

Challenges to the Provision of Emergency Services and Critical Care in Resource-Constrained Settings

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ABSTRACT

The practice of intensive care unit (ICU) care in Sub-Saharan Africa is challenging and can have a significant impact on the lives of people in the region. Sub-Saharan Africa bears a disproportionate global burden of disease compared with the rest of the world. Inadequate emergency care services and transportation infrastructure; long lead times to hospital admission, evaluation, treatment and transfer to ICU; inadequate ICU and hospital infrastructure and, unreliable consumable and medical equipment supply chains all present significant challenges to the provision of ICU care in Sub-Saharan Africa. These challenges, coupled with an inadequate supply of trained healthcare workers and biomedical technicians and a lack of formal ICU-related research in Sub-Saharan Africa, would seem to be insurmountable. However, ICU care is being provided in district and regional hospitals throughout the region. We describe some of the challenges to the provision of emergency services and critical care in Tanzania.

Sub-Saharan Africa accounts for a disproportionate global burden of disease related to maternal and child mortality, human immunodeficiency virus/acquired immunodeficiency syndrome, malaria, and tuberculosis with communicable, maternal, neonatal, and nutritional disorders accounting for 76% of premature mortality in Sub-Saharan Africa [1]. As the region continues to struggle with control of these long-standing global health concerns, the growth in gross domestic product and increasing life expectancies have led to an increase in prevalence of noncommunicable diseases such as hypertension, cardiovascular disease, and diabetes with the proportion of deaths due to noncommunicable disease projected to rise from 59% in 2002 to 69% in 2030 [1,2]. Complications from these diseases and those associated with communicable diseases and sepsis [3,4], maternal health and care of the surgical patient [5,6], and those with traumatic injury [5–7] contribute to the need for appropriate emergency and critical care services.

Whereas the burden of these diseases and the subsequent need for emergency and critical care services is great, the available infrastructure, human resources, diagnostic and treatment capabilities, and financial resources devoted to provision of emergency and critical care services is not [8,9]. Despite these challenges, patients with illnesses and injury are being provided emergency and critical care services at the district and regional hospital levels [10] and in remote rural areas [6]. These hospitals are at the front line of care in Tanzania.

Resources are scarce at all levels of treatment and care. For example, the general lack of transportation infrastructure leads to patients in need often arriving to the hospital hours after injury or days after the development of

critical illness. The lack of an integrated approach to triage, resuscitation, and stabilization of acutely ill patients adds to the delay in treatment [11]. This coupled with lack of critical care resources in the hospital itself such as trained staff, drugs, basic diagnostic and medical equipment, and guidelines [10], as well as the limited ability to transfer a patient to higher levels of care contribute to the high mortality seen in these patients versus those in more resource-rich settings [8].

BACKGROUND

We describe a case that illustrates some of the challenges and resource limitations to providing emergency and critical care services in Tanzania.

Mr. Y is an elderly man brought to the casualty room at a 300-bed district hospital in rural Tanzania by private vehicle. A hippopotamus that had been rampaging a local village attacked him; that village was >30 km away from the hospital. On arrival to the hospital, he was hypotensive and tachycardic with altered mental status. Examination revealed large abdominal wall and pelvis wounds that were contaminated with mud and plant material and eviscerated abdominal contents with active hemorrhage. In addition, he had large buttocks and leg wounds and an open elbow fracture. An intravenous port was inserted and the patient was given normal saline and transferred to the operating theater. There was no blood available in the hospital.

The patient arrived in the operating theater and was attended by a nurse anesthetist while the surgeon finished another operative case. His blood pressure dropped with induction of halothane anesthesia and he received intravenous crystalloid resuscitation until blood was available well

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after the operation had started. He required multiple small bowel resections, irrigation of the abdominal cavity, debridement and reconstruction of the abdominal wall and perineum, irrigation of multiple open wounds, and splinting of an open elbow fracture. He was extubated and transferred to the intensive care unit (ICU) with a systolic blood pressure of 100 mm Hg. Mr. Y remained in the ICU for 2 days until he was stable enough to transfer to a referral hospital.

