

An Introduction to Global Health and Global Health Ethics: Global Surgery and Global Health Metrics

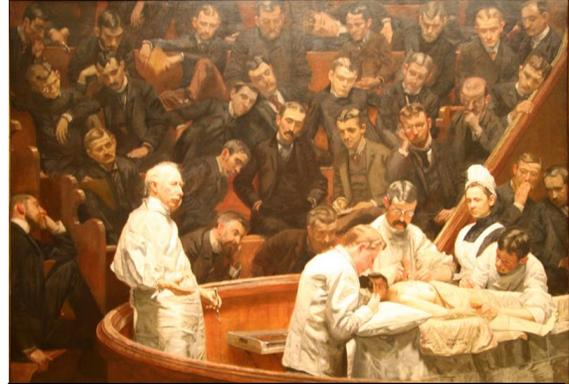
By M. A. Palilonis

Learning Objectives:

1. Describe the components needed for surgical procedures
2. Assess the different methods of measuring disease burden
3. Evaluate the ethical implications of global health measures

Principles of Surgery

Humans have been effecting treatment and cure of disease by incision and manipulation of tissues since ancient times. Egyptian hieroglyphics recorded healers performing caesarean sections, craniotomies and laparotomies by using wine and cannabis as anesthetics.ⁱ For centuries, surgical procedures to close wounds and set broken bones were a part of the skills of traditional healers and physicians. Then, the 19th century ushered in several important medical advancements which allowed surgery to expand. Such discoveries as inhaled anesthetics, sterilization and antisepsis as well as antibiotics improved the outcomes of existing operations and allowed surgeons to work on new areas of the body, such as the abdomen and brain.ⁱⁱ Surgical conditions are those for which surgery is the best option for treatment, cure or palliation. There are so many types of procedures that the field has become specialized with surgeons being trained in trauma, obstetrics/gynecology, pediatrics, oncology and orthopedics, just to name a few. The special components for procedures set surgery apart from other medical interventions.



The Agnew Clinic by Thomas Eakins, 1889.

Components of Surgery

Operating Room: Operating rooms have special needs including a reliable and powered light source, operating tables and the special instruments used during procedures.

Anesthesia: Very few operations can occur without the participation of anesthesia professionals. Their equipment includes anesthetic gas machines, ventilators, and a variety of drugs to both put people “asleep”, under anesthesia, and to “wake them up” again. Just undergoing anesthesia is a risk and in developing nations the rate of mortality can be as high as 1 in 150 from anesthetics.ⁱⁱⁱ

Anti-sepsis: Another important factor in surgical procedures is preserving sterile conditions. This requires the use of an autoclave (a machine that heat sterilizes instruments and linens). Furthermore, the patient, the medical staff and the room have to be cleaned before each procedure. Included in this consideration is the use of antibiotics, both before procedures and afterwards to fight infection.

Post-operative Care: In many cases, as patients recover from surgery and anesthesia they require an intensive level of care: including monitoring of their heart and lungs, wound care, pain management, supportive measures such as IV fluids and antibiotics.

Blood banking: With many types of surgery there is a risk of bleeding. In order to support patients through difficult procedures, blood and blood products are necessary. Blood banking needs laboratory facilities to test and process donated blood as well as storage facilities.

Operating Abroad

In 2008, the WHO estimated that between 187.2 and 281.2 million major surgical procedures were performed worldwide, a volume that significantly exceeded the number of child births in the same year.^{iv} However, 73.6% of these procedures occurred in high-income countries (HIC), while only 3.5% of surgical procedures were performed in low-income countries (LIC).^v The low rates of surgery in developing nations do not necessarily reflect lower rates of surgical conditions, but rather a significant unmet need. People living in developing nations face a number of barriers in accessing surgical care.

