PART I

The Case for Global Surgery

CHAPTER 1

Advances and Disparities: The Current State of Global Surgical Care

INTRODUCTION

In many ways, it is the best of times for surgery. In no previous era has surgery enjoyed so much technological support or so much public expectation. The coevolution of surgery, anesthesiology, radiology, and pathology has made diagnosis and intervention possible with increasing precision and fewer complications. In the past 50 years, each of these fields has developed specialties and subspecialties, allowing further refinement—even to molecular and cellular levels—and, increasingly, minimally invasive surgery. However, these benefits of technology are available only to people in wealthy countries and to the wealthy in middle-income countries. For the poor, diagnostic and surgical services are often basic or rudimentary, even in economic centers and industrial capitals. Shocking gaps are common, with state-of-the-art care available in one location, yet virtually none just around the corner. Surgery is therefore an appropriate model for reexamining issues in public health. As technology develops at an escalating pace, disparities in access and care have the potential to become even more acute. But is increasing disparity necessarily a consequence of increasing technology?

Perhaps nowhere in medicine are global disparities more striking than in surgery. A walk through a public hospital in any developing country

will tell the story. Halls are dimly lit and wards are large and crowded. The emergency room has no oxygen. There are no functioning ventilators for patients who cannot breathe. Family members take shifts with hand-held ventilation (ambu) bags until they are exhausted or the patient recovers. A single nurse is on duty for the night. Electricity cuts out for hours at a time. For a patient in acute distress awaiting surgery, these problems are compounded; but the patient must wait. Who can operate in the dark? The allocation of resources to health care is particularly reflected in emergency departments, intensive care units, and operating rooms because no other areas of hospitals are as dependent on consistent funding for devices and supplies. Deficiencies are apparent at every level, from staff training and salaries to medicines, intravenous catheters, monitors, and sutures. Patients suffer from preventable surgical problems, and their disabilities become an economic and psychological burden to their families and communities. As noted by Duda and Hill (2007, p. 13), "Untreated surgical conditions add to the acute and chronic burden of diseases and have a negative impact on the microeconomy and macroeconomy of a nation. The importance of surgery as a preventive and curative strategy in public health needs to be thoroughly investigated and documented."

In cities and rural regions, disparities are linked to economic conditions of the people. Poverty, poor education, nutrition, housing, and lack of means of communication all undermine the access to surgical care, even where such services are otherwise available and in close physical proximity. When poor patients do get care, their outcomes are significantly worse if their living conditions are unstable (Rogers, 2008). Large metropolitan cities often are home to the striking juxtaposition of cutting-edge surgical diagnosis and care with populations of patients unable to access it. Surgical outcomes can be further scrutinized on the basis of gender, age, caste, class, race, ethnicity, and other factors. On a global map, sub-Saharan Africa, South Asia, Central America, and Haiti are areas of greatest need (Murray and Lopez, 1997a, 1997b; Debas, Gosselin, McCord, and Thind, 2006; Mock et al., 2010; Taira, McQueen, and Burkle, 2009; Ryoo and Ko, 2008; Ivers et al., 2008; Ozgediz, Jamison, Cherian, and McQueen, 2008; The Bellagio Essential Surgery Group, 2007, 2008; Farmer and Kim, 2008).

The problems leading to a lack of capacity for surgical care in different regions of the world are multifaceted and are usually linked to the economy. All have one thing in common: in the world of public health, surgical care, training, and availability have not been on the radar. Public health agencies

have done magnificent work in eliminating many communicable diseases as public health problems globally. Small pox is a prime example. Public awareness of and funding for HIV/AIDS, tuberculosis, and malaria has grown dramatically in the last decade. Even chronic and noncommunicable cardiac disease, diabetes, and cancers have attracted the public eye. Yet a critical component of the diagnosis and treatment of many of the world's diseases is surgical. This chapter will paint a broad picture of the state of surgical care globally and will discuss reasons for disparities, including policy, funding, and workforce. But first, it is helpful to review definitions and concepts in surgery as they interface with the discipline of public health. Subsequent chapters will expand on these and will highlight areas for future research.

THE INTERFACE BETWEEN SURGERY AND PUBLIC HEALTH

In order to fully engage in dialogue about these issues, it is helpful to identify key concepts. Establishing the burden of all disease has been a critical issue in the field of public health. Governments need this information in order to allocate resources appropriately, and it is essential to know which diseases affect people in various regions of the world, as well as the risk factors that lead to them. The World Health Organization (WHO) published a series of studies commissioned by the World Bank on the Global Burden of Disease beginning in 1990, looking not only at communicable diseases but also at chronic illness and psychiatric disorders. This series introduced the new metric, the disability-adjusted life-year (DALY), as a single measure of injuries, risk factors, and burden of disease by region, age, and sex (Murray and Lopez, 1997a). The publication was updated in 2004 (WHO, 2004), and a new update is in progress, in collaboration with the Institute of Health Metrics (IHM), known as the *GBD 2010 Study*. A more detailed discussion of the methodology for these analyses is provided in the most recently available report and will be discussed further in Chapter 2. A separate project, the Disease Control Priorities Project, or *DCP1* and *DCP2* (Jamison et al. Eds., 2006), also funded by the World Bank, is an ongoing effort to prioritize funding for the world's most cost-effective interventions and strategies by defining the costs of the burden of disease and interventions to target them. For the first time, in *DCP2*, surgery is considered to be a cost-effective intervention in certain

