Chapter 1
Global Burden of Surgical Disease and the Role of Academia

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An estimated five billion people worldwide do not have access to safe and affordable surgical and anesthetic care. Most of these people live in low- and middle-income countries (LMICs). Great inequities and disparities exist and the burden of disease, when matched with available resources and capacity, continues to diverge between high income countries (HICs) and LMICs. Furthermore, even within LMIC or HIC countries and regions, inequities exist between communities.

This chapter will introduce some of the concepts relevant to the global burden of surgical disease and disparities in surgical care globally. Recent approaches and initiatives taken by the academic surgical community in this area will be summarized and possible future directions will be proposed. We will also discuss roles of the Academic Global Surgeon and relevant aspects of such a career, and examine the potential position of academic institutions in tackling the issues within global surgical care.

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Global Burden of Surgical Disease

Increased attention has been focused in recent years on the worldwide burden of surgical diseases. Many factors have played a role in this surge of interest, among them:

1. A greater visibility of global health disparities through improved communication networks and an increased number and scale of global health initiatives
2. The associated humanitarian imperative to tackle these disparities for greater global health equity
3. An increased engagement by surgical and perioperative health care providers in surgical care in LMICs
4. Evidence that the burden of surgical conditions in LMICs is significant and surgical care is more cost-effective than previously imagined
5. An unprecedented surge in the interest of students and trainees in HICs for experience, skills and mentorship in this area.

As a result, engagement of the academic surgical community in research and programs related to care of surgical conditions in LMICs has grown. As the target time for the Millenium Development Goals (MDGs) has arrived and focus has turned to the United Nations' Sustainable Development Goals (SDGs), there has been global consensus on the need for Universal Health Coverage (UHC). It has become increasingly clear that the latter cannot be achieved without including surgical care and addressing the diverging global burden of surgical diseases between HICs and LMICs. This concept is underscored by the findings of the Lancet Commission on Global Surgery released in early 2015. (www.thelancet.com/commissions/global-surgery). Working with collaborators in 110 countries throughout the world, they definitively state that surgical services are a prerequisite for the full realization of global health goals. The commission estimates that an additional 143 million surgical procedures/year would need to be performed, predominately in LMICs, by an additional two million providers to achieve the commission's goal of a minimum of 80 % coverage of essential surgical and anesthesia services per country by 2030.

In broad terms, *burden* refers to the individual, family, community and overall public health impact associated with surgical conditions. In the technical language of academic public health, however, 'burden' generally refers to the Global Burden of Disease (GBD) Study, through which the term *disability-adjusted life-year* (DALY) was developed in 1990 as a unique health metric. While previous studies of the burden of disease reported mortality alone, this metric was unique in trying to capture associated disability for those conditions with non-fatal health outcomes. Roughly, the DALY refers to a 'healthy' year of life lost. Over the last several decades, the GBD Study has remained a primary tool for academics, policymakers and the charitable sector as one input (among many) to guide resource allocation in LMICs. One of the advantages of a single metric is the ability to compare diseases

and risk factors objectively. However, the DALY metric has been controversial in public health circles for a host of reasons, and the 2010 iteration of the GBD study attempted to address a number of these shortcomings. Several of the greatest disadvantages have been the lack of practical meaning of the calculations generated, and the extensive statistical modeling required to arrive at national and regional estimates of burden in settings where data are limited.

Some individuals and groups have attempted to use GBD categories or data to estimate burden of surgical conditions, such as injuries, cancer, or emergency conditions. An initial very rough estimate in 2006, based on a survey of 18 international surgeons, was that 11 % of the GBD is surgical, and this number has been widely quoted in the literature surrounding global surgery. Many subsequent estimates, utilizing some of the methods cited below, have put this number much higher, up to 30 % of the GBD. Another approach has been to estimate the DALYs that would be averted for specific conditions or groups of conditions if outcomes in low-income countries would approach those in high-income countries, suggesting, for example, that two million deaths a year could be prevented in severely injured patients by improved trauma care. These efforts have been useful in generating numbers large enough as an advocacy tool to draw potential interest and attention from donors and policymakers. Among the most important work with DALYs have been estimates of cost-effectiveness of hospital wards and even specialist surgical interventions showing that surgical intervention is a much better 'buy' than previously estimated by public health experts. These findings were emphasized by the publication of the DCP3 or *Disease Control Priorities* 3rd edition (http://dcp-3.org/surgery) in Feb 2015, in which essential surgical procedures ranked among the most cost-effective of all health interventions. DCP3 estimated that while universal coverage of essential surgery would require about $3 billion per year of annual spending over current levels, it would have a benefit to cost ratio of over 10 to 1.

