

**Strategies to increase access to surgical services in
resource-constrained settings in sub-Saharan Africa**

Bellagio Essential Surgery group

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**Background Paper for Session on
Strategies to strengthen the delivery of trauma care
with a case study from Uganda**

An important follow-up to the Bellagio meeting was the agreement to address trauma care and to look for ways to improve systems for dealing with trauma. A small working group, led by the Uganda group has prepared this document to provide a background to the working group session. The paper describes the scale of the problem, and proposes the elements of a demonstration project in Uganda for discussion with participants at the meeting.

Although injury is not necessarily the first condition that comes to mind when one considers the health problems of the developing world, it actually represents a major issue. Injury currently accounts for 12% of all disability-adjusted life years (DALYs) lost worldwide, (1) and more than 90% of this burden is borne by low- and middle-income countries. (2) In sub-Saharan Africa, injury accounts for nearly 10% of all DALYs lost, a figure that is more than several well-known infectious diseases including diarrheal illness (6%) and tuberculosis (3%).(1) While malaria deaths predominate in children under five, for children over 5, injury deaths in sub-Saharan Africa outnumber all deaths from HIV, TB, and malaria combined. (3)

Unfortunately, the available evidence suggests that this situation will only worsen in the foreseeable future. By the year 2020, initial projections were that injury will account for fully 20% of the global burden of disease, with road traffic injuries representing the third leading cause of lost DALYs. (4) Even with updated estimates accounting for higher rates of HIV incidence and prevalence compared to the initial data set used in the burden of disease study, road traffic crashes alone are projected to rank fourth by 2030 in DALYs in low-income countries. (5) Trauma accounts for significant proportion of the injury burden in sub-Saharan Africa. In terms of long-term disability, a population-based study conducted by Mock and colleagues in Ghana, found that orthopaedic trauma accounted for three-quarters of all long-term disability due to injury. (6) Africa has the highest road traffic injury mortality rate in the world at 28/100,000 people, and has 50 deaths/10,000 vehicles compared to 1.7 deaths/10,000 vehicles in high-income countries. (7)

In addition to the deleterious health effects of trauma, there are far-reaching socioeconomic consequences as well. It is the young, economically-productive population that is primarily affected by trauma: in the aforementioned study by Sekimpi and colleagues, for example, the 18-45 age group accounted for nearly two-thirds of all fractures.(8) The fact that most trauma victims are male further increases the likelihood that it is the primary breadwinner who is affected by the fracture.(8) In fact, the study conducted by Mock and colleagues in Ghana found that disability resulting from injury was associated with severe economic consequences, with 68% reporting decreased income as a result of the injury and disability, 37% reporting having been forced to borrow money, and 11% reporting having been forced to sell property.(6)

Cross-country comparisons have also been useful to identify disparities in trauma care globally. For example, comparisons of the outcomes of severely injured patients in Seattle, Mexico, and Ghana (between patients with injury severity scores (ISS) > 9) showed that injury mortality rates in this group of severely injured patients varied from 35% to 55% and 63%, respectively. (9) This suggests that globally, 1-2 million deaths a year could potentially be averted by eliminating disparities in trauma care globally. It is estimated that trauma systems in developed countries have reduced medically preventable deaths by 50%. (10) A significant proportion of injury deaths occur in the prehospital setting, which emphasizes the essential role of improving prehospital care, as well as hospital-based care in trauma system development.

In spite of these trends, African governments have paid remarkably little attention to the prevention and treatment of injury. (11) The international donor community has only encouraged this neglect, as infectious disease initiatives receive \$2.00-3.00 per DALY lost, while injury receives just \$0.06 per DALY lost. (12) In Uganda, annual expenditure on road traffic safety is just \$0.09 per capita,(13) in spite of the fact that road traffic crashes cost the nation \$101 million (2.3% of GNP) in 2001. (14) A recent report showed that of the 111 donor-supported projects in Uganda over the last two years totaling over \$300 million, only two of these projects supported regional hospital services. (15)

The WHO and a consensus of international experts have composed the Guidelines for Essential Trauma Care, based on 11 core functions to which all people should have access, in essence, to which all injured patients have a right to have. (16) These functions are presented across the domains of human resources, skills, and infrastructure and supplies. To date, the guidelines have been used as needs assessments in Ghana, Vietnam, Mexico, and India, and others are planning to use them. (10) The guidelines have helped these countries identify changes in the organization of services at very low (and sometimes no) cost that can improve service delivery.

