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Global Cardiac Surgery Capacity Development in Low and Middle Income Countries

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Global Cardiac Surgery Capacity Development in Low and Middle Income Countries

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ISSN 2523-3084 ISSN 2523-3092 (electronic)
Sustainable Development Goals Series
ISBN 978-3-030-83863-8 ISBN 978-3-030-83864-5 (eBook)
https://doi.org/10.1007/978-3-030-83864-5

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Foreword I: Duke Cameron

The current COVID-19 pandemic and its economic consequences, as well as worldwide events that have highlighted disparities in justice and health care among the disadvantaged, have brought global health into sharp focus. In the discussions and debates that have en-sued, we have become more aware of both the moral imperative and the shared dividends of caring for everyone, even those well beyond our borders. As surgeons, we sometimes forget the value we bring to a wide range of medical problems, from cataracts to abscess, fractures, hernias, bowel obstructions, penetrating trauma and curable solid neoplasms. Cardiac sur-gery is often dismissed as too expensive for the developing world, but cardiac disease re-mains a major cause of death in nearly every country, even among its youngest and most productive citizens, and models exist for judicious surgical treatment that is respectful of lim-ited resources. Frequently cited is cardiac surgery's ability to "raise all boats" in hospitals by improving the quality of care in respiratory support, critical care, support for renal insufficien-cy, blood banking and infection, to name a few.

In this book, Kpodonu and colleagues have assembled a remarkable collection of chapters covering global cardiac surgery, from its history to its role in healthcare systems, the role of professional societies in education and its deployment, sustainability and the opportunities for digital healthcare technologies. Finally, "case histories" of cardiac surgery development in individual countries are presented, teeming with lessons for other surgeons with similar hopes and ambitions.

I began reading this book anticipating themes of altruism and humanitarianism. I was not dis-appointed, but I was also impressed by how much thoughtfulness, experience, practical guidelines and collective wisdom are shared within these pages. Herein is a blueprint for sharing the remarkable tools cardiac surgeons hold. The foundations have been laid. It's time for all of us to lend a hand.

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Foreword II: Thiery Folliguet

While humans began to exhibit behavioral modernity around 100,000 years ago, it is only within the last 300 years that surgery was discovered, developed and adopted around much of the world. Initially developed as a result of the many injured on the battlefields during the frequent wars, the methodology of surgery was adopted mostly during the Napoleonic Wars where intervention was required to avoid exsanguination by cauterizing the blood vessels. The introduction of safe cardiopulmonary bypass in the 1960s gave the surgeon the accuracy to operate on the heart, and today, in most of the modern countries, a full team of cardiologists, surgeons, perfusionists, anesthesiologists, ICU specialists and nurses come together to perform cardiac surgery.

The evolution over the many years within specialized medical and paramedical units has allowed these teams to perform an invasive act on the heart with given results, which for most part of the time is predictable and low. Additionally, reviewing the cases where complications and death occurred amongst peers during mortality and morbidity reviews allows the identification of problems and to correct if necessary by establishing rigorous protocols. This constant learning and evaluation generates high-quality surgeries and positive results, which is necessary in this field. The research and the development of new approaches and tools are aimed to simplify procedures and to transform traditional techniques toward surgery that is mini or non-invasive. Unfortunately, what is happening today in the developed world is not applied to developing countries.

The need to develop cardiac surgery in emerging countries is real since cardiovascular disease is the leading cause of death worldwide, responsible for 17.5 million deaths every year, of which 80% occur in low- and middle-income countries. 75% of the world does not have access to cardiac surgery. In most countries, healthcare expenditure parallels the GDP with an average of 12% on health compared with 5% of GDP in low- and middle-income countries. The COVID-19 pandemic unmasked this enormous difference, with some countries unable to provide oxygen for simple face mask treatments, whereas other countries were able to implement mobile medical units allowing patients to have extracorporeal support (ECMOS) placed in any hospital and then transferred to a tertiary hospital for ICU treatment.

