

# Social Determinants of the Impact of Surgical Disease on Health

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## Abstract

Population distributions and patterns have evolved over time to emphasize urbanization and globalization. These realities have not been favorable for public health. Similarly patterns of disease have evolved, causing the global burden of disease to change considerably in the last 20 years. Chronic disease and non-communicable disease has replaced infectious disease as the largest contributor to global disability and death. The leading causes of death now include cardiovascular disease, trauma and cancer, and maternal mortality continues to be unacceptably high. The disease patterns emerging require a new approach to diagnosis, treatment and follow up.

Non-communicable disease including trauma and cancer, as well as some infectious disease and maternal conditions may be treated, cured or palliated with surgical intervention. These interventions, when immediately available, decrease disability and premature death associated with these conditions. But a majority of this disease occurs in low-income countries where, up until recently, there were few options for surgery and safe anesthesia. The advent of data supporting the practical and cost-effective role of surgery within global public health mandates a change in planning and delivery of healthcare services in low-income countries.

The social determinants of health are well-identified contributors to the health of a population, and certainly impact the outcomes of surgical disease in low-income countries. These factors, nutrition, education, poverty, governance, gender, housing and transportation must be considered and addressed in a new era of non-communicable disease where emergency and essential surgery must be available to insure population health.

**Keywords:** Population distributions; Urbanization; Globalization

## Introduction

In the past two decades, Non-communicable diseases (NCD) have increasingly contributed to the global burden of disease [1]. By 2020 cardiovascular disease will be the leading cause of global mortality. Injury and trauma will be in the top five and cancer will be in the top ten leading causes of global death [2] (Table 1). Many of these disease states have surgical interventions that decrease disability and premature death, and are cost effective solutions even in LICs. Surgical intervention often provides treatment, cure or palliation for these conditions and has the potential to decrease disability and improve life quality for patients with these diseases [3].

The social determinants of health- poverty, resource distribution, education, gender, housing, transportation and government-have been well recognized in the public health literature, but have not been specifically applied to specialty and surgical medical care [4]. The work and writings of Paul Farmer have brought communicable diseases like

HIV/AIDS and tuberculosis into the social determinants sphere, but the same has not been done with the Non-Communicable Diseases (NCDs) or the growing burden of chronic disease [5]. While the Global Burden of Disease Project (GBD) does not specifically evaluate social contributors to health, it is obvious from the distribution of global disease that countries most impacted by poverty, malnutrition and poor governance are disproportionately affected by disease and have the fewest resources to change this reality [6]. Surgical disease is no exception.

Social determinants impact surgical health outcomes and the global burden of disease. Poverty, nutrition, education, and lack of access to health care all contribute to late diagnoses of cancer, preventable trauma deaths and to the lack of expectation for emergency obstetrical services [1]. Political decisions and war influence health outcomes related to surgical disease through the subsequent impact on food distribution, population displacement, and interruption in the existing health systems [7]. Resource allocation on a local and global scale impact access to care and surgical health outcomes [8]. A majority

Worldwide	DALYs (x 10 <sup>6</sup> )	Cum %
Ischemic heart disease	1388.8	
Unipolar major depression	82.3	5.9
Road-traffic accidents	78.7	11.6
Cerebrovascular disease	61.4	21.1
Chronic obstructive pulmonary disease	57.6	25.3
Lower respiratory infections	42.7	28.4
Tuberculosis	42.5	28.4
War injuries	41.3	34.4
Diarrheal diseases	37.1	37.1
HIV	36.3	39.7

**Table 1:** Ten projected leading causes of DALYs in 2020 according to baseline projection.

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of the burden of surgical disease is in Africa and other Low-Income Countries (LICs) where the number of surgical, obstetrical and anesthesia providers is the lowest [9,10].

Gender and age are special determinants of surgical health. Poverty, nutrition, education, and lack of access to health care are more common in women, the very young and the elderly. Each of these have led to late diagnoses of breast and cervical cancer and to the lack of expectation for emergency obstetrical services [11,12]. Women and children are disproportionately discriminated against when considering a lack of access to emergency and essential surgery [13]. Men on the other hand are disproportionately affected by trauma, and this reality directly impacts family sustenance and community economics in LICs.

The social determinants that limit access to safe surgery, obstetrics and anesthesia must be a focus. Non-communicable disease as a contributor to public health necessitates increased support and resource allocation for surgical interventions. Improving access to surgical treatment for trauma, cancer and obstetrical emergencies will significantly impact global disability and mortality.

## Burden of Surgical Disease and Global Health

The Global Burden of Surgical Disease (GBoSD) has gained focus within global health since 2005 when the World Bank included a surgery chapter in *Disease Control Priorities 2<sup>nd</sup> Edition* [14]. In this pivotal compilation of data, GBoSD was estimated to be 11% of the total burden of disease. Since that original chapter, many studies have suggested that the surgical burden may be much higher, and the international surgical community has worked to provide improved surgical data, cost-effectiveness analysis, definitions and guidelines for the provision of surgery and the studies of outcomes in low income settings [3,15,16]. The pending 2015 edition of *Disease Control Priorities* will include 4 chapters on surgery and 2 chapters on anesthesia, a significant change in perspective for this important World Bank publication indicative of the role of surgery in global public health.

Guidelines from the World Health Organization on Essential and Emergency Surgery have existed for years, governments and international organizations have ignored them, sighting prohibitive expense and competing priorities [17]. The international literature however supports appropriate surgical intervention in low income countries. Therefore governments, donors and international organizations must eventually recognize and insure the provision of appropriate emergency and essential surgical intervention and safe anesthesia.

## Surgical Disease

Surgical disease is unusually complex [17]. Unlike other conditions or disease states, those that are treated or palliated by surgical intervention are often not limited to one organ system or physiology. Rather, surgical intervention has application to every organ system and to a very diverse set of conditions and disruptions in physiology. For this reason surgical intervention requires a unique, broad definition and thus measuring the burden of surgical disease has proven challenging and difficult.

Defining and prioritizing surgery has been at the center of the argument to include surgical disease in the global health agenda. Two sentinel articles have significantly contributed to the ability to define surgery and related concepts, and also prioritize interventions for LICs [18,19]. These efforts provided clear language and definitions for the

global public health community for both emergency and essential surgery.

The global health community has been slow to recognize that properly applied surgical intervention is an essential part of healthcare and is cost effective when procedures are chosen based on responsible prioritization [19].

## Access to Surgical Resources

Providing surgical intervention requires specific resources—equipment, medications, and consumables, availability of blood, and specialized personnel—most of which are not available in LICs. This resource scarcity creates barriers to early diagnosis and treatment of surgical disease. The district hospital is intended to be the nearest access to emergency surgery but in reality few of these facilities are staffed or resourced for emergency procedures [17,20]. Therefore the location and distribution of equipped hospitals determine access surgical care. Access to transportation, the physical condition of the road and transportation infrastructure all limits access to timely diagnosis and treatment [21]. Populations proximal to regional hospitals are therefore more likely to have access to emergency C-sections and life saving interventions for trauma and abdominal emergencies than those living far from the cities where larger hospitals are located. This disparity increases the burden of surgical disease for rural populations.

## Emergency Surgery

### Injuries/Trauma

Trauma is a leading cause of morbidity and mortality in individuals under age 45. According to the WHO, by the year 2020, trauma will be a leading cause of life years lost in both developed and developing countries [22]. It is estimated that 16,000 people die from injuries daily and those who survive are often left with permanent and disabling health conditions [2].

The WHO has clearly and consistently supported trauma care and has provided practical approaches for providing these services, including surgical intervention in LICs. Nevertheless, these services are most often not immediately available where and when trauma occurs [17].

Conflict related trauma is thought to contribute significantly to surgical burden. When data from the International Committee of the Red Cross and *Medicines Sans Frontiers* are reviewed, conflict related trauma is prevalent, but despite this fact, other sources of emergent surgical disease often eclipse the conflict related statistics [24,25]. However, the role of conflict and war in surgical disease cannot be discounted.

Every year, thousands of individuals living in war-torn countries are victims of antipersonnel mines. There are over 100 million land mines in over 64 countries [26]. The presence and use of landmines creates a tremendous surgical burden for many countries in time of war and in the aftermath of war [27]. Surgical outcomes of landmine amputations are dependent upon early evacuation and prompt surgical care [28,29]. Accessing hospitals with surgical services can be difficult in countries at war or in areas of conflict. In addition, medical facilities in or near war zones are often under staffed and under-equipped [30,31]. Wars increase the exposure of populations to conditions that increase the risk of injuries mandating surgical services while simultaneously decreasing resources available for expenditures on healthcare systems and surgical services.

## Abdominal emergencies

Abdominal emergencies routinely treated in resource rich countries—appendicitis, bowel obstruction, incarcerated hernias—by cost-effective and straightforward surgical intervention often go unaddressed in LICs [14]. Surgical interventions for these emergencies must be available at the district hospital level in order to decrease disability and premature death from these conditions [17].

## Maternal Conditions

Maternal morbidity and mortality is impacted when safe surgery is available for childbirth emergencies. Maternal mortality rates have fallen in many LICs, but remains unacceptably high in spite of improved pre-natal care, increased number of trained birth attendants, and increased availability of medical treatments for high blood pressure and hemorrhage [32,33]. Cesarean section for obstructed labor and eclampsia, and surgical intervention for severe post-partum hemorrhage are critical emergency interventions and ultimately necessary to further decrease maternal morbidity and mortality [9]. Sadly, these life-saving interventions are most often unavailable in LICs, limited by local availability of health care providers, and an absence of transportation to facilities where services are available.

The WHO, consistent with its work in trauma care, has supported the presence of surgery at the district hospital for emergency C-sections and intervention for post-partum hemorrhage [17]. Without funding and an ability to enforce its mandates, the WHO and therefore the vulnerable population are dependent upon the resources and political will of the nation for implementation of these important recommendations.

The WHO has determined that a C-section rate of 5-15% is ideal for insuring optimal maternal and fetal survival while simultaneously respecting the limits of resources and not using this intervention to excess [28,34]. Till emergency surgical intervention becomes immediately (within 30 minutes) and universally available, MMR will remain unacceptably high.

## Essential Surgery

Disparity also exists in LICs with access to essential surgery that, while not emergent, often reduces disability with cost-effective interventions. Essential surgical conditions (Table 2) are those which are common, not life-threatening but if repaired will decrease disability and improve the quality of life. For these reasons, the provision of essential surgical services is considered integral to the basic right to health [35]. The prioritization of surgery has identified those conditions which can be considered “essential” in LICs as those categorized as Priority (Table 3) [35].

Most of the conditions categorized as Priority 1 by Mock et al. are emergencies, but the others included in this category—male circumcision, single cleft lip, hydrocele, hernia, club foot incision and drainage of abscess— are easily and routinely repaired and should be quickly repaired whenever possible [12]. The WHO has recommended that all District Hospitals be capable of treating emergency and essential surgical conditions, and it is critical that this recommendation be implemented and followed by ministries of health and healthcare systems in LICs [17].

## Conclusion

Social factors such as war, poverty, malnutrition, gender, nutrition, education, and governance and transportation influence the availability of emergency and essential surgery and therefore impact disability and premature death from surgical disease. This reality is amplified in LICs due to a centralization of adequate healthcare, and impedes access, timely diagnosis, treatment; healing and follow up for a growing burden of surgical disease (Table 4). The role of surgery in healthcare systems must be supported for the benefit of global public health, and the provision of emergency and basic essential surgery must be available at the district hospital for maximum benefit to the population.

