
Global Surgery and Public Health

A New Paradigm

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Production Credits

Publisher: Michael Brown
Associate Editor: Catie Heverling
Editorial Assistant: Teresa Reilly
Associate Production Editor: Kate Stein
Senior Marketing Manager: Sophie Fleck
Manufacturing and Inventory Control Supervisor: Amy Bacus
Composition: Element, LLC
Art: diacriTech
Cover Design: Kate Ternullo
Cover Images: Top: Courtesy of James H. Kenney, Jr.; Bottom: © Neo Edmund/Shutterstock, Inc.
Printing and Binding: Malloy, Inc.
Cover Printing: Malloy, Inc.

Library of Congress Cataloging-in-Publication Data

deVries, Catherine R.

Global surgery and public health : a new paradigm / Catherine R. deVries, Raymond R. Price.
p. ; cm.

Includes bibliographical references and index.

ISBN-13: 978-0-7637-8048-7 (pbk.)

ISBN-10: 0-7637-8048-0 (pbk.)

1. Surgery—Developing countries. 2. World health. 3. Health services accessibility. I. Price, Raymond R. II. Title.

[DNLM: 1. General Surgery—economics. 2. Health Policy. 3. Health Services Accessibility.

4. Public Health Practice. 5. World Health. WO 100 D514g 2012]

RD27.44.D44D48 2012

362.197—dc22

2010023512

6048

Printed in the United States of America

14 13 12 11 10 9 8 7 6 5 4 3 2 1

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Foreword

Physicians trained in internal medicine and infectious disease have long contributed to developing the field of global health, primarily in response to communicable diseases such as AIDS, tuberculosis, and malaria; indeed, the roots of this emerging field are to be found in colonial medicine's attempts to control epidemic diseases like yellow fever, which slowed trade and halted projects such as the Panama Canal. Surgeons have traditionally taken a different approach—or been absent altogether—in resource-poor countries. Often their interventions have been labeled “parachute missions”: providing significant and much-needed surgical care, but not lasting long enough to build local capacity or create sustainable programs. Although some would argue that short-term surgical missions are more effective than other short-term medical missions, it would be hard to contend that such an approach alone leads to a decrease in the staggering burden of surgical disease borne by the world's poor.

In response to this perceived lack of long-term, locally run surgical programs, Drs. Catherine R. deVries and Raymond R. Price define a new model for surgeons' role in and commitment to the global health movement in *Global Surgery and Public Health: A New Paradigm*. The authors are not just scholars, but also compassionate surgeons personally building “sustainable capacity”—i.e., training local surgeons and medical professionals—in surgical programs around the world. They have spent a great many years optimizing the implementation of surgical care and public health interventions in resource-poor settings. With deVries as the founder of IVU*med*—an inspiring example of a sustainable surgical initiative and educational model—and both Price and deVries having worked with many organizations around the world, they have developed partnerships between clinics in resource-poor countries and surgeons and academic medical centers in the United States.

This, in our view, is precisely what is needed to move surgery into its proper role as a cornerstone of global public health rather than, as we have

argued elsewhere, its neglected stepchild.¹ To make the point without mixing metaphors: almost 345,000 women die each year in childbirth²; almost all of them live in poverty and, for that majority with obstructed labor or hemorrhages, these women die from lack of surgical intervention. Programs such as *IVUmed* are inspiring and educational, but we owe an even greater debt to deVries and Price because they have documented successes and failures. This text is the culmination of their field experience. They summarize the collaborative effort among those interested in public health and surgery, and set the stage for the study and practice of the growing field of global surgery. They identify major needs for integrating surgery and public health, including an improved understanding of the burden of surgical disease, recognition that surgery has a preventive role, and acknowledgment that providing surgical care can be cost-effective. These are the key challenges before us, and the key debates.

The authors begin by exploring the need to understand and define the burden of surgical disease in order to establish parameters for the global response. Thanks in part to successful national and global public health programs (and in part to broader, if uneven, economic trends), deVries and Price predict a changing demographic with decreases in global deaths from communicable causes (acute respiratory infections, AIDS, malaria) and concomitant and significant increases in deaths due to noncommunicable causes (cancer, cardiac and vascular disease, trauma, and birth defects). They correctly place surgical disease within more commonly discussed issues in public health, highlighting surgical conditions such as spina bifida, which can be prevented through public health interventions of folic acid supplementation, and deaths from trauma, which worldwide now equal deaths from AIDS, malaria, and tuberculosis combined. They also point out that we will see rising rates of surgical disease related to an aging world population.

Whether demand and need will ever come together is explored in the following chapters, in which deVries and Price describe the inequity in the distribution of health workers and surgeons and offer some solutions. They remind readers that public health needs and surgical conditions are variable within geographic regions, and that estimating burden requires reporting

¹ Farmer, P. E., & Kim, J. Y. (2008). Surgery and global health: A view from beyond the OR. *World Journal of Surgery*, 32(4), 533–536.