Kpodonu and colleagues have published this book with the purpose of transferring the knowledge, techniques and technology used today in the developed countries to emerging countries, in order to practice cardiac surgery in a safe and reproducible way. Thanks to advances in information technology, patient in need of cardiac surgery can be reviewed and selected by video-conferencing, allowing teams to decrease cost and improve selection of patients. Training new surgeons with simulators and by video-conferencing can also be implemented to speed up the learning process. The entire book is organized into easy-to-read chapters so as to provide the reader with possible solutions to address challenges that are commonly faced in the emerging countries with respect to cardiovascular diseases. The technologies described should help lower the barrier and cost to populations in need of cardiac expertise while achieving excellent cardiovascular outcomes in low- and middle-income countries.

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Preface

Global cardiac surgery can be defined as a platform "that places a priority on improving health outcomes and achieving health equity for all people worldwide who are affected by cardiac surgical conditions or have the need for cardiac surgical care". Surprisingly, of all the surgical subspecialties included in the discourse surrounding the global burden of disease, global cardiac surgery is the one subspecialty that is most often omitted. Much of the disregard, however, is believed to be a result of the perceived difficulty of introducing cardiac surgery in low-resource settings given its complex follow-up, its demand for intensive human resource training, and the required capital funding necessary to establish widely available and sustainable cardiovascular services. Unfortunately, this disregard undermines the parallel attempts to ameliorate the global burden of cardiovascular disease (CVD), a known cause of significant morbidity and mortality of all non-communicable diseases worldwide.

To date, 93% of people living in low- and middle-income countries (LMICs)—nearly 6 billion people worldwide—are estimated to lack access to cardiac surgical care when needed. It is estimated that 4,000 cardiac centers perform open heart surgery around the world, but only a fraction are in LMICs. The latter are commonly located in countries without existing national health insurance schemes, and annual surgical volume is often low due to workforce and resource constraints. In light of the growing burden of CVD around the world, including the epidemiologic transition from communicable to non-communicable diseases in LMICs, recognition thereof is vital to move toward the Sustainable Development Goals and Universal Health Coverage. Establishing cardiac centers requires substantial physical, financial, and human resources, and political commitment. This textbook *Global Cardiac Surgery Capacity Development in Low and Middle Income Countries* is published with the purpose of transferring the knowledge, techniques, and technology used today in the developed countries to emerging countries, in order to practice cardiac surgery in a safe and reproducible way providing a practically applicable resource on how to treat cardiac patients with limited resources and at the same time presenting strategies on how these

can be managed, therefore making it a critical tool for those involved in this field. Understanding approaches taken by existing centers may thus inform and optimize the establishment of new centers to expand comprehensive cardiovascular services worldwide, particularly in LMICs.

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Acknowledgment

Jacques Kpodonu (JK) would like to show his profound appreciation to the numerous outstanding contributors for their contribution in putting this textbook together. Special thanks to Duke Cameron, 98th President of the American Association for Thoracic Surgery, Robert S. D.Higgins, 55th President of the Society of Thoracic Surgeons and President of Brigham and Women's Hospital (Boston), David Tom Cook, MD and colleague members Diversity and Inclusion (D&I) workforce of the Society of Thoracic Surgeons, Dr. John Meara, Director Program in Global Surgery and Social Change Harvard Medical School, and Dr. A. Tom Pezzella for their tireless advocacy and support for global surgery that led to this work. Special recognition to my cardiac surgery colleagues at Beth Israel Deaconess Medical Center/Harvard Medical School for their support, Grant Weston (Springer), Karthikeyan Durairaj, and Ritu Chandwani (Scientific Publishing Services) for their editorial support in making this work possible and completing on time. Finally, I want to thank my wife Tiffany, children Nathalie and Henri, and parents Prof. John Kpodonu and Mrs. Jacqueline Kpodonu for their unwavering support in getting this work to completion.

About the Book

The series Sustainable Development Goals Series focuses on how to provide suitable care to cardiac patients with limited resources reinforcing the SDGs contains detailed guidance for physicians practicing in emerging countries and covers how cardiac surgical care can be used as a tool to strengthen health systems. This book provides a focused resource on the development of cardiac surgery capacity and its role in in the sustainable development and strengthening of associated health systems. A background is provided on the extent of the problems that are experienced in many nations with suggestions for how suitable frameworks can be developed to improve cardiac healthcare provision. Relevant aspects of governance, financial modelling and disease surveillance are all covered. Guidance is also given on how to found and nurture cardiac surgery curriculum and residency programs. *Global Cardiac Surgery Capacity Development in Low and Middle Income Countries* provides a practically applicable resource on how to treat cardiac patients with limited resources. It identifies the key challenges and presents strategies on how these can be managed, therefore making it a critical tool for those involved in this field.

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Part I

Global Surgery as the Neglected Stepchild of Global Health

History of Global Surgery

1

Alexis N. Bowder, Barnabas Alayande, and Zachary Fowler

The neglected stepchild of global health.

Drs. Jim Kim and Paul Farmer

Abstract

Over time the field of "global surgery" has evolved and emerged as a clear and necessary component of global health. This chapter attempts to document the history of this evolution. In the early years of global surgery, we saw the proliferation of faith-based initiatives, non-governmental organizations, and various individual institutional efforts. More recently, over the last thirty years, we have seen an increase in academic partnerships and a focus on ethics in global surgery. Since 2015, key policy milestones including the Lancet Commission on Global Surgery, the World Health Assembly Resolution 68.15, and Disease Control Priorities *Essential Surgery* have helped place an emphasis on the importance of developing regional and national strategies to increase access to surgical care worldwide.

Keywords

History · Global surgery · Global health

1.1 Introduction

The history of "modern" surgery itself is a relatively recent one, given that anesthesia in any form did not emerge until the mid-nineteenth century. As described below, the history of international efforts to improve surgical care goes back to this early time. That high-income countries required at least half a century to progress to a reasonably safe surgical environment within their own borders, though, means that the history of surgical care in the global context begins in earnest quite recently. The last half of the twentieth century saw the proliferation of faith-based initiatives, non-governmental organizations, and various individual efforts, bringing some degree of surgical care to areas of the globe in which health systems, as they were, did not include the vast proportion of health care requiring surgical

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J. Kpodonu (ed.), *Global Cardiac Surgery Capacity Development in Low and Middle Income Countries*, Sustainable Development Goals Series,
https://doi.org/10.1007/978-3-030-83864-5_1

expertise. An intentional look at disparities in access to surgical care around the world did not come until 1980, when Dr. Halfdan Mahler, Director General (DG) of the World Health Organization (WHO), addressed the 12th biennial World Congress of the International College of Surgeons. He stated "The vast majority of the world's population has no access whatsoever to skilled surgical care and little is being done to find a solution…. I beg of you to give serious consideration to this most serious manifestation of social inequity in health care" [1].

In spite of Dr. Mahler's plea, the field stayed within the realm of the ad hoc efforts and vertical programs of the faith-based groups, non-governmental organizations (NGOs), and occasional individuals, which by this time included some educational institutions. However, it was almost thirty years after the acknowledgement by the WHO DG that lack of surgical care was a "most serious manifestation of social inequity in health care" that the oft-quoted epithet "neglected stepchild of global health" was used by Drs. Paul Farmer and Jim Kim in 2008 [2]. In 2015 the Lancet Commission on Global Surgery (LCoGS) estimated that 5 billion people were without access to surgical care worldwide and determined that investing in surgical care was a cost-effective public health intervention [3]. That same year saw the 68th World Health Assembly (WHA) adopt the resolution declaring strengthening surgery and anesthesia services an integral part of universal health coverage. Completing a trifecta, 2015 also saw the third edition of the Disease Control Priorities include a separate volume dedicated to surgical care with a global perspective. The events in 2015 confirmed that global surgery had become a part of the global health family, but the question remained, what does the term global surgery entail?