The social determinants of health must be considered and addressed before the populations in greatest need will benefit from much needed surgical interventions. Governments and Ministries of Health must be educated on the need for prevention and treatment of

Priority 1 surgical conditions are those:	Priority 2 surgical conditions are those:	Priority 3 surgical conditions are those:
• That have a large public health burden, AND	• That have a moderate public health burden, OR	• That have a low public health burden, OR
• For which there is a surgical procedure that is highly successful at treating the condition, AND	• For which there is a surgical procedure that is moderately successful at treating the condition, OR	• For which there is a surgical procedure that is neither highly nor moderately successful at treating the condition, OR
• For which the surgical procedure (and related ancillary services and treatments) is cost-effective and feasible to promote globally.	• For which the surgical procedure (and related ancillary services and treatments) is moderately cost-effective and feasible to promote globally.	• For which the surgical procedure (and related ancillary services and treatments) is low in cost-effectiveness and feasibility to promote globally.

**Table 2:** Preliminary definitions for levels of priority of medical and surgical conditions in LIC district hospitals. This is meant for preliminary discussion and is not meant to be comprehensive or final.

Preliminary categorization of Priority surgical conditions
Trauma
Surgical airway (threatened or obstructed airway)
Thoracostomy tube placement (hemothorax, pneumothorax)
Exploratory laparotomy (hemoperitoneum, pneumoperitoneum, bowel injury)
Splenectomy, splenic repair, packing of hepatic injury, repair of small bowel perforation
Split-thickness skin grafting External fixation Toileting of open fracture Closed management of most fractures
Pregnancy-related Cesarean section Management of ectopic pregnancy Hysterectomy for postpartum bleeding and uterine rupture D&C
Other surgical procedures Hernia repair (umbilical, inguinal, femoral hernias) Hydrocelectomy Appendectomy Exploratory laparotomy (acute abdominal condition)
Bowel obstruction Perforation Cholecystectomy (acute cholecystitis)
Male circumcision Incision and drainage (infection) Drainage of septic arthritis Repair of isolated cleft lip Repair of club foot
**Highlighted procedures are essential surgical interventions; procedures not highlighted are emergency surgical interventions

**Table 3:** Preliminary categorization of Priority surgical conditions.

<b>Which contribute to increased surgical disease</b>
• Congenital Conditions i.e. Cleft lip and palate (nutrition)
• Prevalence of Injury
<b>Which contribute to late diagnosis</b>
• Education
• Patient
• Doctor: Lack of surgical expertise presence
• Large focus on Infectious Disease Research for sake of income rather than surgery
• Transportation
• Traveling Distances increases chances of late presentation—amount of complications increase as the patient postpones clinical visits
<b>Which contribute to poor access</b>
• State capacity
• Poverty
• Lack of governmental investment in the provision of surgical care
• Lack of infrastructure
• Social Services
• Politics: interference, state capacity during disaster
• Even after conflicts subside, health and public infrastructure are rarely recovered
• Trend of Urbanization
• USE of Traditional Cultural Practices
• Religious
• Gender Based
<b>Which contribute to poor outcomes</b>
• Access to essential medicines
• Access to safe anesthesia
• Availability of Blood Products
• Access to follow-up
• Infection
• Poor nutrition—healing
• Inadequate treatment of pain
• Lack of rehab

**Table 4:** Contributors to Surgical Disparity.

non-communicable disease, similar to the education of these entities in the advent of the HIV/AIDS era. Access to safe surgery and anesthesia must be immediately available to populations to prevent disability and death from trauma, cancer, childbirth and other surgical diseases. There is no longer time to wait for surgical care at the district hospital. The burden of surgical disease is large and growing in the poorest countries, and death and disability are already impacting mortality rates of mothers, children and young, healthy individuals contributing to the well-being of their families and communities.

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