² Hogan, M. C., Foreman, K. J., & Naghavi, M., et al. (2010). Maternal mortality for 181 countries, 1980–2008: A systematic analysis of progress towards Millennium Development Goal 5. *Lancet*, 375(9726), 1609–1623.

capacity, which in turn requires partnerships with local providers. As is the case with most medical conditions, the poorest regions of the world have the largest surgical-disease burden and the fewest providers, and these providers perform a disproportionately low number of operations. (In the rural reaches of the poorest parts of the world, there are no operations performed at all.) Adding to the difficulty in establishing surgical programs in resource-poor settings is the fact that surgeons are not the only medical personnel required to provide surgical care: teams also rely on the help of nurses, radiologists, pathologists, and anesthesiologists, and these professionals are also in short supply in the areas in which they are most needed. To address this, the authors discuss “task shifting” as a cost-effective, community-centered initiative. Already, nurse practitioners, advanced care providers, and assistant medical officers are described as providers of a substantial majority of cesarean sections and much of the surgical care in many rural clinics and hospitals; this trend should be promoted and developed even as the slower process of training surgeons and building better infrastructure is pursued.

Employing community-based healthcare workers (CHWs) has proven to be an effective way of providing much of the care related to infectious diseases. At Partners In Health sites in Haiti, for example, more than 4,000 *accompagnateurs* visit patients daily, administer medications and monitor for complications or adverse reactions, answer questions about medical conditions, and help patients seek medical care as necessary. Critically, *accompagnateurs* also help to address patients’ socioeconomic needs, helping them and their families access education, employment, and community support.

This same model can be used worldwide as an economical means of task shifting for surgical care. Educational programs to train nurse anesthetists, nurse’s aides, and radiology technicians are equally vital to building local surgical capacity. *Accompagnateurs* can be trained to diagnose surgical diseases, estimate surgical burden, provide wound care, and partner with surgeons to implement surgical care tailored to local public health needs. In this manner, villages and small towns are linked to health centers, and health centers are linked to district hospitals with more advanced surgical capacity. These ideas are not new, but their implementation in poor and rural areas eludes us still.

A great strength of both this book and deVries and Price’s international work is that they recognize the key need for cross-border education. In Chapter 6, the authors discuss the evolving global surgery ecosystem and the contribution of twinning educational models. Academic medical centers in the United States and other developed countries have the resources

and experience to provide long-term partnerships and help educate surgical care personnel in resource-poor settings. Collaboration, ranging from access to online libraries and medical journals to a formal exchange of surgeons and students, will facilitate education as well as *access to acceptable, appropriate, available, and affordable* surgical care—basic concepts of surgical initiatives laid out by deVries and Price in Chapter 2. These strategies have been successfully applied worldwide by organizations focusing on cataracts, cleft lip and palate, urological disorders, and vesico-vaginal fistulae. As global health programs have grown in scale and popularity, surgeons from around the world have donated time, skills, and equipment while working closely with local surgeons and communities to develop ongoing surgical care programs. Most impressive is Cuba's role in developing global health programs and prioritizing health care as a human right. We applaud the authors' recognition of the Cuban government's commitment to "filling gaps" in poor countries worldwide; in our own work to develop our surgical program in Haiti, we have relied on Cuban anesthesiologists, surgeons, and primary care doctors and know well the immense commitment of that country to the poorest of the poor.

deVries and Price posit that global surgery may have been neglected because it does not neatly fall into a demographic category. It is also usually perceived as costly to patients and to health systems. We submit that much surgery should fall under primary care and, as noted, under women's health, and it is increasingly becoming recognized as a critical area of intervention. Maternal mortality due to obstetric emergencies, for example, continues to be a major source of lost life and can be prevented with access to surgical care. Infant outcomes and maternal disability, such as vesico-vaginal fistulae, can also be improved with surgical care access during childbirth. And if we are to reach the United Nations Development Goal of reducing the maternal mortality ratio by three quarters by 2015, then we must train providers and make available the necessary surgical therapy for pregnant women. To succeed, we must avoid the temptation—common enough in global public health—to set one pathology against another in the quest for resources. Advocating for improved access to women's health services—from family planning to vaccination against HPV to prenatal and perinatal care—should include basic surgical services. Including access to surgical care as an advocacy point in the global movements for primary health care and maternal and child health is a natural, and critical, step if we are to build truly comprehensive systems of care.

