

The Global Trauma Burden and Anesthesia Needs in Low- and Middle-Income Countries

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In the past 20 years, the global disease burden has significantly shifted from communicable to non-communicable disease. Practically, this translates to a higher percentage of death and disability from cardiovascular disease, trauma, cancer, obesity and diabetes. The transition away from HIV, TB and malaria has also increased the necessity for safe anesthesia and surgery to treat these emerging diseases in the countries of greatest need for both: low- and middle-income countries (LMICs).

Trauma is a disease and ranks as the leading cause of global disability and death. Millions of injuries occur around the world, and more than 1.24 million deaths result annually. The majority of trauma-related deaths (91 percent) occurs in the poorest countries and impacts the healthiest population, those aged 15-29 years.¹ Unfortunately, it is in these same LMICs where emergency surgery is most often unavailable, largely due to the lack of safe anesthesia.

- Morbidity and mortality from road traffic injuries:
 - Accounts for 1.24 million deaths annually
 - 50 percent of the deaths are motorcyclists, pedestrians and cyclists
 - Average dollars lost due to premature death and disability equals \$518 billion annually
- For every 1 person who dies in a road traffic crash, 20 are injured
- 1 in 20 of those injured are left with a disability.

World Health Report 2010¹

Mortality from trauma in the United States (U.S.) and other high-resource countries has decreased in the past decade due to the advent of prevention strategies, pre-hospital care, aggressive resuscitation with crystalloid, blood and blood products, trauma systems development, specific education and training, and an emphasis on rapid transition from initial injury to the O.R.



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Photo courtesy of Gerald Dubowitz, M.B., Ch.B.

Physician anesthesiologists were and continue to be integral counterparts in every phase of this success. While some of the evidence from high-resource settings suggests excessive medical expense, there is a more significant impact from the disability that results from lack of basic surgery and safe anesthesia, as well as the loss of life of the youngest, most productive part of the workforce in LMICs.

A high mortality rate is associated with anesthesia in LMICs due to shortfalls in trained personnel, infrastructure and anesthesia equipment.^{2,3} There are only nine physician anesthesiologists in Afghanistan (population of 32 million), eight in Bhutan (population less than 700,000) and 13, excluding expatriates, in Uganda (population of 27 million). In sub-Saharan Africa, the majority of anesthetics are provided by non-physician anesthesia providers working alone, unsupervised and with limited training.⁴

A recent analysis of 22 LMICs, using World Health Organization (WHO) data, demonstrates that 35 percent of health care facilities have no access to oxygen, approximately 50 percent of facilities do not have continuous access to anesthesia machines or pulse oximetry, and that the majority of personnel providing anesthesia are nurses or clinical assistants.⁵ None of the countries in this study reported continuous supplies of water, electricity or oxygen.

Table 1: Surgical Intervention Impact on Global Burden of Disease (GBD)

| Surgical Disease Type | Potentially Averted with Intervention (28% of GBD) |
|-------------------------|----------------------------------------------------|
| Trauma | 38% |
| Malignancy | 19% |
| Congenital Anomalies | 9% |
| Pregnancy and Perinatal | 10% |
| Cataracts | 5% |

Lancet 2012. GBD Project.

A review of the PubMed indexed English literature identified 17 studies that documented surgical and anesthesia capacity from individual LMICs. This literature, representing 12 LICs and five MICs, documented the anesthesia capacity of 555 facilities. Of the facilities, 66.3 percent (281/424) and 54.3 percent (198/364) always had oxygen and electricity; 47 percent (121/254) and 47 percent (145/309) had anesthesia machines and pulse oximeters, respectively. Ketamine anesthesia was available in 72.9 percent of hospitals reporting, whereas general anesthesia was only available in 56.2 percent. Alternative techniques, such as regional and spinal anesthesia, were available in 58.9 percent and 65.9 percent of hospitals, respectively. Adult endotracheal tubes were available in 51 of 109 hospitals (47 percent) and pediatric endotracheal tubes in 44/126 (35 percent).³

This reality, combined with an increasing trauma burden in most LMICs, requires the poorest countries to invest in safe anesthesia. Trained anesthesia providers, basic resuscitation, education and supplies, and essential medicines, including vasopressors, are essential for the improvement of emergency surgery and trauma outcomes. An inadequate and/or an untrained workforce contributes significantly to access to and the safety of surgery provided in LMICs.