Burden of surgical conditions in Uganda

In a population-based study by Kobusingye and colleagues, injury was found to have an annual mortality rate of 217 per 100,000 in Kampala. (17) This mortality rate ranks among the highest in the world, and is several times higher than the rates of 40-60 deaths per 100,000 people seen in the high-income nations of the world. (18) The survey also revealed that, in addition to fatal outcomes, there was a significant amount of injury-related disability, as nearly 3% of all people surveyed reported living with a permanent disability suffered as a result of injury. (17) A hospital-based study conducted by the same group of researchers arrived at similar conclusions, with injuries accounting for 7% of all cases seen in the five hospitals of Kampala during the months of January-December 1998. (19) Subsequent community surveys in three different areas of Uganda have also suggested that injury epidemiology varies by region, with a predominance of road traffic crashes in urban Kampala, intentional violence in the conflict-affected north, and a high incidence of drowning in waterside regions such as Mukono. (17, 20)

In the last burden of disease study in Uganda in 1995, (which analyzed mortality not morbidity), injury ranked in the top ten causes of death in the majority of districts studied. (21) In a 2005 study conducted by Sekimpi and colleagues at Mulago National Hospital, fully one-third of all injuries presenting to the surgical emergency ward were found to be orthopaedic in nature. (8) Fractures of the long bones of the lower extremity were especially common, with the femur and tibia accounting for 25% and 28% of all fractures, respectively. By far the most common cause of these fractures was road traffic accidents, which accounted for 62% of all fractures.

Facilities and Services for orthopaedic trauma care in Uganda

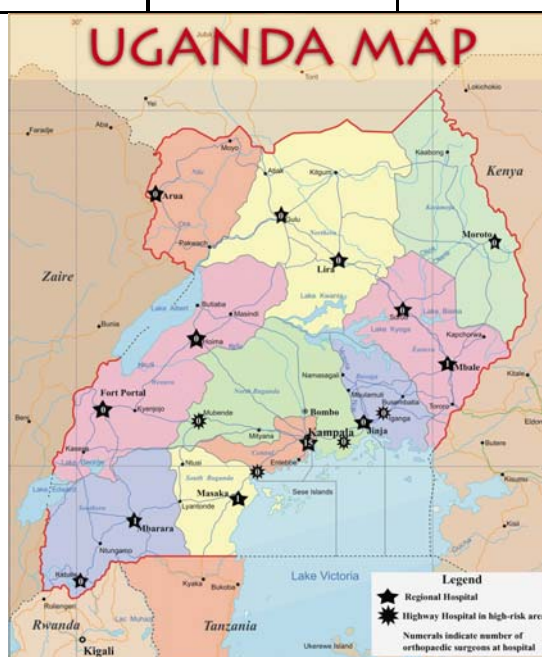
The healthcare infrastructure in Uganda is illustrated in Table 1. Mulago Hospital, a 1500-bed facility located in the city of Kampala, is the national teaching and referral hospital of Uganda. It features a Department of General Surgery and Orthopaedic Surgery. Since Mulago is the only hospital in Kampala with an Emergency Room that is open 24 hours a day, it receives most injuries (~75%) that take place in the capital and surrounding areas. (19) Overall, an estimated 6000 injured patients are treated in Mulago Hospital each year. (22) A high percentage of these injuries have a musculoskeletal component, with the Orthopaedic Trauma Service seeing hundreds of fractures on a monthly basis, and admitting approximately 150 fracture cases per month. (8) While Mulago is the only government hospital in Kampala, there are also four mission hospitals (Mengo Hospital, Kibuli Hospital, Nsambya Hospital and Rubaga Hospital) and one private hospital (International Hospital Kampala) providing care within the city.

Within the city of Kampala, prehospital care is highly inconsistent. While some patients are rescued by paramedics and transported by ambulance to the nearest hospital, the vast

majority of injury victims receive no treatment in the field and are transported by taxi, private car or police. Outside of Kampala, the Ugandan government provides healthcare through a network of regional hospitals, district hospitals, and local health centers. In theory, orthopaedic injuries occurring outside of Kampala are to be treated at the regional hospitals (see Map). In practice, however, these hospitals are not equipped to provide adequate care for orthopaedic trauma. In fact, the majority of regional hospitals don't have a single orthopaedic surgeon on staff (see Map). (In addition to the regional hospitals, the Map depicts four "highway hospitals" in areas with high rates of orthopaedic injury, which should certainly be targeted by any intervention to improve orthopaedic care in the country.) Prehospital care is largely nonexistent outside of Kampala.