Health care, including surgical care, is of course critical to public health. For those interested in promoting access to basic health care as a human

right, surgical care can no longer be excluded from essential healthcare services. As with communicable diseases, this requires a substantial investment. Unfortunately, as the authors note, financial aid targeted for increasing surgical capacity is negligible. Foundations and designated funds have not been available for surgical care as they have been for other diseases. The authors also note that surgery is often viewed as “too costly, despite the evidence, for the world’s poor.” As deVries and Price explain using disability adjusted life years (DALYs)—the years of productive life lost due to disability added to the potential years of life lost due to premature death—this is not the case. Comparing the expected DALYs without surgical intervention to the DALYs averted as a result of intervention helps dispel the myth that these interventions are not cost-effective. At \$33–38/DALY averted, basic surgical care in the district hospital is in fact highly cost-effective as well as comparable to supported public health interventions such as measles vaccination (\$5/DALY averted) and antiretroviral therapy for HIV (\$300–500/DALY averted).

Claims that providing surgical care is not cost-effective serve only to halt conversations about how to bring down costs and create new technologies. Thus, surgeons must pledge to be involved in raising money for service and research and continue to demonstrate that safe, effective surgical care can indeed be cost-effective, especially in those settings where it has been largely unavailable. Donor agencies will require health metrics and quality outcomes data to make decisions about their investments. In both poor and wealthy countries, we must move away from rigid adherence to strict “fee-for-service” models, since they often lead to inequitable access to essential care, and advance models based on performance and outcomes of cost-effective treatments.

Surgical care does not have to be expensive to be both safe and effective—tenets of surgery in both resource-poor and resource-rich settings. Although some surgical care services are expensive, costs of consumables can be driven down just as they were for therapies for AIDS and tuberculosis. For example, deVries and Price discuss a creative and much less expensive polyester mosquito-net mesh as an alternative to the costly hernia mesh used in the United States. Intraocular lenses for cataract surgery are now mass produced in a developing country—Nepal—for a fraction of their cost elsewhere. Handheld ultrasound devices have also proven to be a rapid and reliable imaging system to diagnose surgical disease and, when coupled with internet or teleconferencing, open the door to worldwide collaboration and

consultation with surgical specialists. Economies of scale and the development of international financing mechanisms, such as a Global Fund for Surgery, would further reduce unit costs—and halt sterile debates. Such innovations, adaptations, disruptive technologies, and policies will help make effective surgical care both available and affordable in the poorest areas of the world.

Improvement in population health also requires prevention of surgical pathology. The authors highlight primary, secondary, and tertiary public health prevention strategies as they apply not only to infectious but also to surgical diseases. Trauma and traffic accidents, for example, are emphasized as a major public health problem with significant, but sometimes preventable, injury and death. Public health prevention strategies will include road design and speed limits, use of restraints, availability of basic trauma care, and specialty surgical care when necessary. The need for surgical care for injuries from trauma is also known to reach alarming levels following disasters.

We recently faced one such unforeseen event. At 4:53 pm on January 12, 2010, a massive earthquake struck just outside Haiti's capital city, Port-au-Prince. More than 222,000 people were killed, and another 300,000 were injured. The healthcare infrastructure in the capital city was destroyed just as need for surgical care reached an extraordinary level. Fortunately, a few hospitals in Haiti's outlying rural areas had made an investment in surgical care. It was only because of this infrastructure, which was largely intact after the earthquake, that surgical teams were able to respond immediately while operating rooms in Port-au-Prince were still incapacitated.³ It was not until 8 days after the quake that the USNS Comfort arrived, which meant that Haiti's best hospital was floating in the Bay of Port-au-Prince. But Haiti's best hospital needs to be firmly rooted in Haitian soil. The earthquake reminded us that we cannot be satisfied with a continuing lack of access to surgical care worldwide. If we are to achieve global improvement in public health, then we must also make surgical care accessible with an investment in sustainable surgical infrastructure and education.

While interest in global health is variable, needs are universal. Those trained in internal medicine and infectious disease have blazed trails in

³ Kidder, T. (2010). Recovering from disaster: Partners in Health and the Haitian earthquake. *New England Journal of Medicine*, 362(9), 769–772; Sullivan, S. R.; Taylor, H. O. B., Puyo, T., & Steer, M. L. (2010). Surgeons' dispatch from Cange, Haiti. *New England Journal of Medicine*, 362(7), e19.

global health, primarily in response to diseases such as AIDS, tuberculosis, and malaria, but also to smallpox, polio, SARS, and intestinal parasites. Through decades of hard work and collaboration with local caregivers, the physical infrastructure, supply chain management, and patient populations have grown at medical care clinics around the world. Meanwhile, interest in global health has been slower to penetrate the surgical community. Surgical care remains largely neglected in global public health plans despite clear evidence of a massive surgical disease burden and cost-effective interventions. Drs. Catherine deVries and Raymond Price are leading a growing movement of surgeons who do not wish to blaze a trail of their own, but rather hope to effectively and efficiently build upon existing infrastructure. Now that the movement has started and energy is building around these issues, more and more surgeons are interested in practicing global health. Drs. deVries and Price have raised the cavalry horn with this book, and are letting the public health community know: surgeons have been called to action.