settings such as the district hospital, where the cost per DALY averted was US$33–38 in sub-Saharan Africa and South Asia—compared to other public health measures such as immunizations (Debas, Gosselin, McCord, and Thind, 2006). Finally, the *World Health Statistics*, published annually by the WHO provides a wealth of data on the status and trends of certain health parameters such as maternal mortality and life expectancy at birth in countries around the world as well as the mortality rate of people in different age categories. It also registers trends in risk categories and healthcare workforce trends over time, and lists healthcare expenditures per capita, including important data on health inequities. The *World Health Statistics* publications provide a baseline for comparison not just across the geographic and economic spectrum, but also across time.

So far, however, surgical diseases have been poorly documented (Taira et al., 2009). There has been no funding specifically allocated for data collection for many conditions, especially in low- and middle-income countries, and therefore, health metrics measures must be achieved by modeling based on somewhat scanty evidence. Where there are no resources for treating surgical conditions, they may not be known to exist. Yet, in the United States, where metrics are acquired by third-party payers, hospitals, and regulatory agencies, we know that consumer demand for surgical services is enormous. In low- and middle-income countries, data and statistics are often poorly kept by hospitals and health systems. Often, the large informal sector of providers keeps no records whatsoever. Because much, if not most, care is paid for out-of-pocket to private providers, organized efforts to quantify disease burden and the provision of services are often bypassed. As populations age, the demand for surgical services increases. In the United States, patients average nine operations per capita during a lifetime (Rogers, 2008). Therefore, it is safe to assume that even if the backlog of untreated surgical conditions or "unmet needs" are addressed in Africa, the ongoing demand globally will drive workforce supply and disparity unless different models are engaged for provision of care.

TERMINOLOGY FOR RESEARCH AND COLLABORATION

A collaborative effort to define the burden of surgical diseases and conditions has grown in the last decade in order to estimate the unmet need for

surgical care and to think through strategies to improve care. The Bethune Round Table, Bellagio Group, and the Alliance for Surgery and Anesthesia Presence (ASAP Today, formerly called the Global Burden of Surgical Disease Working Group [GBSDWG]) are a few of the current international coalitions. Surgeons, economists, and public health specialists are approaching the problems from various angles. Standardizing terminology and methodology for measuring surgical disease will allow us to measure the cost and value of surgical care for conditions compared to "nonsurgical" or "medical diseases," including the transition from formerly "surgical conditions" to "medical conditions" and vice-versa. This is the beginning of a large and ongoing project that will define the true needs of communities for surgical services. A recent consensus paper outlined these terms in an effort to establish methodology for future research. They are an outgrowth of a project conducted by members of ASAP Today that in 2008 identified several factors impeding accurate estimations of the burden of surgical disease. The first is that basic definitions of surgery and surgical conditions had not been adequately agreed upon. The second is that previous methods of data capture did not adequately account for the fact that surgery is an interventional, or procedure-oriented, specialty. Capturing data or risk factors for a diagnosis alone would underestimate the contribution of or unmet need for surgery. And third, the wide variation in types of procedures and conditions make capturing and analysis of data particularly daunting. Nevertheless, the GBSDWG proposed a series of definitions that may be used to bridge the gap in terminology between surgical conditions and other conditions and diagnoses accepted in the public health lexicon (Bickler et al., 2010).

Box 1-1

TERMINOLOGY

Surgical condition: Any disease state requiring the expertise of a surgically trained provider. Note that this does not preclude a qualified generalist MD or advanced practice

(*continues*)

Box 1-1

clinician (APC) as the provider of surgical care. This use of the term surgical condition is broader than that described in the chapter on surgery in the *Disease Control Priorities Project* (*DCP2*) (Debas et al., 2006) where a surgical condition was defined as one requiring actual intervention or invasive procedure. The advantage of the broader definition is that, for many surgical conditions, under the newer definition, invasive intervention is not necessary. As practiced around the world, the discipline of surgery also requires judgment about when not to operate. In many cases nonoperative management or delayed operative management is a more appropriate choice for a condition, but a trained surgical provider is the best person to render the evaluation.

Surgical disability: Physical deficit associated with surgical sequelae.

Surgical sequelae: Abnormalities resulting from surgical conditions or their treatment.

Surgical care: Any measure that reduces the rates of physical disability or premature death associated with a surgical condition. The proposed unit of measurement for surgical care would be the disability-adjusted life-year (DALY), which is the sum of time lost due to premature mortality or years of life lost (YLL) and the years lived with a disability (YLD) (further discussed in Chapter 2), and the prevention thereof.

Burden of surgical conditions: The total disability and premature deaths that would occur in a population were there no surgical care provided. This is expressed in terms of DALYs. The global burden of disease (GBD) study is an ongoing project aimed at estimating the sum total of diseases (Jamison et al. (Eds.), 2006); it describes methodology for estimating the burden of disease and the limitations of the methods to achieve these metrics.

Box 1-1

Met need for surgical care: The DALYs averted by surgical care.

Unmet need for surgical care: The potentially treatable disability or premature death due to a surgical condition. This would be expressed as the units of potential DALYs that could be averted if surgery were available and implemented. The terminology is based on the literature for obstetric need studies (UON, 1999).

Unmeetable need for surgical care: The disability and premature death that is not avertable even with the best-known surgical care.

Value of surgical care (VSC): The ability to prevent or avert disability due to surgical conditions.

Disability weight (DW): The weighted value of one disability relative to another. Of course, this type of measurement is somewhat arbitrary because disabilities affect individuals differently. Nevertheless, weighting is widely used in the insurance industry to rate disabilities and is used in the Disease Control Priorities Project to quantify surgical disability on a scale of 1 to 10. If the value of surgical care equals the disability weight (VSC = DW), the surgery is curative. If, on the other hand, VSC < DW, the surgery may only partly improve the condition. If VSC > DW, it is considered a complication, and the complication then receives its own disability weight.

Recognizing that life expectancies vary globally (partly because of underlying medical or surgical disease states), DALYs for the same conditions may not be equal for different regions of the world. Additionally, a disease state in a young person may carry greater weight than the same problem when seen in an adult because the remainder of expected years of life is greater for the young person. The measure does not add weight regarding the relative importance of a person to a family's economic or

physical survival or well-being, however. In such a scenario, the "weight" of a family's mother or father might carry more significant economic burden than a larger "weight" of a small child with little experience or ability to sustain the community but with a greater life expectancy. However, for the sake of measurement, a DALY weighs youth more favorably than age and disability ahead of death.

BURDEN OF SURGICAL DISEASE OR CONDITION

The concept of burden of disease attempts to consider not just the incidence or prevalence of a disease but also its cost to society; hence, a weighting factor is assigned to various conditions. Summary composite measures of health are used in estimating the general global burden of disease (GBD) in the WHO studies (Murray and Lopez, 1997a–c; Lopez, Mathers, Ezzati, Jamison, and Murray, 2006; Mathers and Loncar, 2006). All have used the DALY as a unit measure of disability. Yet certain diseases are universal across geographic regions and populations, and others are highly skewed in terms of geographic, genetic, dietary, and other factors that can affect the incidence, prevalence, and burden of disease. Some diseases are so local that they escape measurement based on estimation methodology, but they constitute large burdens within their communities. Updated projections of the global mortality and burden of disease from 2002 to 2030 were published in 2005. The newer projections take into account better reporting on cause-specific mortality rates by a greater number of countries. Critical variables in the determinants and separate risk factors for disease were these: average income per capita (measured as GDP); the average number of years of schooling in adults as a measure of "human capital"; and time, as a proxy measure of the impact of technology on health status. History has demonstrated a strong relationship between these factors and risk, along with a fourth variable, tobacco use, which correlates with cardiovascular disease and a variety of cancers. Disease states were projected from the International Classification of Disease (WHO, *ICD*) coding sets for standardization and were put forward as "optimistic" or "pessimistic" scenarios.

Results of the life-expectancy projections for the time frame of the study (2002–2030) showed that life expectancy will rise in all WHO regions, with the largest increases seen in regions with the poorest current

economic conditions: the African, Eastern Mediterranean, and Southeast Asian regions. The shift in disease-specific mortality is expected to shift from the Group I causes (communicable, maternal, perinatal, and nutritional), to Group II diseases (noncommunicable causes), which will comprise 66% of all deaths. Deaths in children under age five (which are primarily due to communicable disease and perinatal factors such as prematurity) are expected to fall by almost 40% by 2030. In wealthy and industrialized countries, deaths of infants and children are already more commonly caused by birth defects than by infectious diseases. Birth defects are often treated surgically. Among the global top 20 causes of death projected over the next 20 years, more and more will be treatable or at least will be diagnosed by surgical techniques, although ischemic heart disease will still rank number one. Stroke, HIV/AIDS, chronic obstructive pulmonary disease, respiratory infections, diabetes, lung cancer, road traffic accidents, tuberculosis, and perinatal conditions will also be in the top 10. Other surgical conditions including stomach cancer, other cancers, injuries, and chronic kidney disease account for the majority of the rest. While global DALYs will decrease in the next 20 years relative to the total increase in population size because of the aging of the population, surgical conditions will account for more and more cases. Group 1 causes will remain more prevalent in lower-income countries and Group 2 causes will assume greater importance in wealthier ones.

The global burden of surgical disease has not yet been estimated, although an initial report is due out in 2010 from the Institute for Health Metrics and Evaluation (IHME) at the University of Washington. An initial estimate, based on "best educated guesses" by 32 surgeons of diseases is that 11% of the world's DALYs are surgically treatable (Debas et al., 2006). Of these, 38% were estimated to be injuries, 19% malignancies, 9% congenital anomalies, 6% complications of childbirth, 5% cataracts, and 4% perinatal conditions. These estimations will most likely be revised upward with the forthcoming revision of the *GBD 2010* (IHME, 2010). One of the problems in calculating DALYs in different economic environments is in valuing the relative weight of a disability. For example, a disease or condition in one setting might be more disabling than it is in another where medicine is available to mitigate the symptoms or to change the course of the disease altogether. Considered by region, Africa bears the greatest burden of disease relative to population, whereas Southeast Asia, because of its total population, has the largest total DALYs.

Comparing the volume of surgery actually performed globally according to available data, total volume of surgery was closely correlated with economic resources (Weiser et al., 2008). The analysis of global surgical volume concluded that, in 2004, approximately one major operation was done—in an operating room—for every 25 human beings, which "exceeds by nearly double the yearly volume of childbirth, and is probably an order of magnitude more dangerous (Weiser, 2008, p. 142)." The number of "minor" operations was not calculated, but is likely to exceed the number of major operations by at least double again.

WORKFORCE: BUILDING SUSTAINABLE CAPACITY

The medical workforce is not uniformly distributed around the world (see Figure 1-1). In Western countries, patients' expectations for readily available, highly skilled, surgical specialists are juxtaposed with a projected shortage of manpower in coming decades. This shortfall is anticipated with great anxiety in the United States, where diminishing funding for training new surgeons and a general shrinking of the workforce due to age and attrition mean that the ratio of surgeons to patients will decrease in future years. The economic downturns in the first decade of the new

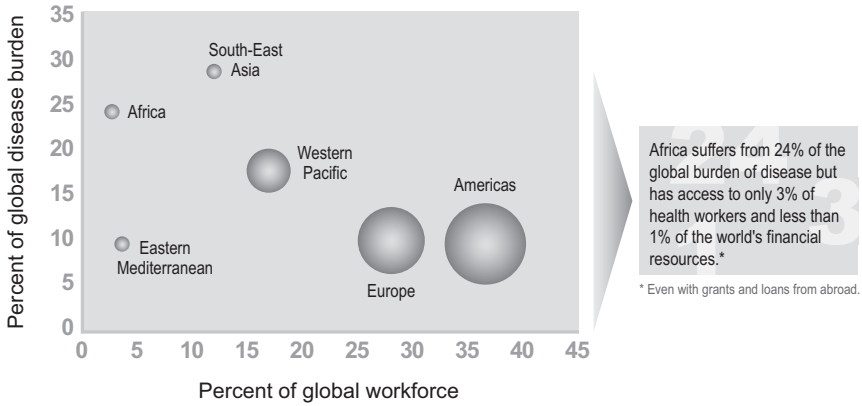

Figure 1-1 Human Resources for Health (HRH) by Region. Distribution of Workers by Health Expenditure and Burden of Disease by WHO region.

From International Finance Corporation, The Business of Health in Africa 2009, Fig A5.1 Redrawn by permission. Illustration courtesy of Intermountain Healthcare.

millennium have forced medical schools to decrease their incoming class sizes as much as 20% (Epstein, 2010), and the supply of surgeons will, in the future, decrease accordingly. In America, the projected shortage of surgeons is based on the current demand for surgical care and the projected numbers of future patients based on population demographics. Compounding the problem with access, subspecialization is also occurring within specialties, and in orthopedics the ratio of subspecialists to generalists has been increasing, especially among newly trained surgeons: general orthopedists account for 29%, specialists for 39%, and generalists with a specialty interest for 32% (Watkins-Castillo and Porucznik, 2006). Among academic orthopedists, nearly all are specialists. However, 80% of orthopedists are in private practice. The number of academic surgeons compared to those in private practice mirrors other specialties. In most surgical specialties, new surgeons around the world prefer to work in urban centers rather than in rural areas. Figure 1-2 illustrates distribution of doctors worldwide.

In Europe, mandatory decreases in work hours for trainees coupled with a lack of growth in numbers of training centers has pushed the United Kingdom to import significant numbers of surgeons from developing countries to fill the ranks. Poor countries have suffered the brunt of

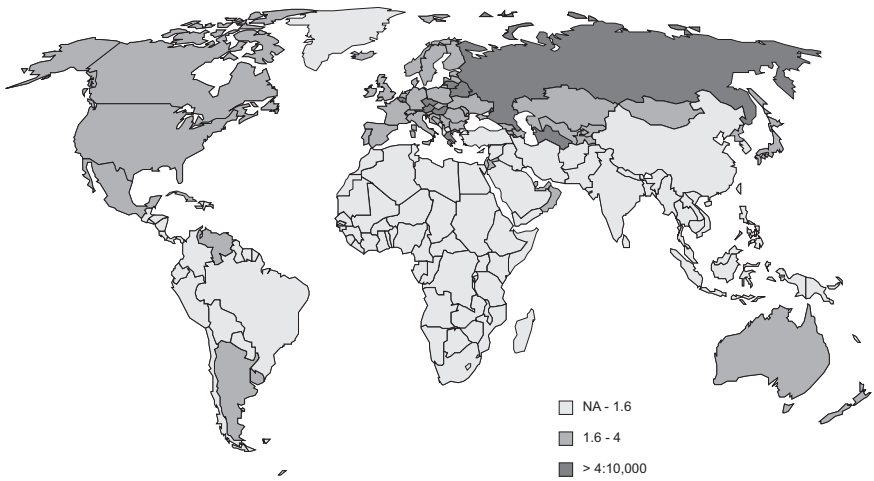

Figure 1-2 Physician Density per 10,000 population.

Data From WHO World Health Statistics, 2009. Illustration courtesy of Intermountain Healthcare.

the loss of personnel as the migration routes of nurses and doctors have become a global phenomenon.

The crisis in the healthcare workforce escalates with increasing consumer demand. Not only is the global population growing (see Figure 1-3), but people in most countries are living longer and are requiring more advanced forms of care later in life. People also expect more from healthcare providers in terms of outcomes. If the age of the population of a country is an indicator of the need for surgical care in the future, then young people, at higher risk for trauma and road traffic accidents, will add to the burden of diseases of aging. The aging population has higher requirements for "maintenance surgery" as well as for cancer and for sequelae of metabolic diseases, such as diabetes. In the poorest African countries, these problems will be most acute. Poverty and social instability correlate highly with higher birth rates (see Figure 1-4), as do cultural norms and religion. Approximately one-third of the world's population is now less than 14-years-old, and in the 48 least-developed countries, the population is projected to triple by midcentury (Population Media Center, www.populationmedia.org).

Figure 1-3 Population.

United States = 305,826,000
China = 1,336,317,000
India = 1,169,016,000

Data from WHO World Health Statistics, 2009 Illustration courtesy of Intermountain Healthcare.

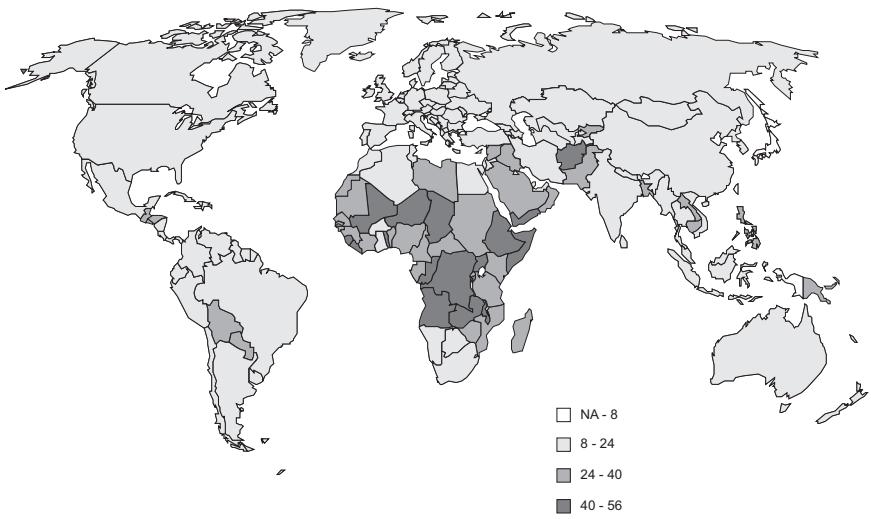

Figure 1-4 Birth Rate per 1,000 population.
The World Fact Book, 2009 (CIA, 2009). Illustration courtesy of Intermountain Healthcare.

Compared with Western European countries and the United States, where migration is likely to increase as a significant source of the healthcare workforce, the former Soviet Union is replete with personnel. However, surgeons suffer a different problem: political, organizational, and infrastructural support for surgery is so lacking that well-trained surgeons are unable to perform at optimal capacity (Rozenfeld, 1996).

In sub-Saharan Africa, doctors in general and surgeons in particular have always been in limited supply, and surgery is frequently performed by generalist doctors or nonphysicians. It has been noted by Massey Beveridge at the Bethune Roundtable on International Surgery (2006) that "to provide the same density of surgeons per capita in East Africa as in Canada would require training 42,000 surgeons."

Clearly, it is unlikely that resources will appear to train such a quantity of surgeons according to Halsted's recommendations at the turn of the last century (Halsted, 1904). The training for surgery is a lengthy process around the world. From country to country, there are few certification standards for what constitutes adequate didactic and practical training. The system for training a general surgeon in Mongolia will differ in many respects from training in Europe, which will, in turn, differ from training in the United States. Licensure and certification are also variably regulated.

A common pathway for training in most countries other than the United States follows the following course. After high school, a future surgeon will spend six years in medical school before qualifying for the MD degree. A year or two of general medical work follows, and in some countries, new doctors are dispatched as generalists to rural positions in district hospitals for their early medical experience. Subsequently, he or she may train in surgery for a variable length of time, but commonly at least three years. Surgical specialization may follow with an additional certificate or degree program. In some regions like Central America, surgical specialty training in pediatric surgery would follow a primary residency in pediatrics rather than in general surgery, as is done in the United States.

In contrast, the United States system dictates four years of college followed by years of medical school. Depending on surgical specialty, additional training requires five to eight years. Surgeons are typically in their early 30s at the completion of training. The American system has significant drawbacks in terms of filling consumer demand for surgery. As Phyllis Saltzman notes, "Compared to the global spread of surgical technology and procedure, educational changes travel at a much slower pace" (Saltzman, 2008, p.10.2). Furthermore,

> Across borders, surgical programs face similar barriers. These include limitations, coping with the dizzying speed of surgical technology and clinical procedure change, information management, time management, attracting best qualified candidates and correctly applying educational technology so it will positively affect educational and surgical outcomes (Saltzman, 2008, p.10.3).

Counterbalancing a desire for specialization, there is a growing recognition among trainees in wealthy countries of the real disparities in care and of the needs of poor countries for surgical care. In the United States, surgery departments are beginning to institute international and rural surgical rotations, and leadership in global surgery is recently evolving to consider how "circular migration," distance learning, and other forms of collaboration might support low- and middle-income countries (LMIC) for improved access.

RELATED MEDICAL FIELDS

Surgery is never a stand-alone specialty. As Halsted said in his address at Yale University in 1904, "Pain, haemorrhage, infection, the three great

evils which had always embittered the practice of surgery and checked its progress, were, in a moment, in a quarter of a century (1846–1873) robbed of their terrors" (p. 252). Anesthesia has become as integral to surgery as the surgeon, yet nurse anesthetists and MD anesthesiologists are in as painfully short supply as are surgeons, and they are perhaps even more subject to migration. Pathologists, with skills both in anatomic and molecular pathology, are similarly rare. Perhaps no discipline has altered the practice of surgery as profoundly in recent years as has radiology, since it is now possible to characterize injury, tumors, stones, and a host of other pathologies safely prior to undertaking a diagnostic or therapeutic surgical procedure. Yet the availability of such technology is limited in poor countries. Even in China, where the economy has recently boomed and the machines and technology can be purchased, doctors with adequate training in their use and in interpretation of results has lagged behind.

MIGRATION

Beyond the workforce migration and training issues that affect the availability of surgery are issues of local and national economies. The economic web of wealthy and developing countries is complex and interconnected. As part of the global economy, small communities in one part of the world may suffer from the effects of decisions made for unrelated reasons in another part of the world. Contracts between governments about unrelated debt repayment, for example, have ramifications at the local level, as salaries for government employees may be linked to budget constraints imposed by international lenders (Labonte and Schrecker, 2009).

As E. Parry noted, "While [many countries in the tropics] may spend over US$15 per head per year on repaying debts, they may have as little as $5 per head for all health services." Since most healthcare workers in low-income countries, including the surgeons and anesthetists, work for the government, their salaries are linked to the government economies. It is no wonder, then, that they look to improve their situations by migrating either within their borders or to other countries (Parry, 1999, p.329).

Migration, otherwise known as "brain drain," is a significant economic problem because home countries bear not only the cost of educating doctors and nurses but also the cost of their loss to regions with better economic opportunities (Dovlo, 2003). With 25% of the world's burden of disease, Africa has only 3% of the health workers and 1% of the

economic resources (Robinson and Clark, 2008). The "pull" factors of wealthy countries include aging populations, changes in working hours and conditions, and limited training opportunities. "Push" factors from home countries are low remuneration, poor working conditions and low job satisfaction, political and ethnic problems, and poor security and civil strife. The three countries recruiting the most foreign healthcare providers are the United Kingdom, the United States, and Canada, although with migration of healthcare personnel from South Africa to those countries and to Australia, more providers from resource-poor countries are considering moving to South Africa to fill the void. Into this mix is also an itinerant population of Cuban doctors who have been serving short-term (three-year) contracts in areas of healthcare gaps since 1960. These doctors have helped to fill voids where loss to migration has occurred.

The loss of human capital from developing countries has been quantified and has been estimated to be as high as US$3.6–5 billion in training an estimated 83,000 doctors emigrating from India between 1951 and 1996. Dovlo (2003) estimated that the United States, with 130,000 foreign medical graduates, has gained in excess of $26 billion in training costs saved. Updated data extending into the new millennium are certainly required, but it is clear that developed countries have benefitted disproportionately from the poor economic opportunities available to qualified doctors in LMICs.

At least as concerning as the current and projected shortages of doctors is the shortage of nurses, technicians, and other mid-level providers. In Ghana alone, the estimated vacancy rates for registered nurses increased from 26% in 1998 to 57% in 2002 (Dovlo, 2003). Up to 24% of Ghanaian trained nurses are currently working abroad, according to the International Organization for Migration (IOM) at its 2007 meeting, "Dialogue with the Diasporas: Setting an Agenda for Development" (Diene, 2007). As has been noted, the issue of the loss of human capital in terms of workforce may be counterbalanced by financial remittances and development.

> One of the most common obstacles identified in all dialogues is the scarcity of professional opportunities for African graduates, including PhD students and health workers, as well as the lack of adequate Research and Development opportunities at home. A strategy to mitigate the impact of this loss of skills was clearly outlined throughout the dialogues: it implies finding ways to facilitate the mobility of professional expatriates who all

> recognized the importance and value of various types of circular migration which could successfully achieve a transfer of skills to bolster capacities at home. These approaches have already been adopted in an ad-hoc fashion by some individuals and migrants' associations. The main challenge remains to unite all those informal initiatives into a comprehensive migration and development policy framework in home and host countries. (Diene, 2007)

Training of nurses and doctors for migration represents an opportunity that may be seen as a win–win situation or even an international economic or foreign policy for the Philippines and Cuba. The Philippines leads the world in training nurses with an original intention of migration, with greater than 10,000 work permits issued in 2002 (Dovlo, 2003).

While some believe that active recruitment of nurses and doctors from sub-Saharan Africa is wrong and could be viewed as a crime (Mills et al., 2008), it is unlikely that market forces will decrease. And it is recognized by the Global Health Workforce Alliance and the WHO that migration is actually a human right (Robinson and Clark, 2008). As discussed in Chapter 3, "Surgery and Health Care Resources," new incentives and investments in sustainability will need to be implemented to improve the attractiveness of the home environment and to retain workers when they might otherwise consider traveling. Figure 1-5 shows the global distribution of nurses and midwives.

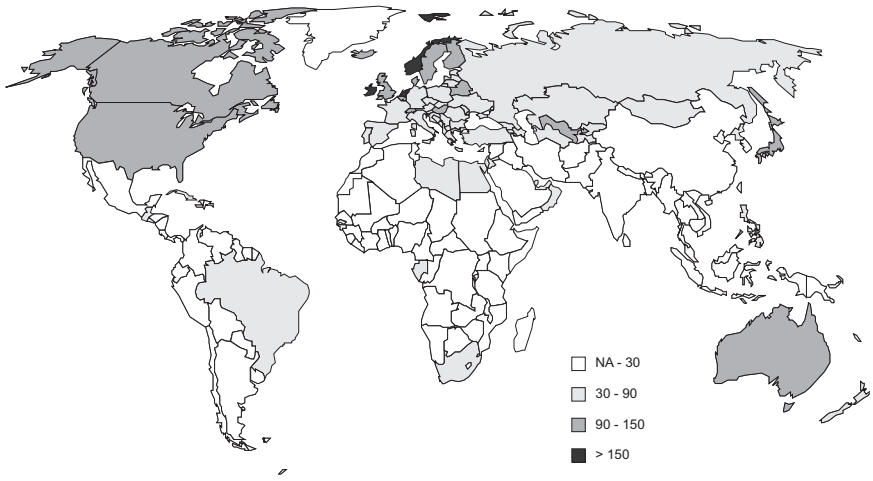

Figure 1-5 Nurses and Midwives, Density per 10,000 Population.
Data from WHO 2009 World Health Statistics. Illustration courtesy of Intermountain Healthcare.

TASK SHIFTING

Over the last 100 years, mass production of medications has alleviated pain in general, treated or prevented many communicable diseases, and brought cures for some types of cancer. Infectious diseases have, in many cases, become "rule-based" in their treatment or prevention, allowing cost-effective, community-centered initiatives. Vaccines can be given in schools, pharmacies, or workplaces. Algorithms for treatment are readily available and can be implemented in the community setting. Mass production of surgical systems, however, has not achieved similar economies of scale. Can surgery scale up by adopting these ideas? Certain surgical procedures have already become "rule-based."

Skilled nurses and physician assistants—otherwise known as advanced care providers (ACPs)—and assistant medical officers (AMOs) with advanced training are increasingly filling roles that physicians have historically occupied by assuming responsibility for systems management like trauma or intensive care, invasive procedures like placement of central catheters, anesthesia, and surgery (see Figure 1-6). In Mozambique, practitioners called *técnicos de cirurgia* perform many of the same functions. They perform a substantial majority of operations for obstetric care, such as caesarian

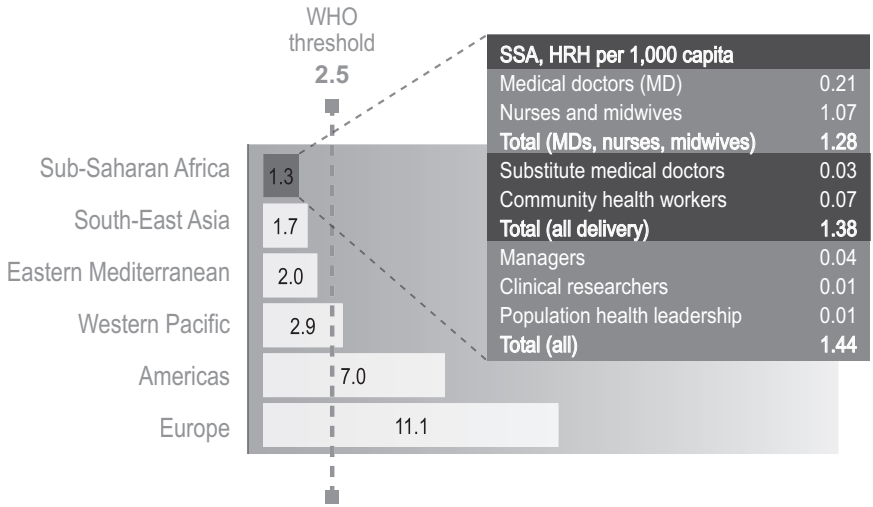

Figure 1-6 Medical Doctors, Nurses, and Midwives by WHO region, 2006.
Re-drawn from Fig A5.2 International Finance Corporation, Business of Health in Africa, 2009, by permission. Illustration courtesy of Intermountain Healthcare.

sections (Pereira et al., 2007). In Tanzania, AMOs trained in radiology comprise a significant portion of the radiographic personnel in district hospitals. The benefits to healthcare systems are the lower cost of training and salaries and the fact that these degrees are somewhat less portable than are those for doctors of medicine. Nurse practitioners, physician assistants, and assistant medical officers are more likely to stay within the country where they are trained, and they provide much of the care in rural clinics and hospitals.