Table 1: Description of health infrastructure in Uganda

| Health Unit | Location | Population |
|----------------------------|------------------------|----------------------|
| HC I | Village | 1000 |
| HC II | Parish | 5000 |
| HC III | Sub-County | 20,000 |
| HC4 | County | 100,000 |
| District Hospital | District | 100,000 to 1 million |
| Regional Referral Hospital | Region (3-5 Districts) | 1-2 million |
| National Referral Hospital | National | Over 20 million |



Human resources for trauma care in Uganda

There are approximately 75 general surgeons in Uganda, and 25 orthopaedic surgeons, the majority of which are at in Kampala at Mulago National Referral Hospital. It is generally difficult to attract physicians in training to the surgical fields primarily due to the attractiveness of careers in infectious disease. (23, 24) The orthopedic surgeons account for the vast majority of surgical fracture care in the city, although it should be noted that a large proportion of orthopaedic trauma is treated on an outpatient basis by orthopaedic technicians who see emergency cases in the Casualty Department.

The operative management of trauma at Mulago is greatly hindered by the inadequacy of anesthesia staffing at the hospital. It is not uncommon for one or more operating rooms to remain unused for an entire day due to lack of anesthesia coverage. These deficiencies appear to be the result of inadequate numbers, as well as poor motivation. Most of the nation's anesthetic care is provided by anesthetic officers, of which there are approximately 350 in the country, as opposed to approximately 10 physician anesthesiologists. (25, 26)

Outside of Kampala, the situation is considerably worse. A minority of general surgeons and only 3 orthopaedic surgeons practice outside the capital, in spite of the fact that 93% of Uganda's population lives outside Kampala.(27) The vast majority of general and orthopaedic trauma occurring outside the capital is handled by orthopaedic technicians, general surgeons, general practitioners, and traditional bonesetters. For orthopedic trauma, the management is almost exclusively conservative (including traction, splinting and casting), even in the case of long bone fractures of the lower extremity. A significant percentage of these cases fail to heal properly and are eventually referred to Mulago for appropriate management, but often not until weeks, months or even years have passed from the time of initial injury.

A number of trauma-training courses have also been ongoing in Uganda and other countries to equip health personnel with the skills to care for injured patients, and this is also emphasized in the ETC guidelines. (28) The American College of Surgeons Advanced Trauma Life Support (ATLS) course has been piloted in some low-income countries, and has even been shown to impact mortality. (29) A modified version of this course was offered this spring to all surgical trainees at Mulago Hospital by faculty in the Departments of Surgery and Orthopedics, and this course is currently under evaluation. In addition, a Primary Trauma Care course has been adopted from ATLS to the austere medical setting of the district hospital, and this has been used in several countries in Africa, though more resources are needed for its dissemination. (30) The Injury Control Center-Uganda has recently evaluated its ongoing trauma-team training course implemented in rural hospitals and advocated for its further dissemination. (31)

The training of lay first responders has been emphasized as a low-cost and very feasible first step to building on existing informal prehospital services. (33-35) This model is currently being piloted in Kampala in training police, taxi drivers and conductors, and local government officials and could be scaled up both within the city and across the country with greater support. There is no current organized prehospital system—while there are several private ambulance services in Kampala, these are fee-based and not available to the general public. In addition, they are very sparsely equipped in terms of supplies and primarily serve as means of transporting patients to the hospital.

Development of a demonstration project to strengthen trauma systems in Uganda

Given the structure of the health system in Uganda today (see Table 1), it makes most sense to focus on a trauma system structured around a regional referral hospital (RRH), i.e. serving a population of 1-2 million people. A RRH takes referrals from several district hospitals. The RRH is generally staffed by specialists, while a district hospital is staffed by general practitioners (medical officers) and non-physician clinicians (clinical officers). One such RRH is in the Masaka region of Uganda where we propose to pilot the project.

Masaka hospital is 130 km from Kampala. Current staffing there includes an orthopedic surgeon, two general surgeons, and an anesthesiologist. It is on a major highway. The estimated “catchment area” is 2 million. Hospitals included in the region are Kitovu, Villa-Maria, Kalisizo, Lyantonde, Rakai, Kakuto, Nkozi Hospitals. Several of these private hospitals have specialist services.