Geography: Often, in developing countries, surgical services are only available in urban centers. Due to long distances and poor travel conditions many people with surgical conditions are not seen.^{vi}

Limited Personnel: Furthermore, there is a shortage of surgical personnel in low- and middle-income countries (LMICs). In Sub-Saharan Africa there is 1 trained surgeon for every 2.5million people, and the numbers for physician-anesthesiologists are even lower.^{vii}

Poor Infrastructure: Operating rooms and peri-operative wards depend on specialized machinery to care of patients, perform surgery and sterilize equipment. As a result, hospitals require reliable sources of electricity, water and oxygen, among other things. A study done by the WHO in 132 facilities in eight developing nations showed that facilities had, on average, 50% availability of clean water, 36% for electricity and 21% available supply of oxygen.^{viii}

Limited Resources: Surgery depends on medications and antibiotics for patient safety as well as sterile drapes, gloves and personal protective equipment for infection control. The same study revealed that while some hospitals had consistent supply of items like eye protection and sterile gloves, others had less than 5% availability.^{ix}

Financial Concerns: In many developing countries surgery is on a fee-for-service basis. Only patients who can afford to pay for drugs, supplies, and tests, as well as the surgeon's time, can access service. On the other hand, charitable donations to cover resources and personnel can help but often come inconsistently as donors make single instead of ongoing contributions.^x

Patient Barriers: Finally, cultural and educational barriers may exist in supplying surgical services. Many times patients rely on traditional healers to treat surgical conditions or do not seek care due to fear and misunderstanding of surgery.^{xi}

Surgery in Global Health

Perhaps the most important impediment to improving global surgery is the lack of attention at the international level. During the second half of the 20th century the policymakers in the field of global health focused mainly on the prevention and treatment of communicable diseases. In 1993 the World Bank commissioned the *World Development Report - Investment in Health* that would influence global health policies and funding for the next decade. The report

emphasized the importance of cost-effective measures to improve health and labeled surgery as high cost and low effect. The following decade brought huge resources towards combating communicable disease such as, the Global Fund to Fight AIDS, Tuberculosis and Malaria (2001) and the President's Emergency Plan for AIDS (PEPFAR, 2003).^{xii} While non-governmental organizations (NGOs), such as Operation Smile and Doctors without Borders (MSF), continued their work in global surgery, the field was not included in the global health agenda.

That is until 2006, when for the first time the World Bank report setting priorities for aid to developing countries included evidence that surgical care could be as cost-effective as other interventions, like vaccinations and anti-retroviral therapy. The World Health Organization (WHO) followed with their *World Health Report* in 2008 including surgery as a part of primary care.^{xiii} This gradual inclusion of surgery into the global health agenda was part of a greater trend within global health.

Epidemiologic Shift

During the 21st century, global health began to respond to the shifting demographics of the world. Life expectancy in women increased from 48 years (1950-55) to 70 years (2005-2010) and 45 years to 65 years in men, mostly due to rapid increases within developing countries.^{xiv} The changes were, in part, due to decreased rates of infant and childhood mortality, better access to clean water and sanitation and better control of communicable diseases, such as HIV/AIDS, tuberculosis and malaria.^{xv} As a result, more people are living longer and the burden of disease is changing. Now, as the population ages non-communicable disease (NCDs), such as heart disease and cancer and other conditions treated, in part, with surgery have become leading causes of death.^{xvi} This epidemiologic shift is reflected not only in existing statistics but also in the types of measurements policy-makers are using to set global health priorities.

Classic epidemiology came along with other population sciences in the late 18th and early 19th century. Disciplines such as epidemiology, sociology and public health studied humans in terms of populations, instead of individuals, for the first time. Demographic indicators such as birthrate, mortality, fertility and life-expectancy were used to compare countries during industrial and economic development. Measurements such as incidence, prevalence and case-fatalities allowed public health officials to track epidemics and endemic diseases.^{xvii} When global health was dominated by concerns about communicable diseases, these indicators were sufficient to measure areas of need and the improvements made by interventions such as antibiotics and vaccinations.

Classic Epidemiologic Metrics^{xviii}

Life Expectancy: Average length of life (in years) in a given population.

Birthrate – Number of children born in a given population; usually expressed as X per 1,000 people.

Mortality (Death Rate): Number of deaths in a given population; expressed as X per 1,000 people.

