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Building Surgical Capacity in Developing Countries: Lessons from Haiti and Honduras

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Summary: The unmet burden of surgical disease in developing countries is large and growing. We successfully initiated two surgical field hospitals in austere environments. Similar problems were encountered in the areas of facility development, operations, and social considerations. A literature review was performed to contextualize our experience and compare it with that of others.

Key words: Developing countries: economics; general surgery: organization, and administration; health care disparities; international cooperation; medically underserved area; operating rooms: organization and administration; poverty; program evaluation; surgical procedures, operative/utilization; world health; voluntary workers: organization and administration.

Background

We describe the development of two non-governmental organization (NGO) surgical field hospitals, one in Honduras and the other in Haiti. These two countries have some of the worst health indicators in the Western hemisphere, though Haiti is comparatively poorer and spends far less *per capita* on health expenditures (Table 1).¹

In Haiti surgery is provided in three ways: by private hospitals that charge high fees and serve the rich; by public hospitals that have low or no fees but require patients to purchase all necessary supplies, laboratory testing, and medications; and lastly, by non-governmental organizations (NGOs).² The 2010 earthquake shredded this patchwork health infrastructure. In Honduras, health services are similarly provided, with the underfunded *Secretaria de Salud* charged with distributing scarce health resources to five million Honduran poor entirely dependent upon it for care.³

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Table 1.**COUNTRY COMPARISONS AT TIME OF PROGRAM DEVELOPMENT FOR HAITI AND HONDURAS**

Category	Honduras in 2009	Haiti in 2012
Population	7,469,844	10,173,775
Life expectancy	73	63
GNI ^a per capita	\$1810	\$1220
National poverty rate	58.8%	77% (2001—most recent data)
Per capita health expenditure	\$172.6	\$52.5
Politics	Democracy, president ousted in military-backed coup in June 2009	Democracy, United Nations MINUSTAH peacekeeping mission since 2004
Surgery center catchment area	Greater Tegucigalpa 765,675 (2001 UN data)	Greater Port-au-Prince 2,207,000 (2011 UN data)
Natural disasters	Largely free since Hurricane Mitch in 1998	2010 earthquake decimated health infrastructure

Source: World Bank: Honduras and Haiti data repositories.
GNI = Gross National Income. Data in US dollars where indicated.

Our two NGOs, the St. Luke Foundation for Haiti and Nuestros Pequeños Hermanos (NPH), developed surgery programs to address local needs. The St. Luke program began in August 2012 with elective and minor procedures (e.g., hernia repair, hydrocele repair, and excision of masses and cysts) that contribute to disease burden but are largely unavailable for the poor (Table 2). Slowly it expanded to urologic, orthopedic, and other subspecialties. The surgery program at NPH-Honduras began in 2009 with elective orthopedic procedures and grew in like fashion (Table 2). All treatments are provided free of charge or for a symbolic fee.

What We Did

We found three major areas of consideration when building surgical capacity in these two countries:

- 1) Facility planning, design, and project management,
- 2) Operational planning and execution, and
- 3) Integration into the social cultural context of the community and geopolitical environment.

Within each of these areas we describe the challenges we encountered common to both locations.

Table 2.**NUMBER AND TYPES OF OPERATIONS PERFORMED,
HONDURAS AND HAITI**

Operation	Honduras	Haiti
General Surgery	263	193
Hernia	164	108
Hydrocele	15	70
Strangled hernia	1	2
Lipoma excision	48	13
Lap cholecystectomy	24	0
Other (breast, thyroid)	11	0
Gynecologic	32	0
Urologic	28	38
Prostate resection	6	26
Circumcision	3	12
Other	19	0
Otolaryngology	69	0
Ophthalmologic	56	0
Other	2	7
Orthopedic	696	24
Total	1146	262

Note: Table listing the number and types of surgical procedures performed at NPH in Honduras (2009–present) and the St. Luke Foundation in Haiti (2012–present), respectively.

Facility planning, design, and project management. Both the Haiti and Honduras programs encountered similar challenges to facility development across all phases. In Honduras, to minimize costs, surgical facility design expertise was not sought early on. Physicians, engineers, and local contractors worked together to design buildings that permitted safe and efficient surgery, but they lacked health care facility design and construction expertise. Disparity was found between the ideals of published guidelines⁴ and the realities of available space, materials, financing, and local construction capabilities. Local building codes were difficult to find or nonexistent. Under these circumstances, design flaws were subsequently discovered that caused delays avoidable by earlier, more widespread input and consensus on patient flow and capacity during the process.