For this purpose, we propose to establish a National Trauma Council as a semi-autonomous body independent of the Ministry of Health, hospitals, etc. with all relevant stakeholders. Members would include representatives from the Ministry of Health, Makerere University, Ministry of Works and Transport, WHO, development partners, UTODA, Police, petroleum companies, Injury Control Center-Uganda, Uganda Red Cross Society, Uganda Road Safety Council, professional bodies, and health personnel. The Council should have a Board of Directors to oversee its governance and activities.

Issues for consideration in the development of the model will include:

Needs Assessment:

- Review of the Guidelines for Essential Trauma Care by the Council and their adaptation to the Ugandan situation.
- Use of these adapted guidelines as needs assessments at selected health facilities in the country.
- Nationally, identification of geography-epidemiology specific trauma needs (i.e. hospitals near major highways should be prepared for road traffic crashes and

mass casualty incidents; maybe waterside communities should have more drowning prevention programs).

- Development of quality assurance mechanisms and regular monitoring.
- Overall improved surveillance; creation of a trauma-related health information system as the current health information system includes very little detail on trauma.
- Review of the currently collected data by the Ministry of Health (HMIS), police, hospitals, on road traffic crashes and consideration of how data collection can be improved.
- Building on the trauma registry established by the Injury Control Center-Uganda, which has been used in 5 hospitals, and expanding to all hospitals.
- Integration of trauma and injury into Demographic Health Surveys or Demographic Surveillance sites (ongoing in Rakai and Iganga).
- Community-based participation in needs assessments for trauma.
- Evaluation of current referral patterns/reasons for referral to higher level of care.

Prehospital care:

- Training of lay first-responders (first-tier) such as police, taxi drivers, ambulance and hospital drivers, teachers, local council community leaders. Integration of this training in obtaining licenses for operation of commercial vehicles.
- Paramedic training (second-tier): Short-term of a smaller number of hospital-based staff who can respond to emergencies; Long-term development of a separate cadre of paramedics.
- Projections for its development into a National Emergency Medical System including an ambulance service.
- Mandatory basic life support courses in all health training institutions.

Hospital Care:

- Certified trauma training program for hospital personnel (including doctors, clinical officers, nurses, orthopedic clinical officers, anesthetic officers) using ATLS-like curriculum or similar kind of program (ie the Primary Trauma Care course); ongoing on-site CME for regional and district hospital and centralized training at Mulago Hospital and Mbarara University Hospital with gradual decentralization of training programs to regional hospitals. Mandatory re-certification of health personnel at regular intervals as recommended by the National Trauma Council.
- Agreement on posting of surgeons and anesthesiologists to regional and-or district hospitals (staffing norms).
- Incentivization of posting of health personnel to rural areas, perhaps through more rural hardship allowances.
- Optimal Organization of hospital resources and assurance of essential supplies to care for injured patients (akin to essential drugs).

- Protocols and resources for patient transfer to higher-level facilities. Identification of conditions most likely to have a higher chance at better outcome at a higher level of care.
- Long-term development of designating “levels” of trauma care at hospitals as recognized by the National Trauma Council. National Trauma Council will establish criteria (staffing, equipment, infrastructure, skills, data management) for each level and provide accreditation through site visits, performance monitoring, adherence to staffing norms.
- Long-term development of a trauma units and wards at regional and national health facilities.
- Integration of trauma care with primary health care at district hospitals and health center IVs.

Rehabilitation:

- Assurance of adequate physical and psychosocial rehabilitation services for injured patients at regional and national hospitals.

Advocacy:

- Community awareness programs: Mass media, churches, local councils; Mandatory first aid courses in schools.
- National Trauma Council to have periodic meetings with advocacy groups for direct accountability to the public.

Prevention:

- Review of existing prevention programs and their effectiveness and cost-effectiveness, for example: enforcement of laws on use of seat belts, helmets, traffic lights, speed limits; vehicle design and mechanical condition; road development-speed bumps; zebra crossing; pedestrian safety and walkways; cycle lanes; visibility enhancement.
- The National Trauma Council will establish a timeline for implementation of this proposal with periodic progress reports and monitoring.

Some questions the working groups might like to address include:

- What current emergency care infrastructure is in place in each country?
- What surveillance data on trauma is currently collected and how should data collection be expanded?
- What is the epidemiology of trauma within each country?
- What is the current trauma training provided to health care staff?
- How should the curriculum be designed?
- Should trauma training be incorporated into the formal training programs for the health care workforce and at what levels should it be considered?
- How can a trauma system be incorporated into the existing health system?
- What trauma prevention and control strategies are currently being undertaken by other stakeholders such as the police and how should the health system collaborate with them to promote a synergistic response to trauma?

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