| 1.92 | Rhesus blood grouping testing                                                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                          |                          |                          |
| 1.93 | Cross-match testing by direct agglutination                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                          |                          |                          |
| 1.94 | Cross-match testing by indirect anti-globulin testing or other test with equivalent sensitivity                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                          |                          |                          |
| 2.1  | Please tell me if the following equipment items and reagents for blood typing and crossmatching are available and functional today                             | AVAILABLE                |                          |                          | FUNCTIONAL               |                          |                          |
|      |                                                                                                                                                                | Observed                 | Reported not seen        | Not available            | Yes                      | No                       | Don't know               |
| 2.11 | Centrifuge                                                                                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.12 | 37-degree Celsius incubator                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.13 | Grouping Sera                                                                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

|            |                                                                                                                                                                                                                                                                                              |                                                             |                                       |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|---------------------------------------|
|            | <b>7. GENERAL SERVICE READINESS-BASIC AMENITIES</b><br><b>Infrastructure</b><br><a href="http://ugspace.ug.edu.gh">University of Ghana http://ugspace.ug.edu.gh</a>                                                                                                                          |                                                             |                                       |
|            | ASK TO BE SHOWN THE LOCATION IN THE FACILITY WHERE SERVICES ARE DELIVERED. FIND THE PERSON MOST KNOWLEDGEABLE ABOUT COMMUNICATIONS, EMERGENCY TRANSPORT, ELECTRICITY SUPPLY SERVICES IN THE FACILITY. INTRODUCE YOURSELF, EXPLAIN THE PURPOSE OF THE SURVEY AND ASK THE FOLLOWING QUESTIONS. |                                                             |                                       |
|            | <b>Please indicate role you play in trauma care delivery.</b>                                                                                                                                                                                                                                |                                                             | <input type="text"/>                  |
| <b>1.0</b> | <b>COMMUNICATIONS</b>                                                                                                                                                                                                                                                                        |                                                             |                                       |
| 1.1        | Does this facility have a functioning land line telephone that is available to call outside at all times client services are offered? CLARIFY THAT IF FACILITY OFFERS 24-HOUR EMERGENCY SERVICES, THEN THIS REFERS TO 24-HOUR AVAILABILITY.                                                  | YES ..... 1<br>NO ..... 2                                   |                                       |
| 1.2        | Does this facility have a functioning cellular telephone or a private cellular phone that is supported by the facility?                                                                                                                                                                      | YES ..... 1<br>NO ..... 2                                   |                                       |
| 1.3        | Does this facility have a functioning short-wave radio for radio calls?                                                                                                                                                                                                                      | YES ..... 1<br>NO ..... 2                                   |                                       |
| 1.4        | Does this facility have a functioning computer?                                                                                                                                                                                                                                              | YES ..... 1<br>NO ..... 2                                   |                                       |
| 1.5        | Is there access to email or internet within the facility today?                                                                                                                                                                                                                              | YES ..... 1<br>NO ..... 2                                   |                                       |
| <b>2.0</b> | <b>AMBULANCE /TRANSPORT FOR EMERGENCIES</b>                                                                                                                                                                                                                                                  |                                                             |                                       |
| 2.1        | Does this facility have a functional ambulance or other vehicle for emergency transportation for clients that is stationed at this facility or operates from this facility?                                                                                                                  | YES ..... 1<br>NO ..... 2                                   | If yes, go to 2.3                     |
| 2.2        | Does this facility have access to an ambulance or other vehicle for emergency transport for clients that is stationed at another facility or that operates from another facility in near proximity?                                                                                          | YES ..... 1<br>NO ..... 2                                   | If yes or no go to 3.1                |
| 2.3        | Is fuel for the ambulance or other emergency vehicle available today?                                                                                                                                                                                                                        | YES ..... 1<br>NO ..... 2                                   |                                       |
| <b>3.0</b> | <b>POWER SUPPLY</b>                                                                                                                                                                                                                                                                          |                                                             |                                       |
| 3.1        | Does your facility have electricity from any source (e.g., electricity grid, generator, solar, or other) including for stand-alone devices (EPI cold chain)?                                                                                                                                 | YES ..... 1<br>NO ..... 2                                   | If no, end this part of questionnaire |
| 3.2        | What is the electricity used for in the facility?                                                                                                                                                                                                                                            | ONLY STAND-ALONE ELECTRIC MEDICAL DEVICES/APPLIANCES (e.g., |                                       |