Tanzania, a country in East Africa, has a population of nearly 45 million that has increased by 30% in the decade between 2002 and 2012 [12]. Great strides have been made in reducing infant and maternal mortality, diagnosis and treatment of malaria and human immunodeficiency virus, and in increasing the number of health workers and access to health care; yet, Tanzania still struggles with inadequate healthcare delivery and resource limitations. The majority of the population (70%) lives in rural areas and is involved in subsistence farming, except in areas bordering large lakes such as Lake Victoria where fishing is also a means of employment [12]. Road infrastructure, except in major towns, is primarily composed of dirt roads.

Basic health care is provided in villages at dispensaries staffed by a clinical assistant. The next level of care is at a health center staffed by a clinical officer (CO), with 3 years of training after secondary school, and a nurse [13]. Health centers may also have an assistant medical officer (AMO), who has 2 years of additional training after CO school, and a nurse midwife. AMOs have been trained to perform operations including caesarian sections, and some health centers have emergency caesarian section theaters. The next level of care is provided at the district hospital level with usually 1 designated hospital for each district. In general, they provide a full range of basic services including laboratories, radiology machines, and operating theaters. They are staffed by general medical doctors, AMO, CO, nurse, and attendants and may or may not have specialists. Patients needing a higher level of care are referred to a regional or referral hospital.

EMERGENCY PRE-HOSPITAL CARE, TRANSPORTATION, AND REFERRAL SYSTEMS

The district hospital that served as the first point of contact with the healthcare system for Mr. Y is located in a rural Tanzania in a geographic area that encompasses 3,335 km² and borders on Lake Victoria. Its catchment area has a population of 501,915, and the hospital is 60 km from the nearest major referral hospital [14]. Sending a patient to the referral hospital for a higher level of care requires a minimum of 1.5 h and a 25-min ferry ride across Lake Victoria. There is no coordinated community-based pre-hospital care for the severely injured or ill.

Community-based care is a first step in the care of critically ill and injured patients. The lack of coordinated acute care referral systems that include pre-hospital care and transportation at the community level is the first bottleneck in the care of the acutely ill and injured in

Tanzania [15] and is critical to improving the delivery of care for these patients by leading to shorter pre-hospital times and quicker time to treatment [16]. The lack of pre-hospital care means that severely injured or ill patients often die prior to reaching the hospital or deteriorate en route. The Bellagio Essential Surgery Group, a group committed to raising international awareness to increase access to surgical services in resource-constrained settings in Sub-Saharan Africa, recommends improvements of systems for the delivery of trauma and acute care [17] as 1 of 4 key recommendations. They recommend improvement in pre-hospital care as the first step in this process, in addition to strengthening patient management, referral systems, and care at clinics and hospitals, as well as the removal of financial barriers to care. Improvements in pre-hospital care by training lay persons in the community in basic first aid for trauma can be achieved in developing countries [16,18]. These interventions have been shown to be efficacious and can be done in a cost-effective manner—approximately US\$3 per life-year saved [19].

As in the case of Mr. Y, a private vehicle is the most common method of emergency transportation of a critically ill or injured patient. These vehicles may be automobiles, trucks, police vehicles, minibuses, motorbikes known as “piki” or “boda,” or nonmotorized vehicles such as bicycle and carts. Ambulances are pre-positioned at several health centers in the district and at the district hospital. Ambulance transportation from the outlying health centers and dispensaries to the hospital is used for the transport of pregnant women in labor or other critically ill patients and is arranged via telephone with the district medical officer or their representative. Ambulances do not routinely go to the scene of a traumatic event or to the home of an ill person. Whereas ambulance services may be better suited to densely populated urban areas, they can still be cost effective and do save lives by performing pre-hospital care and hastening the time of arrival to definitive care [19]. However, their wider use in Tanzania is limited by their number, working order of the vehicles, and funds for maintenance and repair, in addition to the lack of a coordinated system for dispatch.

Cell phone service, even in rural areas, is ubiquitous throughout most of Tanzania, allowing for ease of communication. Although there are multiple M-health initiatives that use cell phones for health education, community health worker training, telemedicine [20], referral systems primarily for pregnant women [21], and community-based care [22], their use in the pre-health care facility environment for referral from the field has yet to be fully developed and is a potential avenue for intervention [23].

HUMAN RESOURCES

Mr. Y was evaluated in a casualty department staffed by a nurse and a CO and cared for in an ICU that was staffed by 2 nurses. The hospital, despite performing over 5,000 major operative cases a year with nearly 10,000 deliveries,

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