A number of groups in recent years have expanded the discourse and application of surgical metrics far beyond the DALY. Early work attempting to quantify surgical burden and need was primarily limited to facility–based operative logbook analysis, sometimes linked to population data. Recent emphasis has focused on capacity surveys through measuring infrastructure and human resources of hospitals to care for essential and emergency conditions. There have been numerous such tools developed and piloted across countries and regions. Universally, they have measured deficiencies in capacity to treat high priority surgical conditions. The development of these tools and the documentation of capacity gaps have been critical for funding and advocacy efforts.

Given that a significant proportion of patients with surgical needs do not interact with the health care system in many LMICs, a greater number of population-based surveys have been performed to estimate surgical death and disability at the household level. This has resulted in a more accurate estimate of burden than what can be found through modeling from facility-based surveys alone.

Less work has been done in the area of qualitative research, which could help shed light upon aspects of burden that are less likely to be captured by other estimates of mortality and morbidity. This research may include evaluation of health seeking behavior, perception of disease, confidence in the health care system, impact of the system of traditional healers, social stigma or even economic consequences of surgical disease on vulnerable populations.

Nonetheless, more accurate and meaningful measures of surgical burden are needed to capture the broad dimensions of the need and consequences. Further needs include metrics that capture the tremendous access barriers and difficult choices faced by populations in these environments. Perhaps the most important work yet to be done involves translation of this knowledge to implement *surgical scale up* projects or programs with associated measurement of cost and burden.

Many challenges affect the development of meaningful metrics for surgical care, and the development of 'packages' of care. Surgical care has a broad reach and plays a critical role in many disease processes such as trauma and emergency surgical care (inclusive of disaster and conflict settings), emergency obstetric care, child health, infectious diseases and non-communicable diseases such as cardiovascular disease, cancer and diabetes. Due to this intersection with a wide range of disease processes, age groups, and breadth in urgency of intervention (from time-critical care to elective care), development of a coherent package to improve care can be a challenge. Furthermore, surgical treatment may be needed for only a subset of patients with certain conditions or at a certain stage of disease. Even the term *surgical care* has been debated, clarifying the difference between surgery, surgical conditions and surgical treatment. These distinctions are practically important as some conditions require the presence of surgical expertise and decision-making all the time, but may require an operation to be performed only rarely.

More broadly, concepts such as *met* and *unmet* need for health services and coverage of surgical services are also part of the discussion about surgical burden and require greater refinement and practical application. They have been used for other priority health interventions but not in detail or depth for surgical conditions. This has led to the general sense that surgery requires expansive *systems strengthening.* Still, some groups and individuals have called for resources to treat specific conditions only.

Due to this broad scope of disease and context of need, the public health disciplines that could inform solutions for surgical service delivery in LMICs are also wide-ranging, and include epidemiology, health policy, health services research, health economics, gender studies, medical anthropology, ethics and human rights related to health care, among others. In addition, it is important to remember that clinical surgery is truly a *team sport* that requires anesthesia and other perioperative care providers such as nursing and theater staff. Inclusion of these groups in surgical solutions is essential but often lacking. This may reflect overemphasis on the 'operation' that may be part of the care of a potentially surgical condition, rather than the package of resources needed for holistic care including adequate disease identification, and pre- and post-operative management.

Despite the ongoing needs and work yet to be done, mounting evidence such as the DCP3 publication and the Lancet Commission report, make it quite clear that surgery is indeed an integral and inseparable part of comprehensive universal health care. As a reflection of this and a hopeful nod to the future, in May 2015 the 68th World Health Assembly ratified a historic resolution on strengthening Emergency and Essential Surgical and Anesthesia Care as a Component of Universal Health Coverage.

What Is an Academic Global Surgeon?

Academic work in global health has greatly increased over the last several decades, but much of this focus has been in communicable disease research such as HIV, TB and malaria. Along with a surging literature related to surgery in LMICs, recent papers and textbooks have discussed the concept of *Global Surgery*, building on previous similar conversations defining *Global Health* as a science. These terms are quite loosely defined, but an Academic Global Surgeon generally refers to a surgeon interested in surgical conditions affecting vulnerable populations, often in resource-poor environments where health access may be limited. While this often includes vulnerable populations in LMICs, it may include similar populations in HICs.