Incidence: Number of new disease cases over a given time period; expressed as rate (cases/time).

Prevalence: Total number of cases in a period of time; expressed in person-years

$$\text{Prevalence} = \text{Incidence} * \text{Duration}$$

Now, as chronic conditions have become a larger part of the global burden of disease, policymakers have begun to use composite measures to improve our understanding of the state of global health. The classic epidemiologic metrics measured health indirectly by describing the ultimate outcomes (lower mortality, higher life-expectancy), but were unable to capture the disability caused by disease. Metrics such as disability adjusted life years (DALYs) and healthy life expectancy (HALE) recognize that living a life with a chronic condition, such as cancer, is not the same as being completely healthy.^{xix} The shift towards calculating the burden of disease and not just the outcomes has helped to re-prioritize the policies within global health.

Composite Health Indicators:^{xx}

Disability Adjusted Life Year (DALY): $\text{DALY} = \text{YLL} + \text{YLD}$

1 DALY = 1 year of life lost to disability or death

Years of Life Lost (YLL) – premature death from disease; age of death subtracted from standard life expectancy

Years of Life Lost to Disability (YLD) – calculated based on incidence of a disease, disability weight and average length of time lived with disease (either until cure or death)

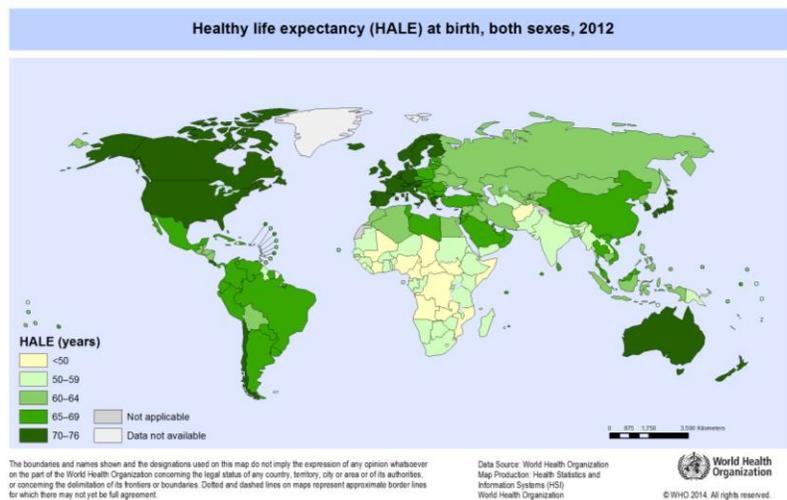
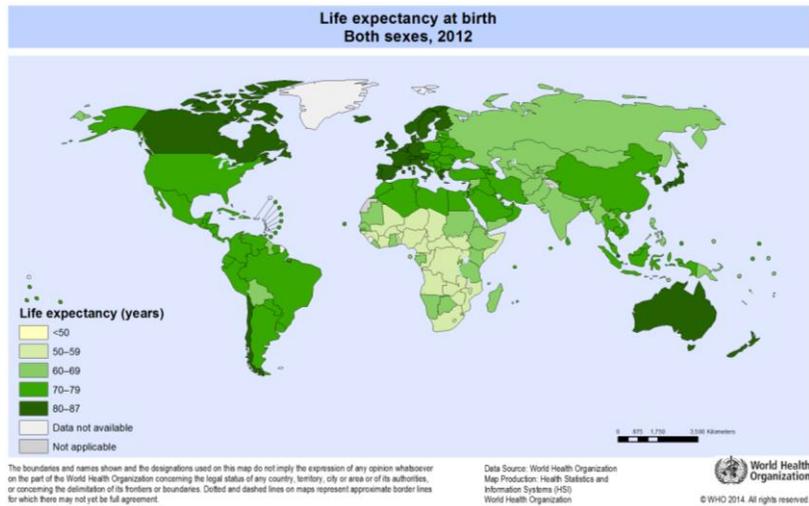
Disability weight – determined by in-country surveys and expert opinion on disability caused by disease, 1.0=no disability and 0.0=disability akin to death