|     |                                                                                                                                                                    |                                                                                                                                                                                                                                                                                 |                                            |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
|     |                                                                                                                                                                    | EPI cold room, refrigerator, suction apparatus, etc.) ..... 1<br>ELECTRIC LIGHTING (EXCLUDING FLASHLIGHTS) AND COMMUNICATIONS ... 2<br>ELECTRIC LIGHTING, COMMUNICATIONS, AND 1 TO 2<br>ELECTRIC MEDICAL DEVICES/APPLIANCES ..... 3<br>ALL ELECTRICAL NEEDS OF FACILITY ..... 4 |                                            |
| 3.3 | What is the facility's main source of electricity?                                                                                                                 | CENTRAL SUPPLY OF ELECTRICITY (e.g., national or community grid) ..... 1<br>GENERATOR (FUEL OR BATTERY-OPERATED GENERATOR) ..... 2<br>SOLAR SYSTEM ..... 3<br>OTHER ..... 96<br>(SPECIFY)                                                                                       |                                            |
| 3.4 | Other than the main or primary source, does the facility have a secondary or backup source of electricity?<br>IF YES: What is the secondary source of electricity? | NO SECONDARY SOURCE ..... 0<br>CENTRAL SUPPLY OF ELECTRICITY (e.g., national or community grid) ..... 1<br>GENERATOR (FUEL OR BATTERY-OPERATED GENERATOR) ..... 2<br>SOLAR SYSTEM ..... 3<br>OTHER ..... 96<br>(SPECIFY)                                                        |                                            |
| 3.5 | During the past 7 days, was electricity available at all times from the main or any backup source when the facility was open for services?                         | ALWAYS AVAILABLE (NO INTERRUPTIONS) ..... 1<br>OFTEN AVAILABLE (INTERRUPTIONS OF LESS THAN 2 HOURS PER DAY) ..... 2<br>SOMETIMES AVAILABLE (FREQUENT OR PROLONGED INTERRUPTIONS OF MORE THAN 2 HOURS PER DAY) ..... 3                                                           |                                            |
| 3.6 | Is the generator functional?                                                                                                                                       | YES ..... 1<br>NO ..... 2<br>DON'T KNOW ..... 98                                                                                                                                                                                                                                | Answer if facility has a generator present |
| 3.7 | Is there fuel or a charged battery available                                                                                                                       | YES ..... 1<br>NO ..... 2<br>DON'T KNOW ..... 98                                                                                                                                                                                                                                | Answer if facility has generator available |



|     |                                                 |                                                                                                                                                 |                                               |
|-----|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| 3.8 | If facility has solar system, is it functional? | YES, FUNCTIONING .....1<br>PARTIALLY, BATTERY NEEDS<br>SERVICING/REPLACEMENT<br>..... 2<br>NO, NOT FUNCTIONAL .....<br>3<br>DON'T KNOW ..... 98 | Answer if facility has solar system available |
|-----|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|



# 8. INFECTION CONTROL PRECAUTIONS

University of Ghana <http://ugspace.ug.edu.gh>

Please indicate role you play in trauma service delivery

| 1.  | Please tell me if the following resources/supplies used for infection control are available in the general outpatient area of this facility today. ASK TO SEE THE ITEMS. Please respond by ticking✓ | OBSERVED                 | REPORTED SEEN            | NOT | NOT AVAILABLE            |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|-----|--------------------------|
| 1.1 | Clean running water (piped, bucket with tap, or pour pitcher)                                                                                                                                       | <input type="checkbox"/> | <input type="checkbox"/> |     | <input type="checkbox"/> |
| 1.2 | Hand-washing soap/liquid soap                                                                                                                                                                       | <input type="checkbox"/> | <input type="checkbox"/> |     | <input type="checkbox"/> |
| 1.2 | Alcohol based hand rub                                                                                                                                                                              | <input type="checkbox"/> | <input type="checkbox"/> |     | <input type="checkbox"/> |
| 1.4 | Disposable latex gloves                                                                                                                                                                             | <input type="checkbox"/> | <input type="checkbox"/> |     | <input type="checkbox"/> |
| 1.5 | Waste receptacle (pedal bin) with lid and plastic bin liner                                                                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> |     | <input type="checkbox"/> |
| 1.6 | Sharps container (safety box)                                                                                                                                                                       | <input type="checkbox"/> | <input type="checkbox"/> |     | <input type="checkbox"/> |
| 1.7 | Environmental disinfectant (e.g., Chlorine, alcohol)                                                                                                                                                | <input type="checkbox"/> | <input type="checkbox"/> |     | <input type="checkbox"/> |
| 1.8 | Disposable syringes with disposable needles                                                                                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> |     | <input type="checkbox"/> |
| 1.9 | Auto-disable syringes                                                                                                                                                                               | <input type="checkbox"/> | <input type="checkbox"/> |     | <input type="checkbox"/> |

## APPENDIX II: ETHICAL APPROVAL CERTIFICATE

**GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE**

*In case of reply the number and date of this Letter should be quoted*



My Ref: GHS/RDD/ERC/Admin/App 122/2022  
Your Ref. No.

Research & Development Division  
Ghana Health Service  
P. O. Box MH 190  
Accra  
Digital Address: GA-050-3363  
Mob: +233-50-3539896  
Tel: +233-302-681109  
Email: [ethics.research@ghsmai.org](mailto:ethics.research@ghsmai.org)  
22<sup>nd</sup> August, 2022

Angela Akua Esson Woode  
P. O. Box AM 179, Amasaman- Accra

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol.

|                  |                                                                                                           |
|------------------|-----------------------------------------------------------------------------------------------------------|
| GHS-ERC Number   | <b>GHS-ERC: 058/07/22</b>                                                                                 |
| Study Title      | Availability and Readiness for Emergency Trauma Care Delivery: A Case Study of Nsawam Government Hospital |
| Approval Date    | 22 <sup>nd</sup> August, 2022                                                                             |
| Expiry Date      | 21 <sup>st</sup> August, 2023                                                                             |
| GHS-ERC Decision | <b>Approved</b>                                                                                           |

**This approval requires the following from the Principal Investigator**

- Submission of a yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months,
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report after completion of the study
- Informing ERC if study cannot be implemented or is discontinued and reasons why
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.

**You are kindly advised to adhere to the national guidelines or protocols on the prevention of COVID -19.**

Please note that any modification of the study without ERC approval of the amendment is invalid.

The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Kindly quote the protocol identification number in all future correspondence in relation to this approved protocol

SIGNED.....  
Mr. Kofi Wellington  
(GHS-ERC Vice Chairperson)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra

