

Access to Safe Anesthesia: A Global Perspective

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Basic surgery and safe anesthesia are essential health services, but their importance has been consistently undervalued in global health efforts. One third of the world population does not have access to essential surgery and even more are subjected to unsafe anesthesia. At the same time, the global burden of injuries and other non-communicable diseases requiring surgery and anesthesia is rapidly increasing. Despite tremendous global disparities in access to safe anesthesia, governments and major donors have been reluctant to prioritize the issue because of myths about burden of disease and the cost-effectiveness of surgical services. This article summarizes the most up-to-date literature on anesthetic capacity in low- and middle-income countries, discusses the compelling reasons why safe anesthesia is a vital part of health system planning and provides future strategies to improve global disparities in access to care.

INTRODUCTION

The World Health Organization (WHO) and World Bank expect that by 2026, the burden of diseases requiring surgery and anesthesia will eclipse that of HIV, tuberculosis and malaria (measured in disability adjusted life-years).¹ However surgery and anesthetic care has long been “the neglected stepchild of global health”.² There is no global funding organization for improving these services as there is for HIV or vaccine preventable diseases.^{3,4} In general, major donors have been unwilling to acknowledge and support the provision of safe surgery and anesthesia as part of improving global health. This has been because of misconceptions about both the burden of disease requiring surgery and anesthesia and the cost-effectiveness of anesthetic care, in addition to a lack of a coordinated and sustainable strategy for providing services in many low resource settings.⁵ This commentary describes the global inequities in access to safe anesthesia, discusses the compelling reasons why it should be prioritized in global health efforts and provides possible strategies to improve access to quality anesthetic care.

GLOBAL CAPACITY OF ESSENTIAL SURGERY AND ANESTHESIA

The global volume of major surgery in 2004 was between 187 and 281 million cases; meaning approximately one in every 25 people underwent an operation requiring anesthesia.⁶ But recent estimates point to a much larger and unmet need for operative management along with significant global inequities in access to care. It is estimated that two billion people worldwide—or 30% of the world’s population—do not have access to surgery, let alone safe anesthesia.⁷ 75% of major operations were performed in the wealthiest third of the world’s countries, while the poorest third of the world’s population underwent only 3.5% of operations.⁶ This reflects a profound disparity in access to essential surgery and safe anesthesia and a large, untreated global burden of disease.

Part of the problem is that basic facility infrastructure is vastly inadequate in many low and middle-income countries (LMICs). Despite WHO’s expectations that surgical and anesthetic care be available at district hospital level, operating theatres remain a scarce resource.⁸ In a study of 78 district hospitals in seven LMICs, there was less than one operating theatre per 100,000 people in five of the countries.⁸ Aside from inadequate physical infrastructure, the other key factors limiting anesthetic capacity and access to services are shortages and misdistribution in the anesthetic workforce and shortages in anesthetic equipment and medications. These will be discussed.

ANESTHETIC CARE: WHY IS IT IMPORTANT?

Anesthetic-related mortality is closely connected to the level of development in countries and the number of anesthetic physicians.⁹ A recent systematic review and meta-analysis by Bainbridge et al. found that anesthetic-related mortality was three times higher in developing compared to developed countries.⁹ Furthermore, this is likely to be an underestimate, because the review excluded many countries with a gross domestic product per capita lower than any of the included countries.¹⁰ In reality, anesthetic mortality is probably much higher, especially in sub-Saharan Africa—reportedly as high as one in every 150 cases.¹⁰

Aside from the problem of inadequate physical resources, there are significant gaps in the global anesthetic workforce. The shortage of trained anesthetic physicians and nurses has been, until recently, poorly documented. In a study of 12 LMICs, 11 countries had less than one anesthetist or non-physician anesthetic provider per 100,000 population.¹ The worst shortage documented in the study was in the Democratic Republic of Congo, which had one anesthetist for every five million people.¹ In another study of 22 countries, irrespective of the size of hospitals or complexity of cases, nurses or clinical assistants were the main providers of anesthetic care, often without supervision or adequate training.¹¹ This has been recognized as the rule rather than the exception in most LMICs.¹¹

Recruitment and retention of anesthetic physicians also remains a significant challenge. Training opportunities for anesthetists are mostly limited by the costs and availability of anesthetic equipment and medications, particularly general anesthesia. In Uganda, training positions remain unfilled, because potential trainees are unable to afford the costs of specialist anesthetic training.¹ The yearly study cost for anesthetist trainees is US\$1750, which is almost ten times the average annual household income.¹ Similar workforce problems exist in other sub-Saharan African countries. In Kenya, only 13 of the country’s 120 anesthetists work in public hospitals.⁷ In many LMICs, both public and private sectors implement ‘user fees’; most patients are unable to afford government-subsidized healthcare in public hospitals, let alone private healthcare. This workforce misdistribution between public and private sectors (even within cities) is another barrier to adequate surgical and anesthetic care.