Age Weighted – the DALY includes a weight for age with the beginning and end of life having less value than young adulthood

Healthy Life Expectancy (HALE)

Life expectancy minus years lived with disability

Uses surveys to account for prevalence of disability at each age; not disease specific



Global Burden of Surgical Disease

The *Disease Control Priorities in Developing Countries Report* (2006) estimated that surgical disease accounted for 11% of the total DALYs in 2004, which was more than the DALYs for HIV/AIDS, tuberculosis and malaria combined.^{xxi} Contributing to that number were surgical needs for trauma, tumors, congenital abnormalities, pregnancy complications and cataracts.^{xxii} As such, surgery is an integral part of reducing childhood mortality and improving maternal health.

Take for instance the burden caused by trauma, which accounts for 38% of the total surgical burden of disease.^{xxiii} Injuries, including road traffic accidents, kill more than 5 million people each year and cause millions more to become disabled. Of those killed, approximately one third are between the ages of 15 and 44.^{xxiv} In addition, 5% of mortality in children under 5 years old (approx. 345,000 children in 2011) is attributed to injuries.^{xxv} Overall, road traffic accidents and injuries are among the top 20 leading causes of DALYs each year.^{xxvi} What is perhaps more disturbing is the more than 90% of deaths from injuries occur in developing

countries,^{xxvii} often from a lack of access to care, including treatment for broken bones, abdominal injuries and burns – all provided by surgeons. Injuries cause not only death but can permanently disable victims and lead to serious economic consequences. Trauma care can cost developing nations up to US\$ 100 billion dollars a year and send millions of people into poverty.^{xxviii} This is one example of how surgical disease can cause the disability and mortality reflected in DALYs.

Future Directions

As the significant and increasing burden of surgical disease becomes clearer, the next concern is how to address it. Until recently, global surgery often took the form of short term interventions either for a specific condition, such as Operation Smile for cleft lip or Heartlink for congenital cardiac defects, or in response to conflict/disasters. However, more long-term efforts are required to address the ongoing needs for surgery in developing countries.

Education

Enhancing Local Education: The Pan-African Academy of Christian Surgeons (PAACS) is one of the few programs training surgeons in Africa. Since 1996 they have developed eight 5-year programs in 6 countries and have a goal of training 100 new surgeons by 2020. These programs have the advantage of training surgeons in a wide variety of procedures that reflect the needs of the communities.^{xxix}

“Twinning”: This refers to a practice where Western healthcare institutions partner with an institution in a developing country for the exchange of education and research. While these programs can provide aid to individual hospitals, they do not address overall deficiencies.^{xxx}

Task-shifting: This refers to the strategy of teaching surgical skills to non-physicians to meet the need for simple surgeries. It is a way to increase personnel but critics are concerned that this technique can result in poorer outcomes.^{xxxi}

Infrastructure: In 2005 the WHO created the Global Initiative for Emergency and Essential Surgical Care (GIEESC) in order to characterize the epidemiology of surgical disease and assess options for improvement. As part of their work the GIEESC developed tool kits to help hospitals assess and improve their practices. Tool kits included best-practice manuals, instructional videos and research topics. The GIEESC works with regional and local surgeons and now includes over 400 surgeons in over 60 countries.^{xxxii} These measures, along with other investment by governments and international aid organizations in overall health infrastructure, can help improve access to surgical care in developing countries.

Ethical Considerations

It is important to consider the value judgments behind the feedback loop of measuring health, allocating aid and measuring its effect on health. While the changing metrics of health reflect the epidemiologic shift happening in the world, they also reflect a changing set of values.

Health, as defined by the WHO is, “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.”^{xxxiii} The DALY reflects that belief by accounting for anything less than complete year of health. However, it does not treat all years equally.