Some suggested possibilities for modifying the current unwieldy educational system include starting training for surgery early—even as early as 18 years of age or younger. An analogy may be found in the world of sports, where the advent of video gaming and sports simulation has resulted in younger players entering professional life with a more sophisticated knowledge of strategy and team dynamics, reducing the "break-in" time on professional teams (see Chapter 4, "The Innovator's Scalpel: Remodeling Surgery for the Community"). Other possibilities include earlier tracking into surgical specialties and shortening the core curriculum, with additional modules offered at a post-graduate level to add qualifications and certification as systems and technologies change.

Consensus across borders and regions will also allow flexibility and reciprocity for service and training of surgeons. The gaping disparity in services between highly technical surgical subspecialists in the United States is staggering. Yet there are some promising developments afoot, with improvements in communications technology that may allow a higher degree of sharing information and resources across borders through distance learning. Perhaps surprisingly, even in sub-Saharan Africa, a significant portion of health care is provided by the private sector. This sector is presumably complementary to the public health sector, but this remains to be determined.

Box 1-2

CUBA'S INTERNATIONAL MEDICAL PROGRAMS

Cuba's international medical programs could be seen as major successes by any standard. Considering its own

(*continues*)

Box 1-2

relative lack of resources during the American Embargo and the "Special Period" after the withdrawal of Soviet support, the island nation was in serious financial distress. Yet, as a national priority and as foreign policy, Cuba has focused on health care as its global calling card. Its first overseas programs began in the 1960s, when medical teams were first sent to Chile after a severe earthquake. By the 1970s, there were approximately 1,400 medical personnel in sub-Saharan Africa, and by the late 1980s, there were 46,000. To date, more than 100,000 medical personnel have worked, primarily in service missions, in more than 100 countries, including the poorest countries in sub-Saharan Africa, Central America, South America, and the Caribbean. In 2009, 28,000 Cuban medical personnel, including 17,000 doctors, were serving abroad—more than all the Group of Eight (G8) nations combined under the Comprehensive Healthcare Delivery Program (CDHP) or Programa Integral de Salud. The doctors (of all specialties, but mostly primary care) work in rural areas and the slums of major cities, filling gaps in indigenous medical programs (Kirk and Erisman, 2009). The countries that host Cuban doctors are obligated to pay for their lodging, transportation, food, and a small stipend. But from a cost-efficiency point of view, Cuban rotating doctors are an efficient way for many low-income countries to fill vacancies, especially when their own doctors migrate to other countries. The Cuban government has assisted in building and developing more than ten medical schools in Africa and Haiti and also offers scholarships for foreign nationals to train at the Medical School of the Americas. Cuba continues to provide short-term disaster relief and has been on the scene as recently as the 2010 earthquakes in Haiti and Chile. By many reports, their coordinated and sustained approach was superior to that of many wealthier countries that also sent support teams. Cuba has recently also been developing

Box 1-2

trilateral programs that include Japan—for example, a vaccine program for Haiti.

From the surgical point of view, Cuban doctors serve mostly as clinicians rather than academics, and in that sense they are not part of a long-term, sustainable effort for building capacity in the local healthcare system. General surgeons and specialists are found in most African countries. However, from the global-health point of view, the embargo has severely limited Americans from interacting with Cubans, and many policy and priority statements are made by international experts without Cuban input. From the philosophical point of view, the idea of privatizing much of African health care by the IFC is directly at odds with the Cuban approach, wherein all doctors work in government-supported hospitals and healthcare systems, and there is no significant opportunity for private practice.

CONCLUSION

Surgery has been addressed as an issue of human rights and as an issue of economic advancement. It has been called "the neglected stepchild of public health" (Farmer and Kim, 2008). As a model or paradigm for global public health, surgery as an interlocking group of fields highlights the potential for the noblest uses of evolving technologies. Using current technology and "disruptive" systems borrowed from business, we can begin to re-think how to better use our surgical skills where they are most needed, while maintaining the satisfaction and remuneration necessary to retain a vibrant workforce. Telecommunication has advanced to the point where people everywhere can talk in real time. And yet surgery, hardly more complex in its elements, is thought to be too costly, despite the evidence, for the world's poor. We must take a critical look, then we must determine where we might change these misperceptions, and then we must employ new developments in technology, disruptive technology to change the tide.

STUDY QUESTIONS

1. How is a "surgical condition" different from a surgical operation or disease?
2. The practice of surgery requires the collaboration of many interlocking medical specialties. In what ways do they support each other?
3. How is technology a driving factor in development and delivery of surgery?
4. The migration of healthcare providers is often cited as an ethical problem in public health. In your opinion, should migration be discouraged? Compensated for by recruiting governments? Free choice of the providers?
5. Comparing the current population, the birth rate, and the number of doctors and nurses in different regions, discuss possible solutions to disparities in care.

FOR DISCUSSION

Discuss the surgical workforce and alternatives to the traditional surgeon. Think about who is available and who can be taught "outside the box." What are the possibilities for volunteer, university, and cross-national collaborations?

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