Many countries have attempted to alleviate workforce problems by training anesthetic officers or nurse anesthetists that can perform basic peri-operative management, a relationship analogous to physicians assistants and doctors in the United States.^{12,13} Despite some successes, workforce expansion is limited by a shortage of anesthetic physicians to provide adequate training and supervision.¹ These anesthetic officers and nurses may be able to provide basic peri-operative care, but they are unable to

provide the expertise required in more complex surgery—for example, surgeries to combat solid organ malignancies and ischemic heart disease. Furthermore, the number of these basic anesthetic providers still does not meet workforce requirements in many settings.¹

DEBUNKING MYTHS AND RECOGNIZING ITS IMPORTANCE

There has been a pervasive perception in global health discourse that essential surgery and safe anesthesia poses only a limited global burden of disease and therefore should not be prioritized. This misconception dates back to the Millennium Development Goals (MDGs), a set of eight overarching targets established by the United Nations, that have driven global development efforts since 2000. Health was a key priority in the MDGs and was represented in three of the eight goals (reducing child mortality, improving maternal health and combating HIV/AIDS, malaria, tuberculosis and other diseases). Despite a burden of disease greater than the “other diseases” (infectious tropical diseases such as dengue fever, lymphatic filariasis and schistosomiasis), essential surgery and anesthesia were never directly addressed in the MDGs. Even by the most conservative estimates, conditions that require surgery and anesthesia account for 11% of the global burden of disease.¹⁴ On the other hand, infectious tropical diseases, accounting for 1.3% of the global burden of disease, were directly addressed as “other diseases” in MDG Six (Table 1).^{14, 15} This lack of prioritization has carried over into the new Post-2015 Development Agenda, which will succeed the MDGs.¹⁶

The misconception that surgery and anesthesia are not cost-effective public health interventions has continually hampered efforts to galvanize global health action. This assumption is not supported by recent studies. For example, the cost-effectiveness of basic surgical and anesthetic care—US\$11 per each of 33 disability-adjusted life years (DALY) averted—is comparable to other public health interventions such as vitamin A supplementation (US\$9/DALY averted) and detection and home treatment of acute respiratory tract infections (US\$20/DALY averted).^{17,18} Basic surgery is more cost-effective than anti-retroviral therapy (US\$300-500/DALY averted), even assuming high compliance and low-cost production.¹⁴ Emergency obstetric care, of which anesthesia is an essential component, provides one of the best returns on expenditure (US\$10.93/DALY averted).¹⁸

The prioritization of infectious diseases over non-communicable and surgical diseases has meant that improvements in local surgical and anesthetic capacity in many LMICs have been generally short-term and related to medical missions.⁵ While significant progress has been achieved in other development indicators, the absence of long-term, sustained funding has meant that anesthetic equipment and infrastructure is critically undersupplied.¹

One example of essential anesthetic equipment is the relatively simple pulse oximeter, which is used to monitor patients' oxygenation status and to detect any sign of deterioration during operations. Because of their usefulness, pulse oximeters have been included as essential components of the WHO's Guidelines for Safe Surgery and are often used as a proxy measurement for anesthetic capacity. However, in one large study of 590 healthcare facilities in 22 LMICs, approximately half of all facilities studied did not have reliable and continuous access to functioning pulse oximetry.¹¹ Anesthetic machines, or basic airways management such as adult endotracheal tubes and laryngoscopes, are also scarce in most low and middle income countries.¹¹ This peri-operative equipment is essential for the provision of general anesthesia. The type of anesthesia available was also variable. Regional and spinal anesthesia was available in 56% and 65.5% of facilities respectively, while general inhaled anesthesia was available in 58.5% of facilities.¹¹

While equipment and infrastructure is lacking, epidemiological shifts are increasing the strain on existing surgical and anesthetic resources. Non-communicable diseases have already surpassed infectious diseases and become the leading cause of death and disability worldwide.¹⁹ The burden of these diseases is disproportionately carried by the world's poorest; 80% of deaths from NCDs occur in LMICs. Conditions such as cancer and injuries will therefore comprise an increasing global burden of disease and disproportionately affect LMICs, which have little or no anesthetic capac-

Table 1. Comparison between surgical/anesthetic diseases and neglected tropical diseases

	Global burden of disease (%)	Disability-adjusted life years in Africa	MDG recognition
Surgical/anesthetic diseases	11	25 million	None
Neglected tropical diseases	1.3	20 million	Goal 8 (as part of 'other diseases')

ity. Poor access to essential surgery and safe anesthesia contributes to an enormous disparity in global deaths from injuries; 90% of deaths from injuries occur in LMICs.⁵ The Global Burden of Disease Study estimates that by 2030, injuries will be the fifth leading cause of death in developing countries, ahead of HIV, tuberculosis and malaria.²⁰ The situation is most urgent in sub-Saharan Africa, which has the smallest proportion of motor vehicles globally but highest proportion of road accidents.²⁰ 85% of children in the region will require surgical and anesthetic care by the age of 15, yet access to these services remains among the worst in the world.²¹ Strategies to address the increasing burden of injuries in Africa must prioritize access to surgery and anesthesia.

ADVOCACY AND FUTURE DIRECTION

Improved advocacy for access to essential surgery and anesthesia will require more systematic research into workforce, equipment and infrastructure deficiencies. Developed in 2007, the WHO Tool for Situational Analysis to Assess Emergency and Essential Surgical Care is an evidence-based tool designed to provide a “snapshot” of surgical and anesthetic resources.¹¹ Partnerships between researchers, non-government organizations and health ministries can help facilitate the collection of this data. Nevertheless, accurately measuring access to safe anesthesia remains challenging, because there is no single indicator that describes access and quality of anesthetic services, unlike access to essential medicines where registry-level data are available. Establishing a reliable epidemiological evidence base for anesthetic capacity is much more difficult than for single diseases, where population studies using a single disease marker (e.g., glycosylated hemoglobin levels in diabetes mellitus) can estimate prevalence rates. Several surrogate markers of anesthetic and surgical capacity, for example, perioperative mortality rate, caesarean delivery rate per live births and availability of pulse oximetry, have been proposed and tested.^{7,11} Future studies should incorporate these as part of anesthetic capacity assessments. Utilizing new technology, for example, WHO Service Availability Mapping, offers a low-cost and fast way to monitor health service capacity.²² Ongoing efforts to implement these tools to compare information between and within LMICs will lead to better quality data and strengthen advocacy efforts.

Proponents of safe surgery and anesthesia must discard the idea that anesthesia is a cost-ineffective luxury. Advocates for infectious disease programs cite a basic human right to health. The global surgical and anesthesia communities must appropriate this argument and highlight the poverty-lifting potential of improving access to operative management.²³ Emphasizing disparities in access to care and exposing myths about the cost-effectiveness of basic services will also be important. Framing the situation as a human rights issue will also help galvanize support from donors and policy makers.

Despite the bleak picture, surgical diseases are starting to be recognized by the global health community. The implicit inclusion of injuries in Goal 4 of the Post-2015 Development Agenda (through recognition of non-communicable diseases) is an important step.¹⁶ Proponents of surgery and anesthesia should point out that these services improve public health and strengthen health systems.⁸ There are numerous opportunities to integrate surgery and anesthesia into maternal, child health and non-communicable disease programs.¹⁴ Operative resources are essential for improving maternal health (Goal 5 of the MDGs) by providing services for dilation and curettage, placental extractions and caesarean sections. The early detection and treatment of cancer, prioritized in the Post-2015 Development Goals, must link primary and surgical care.¹⁴ Even tropical infectious diseases, such as lymphatic filariasis and schistosomiasis, can often require surgical interventions. These examples illustrate the important role that good operative resources, which include anesthesia, can play in improving health systems in LMICs.

How can basic anesthetic supplies and workforce issues be improved? Improving the skills of existing health professionals and expanding training programs for non-physician anesthetic providers will help to fill workforce gaps; however, there must be close collaboration between physicians, universities and health ministries to ensure quality training and supervi-

sion.⁸ Advances in anesthetic equipment and technology have been preferentially developed for high-resource settings due to financial incentives.¹⁴ The same problem has occurred in the pharmaceutical industry, where diseases that are more prevalent in high-income countries are prioritized for drug development. Public-private partnerships and the establishment of not-for-profit anesthetic supply companies may help to solve this problem.²⁴ Currently in many LMICs, essential surgical and anesthetic supplies are imported.¹⁴ Reducing the cost of equipment and medications could be achieved by encouraging locally- and mass-produced generic anesthetic toolkits.²⁵

CONCLUSION

The global burden of disease is shifting, and the increasing incidence of surgical diseases will disproportionately affect developing countries with poor access to anesthesia. The global health community must recognize the importance of essential surgery and safe anesthesia and prioritize it as part of an integrated effort to improve health systems. Improving access to safe anesthetic care will require systematic research into resource gaps in local settings, sustained advocacy, multi-sector collaboration, political prioritization and innovative funding solutions to improve anesthetic workforce, equipment and infrastructure.

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