Special measures were required to provide adequate power, clean water, and waste disposal. Honduras had intermittent government grid power, which frequently suffered current variability (“brownouts”). A backup generator was installed with an automatic transfer system to resupply power within seven seconds of an outage and supplement during brownouts (Figure 1). Government-supplied electricity in Haiti is unreliable, and the extreme current variability damages expensive equipment, requiring operations to be run entirely off generators and solar power. These costly investments proved cost-



Figure 1.

effective by preserving the life of expensive operating room equipment. Clean water in rural Honduras suitable for large-scale sterilizers required investments in multiple filtration systems (Figure 1). In Haiti, clean water for plumbing was provided by a well project from Operation Blessing International (Figure 1), and a large steam autoclave required modest amounts of distilled water purchased locally. Waste in both facilities was incinerated off-site, while sterilization, disinfection, and laundry were performed on-site in accordance with WHO guidelines.⁵

Medical gas and suction systems were another important consideration. Piping the Honduras center for wall gas and suction was deemed necessary in order to facilitate high volume, rapid turnover medical brigades performing upwards of 20–25 surgeries per day in three operating rooms. Physicians worked with engineers on the discovery and design phases of medical gas and suction systems to articulate needs, leaving the engineering and specification to these professionals. Decisions were required on gas and suction sources and size, outlet number and placement, and types of wall connections that would work with available anesthesia machines and other equipment (Figure 1). Medical gas design guides take one through the basic steps.⁶ The Haiti program did not anticipate similar high case volumes and opted for cheaper portable field suction and oxygen and nitrogen cylinders connected directly in the rooms (Figure 1).

Operations. Surgery requires a fixed investment in capital equipment and reusables plus a steady supply of certain disposables and medications, most of which are difficult or impossible to find in-country.⁷ We worked with Direct Relief, Project Medshare, AmeriCares, and private donors to supply many of these items. In-country warehouses

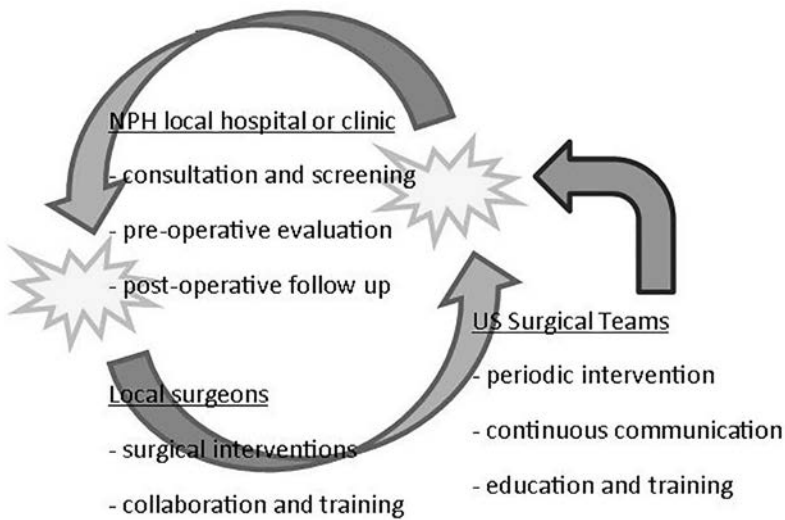


Figure 2.

adjacent to the surgical facilities held these supplies until needed (Figure 1). Certain generic medicines and basic surgical supplies could often be obtained locally and at comparable cost.

The staffing structure combined local providers and staff with intermittent visiting foreign volunteer surgical teams (Figure 2). This model is a hybrid of the “twinning” and NGO models, leveraging foreign aid and expertise by training local providers to augment their capabilities while also providing immediate relief. NPH-Honduras hired a young, recently graduated orthopedic surgeon to direct the surgical center, operate, and receive additional training under visiting surgeons. The local surgeon and nursing staff provided triage, surgical care, and post-operative follow up for regularly scheduled U.S. teams. In Haiti, the local St. Luke Hospital medical staff identified and performed pre-operative evaluations for elective surgeries performed by contracted Haitian surgeons (Table 2). Intermittent U.S. teams supplemented this care every two to four months. A recent orthopedic surgical trip partnered with two Haitian orthopedic surgery residents to provide training in techniques not available at Hôpital General (their primary training site).

Integration into the social-cultural context of the community and geopolitical environment. Honduras and Haiti have some of the worst health indicators in the Western hemisphere.¹ In Haiti, less than half the population has access to an improved drinking source.¹ Water and vector-borne illnesses, especially cholera and most recently chikungunya, persistently affect a country that has seen surgical disability rise concomitantly as motor vehicle use increases.⁸ Over half of all deaths in Haitian children under five are due to injury,⁹ and the initial care of patients with road injuries is often especially inadequate.¹⁰ Honduras, while classified as a lower-middle-income country, still has 60% of citizens living below the poverty line.¹ Quantifying the precise morbidity and mortality attributable to surgical disease in these countries and others is

beyond the capability of current data. The Global Burden of Disease project notes that in Honduras and Haiti, from 1990 to 2010, there was an increase in the prevalence of many diseases for which a significant proportion is treated surgically, including forces of nature, diabetes, interpersonal violence, and road injuries, while other non-surgical causes of premature death and disability decreased.¹¹ Political instability creates risk for those programs that are in place and furthers a downward spiral of service availability.¹² The NPH-Honduras program continued to operate following the 2009 *coup d'état* of former president Manuel Zelaya. Haiti has experienced continuing political unrest since its independence in 1804, most recently during the 2010 presidential election and subsequent run-off.¹³