The academic aspect may be most broadly interpreted as some focus on scholarly activity related to the above, often in association with education, research, advocacy or service delivery. An academic focus may be in contrast to an exclusive focus on service delivery and surgical humanitarian aid more primarily focused on direct patient care, often through the model of a short or long-term term mission. A role as an Academic Global Surgeon may be less recognized as an esteemed position compared to the more traditional roles of the academic surgeon scientist with a focus on basic science, the surgeon-educator, and-or the surgeon clinical-researcher. Nonetheless, all of these skill sets have roles to play in surgical global health.

The Academic Global Surgeon most commonly has ties to a university and may use this academic base to translate the needs and consequences of limited surgical care in LMICs into action. Time spent in the resource-poor setting for the Academic Global Surgeon may vary from full-time to part-time. In addition, an increasing number of surgeons associated with relief organizations and humanitarian groups have engaged in valuable scholarly activity through planning, implementation and monitoring and evaluation arm of these organizations.

Skill sets of the Academic Global Surgeon often include familiarity and experience with the delivery of surgical care to vulnerable populations in the resource-poor setting, as well as the many barriers associated with health care access for these populations. Those with experience in health disparities research and access to care, as well as surgical education, in the HIC setting may apply these concepts to the LMIC setting through academic collaborations. Experience with clinical service delivery in resource-poor areas coupled with a public health mindset can help to translate the clinical and access challenges into meaningful research studies.

Questions such as, *Why is this patient here now?*, *What are the challenges and possible solutions for surgery in this environment*?, and *Who are the local champions for surgical care?* are a starting point that lead to focused areas for development and implementation. Another critical aspect is the ability to work with not only surgical colleagues at other institutions and regionally, but also colleagues in anesthesia and nursing providers. Surgical solutions require a multidisciplinary approach.

Scholarly activity for the Academic Global Surgeon can take many forms, and may include research into the concepts outlined in first section of the chapter, such as burden of surgical disease, met and unmet need for surgery and health care access and disparities. Research into these areas is generally conducted through collaborations with clinicians or researchers in LMICs where knowledge creation may have the greatest impact. Some academic surgeons may spend minimal time away from their home institution while remaining heavily involved in research of this kind. Planning and conduct of such research, as well as authorship in publications related to this work, should also be shared in equitable research collaborations.

The area of ethics in global health research has garnered more attention in recent years with increased experience in the areas that have received the most funding, generally communicable diseases. Much can be learned from the successes and challenges faced by some of these longstanding collaborations. One of the reported pitfalls of this work has been the extractive nature of some of the research, where knowledge generated does not clearly feed back to the setting where it is most needed.

Academic Global Surgeons may also be involved in research related to innovation of equipment and devices tailored to the resource-poor setting. As has been well-described, one of the most significant barriers to surgical care in resource-limited settings is the lack of equipment and supplies. In the last decade, an increasing number of providers have tried to develop locally sustainable, low cost supplies and equipment suited for resource-poor areas. Academic Global Surgeons are often involved in this process, from the identification of essential equipment to the process of device development and testing. This process often requires collaboration with other disciplines as well. The reverse situation is also possible, in that practitioners in resource-poor settings may develop a more cost-effective practice or use novel technology that could reduce costs in HICs.

Scholarly activity may take many other forms as well. For example, many academic surgical collaborations have a focus on improvement of training and education to support surgical capacity of trainees in the LMICs. The design of short courses suited to the LMIC context or the measurement of skills transfer for outreach activities targeting surgical education may be another area of focus. Others have edited textbooks geared to common clinical surgical scenarios (in general surgery or in surgical subspecialties) in the resource-poor setting or have engaged in curriculum development with colleagues in LMICs. Furthermore, some have made a long-term commitment to development of post-graduate and sub-specialty train-

ing programs in LMICs supported through American universities and/or the faith-based community, private philanthropy or international development organizations. A number of recent global health textbooks, policy briefs and new editions of classical surgical texts now include chapters on global surgery. Academic Global Surgeons have also been involved in an increasing number of university-based global health courses and programs by planning modules focused on global surgery and full courses devoted to global surgery that may run through a department of public health.

