

# Burden of Surgical Disease: Strategies to Manage an Existing Public Health Emergency

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## Abstract

The World Health Organization estimates that the burden of surgical disease due to war, self-inflicted injuries, and road traffic incidents will rise dramatically by 2020. During the 2009 Harvard Humanitarian Initiative's Humanitarian Action Summit (HHI/HAS), members of the Burden of Surgical Disease Working Group met to review the state of surgical epidemiology, the unmet global surgical need, and the role international organizations play in filling the surgical gap during humanitarian crises, conflict, and war. An outline of the group's findings and recommendations is provided.

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## Background

The global burden of surgical disease is thought to be large, although its true scope remains unknown. The Disease Control Priorities Project estimated that 11% of disability-adjusted life years (DALYs) arise from conditions that may be averted with surgical intervention. Trauma, obstetrical emergencies, and congenital abnormalities are prominent contributors to the surgical burden of disease.<sup>1</sup>

Globally, injuries kill five million people annually, causing 1 out of every 10 deaths. Approximately one-third of injury-related mortality affects those aged 15–44 years, the most economically productive segment of the global population.<sup>2</sup> Many of these deaths could be prevented by access to surgical services. Similarly, emergency obstetrical surgery could prevent 500,000 deaths from pregnancy-related complications. The World Health Organization (WHO) estimates that the burden of surgical disease due to war, self-inflicted injuries, and road traffic incidents will rise dramatically by 2020.<sup>3</sup>

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## Abbreviations:

GIEESC = Global Initiative for Emergency and Essential Surgical Care

HHI/HAS = Harvard Humanitarian Initiative/Humanitarian Action Summit

IO = International Organization

LMIC = low- and middle-income country

MSF = Médecins sans Frontières

NGO = non-governmental organization

PGO = private governmental organization

PVO = private volunteer organization

WG = working group

WHO = World Health Organization

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Despite these staggering figures, surgery has been neglected as a public health and humanitarian intervention. The global health workforce crisis in many low- and middle-income countries (LMIC) has hindered surgical delivery worldwide. Similarly, deficiencies in health system infrastructure have limited data collection related to these services. Although there is international consensus in the diagnosis and management of most surgical diseases (i.e., appendicitis,) there tends to be a wide variation in the cultural acceptance of a standard provision of treatment (i.e., appendectomy) and follow-up.

Limited information on surgical provision in LMIC is reported in the world's literature.<sup>4</sup> Greater evaluation and reporting are needed to estimate unmet surgical needs and surgical outcomes across cultures. International organizations (IOs), which include private governmental organizations (PGOs), non-governmental organizations (NGOs), and private volunteer organizations (PVOs), provide surgical services in many LMICs. Although many of these IOs work collaboratively with surgeons in these countries, the delivery of surgical care can be independent from local health systems. Thus, the data from these settings can be fragmented, resources for collection are scarce, and the data collected rarely are evaluated and are shared infrequently between IOs. Even though few in number, IOs that have currently established surgical data monitoring and outcome measures include Médecins sans Frontières (MSF), Operation Smile, and Konbit Sante/Cap Haitien Health Partnership, and serve as examples for other IOs that are looking to include similar expertise into their programs.<sup>5-9</sup>

Available data suggest that annually, relief organizations perform approximately one-quarter of a million operations in resource-poor countries.<sup>10</sup> The members of MSF performed approximately 50,000 surgical cases during 2008.<sup>6</sup> The International Committee of the Red Cross reported 108,311 operations performed at 56 hospitals during 2008.<sup>11</sup> Added to the surgical services collectively performed by IOs, the sum of surgical services provided globally is significant.

Recently, increased attention has been dedicated to understanding and addressing the global burden of surgical disease. In December 2005, the WHO established the Global Initiative for Emergency and Essential Surgical Care (GIEESC), a partnership of IOs and individual professionals that aims to improve access to emergency and essential surgical procedures.<sup>12</sup> The 2006 WHO Disease Control Priorities Project first highlighted surgery as a cost-effective public health intervention, comparable to vaccination.<sup>1</sup> In April 2008, the Global Burden of Surgical Disease Working Group (GBDWG) met in Seattle, Washington. The GBDWG consists of surgeons, anesthesiologists, and public health experts. The GBDWG advocates for a better understanding of the global burden of surgical disease and for improved surgical capacity in poor countries, including conflict and post-conflict settings.<sup>13,14</sup>

Surgery is primarily procedure-based; therefore, describing the burden of surgical disease requires consistent definitions of both surgical conditions and the interventions applied to treat them, as well as accurate surgical epidemiology. Attempts to address unmet global surgical need are complicated further by the scarcity of resources for surgical infrastructure and the absence of monitoring of surgical

disease. Based on consensus of the GBDWG, Bickler *et al*, articulated the challenges of calculating the burden of surgical disease without uniform terminology or methodology. This work suggests definitions for surgical epidemiology and a framework of analysis to assess the impact of surgical conditions and surgical care.<sup>15</sup>

### Objectives

During the 2009 Harvard Humanitarian Initiative's Humanitarian Action Summit (HHI/HAS), members of the GBDWG met to review the state of surgical epidemiology, the ongoing work to identify the global burden of surgical disease, and to discuss the results of the literature review and IO survey. Surgical practitioners and public health professionals from IOs and academic institutions conducted online discussions during the year prior to the Summit and met in March 2009 in order to:

1. (a) Improve measurement and surveillance of surgical disease globally, and contribute to understanding of the global burden of surgical diseases and unmet surgical needs, especially as it relates to injuries and obstetrical and surgical emergencies; and (b) advocate for data collection and analysis by organizations providing surgery worldwide;
2. (a) Consider baseline global standards for IOs involved in the provision of surgery in order to improve surgical and anesthesia safety; (b) advocate for measurement of short- and long-term surgical outcomes; and (c) review and propose guidelines for infrastructure needed for safe surgical delivery; and
3. Provide an opportunity for collaboration between IOs, and support efforts to advance the role of surgery within global public health initiatives (such as those by WHO and the GBDWG).

### Working Group Findings

#### *Burden of Surgical Disease List of Resources*

A bibliography, including articles on global surgical epidemiology, best practices, and surgery as a public health issue was compiled. This bibliography includes items ranging from the WHO Essential and Emergency Surgical Checklist to articles addressing practical ways to tackle the lack of surgical capacity in resource-poor settings. A portion of this bibliography is available on the HHI/HAS website, and the entire bibliography is in the appendix.<sup>16</sup>

#### *Survey of Humanitarian Organizations Providing Surgery*

A 17-item online survey of 100 IOs that provide surgical services globally was conducted prior to the Summit. This survey assessed data collection practices, the presence of an educational program, and the interaction of these organizations with local health systems. The preliminary results were presented during the HHI/HAS, and provided the basis for the WG's discussion. Approximately half of the IOs responded, representing a wide variety of surgical services. Twenty-five percent of respondents performed fewer than 100 surgeries per year, while another 20% provided >1,000. These IOs performed a broad range of interventions, including gynecologic, vascular, orthopedic, ophthalmologic, and general surgery.<sup>17</sup>

The majority of these IOs used non-physician providers (i.e., physician assistants, nurses, and medical students) in order to provide the necessary services. The specific role of task-shifting in service delivery was not captured by this survey. Ninety-six percent of respondents stated that they tracked the number of surgical procedures they provide each year. Approximately 80% recorded surgical mortality either intra-operatively or long-term. A similar number of IOs reported that they tracked operative complications, while only 61% specifically recorded post-operative infections. Not surprisingly, the NGOs had varying approaches to post-surgical follow up, with some providing 1–2 week post-operative checks, while others were able to provide follow-up months later. The proportion of patients who returned for these follow-up visits was not specified. The majority of IOs remarked that follow-up was conducted by local partners after the surgical team had departed. Similarly, a majority (90%) of those surveyed provided some ongoing education, and most were integrated into local health systems.<sup>17</sup>

#### *Working Group Session*

Based on a discussion of this survey and a literature review, the GBDWG articulated the following recommendations to improve surgical service delivery by humanitarian organizations.

The group divided its recommendations in the following manner:

1. *Understanding the local context*—Conduct local needs and infrastructure assessments prior to planning a program or delivering services;
2. *Delivery of surgical care*—Incorporate best practices into the ongoing delivery of surgical care, including the use of infrastructure and safety checklists and mechanisms for appropriate follow-up; and
3. *Data collection*—Integrate routine collection of data on surgical conditions and outcomes for evaluation of surgery and anesthesia.

#### *Understanding the Local Context*

Many factors play a role in how a site is selected by an IO. For example, often an IO is invited to a country or region based on needs identified by local authorities. In other instances, an IO seeks to address a need it has identified. The services provided may depend on the expertise of the IO rather than the most urgent surgical needs of the beneficiaries. In response to these discrepancies, the GBDWG identified a comprehensive needs assessment as a critical first step to the development of a humanitarian surgical program. In order for a program to be locally relevant, it is crucial to differentiate between a site where a high percentage of local surgical mortality is related to peri-partum conditions from one where the majority of surgical disease stems from road traffic incidents or landmine injuries. Understanding the local culture also will help to identify when certain interventions might not be culturally acceptable. This type of surgical assessment was done at Justinien Hospital in Cap Haitien, Haiti by Dr. Samuel Broaddus *et al* during his work with Konbit Sante.<sup>7</sup>

Similarly, a thorough assessment of local resources must be made prior to establishing a surgical program. According

to a checklist developed by Médecins sans Frontières (MSF), basic requirements include infrastructure (buildings, tents, etc.), security, supplies and equipment, medications, electricity, clean water, hygiene, sterilization, blood, and appropriate personnel. The MSF has estimated that 100–300 liters of clean water are required for each surgical patient; this includes water for cleaning equipment and sterilization.<sup>18</sup> Specific requirements will vary according to the type of surgery planned and local surgical volume. However, the GBDWG emphasizes that any group planning to provide surgery in a humanitarian setting should carefully consider their needs prior to arrival.

Once needs are identified, acquisition of resources will vary according to organizational and local capacity. Some IOs bring supplies, tents, medications, and sterilization equipment to the field, while others rely heavily on local capacity, operating out of local hospitals and employing local personnel.

The GBDWG recommends that a clear mechanism for follow-up be established if surgical delivery is to be considered. The extent of follow-up and who provides it (e.g., the IOs and/or local partners) may depend on local realities. Nevertheless, for patient safety, appropriate follow-up must be considered and addressed. One representative in this WG remarked on the results of home visits to post-operative patients who did not return for follow-up. This IO had assumed these patients stayed home because they were “doing well”, but sometimes found that these patients required further care.

Follow-up in LMICs may offer unique challenges. Many patients who present for surgery may have traveled long distances, have limited means of transportation and communication, and may rarely see a physician due to financial and access constraints. Novel technology-based means, such as those that use mobile telephones, may help track patients during the post-operative period.

#### *Delivery of Surgical Care*

Once a surgical program is established, ongoing measures should ensure that quality surgical care is delivered. First, prior to providing any surgical interventions, the checklist of necessary minimum requirements for surgery must be revisited. Staff must reconfirm adequate supplies, water, security, blood, anesthesia, etc. based on the program's specific needs.

In addition, the WG recommends that all of the IOs providing surgical care in humanitarian and low-resource settings use a checklist to ensure surgical and anesthesia safety. At a minimum, the checklist should confirm patient identity, correct surgical site, drug allergies, documented informed consent, whether verbal or written, as well as other information pertinent to the surgical procedure. This checklist may be based on one of several currently available, such as the WHO Safe Surgery Saves Lives Checklist—and can be modified for the local context.<sup>19</sup> A recent study by Haynes *et al* showed a significant reduction in mortality and operative complications when this surgical safety checklist was used.<sup>10</sup>

Finally, the GBDWG recommends that surgical programs determine a mechanism to provide post-operative care to all patients who might require follow-up. This care can be delivered by local providers or by the surgical team themselves. Adequate identification and treatment of post-operative complications, including post-operative infec-

tions, hernias, deep vein thrombosis, and disability not only ensures the best possible care for the patient, but serves as a means of quality assurance to guide changes to the program or procedures provided. The GBDWG noted that consideration of adequate follow-up should be essential for all IOs engaged in delivery of surgical services.

#### Data Collection

International organizations play an important role in meeting surgical needs in resource constrained settings where local infrastructure may not be able to provide sufficient health services. In addition to providing much needed services, these IOs can provide a wealth of information on the numbers, breadth, and outcomes of surgical procedures performed globally, as well as information on surgical epidemiology and unmet surgical need.

The GBDWG advises humanitarian organizations to collect information on their own surgical interventions and outcomes, to the extent that this information would improve internal monitoring and evaluation in a timely manner. Internally-collected data may improve rational and cost-effective allocation of resources for improved outcomes. These data also may inform external efforts to gauge the value of surgical interventions on public health. The GBDWG notes the potential to enhance and streamline data collection and promote data sharing among organizations with standardized data collection definitions. Anonymous reporting mechanisms may be used, given concerns over the effects of data sharing on relations with local counterparts, donors, and other IOs.

#### Recommendations

In summary, the GBDWG makes the following recommendations:

1. Understand local context by conducting an assessment of needs, local resources, and infrastructure prior to establishing a surgical program in a low income or humanitarian setting. A mechanism for follow-up should be considered, either with local partners or within the program itself;
2. Incorporate best practices into ongoing delivery of surgical care. The IOs should revisit the minimum requirements necessary for a functioning surgical program once they have established their program. A surgical safety checklist should be used when performing surgery. Post-operative follow-up should be an essential part of any surgical program; and
3. The IOs should collect data relevant to surgical conditions and their treatment. Such information would improve surgical care quality, cost, and access provided by the IOs. Relevant metrics may include breadth of procedures performed, volumes of specific procedures, estimates of surgical disease that the organization was unable to treat due to resource limitations, surgical outcomes, and post-operative complications. Such data may advance our understanding of the volume of global surgical services already provided and inform efforts to address unmet needs.

#### Suggested Strategies

The implementation of these recommendations will be a topic of discussion at the upcoming Burden of Surgical Disease meeting in May 2009 in Chicago, Illinois. In addition, the IO Surgical Delivery Survey will be published in its entirety. Finally, the role of surgery in humanitarian settings should continue to be studied and refined, not only during the upcoming meeting in Chicago, but by continued involvement of surgical providers in the field and in other humanitarian forums.

#### References

1. Debas HT, Gosselin R, McCord C, *et al*: Surgery. In: *Disease Control Priorities in Developing Countries* (2d ed), New York: Oxford University Press, 2006, pp 1,245–1,260.
2. Mathers CD, Lopez AD, Murray CJL (eds): *The Burden of Disease and Mortality by Condition: Data, Methods, and Results for 2001. 2006. Global Burden of Disease and Risk Factors*, New York: Oxford University Press, pp 45–93.
3. WHO: Emergency and essential surgery: The backbone of primary health care. Available at <http://www.who.int/ehs/sb/en/index.html>. Accessed 29 March 2009.
4. Taira BR, Kelly McQueen KA, Burkle FM Jr: Burden of surgical disease: Does the literature reflect the scope of the international crisis? *World J Surg* 2009;33(5):893–898.
5. MSF International: <http://www.msf.org/>. Accessed 27 April 2009.
6. Chu K: MSF Surgical Field Programs. Presentation at Humanitarian Action Summit, Cambridge, Massachusetts, 27 March 2009.
7. Broadus S, Cushing B, Sante K: Assessment of Surgical Services at Hôpital Universitaire Justinian Cap Haitien, Haiti. (unpublished) Available at <http://www.konbitsante.org>. Accessed 28 April 2009.
8. McQueen KAK, Burkle FM, Al-Gobory ET, *et al*: Maintaining baseline, corrective surgical care during asymmetrical warfare: A case study of a humanitarian mission in the safe zone of a neighboring country. *Prehosp Disaster Med* 2007;22(1):3–7.
9. McQueen KA, Magee M, Crabtree T, *et al*: Application of outcome measures in international humanitarian aid: Comparing indices through retrospective analysis of corrective surgical care cases. *Prehosp Disaster Med* 2009;24(1):39–46.
10. Haynes AB, Weiser TG, Berry WR, *et al*: A surgical safety checklist to reduce morbidity and mortality in a global population. *N Engl J Med* 2009; 360(5):491–499.
11. International Committee of the Red Cross: International Committee of the Red Cross 2007 Annual Report. Available at [http://www.icrc.org/Web/Eng/siteeng0.nsf/htmlall/section\\_annual\\_report\\_2007](http://www.icrc.org/Web/Eng/siteeng0.nsf/htmlall/section_annual_report_2007). Accessed 27 April 2009.
12. WHO: WHO established the Global Initiative for Emergency and Essential Surgical Care. Available at <http://www.who.int/surgery/globalinitiative/en/>. Accessed 03 April 2009.
13. Global Burden of Surgical Disease. Available at <http://www.gsd2008.org/>. Accessed 03 April 2009.
14. Ozgediz D, Hsia R, Weiser T, *et al*: Population health metrics for surgery: Effective coverage of surgical services in low-income and middle-income countries. *World J Surg* 2009;33(1):1–5.
15. Bickler S, Ozgediz D, Gosselin R, *et al*: Key Concepts for Estimating Burden of Surgical Conditions and Unmet Need for Surgical Care. (submitted to *WHO Bulletin*, 2009).
16. Harvard Humanitarian Initiative Humanitarian Action Summit, Burden of Surgical Disease Working Group: Available at <http://hhi.harvard.edu/events/humanitarian-action-summit/working-groups/burden-of-surgical-disease>. Accessed 29 March 2009.
17. Casey K: 2009 Presentation at Humanitarian Action Summit, Cambridge, Massachusetts, 27 March 2009.
18. Chu K: 2009 Minimum Standards in Safe Surgery. Presentation at Humanitarian Action Summit, Cambridge, Massachusetts, 27 March 2009.
19. WHO: WHO safe surgery saves lives. Available at <http://www.who.int/patientsafety/safesurgery/en/>. Accessed 02 April 2009.