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Introduction

One Sunday morning, everything changed.

On a rainy rural road in southern Vietnam, a bus hit our van head on. Aboard were a dozen surgeons, anesthesiologists, and nurses; the team was shattered. Multinational, multidisciplinary, and multilingual, we shared singular focus—a commitment to bring surgical care to the needy children of Vietnam.

In 1996, South Vietnam had been isolated from Western influence, education, and technology for over 20 years. During that time, the population of more than 6 million depended upon a rudimentary medical infrastructure and workforce. Many medical professionals had spent long years in re-education camps; their once fluent English or French now rusty at best; their medical skills dormant. But their professionalism and national pride were unscathed and propelled them forward.

After working together for three years, on that fateful morning, our team felt like we were just beginning to hit our stride. We were on our way to tour the Cao Dai Temple, home of an indigenous Vietnamese religion. In the crash, 12 team members were critically injured—and survived. But we were all transformed. In that moment, commitment deepened, resolve was steeled, focus sharpened, and hopeful determination was set. Fourteen years after that crash, we find ourselves on a road to a richer destination than was originally envisioned . . .

This book is about surgery and public health. It is about how surgical interventions can transform individuals and communities even in countries with limited resources. While surgery is viewed by many in the field of public health as too expensive, surgical interventions have always been a part of medicine for treating infections, fractures, burns, or congenital defects. In these chapters we consider how rethinking technology, engineering, and health systems can produce affordable surgical care even in rural settings and in impoverished countries. We review the global climate of collaboration among public sector, nongovernment organizations, and academics to explore how such collaborations can benefit people at all levels of society. And finally, we argue in favor of innovations in surgical delivery—even in wealthy countries—to bring down the costs for individuals and society.

Recent experiences with natural disasters—such as earthquakes in China, Pakistan, and Haiti—highlight the necessity for emergency surgical planning and delivery for critically injured patients, sometimes on a massive scale. Many people die or are disabled for life due to a lack of surgical planning or availability when simple measures could have significantly decreased morbidity and mortality. Surgical treatment has the capacity to save lives not only by removing or repairing damaged tissue, but also by preventing overwhelming infection and shock. Trauma surgery is equally applicable in natural disasters and in human conflict. With the globalization of the media and real-time delivery of news, the globalization of healthcare has also entered the spotlight. In these urgent situations, surgeons play significant roles. The World Health Organization has recognized the need for essential, safe, and emergency surgery globally, and in 2005 it established the Global Initiative for Emergency and Essential Surgical Care (GIEESC, 2005). In the last decade there has also been new interest in global surgery at the policy level. Already recognized as a major public health problem, traffic accidents have been recognized as a significant risk factor for injury and death, especially in poor countries.

On the other hand, even more people are disabled by chronic communicable and noncommunicable diseases, and the treatment of many of these involves surgery. In tropical climates, a spectrum of historically neglected infectious diseases requires surgical intervention for the control of morbidity. For example, infection by the lymphatic filariasis parasite *Wuchereria bancrofti* affects up to 120 million people, mostly in India and sub-Saharan Africa. Of these, 25 million men suffer from manifestations of the disease (WHO, 2009). For these men, medical therapy alone will not treat the physically crippling and psychologically devastating problems of hydrocele or “filarocele.” While it is hoped that mass drug administration (MDA) for populations at risk will ultimately eradicate this disease, surgical management remains the best form of rehabilitation for these mostly poor patients. In the district hospital, surgery can be less expensive than medical treatments for other chronic diseases, and recently, the “neglected tropical diseases” have received greater attention than in previous years. Still, little funding has been available for surgery to help the patients suffering from such debilitating diseases.

With improvements in the economies of many low- and middle-income countries (LMICs), some communicable diseases have been

controlled and others are better managed. However, millions of people now have another problem—noncommunicable diseases such as diabetes and cancer. The surgical aspects of these diseases cannot be ignored by local, national, or global health care.

Too many policy makers believe that quality surgical care is attainable only when resources for medical treatment are plentiful. Yet this argument does not hold up when the relative costs of other forms of health care are considered. To begin with, fixed costs of surgical equipment and instruments are often nonrecurring; therefore, it is critical to partition the start-up and maintenance costs of surgical units separately from those of large general hospitals in order to gain a more accurate assessment of the cost of surgery in low-resource settings. Nondisposable instruments, sturdy monitors, and anesthesia equipment have proven to remain durable and serviceable for a quarter of a century or more.* And while surgical equipment such as diathermy (cautery) machines—now available for US\$1,000 or less—have been considered too costly for rural hospitals by public health policy makers, other medical treatments such as antibiotics for resistant tuberculosis and antiretroviral therapy for HIV/AIDS have historically cost even more. Additionally, innovative approaches such as mobile operating theaters on river boats and outreach services such as those provided by the African Medical Research Foundation (AMREF) bring the technologies of telemedicine together with rotating teams of outreach surgeons to serve the needs of rural communities. Experience has shown that international pressure can bring the cost of treatment down to better align with public health objectives of population-based medicine. Such pressure could also be brought to bear on surgery.

While the approach to surgical care in wealthy countries like the United States is based on a resource-intensive model that cannot be replicated globally, innovations in surgical technology and delivery could allow surgery to become a tactical public health resource that is utilized for the betterment of people in communities everywhere.

This book discusses innovative strategies that can guide us to implement surgical care in a way that makes it broadly available, resource

*In Danang, even 25 years after the end of the U.S./Vietnam conflict, the Danang General Hospital was using instruments, ventilators, and other surgical equipment left after the departure of the U.S. Army. This fact speaks to the longevity of quality equipment and the fact that with ingenuity, surgery and surgical instrumentation need not be as expensive as it is in our current system that uses largely disposable supplies.

appropriate, and an integral part of locally tailored public health initiatives. We provide an overview of the state of surgery around the world with a brief review of the historical dynamics that have brought this type of medical care to its current status. We outline principles adapted from the worlds of business and engineering for innovative development such as “leap-frog technology” and disruptive interventions that provide a foundation for developing a new strategic approach for the emerging field of global surgery. Finally, we offer suggestions for developing and implementing locally appropriate surgical healthcare in the context of community health, including case studies illustrating successes and demonstrating how health issues can benefit from these approaches.

Chapter 1 addresses the current state of global surgical care and how it developed. Although surgical treatment of certain problems has existed throughout history, surgery as an elite discipline within the medical community has only existed in its current form for less than a century. For most of history prior to the availability of anesthetic agents and aseptic technique, it was a specialty held in low esteem. Outcomes only began to improve when the need for extreme haste to prevent bleeding and prolonged pain had been tamed by anesthesia, and when surgeons could perform more careful, safer, and better operations. In its current trajectory, surgery is increasingly reliant on other highly technical medical fields such as radiology, pathology, and anesthesiology for diagnosis, surgical monitoring, and safety. It also depends on an industry that has grown to support and also drive the progress of surgery toward more minimally invasive techniques and even toward new medical interventions that supplant the need for surgery altogether.

As in “disruptive models” in business and technology, access to surgical innovations is typically limited to wealthier patients in urban areas of wealthier countries, at least at the outset (Christensen, Grossman, & Hwang, 2009). Indeed, disparities in surgical health care, are, in part, caused by advancing technology and the destabilizing forces of globalization. Conversely, these very advances—like the mobile phone—have the capacity to alleviate disparities by decreasing dependence on the expensive infrastructure that is only available in cities, allowing for communication and sharing of resources more equitably across the world.

By bringing the methods of public health to the delivery of surgical care, we can begin to examine the strengths and weaknesses in the

delivery of surgical care in the community. For example, in order to allocate resources and to formulate balanced policies for resource allocation, we must understand the magnitude of surgical problems. In the United States, the burden of surgical disease can be estimated based on current utilization of resources since, in all hospitals, doctors' offices, and other medical settings, diagnoses and treatments are coded in fine detail. These codes form the basis of payment and of analysis of the burden of disease in developed countries where they are kept. However, in low- and middle-income countries, and even in some wealthier countries, coding is not uniform, and recordkeeping is not standardized. One of the fundamental challenges in addressing disparities in health care is to quantify and to qualify these differences and to interpret this data in light of the global burden of disease.

As has been clear from economic studies, poverty and disease are intimately related. Not only are the poor at greater risk for acquiring diseases of all types, but disease can create poverty by robbing individuals, families, and communities of the resources necessary for food, housing, education, work, and other basic societal functions. Preventing and mitigating disability contributes to a community's resources by keeping families as productive as possible. The role of surgery is critical to improving the sustainable economies of families and the community.

And finally, to care for surgical disease, we need surgeons. Training a general surgeon to the standards advocated by Halsted (Halsted, 1904) for elite academic professors is a lengthy and expensive process. The costs for training surgeons in both wealthy and impoverished countries are great. Throughout the world, the demand for surgeons is accelerating at a rate greater than surgeons can be trained in the current system. Laws and residency training regulations constrain many aspects of the learning environment, which are therefore relatively inflexible. Changing any aspect of surgical training—whether it be the number of surgeons trained at an academic center, the years of training, the types of index cases required, etc.—can be ponderously slow. And yet, we see increasingly strident calls for more surgeons in the developed world. Surgeons themselves are aging along with the population, and systems have not developed the flexibility to address the increased demand.

In developed countries, the burden of surgical disease expands not just with the increasing age of patients, but with the increasing medical

burden of prosperity— obesity, metabolic syndrome, and their related ills. Workforce issues are therefore tightly linked to healthcare economics. A new paradigm is needed to provide quality care for patients at a cost that can be born by society and by engaging with advanced care providers such as specially trained physician assistants and nurse practitioners. The training of surgeons and the provision of much surgical care in low-resource countries has relied to a great extent on the faith-based and humanitarian communities to fill the gaps related to surgery in public health. Yet, this is not a sustainable solution in the long term, although it is laudable and valuable as a transitional step.

Since Learmonth's 1949 seminal monograph on surgery as preventive public health, surgery is again being considered preventive in the public health context, as in the prevention of HIV/AIDS. Circumcision appears to diminish the rate of transmission of HIV/AIDS in the heterosexual population in countries where it is highly prevalent in conjunction with education and community outreach (Siegfried, Muller, Deeks, & Volmink, 2009). With advanced economies, the ecosystem of surgery and the practices of surgeons become ever more specialized. Paradoxically, with these levels of specialization, the need for highly skilled surgeons may actually be changing. We are at a point now in most industrialized countries where specialization has partitioned surgery into such small pieces that much of it could be done competently by specially trained doctors (who are not fully certified surgeons) or by

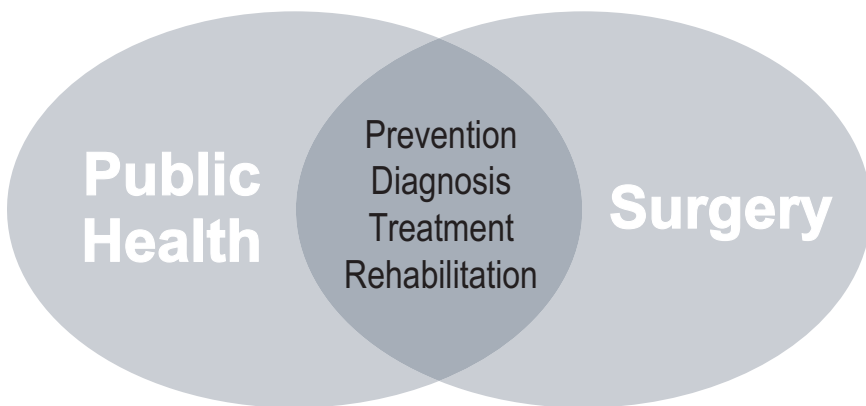


Figure Intro-1 Overlap Between Surgery and Public Health

Illustration courtesy of Intermountain Healthcare.

skilled technicians or nurses. This has been amply demonstrated by the Shouldice Clinic for hernia surgery in Ontario, Canada (Christensen, Grossman, & Hwang, 2009; Gawande, 2002). We are now at a crossroad where the expense of certain surgical operations and the current hospital ecosystem may not be sustainable even in the developed world.

The old argument that surgery is too expensive for the developing world may now be true for certain healthcare systems in the wealthier, developed world. The energy economy may ultimately begin to impact health care and the more technically driven fields, like surgery and radiology. Our current hospital infrastructure is so reliant on a functioning electrical grid and on other complex components that we risk major damage to service in the case of natural disaster. A backup system with efficient, lower-cost technology would serve us well for mobile disaster preparedness as well as rural treatment centers. As we have seen with recent geological and meteorological activities, any major natural disaster such as a hurricane or major earthquake can destroy healthcare systems whether they be in developing or developed countries. Mobile surgical units have long been used by the military overseas, but they are insufficiently stocked for domestic use in the United States. Additionally, the trend toward disposable instruments and supplies leads to expensive waste, with little gain, except to the manufacturers of these supplies. We must seek innovations to disrupt the current high-cost system to make surgery affordable, accessible, acceptable, and available. Disruptive innovation is an approach to making technology both cheaper and better. In surgery, we have both the opportunity and the obligation to engage these concepts and to reimagine surgical technology, education, and provision of service to patients.

The practice of surgery has traditionally been thought of as a one-to-one relationship between a patient and a surgeon. As Learmonth astutely noted, this unique relationship can advance innovation in ways not possible at an institutional level. Yet the surgical environment is a complex ecosystem, involving networks of people with complementary skills. Nurses and doctors typically do not share the same incentives and rewards, and even among surgeons, specialists from each discipline maintain their own territories. In wealthy countries, this ecosystem is particularly specialized, with relatively little overlap in skill sets. In resource-limited settings, an operating room (or theater) can be as simple as a treatment area or a mobile van, a few instruments and dressings, a doctor or medical officer with appropriate training, and perhaps a nurse.

The mobile phone has dramatically altered medical and surgical care around the world. Telephone lines, once prohibitively expensive in Africa, for example, have been made obsolete by the advent of the cell phone. The Internet has allowed real-time surgical consultations across continents, for free. This type of revolutionizing technology, known as disruptive technology (Christensen, 1997) is also being applied to the hands-on practice of surgery. For example, laparoscopy and the video cameras and monitors that support it are rendering minimally invasive surgery inexpensive and useful in facilitating mobile clinics away from expensive general hospital settings.

In the following chapters we will look toward solutions for developing equity in surgical care in communities around the world by considering the healthcare systems, technical innovations, and surgical providers. Our colleagues in Africa, Asia, Europe, Central, South and North America, and Australia all have much to contribute. In the global economy, worldwide dialogue and global solutions will allow us to better share our technological and intellectual resources for the better health of families and communities. This book is an initial effort to draw the communities of surgery and public health together beyond working groups and to engage students and practitioners in the discussion. The emerging literature of surgery and public health, not even a decade old, is growing rapidly. In the near future, we may hope to build strong partnerships and alliances for sharing surgical resources and knowledge across borders and continents to serve patients in need.

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Acknowledgments

Rather than a simple collaboration between two colleagues, this book actually represents a collaboration among families, friends, students, and mentors, and many others who have taught us and allowed us the freedom to travel and to learn. Our fathers, Pieter A. deVries and Richard R. Price, both surgeons, showed us by example the joy and commitment that a career in surgery requires. Ray, his wife Anne, and their children have participated together on various humanitarian trips. Catherine's children and a revolving home team held down the fort except on occasional trips overseas. In recent years, her husband Scott has kept the ranch and homework going during her absences. The logistics of maintaining surgical practices and family life have required the gracious support of our medical partners and the encouragement of our patients.

Catherine R. deVries

There are a many people whose direct influence and contributions have been critical to our work. Dr. Hulda "Jo" Thelander, who traveled the world after training in pediatrics in the early 1920s, was my pediatrician and early inspiration. Dr. Donald Laub, a professor at Stanford and Founder of Interplast, mentored me in global reconstructive urology. And Dr. David Addiss, formerly of the CDC, introduced me to the complexities of the dialogue between the worlds of surgery and public health. My colleagues overseas have graciously taught me about what it means to be a surgeon, especially under adverse conditions, anywhere in the world.

Raymond R. Price

Watching my father stop and voluntarily deliver emergency care at the scene of accidents while we were on our family vacations and the tenacious endeavors of my mother, Lynn Price, to right the many social wrongs in our society helped to instill within me a passion to find sustainable solutions to provide surgical care throughout the world. The unwavering support of my dear wife and her constant care of our large family

has made this work possible, and continues to deepen my love for her. Charles Swanson, CEO of the Swanson Family Foundation, provided me with the vision, resources, and support to explore the possibilities of developing advanced surgical care in resource-poor areas while Carolyn Dailey, president of Ascend Alliance, introduced me to the intricacies and challenges as well as the possibility of designing appropriate solutions for the most resources constrained areas. The vision of Dr. Sergelen Orgoi, chief of surgery at the Health Science University of Mongolia, and Dr. Lkhagvaa Byadran, medical director at Songdo Hospital in Ulaanbataar, Mongolia, of expanding advanced surgical care in their country taught me the importance of listening to the voice of the local community. However, it was Dr. Ron Lett, founder of the Canadian Network for International Surgery (CNIS), Dr. Haile Debas, Executive Director for the UCSF Global Health Sciences, and Meena Cherian, head of the World Health Organizations Global Initiative for Emergency and Essential Surgical Care (GIEESC) who expanded my vision to the glaring disparities in surgical care worldwide and introduced me to the public health benefits of surgical care and its role for advancing health care globally. And finally, Dr. Edgar Rodas, previous Minister of Health of Ecuador and founder of the Cinterandes Foundation has inspired me that all things are possible. Through his life-long example of searching for and providing ways to improve the lives of the people throughout Ecuador by combining surgery and basic medical health programs in socially acceptable ways he has improved the overall public health in even the most remote communities.

Catherine R. deVries and Raymond R. Price

We would like to thank the following people for their assistance with writing the book. Jenna S. Rosenberg and Marguerite H. Roberts were an integral part of the production team and kept us on task. Dr. Steve Alder provided a home in public health and helped with early conceptualization of the book, and cotaught our course on surgery and public health at the University of Utah. The team at IVU*med* and Aaron Rosenberg read drafts, and Drs. Kathleen Casey, Geoff Tabin, and Mike Feilmeier made important editorial suggestions. Jill Rhead remained cheerful throughout our many attempts to graphically depict what we were trying to say. Permission for adaptation of art was also kindly granted by the International Finance

Corporation (IFC), the Global Flour Initiative, the Institute for Health Metrics and Evaluation, Paul Godfrey, Dr. Edgar Rodas, the Global Energy Network Institute, Design that Matters, Dr. G. Priuli, Dr. Geoffrey Tabin, Dr. Bruce Steffes and the Pan-African Association of Christian Surgeons (PAACS), Operation Smile, and Dr. Dan Egan.