As previously noted, there has been an unprecedented surge in interest from students and trainees in HICs for exposure to global surgery. There remains a gap, however, between the growing number of young trainees with this interest and the limited number of Academic Global Surgeons with a career focus in this area. Academic Global Surgeons frequently mentor students and trainees with this interest in either the research or clinical realms. Ideally this mentorship may also involve modeling around ethical global health collaborations and relationships. On a broader level, many Academic Global Surgeons have led their institutions to forge collaborations with institutions in LMICs. Development of these types of collaborations requires sensitivity to the needs in LMICs and extensive work in the medico-legal aspects of establishing these collaborations, in addition to the establishment of funding to support these activities.

Some Academic Global Surgeons have worked through professional societies such as the Association for Academic Surgery, Society of University Surgeons or various specialty surgical societies to raise the visibility of global health activities of the membership and to increase the scope of work that these organizations do related to surgical care in LMICs. Examples of such work include: *global surgery* committees with a wide scope of activities, such as the funding of research projects in these areas; research panels and presentations with a focus on surgical care in resource poor areas; supporting funding of selected LMIC providers to attend meetings in North America; and, establishment of clearinghouses for short courses geared to the HIC surgeon who is engaged in volunteerism with a focus on clinical scenarios, surgical techniques or challenges in the resource-poor setting. Others work closely with or have created their own non-profit organizations of varied size and scope to support or coordinate surgical care in LMICs. Many such organizations have developed in the last decade alongside university-based collaborations to fill the critical gaps to advancing the global surgery agenda. A major driving force moving forward, as in other areas of global health, is to explore if and how some of these organizations can work together.

Perhaps the most important role of an Academic Global Surgeon is as an advocate for surgical providers and service delivery in LMICs to populations in need. This requires close working relationships with LMIC counterparts, often developed over time through mutual trust. It requires an ability to work with local providers not only to identify needs, but also to help prioritize these needs and translate these needs to practical solutions. This also requires the identification of *local champions*,

or providers in the resource poor setting with a great commitment to improve local health care. Most successful collaborations in global surgery and in other disciplines have identified the presence and involvement of such a champion as essential.

To promote the essential right to surgical services, advocacy may also take place at the level of major international organizations such as the International Red Cross, the United Nations, and the World Health Organization. This effort is often accomplished through official documents, policies and guidelines that may guide health planning in LMICs and help set the agenda for philanthropy.

Given that global surgery is emerging as a new field, the academic surgeon has the opportunity to shape this field and to further establish its legitimacy as an academic pursuit.

The Role of Academic Institutions

To reduce the burden of surgical disease (BSD) and to narrow inequity and disparity gaps requires targeted collaborative partnerships between HICs and LMICs. Academic institutions have a key and central role to play in this regard, as they are strategically positioned and structured to provide leadership and develop innovative solutions. Such collaborative partnerships can be achieved through traditional functions and responsibilities of academic centers.

Teaching and Training

There is currently a severe shortage of surgical providers in LMICs, including the support staff required to provide safe surgical care. This situation is compounded by the limited training opportunities available to increase the numbers of providers. For some surgical specialties, training opportunities do not exist at all. In some settings, there are not enough doctors and those taking up surgical training are even fewer. There are also few active surgical trainers, who are often over-burdened with provision of essential surgical services at the same time.

Reduction in the BSD and existing disparities in surgical care cannot be achieved without significantly expanding the workforce capacity in LMICs. Such expansion is best achieved through training and provision of appropriate support for training.

Academic institutions in HICs can leverage their wealth of surgical expertise and resources to develop partnerships that would create and develop training programs where none exist or to support and strengthen existing training programs through curriculum enhancements, development of effective and innovative training tools and continuing development of trainers.

Research

This is discussed in-depth in a separate chapter. However, as discussed in the first section, accurate and reliable data on BSD in many LMICs is not readily available, and data on surgical capacity to address the high BSD are often lacking. The cost effectiveness of surgery and surgical interventions in resource poor settings has not been fully ascertained, though a number of studies, including the DCP3, suggest surgical care is a better investment for public health than previously assumed. Given the current data, developing targeted solutions to address the BSD becomes quite challenging. Also, the surgical epidemiology, treatment and outcome profile of many surgical diseases in LMICs remain under-studied. Furthermore, innovative, context-specific solutions to address the BSD need to be developed and implemented. As an example, there has been much discourse on the role of mid-level surgical and anaesthesia providers and task sharing to address workforce shortages in LMICs. However, their acceptability, safety and overall impact remain controversial. Novel approaches and programs addressing these workforce shortages are needed. Academic institutions, with their wealth of expertise and resource base are in a vantage position to cultivate research partnerships that would help to adequately define and provide accurate and reliable data for all needed research.