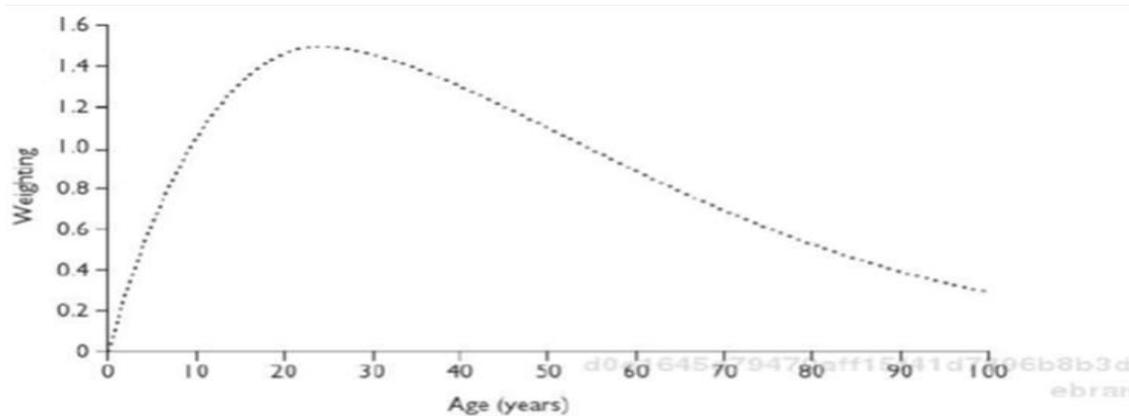


FIGURE 8.2. An age-weighting mechanism that can be used in calculating the global burden of disease. Source: Christopher J. L. Murray, “Quantifying the Burden of Disease: The Technical Basis for Disability-Adjusted Life Years,” *Bulletin of the World Health Organization* 72, no. 3 (1994): 436.

The age weighting of DALYs reflects the belief that people in young adulthood have more value than either infants or the elderly. This is clearly linked to their earning potential. Do you think that DALY should include an age weight? Why might some argue that an age weight be necessary when calculating the cost-effectiveness of a health intervention?

Women often have a lower earning potential than men due to time away for pregnancy and child-rearing; should the genders have different weights when calculating the DALY? Why or why not?

Consider now the implications of using the DALY instead of mortality as the ultimate cost-effective measure. When measuring with DALYs it becomes clear that non-fatal conditions such as depression and back pain cause a lot of disability (DALYs) throughout the world. In fact, unipolar depression was the 3rd leading cause of DALYs in 2004, preceded only by lower respiratory infections and diarrheal diseases. While much of the DALYs in lower respiratory infections and diarrheal disease are due to premature death,^{xxxiv} depression is generally not fatal. However, the DALY model treats years lost to premature death (YLL) as equal to years lost to disability (YLD). (DALY = YLL + YLD)

If resources are to be distributed based on disease burden as measured in DALYs, is it appropriate to favor depression over other, more lethal conditions? If not, how could you change the metric to reflect a different value?

Additional Resources:

Visit GapMinder.org to hear Hans Rosling’s talk on the *The Joy of Stats* and how statistics influence global health.

<http://www.gapminder.org/videos/the-joy-of-stats/>

ⁱ E S Natuzzi et al., “Surgical Issues in Global Health,” in *Understanding Global Health*, ed. W H Markle, M A Fisher, and R A Smego Jr, 2nd ed. (New York: McGraw-Hill, 2014).

ⁱⁱ Atul Gawande, “Two Hundred Years of Surgery,” *New England Journal of Medicine* 366 (2012): 1716–23, doi:10.1056/NEJMra1202392.

ⁱⁱⁱ a. Thomas Pezzella, “International Cardiac Surgery: A Global Perspective,” *Seminars in Thoracic and Cardiovascular Surgery* 14, no. 4 (2002): 298–320, doi:10.1053/stcs.2002.0140298.

^{iv} Thomas G. Weiser et al., “An Estimation of the Global Volume of Surgery: A Modelling Strategy Based on Available Data,” *The Lancet* 372, no. 9633 (2008): 139–44, doi:10.1016/S0140-6736(08)60878-8.; Thomas G. Weiser et al., “Standardised Metrics for Global Surgical Surveillance,” *The Lancet* 374, no. 9695 (2009): 1113–17,

doi:10.1016/S0140-6736(09)61161-2.