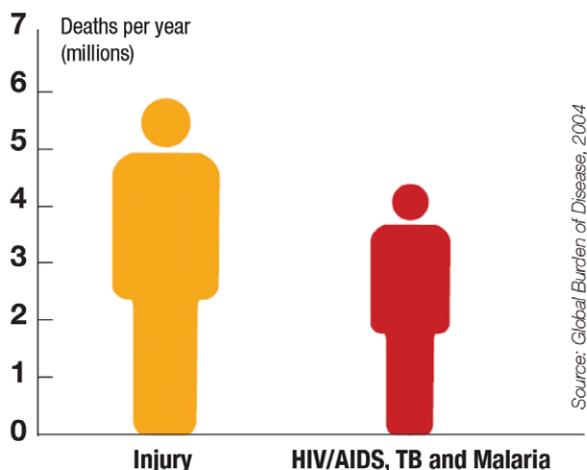
A recent extraction for the WHO Situational Analysis Tool database collected information on the number and type of anesthesia providers working in full-spectrum medical facilities in 28 LMICs revealed that 30.4 percent (n=344) of all medical facilities reported having no full- or part-time anesthesia personnel, including anesthesiologists, general doctors providing anesthesia or nurse/clinical/assistant medical officers providing anesthesia. In these same institutions, only

Continued on page 18

41 percent of the anesthesia providers are certified, registered or licensed.⁶ Further, only 37.1 percent (n=485) of all medical facilities evaluated employ anesthesiologists, and of those, only 50.9 percent are certified, registered or licensed.

Imagine being in a car accident while on vacation with your family in Africa. In the U.S., you would depend on timely, aggressive resuscitation and surgery, giving you the best chance of survival and return to work and leisure activities. In Africa, you have a much greater chance of dying.

Figure 1: Injuries and Violence: The Facts.
World Health Organization 20101



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Globally, an estimated 2 billion people lack access to emergency surgical care and safe anesthesia. A perioperative mortality rate (POMR) is the proposed new indicator of safe anesthesia and surgery in LMICs. The POMR is defined as the all-cause mortality of ASA Physical Status 1, 2 or 3 patients within 24 hours of a surgical intervention with anesthesia. It is not specific for cause or etiology and reports mortality related to both surgery- and anesthesia-related issues. International reporting of the POMR is likely to become an important metric for tracking worldwide improvement in perioperative care.⁷

There is a critical need for systematically collected, national-level data regarding surgery providers in LMICs to guide improvements in surgery access and care. Of the 57 WHO-designated countries in a “health workforce crisis,” there are no national data on 40 percent of these countries.⁸ The Harvard Global Surgery Workforce Initiative and the WHO global surgical workforce database are both addressing this need by surveying ministries of health and surgical professional organizations around the world. Global surgery workforce data are necessary for achieving international accountability for the surgical workforce crisis in LMICs.⁸ A commitment on the part of our specialty is necessary to help this crisis. We urge you to recognize the critical need for anesthesia providers, improved resuscitation and access to emergency services in the poorest countries, as well as to take action by creating awareness among your colleagues and advocating for improved global funding for trauma systems and safe anesthesia in low-income countries.

Figure 2: Availability of Anesthesia-Related Supplies in 17 LMICs³

| Variable | Percent of hospitals with resource (% of total hospitals responding) | Percent of low-income hospitals with resource (% of total LIH responding) | Percent of middle income hospitals with resource (% of total MIH responding) |
|-------------------------------|----------------------------------------------------------------------|---------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Continuous oxygen supply | 68 (82%) | 71 (75%) | 77 (100%) |
| Continuous electricity | 54 (70%) | 56 (60%) | 51 (100%) |
| Pulse oximeter in O.R. | 47 (60%) | 41 (69%) | 80 (33%) |
| Functional anesthesia machine | 47 (49%) | 50 (51%) | 38 (44%) |

LIH – low-income hospital; MIH middle-income hospital

Table 2: Surgical Interventions Most Often Unavailable in LICs

| | Emergency and Essential Surgery at First Referral Hospitals |
|-----------|--------------------------------------------------------------------|
| Emergency | C-Section/D&C |
| | Appy/Ex Lap |
| | Anesthesia/Emergency Airway |
| | ORIF/I&D |
| Essential | Hernia |
| | Cataract |
| | Cleft Lip/Club Foot |

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