Service

Academic institutions, by nature have a social obligation, which includes bringing services and developments to areas where these are limited or do not exist. This obligation provides the Academic Global Surgeon with a unique opportunity to influence change in populations that are under-served and under-resourced. Given the current limitations in surgical workforce, infrastructure and equipment in many LMICs and resource poor areas, it would take some time to scale up the capacity to meet local needs and address the BSD. Partnerships that provide and support surgical services are needed and can be quite effective in addressing BSD, at least in the short term. Academic institutions can provide the relevant personnel and resources to support and strengthen existing surgical services. Where services do not exist, new services (including specialized services) can be developed by partnering with local surgical champions and institutions.

These service-oriented partnerships need to have clearly defined focus and context-specific goals and can be in the form of:

(a) Short visits with surgical team, for a few weeks or months at a time, but regularly at least every year
(b) Long-term, continuous commitment: a surgical team always available all year round

(c) Surgical outreach: surgical team visiting and providing surgical care for only a few days at a time

Whichever type of service partnership that is developed should include scaling up of local workforce capacity through training and introduction of sustainable initiatives. This would help avoid a long-term cycle of dependence.

As partnerships are developed, multidisciplinary collaborations are important, as safe surgical care cannot be provided without the involvement of relevant specialties such as anesthesia, nursing and biomedical engineering. The capacity for most of these complementary services in LMICs is limited and often poorly developed.

Advocacy

With their visibility in the public eye, academic centers have a unique ability to act as ongoing advocacy platforms for Global Surgery. They can achieve this in a variety of ways including, promotion of a standing center for Global Surgery within their own institution, joining with similar institutions such as has been done with the Consortium of Universities for Global Health (CUGH), or through partnerships with NGO's to advocate for improved care of surgical diseases of particular concern in their partnership region. Furthermore, academia can effect policy change through collaborative international partnerships that could campaign to include surgical care in universal health coverage and post-MDG sustainable development goals. An attempt at this latter type of collaboration has come recently in the form of the G4 alliance (The Global Alliance for Surgical, Obstetric, Trauma, and Anaesthesia Care: www.g4alliance.org), which is an advocacy-based organization of academic centers, professional societies, and NGO's dedicated to building political priority for surgical care.

It's encouraging to note that academic groups and academic institutions have had great impact in other areas of global health, including infectious diseases and, maternal and child mortality. The role of HIC academic institutions in alliance with LMIC partners in the fight against HIV/AIDS provides an encouraging example of what can be achieved through academic collaborations in global health. Through such partnerships, HIV/AIDS changed from a fatal disease to a now manageable chronic disease condition. The prospect for academic surgery to achieve comparable or greater success in addressing the global burden of surgical disease is exciting and promising.

Academic institutions in LMICs do not have the same wealth of personnel and resources as those in HICs, but are desirous of mutually beneficial partnerships. In forging partnerships, it is critical to identify already existing partnerships in a given area and setting to:

(a) Avoid undue duplication of activities
(b) Avoid unhealthy competition
(c) Minimize redundancy in a setting where multiple academic groups are working

(d) Maximize impact of activities and programs
(e) Harmonize and pool resources, where this would be complementary

Whom to Partner With

Partnerships are most commonly with universities, as these institutions would already have existing structures and avenues for collaborative partnerships. However, universities in LMICs are few and may not always be appropriate for all collaborative partnerships. Other partnering bodies exist and should always be considered (Table 1.1).

Joining with non-profit organizations and agencies can be helpful and should be explored whenever possible and necessary. Some non-profit organizations already have established programs, networks and extensive experience in LMICs. Partnering with them would bring on their unique capacities and capabilities, experience and resources in actualizing the desired goals of academic global surgery. However, non-profit organizations may have goals and objectives that conflict with those of Academic Global Surgery, and such potential conflicting areas should always be addressed and eliminated from the outset of any partnership. Any successful partnership requires significant planning at each step, maintains clarity with regard to roles and responsibilities, and always balances the needs of both sides (Fig. 1.1).