^v Natuzzi et al., “Surgical Issues in Global Health.”

^{vi} PE Farmer and JY Kim, “Surgery and Global Health: A View from beyond the OR,” *World Journal of Surgery* 32, no. 4 (April 2008): 533–36, doi:10.1007/s00268-008-9525-9.

^{vii} Walter D Johnson, “Surgery as a Global Health Issue.,” *Surgical Neurology International* 4 (2013): 47, doi:10.4103/2152-7806.110030.

^{viii} Adam L. Kushner et al., “Addressing the Millennium Development Goals From a Surgical Perspective,” *Arch Surg* 145, no. 2 (2010): 154–60.

^{ix} Ibid.

^x Natuzzi et al., “Surgical Issues in Global Health.”

^{xi} Anji E. Wall, “Ethics in Global Surgery,” *World Journal of Surgery* 38, no. 7 (2014): 1574–80, doi:10.1007/s00268-014-2600-5.

^{xii} Natuzzi et al., “Surgical Issues in Global Health.”

^{xiii} Johnson, “Surgery as a Global Health Issue.”

^{xiv} Ahmad Reza Hosseinpoor et al., “International Shortfall Inequality in Life Expectancy in Women and in Men, 1950-2010,” *Bulletin of the World Health Organization* (World Health Organization, 2012), doi:10.2471/BLT.11.097378.

^{xv} W.A. Hale, J.D. Joubert, and S Kalula, “Aging Populations and Chronic Disease,” in *Understanding Global Health*, ed. W H Markle, M A Fisher, and R A Smego Jr, 2nd ed. (New York: McGraw-Hill, 2014), 208–29.

^{xvi} World Health Organisation, *World Health Statistics 2014*.

^{xvii} Wahlberg and Rose, “The Governmentalization of Living: Calculating Global Health.”

^{xviii} Martin, “Epidemiology, Biostatistics, and Surveillance.”

^{xix} T D Bui and W H Markle, “The Global Burden of Disease,” in *Understanding Global Health*, ed. W H Markle, M A Fisher, and R A Smego Jr, 2nd ed. (New York: McGraw-Hill, 2014).

^{xx} Ibid.

^{xxi} Wall, “Ethics in Global Surgery.”

^{xxii} Doruk Ozgediz et al., “Surgery in Global Health Delivery,” *Mount Sinai Journal of Medicine* 78, no. 3 (2011): 327–41, doi:10.1002/msj.20253.

^{xxiii} Doruk Ozgediz et al., “Bridging the Gap between Public Health and Surgery: Access to Surgical Care in Low- and Middle-Income Countries.,” *Bulletin of the American College of Surgeons* 94, no. 5 (2009): 14–20.

^{xxiv} Jin Yung Bae, Reinou S. Groen, and Adam L. Kushner, “Surgery as a Public Health Intervention: Common Misconceptions versus the Truth.,” *Bulletin of the World Health Organization* 89, no. 6 (2011): 394, doi:10.2471/BLT.11.088229.

^{xxv} Johnson, "Surgery as a Global Health Issue."

^{xxvi} The World Health Organization, "Burden of Disease : DALYs," *The Global Burden of Disease: 2004 Update*, 2008, 40–51.

^{xxvii} Ozgediz et al., "Surgery in Global Health Delivery."

^{xxviii} Ibid.

^{xxix} Johnson, "Surgery as a Global Health Issue."

^{xxx} Farmer and Kim, "Surgery and Global Health: A View from beyond the OR."

^{xxxi} Wall, "Ethics in Global Surgery."

^{xxxii} Natuzzi et al., "Surgical Issues in Global Health."

^{xxxiii} WHO, "Constitution of the World Health Organization," *Ten Years of the World Health Organization*, no.

January 1984 (1958): 1–18,

<http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Constitution+of+the+World+Health+Organization#8>.

^{xxxiv} The World Health Organization, "Burden of Disease : DALYs."