In addition to these macro considerations, there are unique considerations at the micro level: the interpersonal relationships in a community. Surgery occurs between patients and providers with distinct values and beliefs, and understanding these factors and communicating within them is critical. Surgical consent and post-operative compliance require clear communication of expectations between patient, family and health care providers.¹⁴ Most communication occurs through nonverbal and paraverbal styles which are highly situational and culturally dependent.¹⁵ The use of local *ad hoc* interpreters was preferred by health care volunteers and felt to facilitate trust, diplomacy and relationship centered care. In both communities, partnerships established with local professionals bridged the cultural gap and translated patient education material to promote compliance.

Literature review

We reviewed the relevant literature to contextualize our experience and compare it with that of others. We comprehensively searched several worldwide databases, searching each from its earliest inception to May 31, 2014. Language was designated as English or translated into English, and any population was considered. The databases searched were MEDLINE and MEDLINE In-Process & Other Non-Indexed Citations, Scopus, EMBASE, and Cochrane Central Register of Controlled Trials and Database of Systematic Reviews, using the MeSH (Medical Subject Headings) search terms *Delivery of Health Care, Developing Countries*, and *Surgical Procedures, Operative or General Surgery*, or *Orthopedics*. This returned 1,282 titles, which we reviewed for relevant articles. The reference lists of relevant articles were also reviewed.

The results of this search were informative, indicating that the burden of surgical disease in developing countries is large and growing; it is conservatively estimated at 11–15% of the global disease burden.^{4,16} It comes with an increasing disparity between the need and the availability of surgical services, as health systems struggle to keep pace.^{17,18} Furthermore, there is a cost-effective benefit provided by surgical treatment that is comparable to other public health interventions, supporting the idea that surgery is a reasonable and attainable goal for health policymakers.^{19–22} This view of surgery as a public good for public health and prevention, however, has only recently begun to gain traction.^{4,7} Field leaders have called on surgeons to involve themselves in the brick and mortar issues of facility construction,⁷ while others have suggested mechanisms by which existing surgery programs can be scaled up.^{23,24} These are usually academic

twinning (so called) programs that include various degrees of residency education and research,²⁵ or NGOs that are variably integrated with the local health infrastructure.^{2,12}

We found little discussion of the facility design and development issues we experienced. For example, *Médecins Sans Frontières* (MSF) developed a model using ready-made containers of supplies whereby they can rapidly deploy in crisis situations, but their focus was on relief work.¹² Academic twinning programs are mostly engaged in training, publications, and resident experiences rather than local construction and administration considerations.²⁵ Important policy papers and field guides provided by the World Health Organization (WHO) address the problem of surgical care provision from the perspective of the district hospital administrator but are highly theoretical and not geared to NGOs.^{4,5,26} There remains a void in the literature of how NGOs have faced practical challenges and integrated themselves into local health systems. Our report has attempted to provide insight into some of these issues.

Our review also found that our programs shared similarities with other published accounts, yet differed in important ways. Some NGO work focuses only on surgical service provision during disasters.^{12,27} Chu *et al.* have described generally the work of MSF in over 70 countries. While they integrate with local health ministries, their goal remains disaster relief: they will pull out of countries once local health systems can assume full responsibility for surgical care provision.¹² Nonetheless, in Haiti they have been the *de facto* provider of trauma surgery for the poor in the Port-au-Prince catchment area for many years.²⁸ The Partners In Health surgical program at Zanmi Lasante is similar to ours in that it is an NGO providing sustained surgical care with a mix of local employees and foreign specialists, expanding the health infrastructure in Haiti's central plateau.² Twinning programs like the one described by Ozgediz *et al.*²⁵ in Uganda scale up surgical capabilities in participating institutions, but they focus on training and research rather than infrastructure and operations.

Conclusion

The unmet burden of surgical disease in the developing world is increasingly recognized as an important and justifiable public health priority,^{4,7} but there is a great deal of work to be done. We still do not know the precise burden of surgical disease in low and middle-income countries around the world. Countries must collect better data quantifying not only the current amount of surgical care being performed, but that details the numbers and types of surgical problems that go untreated. Only then can the global humanitarian community fully understand the problem and be engaged to bring the necessary resources to bear in a coordinated fashion. In addition to understanding local facility infrastructure and operational needs, building sustainable surgical capacity requires an understanding and engagement of the community being served.

Acknowledgments

The authors would like to acknowledge Massimo Gambarin for his assistance, and Dr. Merlin Antunez and Dr. David Nordin for their work in Honduras. They also

acknowledge Reinhart Kohler, Director of NPH Honduras, and the many donors and partners, too numerous to count here by name, who have contributed to the success of these two programs.

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