Drs. Max Parkin, Leslie Akporiaye, Harlan Muntz, Mark Litwin, and Mahmood M. Quereshi were most helpful with comments and suggestions. Dr. Kelly McQueen has done a remarkable job of bringing together the community of surgeons, anesthesiologists, and gynecologists for advocacy and research in the Global Burden of Surgical Disease Working Group, recently changed to the Alliance for Surgical and Anesthesia Presence (ASAP-Today).

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Dr. Catherine R. deVries is a Clinical Professor of Surgery and Public Health at the University of Utah School of Medicine. A graduate of Harvard University, she holds a master's in pathology from Duke University and an MD from Stanford University. She trained in urology at Stanford University with fellowships in Pediatric Urology at University of California, San Diego and executive leadership in academic medicine (ELAM) at Drexel University.

She began working in global urological surgery in 1992 and founded International Volunteers in Urology (now *IVUmed*) in 1994. She continues as President of the Board. *IVUmed* is dedicated to urological education worldwide and focuses on training doctors and nurses in developing countries. Dr. deVries has developed urological training programs in Asia, Africa, the Caribbean, and Latin America. She serves as a member of the Global Alliance for Elimination of Filariasis (GAELF), and on the Board of Chairmen of the Société Internationale d'Urologie (SIU) as the Chair of International Relations.

Honors include the American Urological Association's 2009 Distinguished Contribution Award; The Southeastern Section AUA Presidential Lecture, 2009; Globus Medical Award, 2007; American Medical Association's 2006 Dr. Nathan Davis International Award in Medicine; and the American Medical Women's Association (AMWA) Award for Community Service in 1998.

Her clinical work focuses on pediatric urology. When not engaged in medical activity, she and her husband, Scott Lucas, enjoy their ranch at the base of the Uinta Mountains in Wyoming.

Raymond R. Price, MD, FACS

Dr. Raymond R. Price, a member of the Intermountain Surgical Specialists of Intermountain Healthcare, is board certified in general surgery focusing on advanced laparoscopy, surgical oncology, endocrinology, and trauma surgery at Intermountain Medical Center in Salt Lake City, Utah where he serves as director of surgical education. He is an Adjunct Associate Clinical Professor of Surgery and Adjunct Professor of Public Health at the University of Utah. After graduating from the University of Utah, he received his MD degree from Harvard Medical School (1987) before completing a surgical residency at the Brigham and Women's Hospital in Boston (1992).

Dr. Price developed a passion for global medical work while serving as a missionary in Thailand (1978–1980) followed by volunteer efforts relocating and translating for refugees from Southeast Asia. He has dedicated much of the last 10 years to improving education and access to surgical care globally, especially in resource-poor areas. He has participated in or led medical and surgical expeditions to Indonesia, Mexico, Ethiopia, Ecuador, China, Belize, Mongolia, and Haiti. He currently serves as the Medical Programs Director for the Swanson Family Foundation, focusing on establishing laparoscopic surgery in Mongolia. He also serves on the board for ASCEND Alliance, a humanitarian organization to empower those in need to ascend out of poverty. He directed a disaster-response team during the first few weeks following the 2010 earthquake in Haiti and continues to work on medical recovery efforts. Dr. Price serves on international committees and subcommittees for the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) and the American College of Surgeons (ACS). He is the ACS Governor from the state of Utah and member of the ACS National Committee on Trauma. He is a member of the Alliance for Surgical and Anesthesia Presence (ASAP-Today).

Honors include a Medal of Honor (2009) from the Minister of Health of Mongolia for improving surgical care throughout Mongolia and multiple resident teaching awards from the University of Utah and Harvard. His greatest work, however, is with his wonderful wife Anne and their seven daughters and one son who also volunteer internationally and domestically.

Drs. Price and deVries have been actively promoting and developing a multidisciplinary approach (i.e., medicine, engineering, business, social, and legal) at the University of Utah to help find solutions to the barriers for sustaining surgery in resource-poor areas. They developed and taught a course on global surgery and public health and organized the bio-design program where undergraduate engineering students design surgical products that are durable, cost-effective, and can be made easily in resource-poor areas. This has led to the current development of the Utah BioWorld program focusing on developing a systematic way for students to identify the business, cultural, and medical needs in resource-poor areas and to design plans and business models that can provide useful, cost-effective, high-quality, and durable medical devices while at the same time promoting local economic stimulation.