Benefits of Involvement in Surgical Care in Resource-Poor Settings

Involvement in surgical care in resource poor settings can be gratifying and offers several types of benefits for both the individual and the institution:

Table 1.1 Partnership organizations for academic global surgery

Academic institutions
Universities
University Hospitals
Research Institutes
Public and governmental organizations
Ministries of Health
World Health Organization
Others
Non-profit, non-governmental organizations
Humanitarian
Surgical Mission Groups
Academic Groups
Training colleges

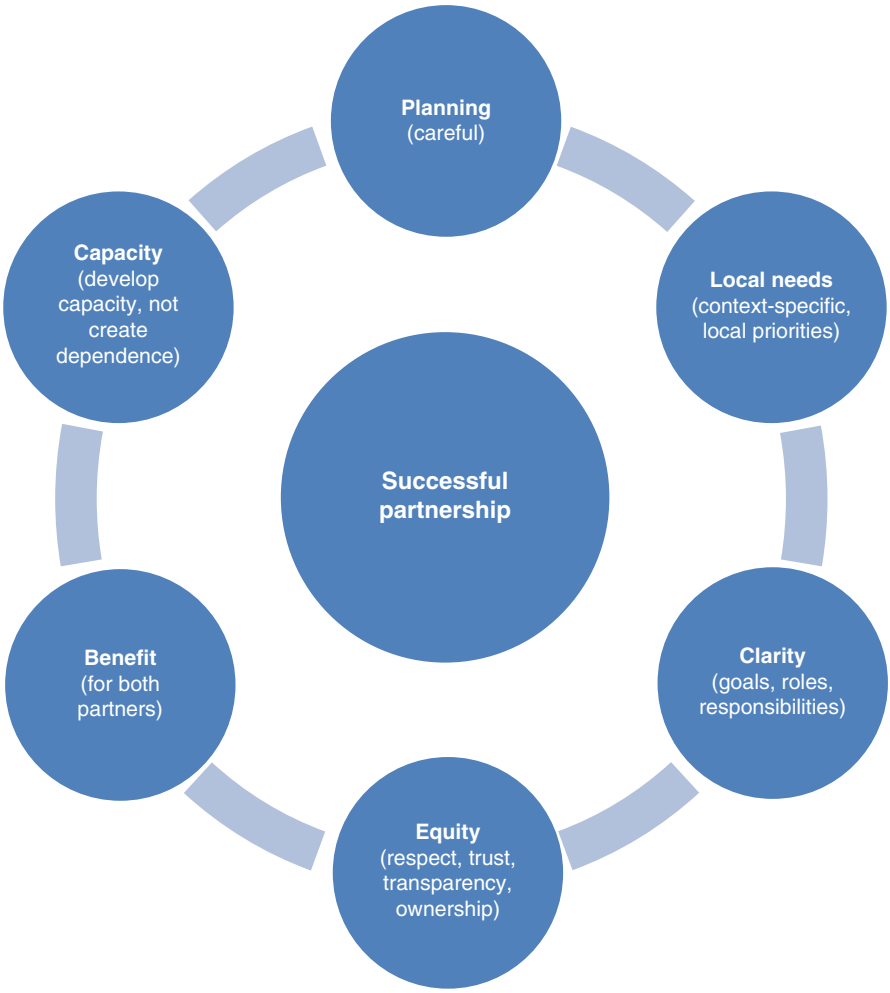

Fig. 1.1 Cycle for successful collaborative partnerships

1. Trainees in the HIC may develop interest in the field
2. Cost-conscious medicine: involvement in resource poor settings often creates the necessity to avoid wastefulness and only do that which is necessary, relevant, and effective.
3. Investigations into diseases or care delivery models may benefit patients in all settings.
4. Supporting surgical care and surgical systems would invariably result in improvements in the entire health system in HIC and LMICs.

Conclusion

The global burden of surgical disease is increasingly recognized as a significant public health issue. This is a stark departure from the past landscape of global health that often reserved surgical involvement to no more than a mission activity. Academic institutions can and should be involved in supporting this nascent field by engaging in training, research, and service delivery to vulnerable populations in resource-poor areas. Similarly, the global surgeon can contribute significantly with scholarly work and a wide range of skill sets. Despite existing challenges, the prospects are promising for a career in academic global surgery. For any partnership between an individual or institution and a resource-poor region to be successful and sustainable, the collaboration must be truly bilateral and mutually beneficial.

Suggested Reading

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