Just as the term global health has been known to carry a number of different definitions or connotations, the term global surgery is still being defined. In 2014, a lengthy definition of global surgery was provided by many of the same authors who wrote the LCoGS. Here it was defined as an "area for study, research, practice, and advocacy that places priority on improving health outcomes and achieving health equity for all people worldwide who are affected by surgical conditions or have a need for surgical care," stating that this definition applies to a wide group of specialties including all surgical specialties (including obstetrics and gynecology), anesthesia, perioperative care, emergency medicine, nursing and more. The definition goes on to describe the populations, solutions, and issues addressed by global surgery [4]. More recently a shorter definition was provided by Fitzgerald et al. who define global surgery as "a term used to describe a multidisciplinary field, concerning the improved and equitable surgical care across international health systems with an explicit focus on Low- and Middle-Income Countries (LMICs)" [5].

Perhaps more important than having one standard definition of the field is understanding its beginnings and progression over the last 40 years. This chapter describes the history of the field of global surgery encompassing the foundations of medical missions, institutional efforts, academic global surgery, key policy shifts in the field, and the evolution of national surgical, obstetric and anesthesia plans.

1.2 The Foundations of Medical Missions

The history of global surgery is incomplete without an understanding of the contribution of medical missions. Some of the first medical missions started as early as 1838 and continue to hold a place in global surgery today [6]. This term specifically refers to temporary surgical platforms including short-term surgical trips and self-contained surgical platforms, and specialty surgical hospitals which may or may not be faith-based [7, 8]. Despite the critical tilt away from short term, non-development related surgical work, the roots of global surgery run deep into these efforts. Humanitarian efforts (missions that operate under the setting of acute emergencies), and work by charitable organizations (those that, at least in part, are funded by private donations) have contributed immensely to surgical efforts

worldwide [7]. Resulting from the observation that these contributions were initially individual and later institutional, the history of surgery in medical missions is hydra-headed.

1.2.1 Faith-Based Missions

A prominent pioneering figure of faith-based surgical missions was the Framingham born Peter Parker, who was said to have "opened China to the gospel at the point of a lancet" [6]. Armed with skill in general surgery and ophthalmology, he sailed to Guangzhou, China under the cover of the American Board of Commissioners for Foreign Missions. His success in treating more than 50,000 Chinese patients, coupled with his connections with British and American businessmen and missionaries positioned him as a leading figure in developing the idea of medical missions. He was involved in the founding of the Medical Missionary Society in China in 1838 and when forced out of China by the First Opium War, he travelled extensively through Europe and the United States successfully popularizing an agenda of faith-based medical missions' advocacy with a surgical bent [6].

In the 1950s, a juxtaposition of medical missions and early academic global surgery can be seen in the work of pioneers like Dennis Burkitt, a surgeon who served during World War II in Africa and Sri Lanka, eventually settling at Mulago hospital, Kampala Uganda [9]. He identified a facial tumor of young children and, beginning with a grant of 25-pound sterling, surveyed hospitals by mail and identified an ecological effect on distribution of a cancer. Through a 'global collaboration', Burkitt and his overseas partner, Tony Epstein, identified the role of the Epstein Barr virus. He eventually travelled over 10,000 miles by vehicle to properly map the geographical extent of the tumor's occurrence [9].

In the following years, a number of organizations would partake in surgical missions, and Shrime et al. have attempted to classify international surgical endeavors for ease of evaluation. They classify these efforts as follows; short-term reconstructive missions, self-contained surgical platforms and specialty mission hospitals [7]. The history of these different thrusts are distinct and detailed below.

1.2.2 Short-Term Reconstructive Missions

Historically, short-term surgical trips have been dominated by those for plastic surgery, including cleft lip and palate care, post burn contracture management, general reconstructive surgery. There have been numerous organizations that have used this model; many have evolved, at least to some extent, into broader models. The first of these was Interplast (now known as Resurge International), which developed out of the plastic surgery department at Stanford University in 1969. Several others grew out of Interplast, including Operation Smile in 1982, which is by far the largest [10]. This model has served to introduce many High-Income Country (HIC) medical professionals to LMIC surgical needs, but as global economies have improved and the importance of health systems development has become apparent, it has fallen increasingly into disfavor.

Another NGO, The SmileTrain, was created by founders who had previously worked with Operation Smile [11]. It introduced the model of paying surgeons in LMICs directly to provide cleft care, rather than sending foreigners to do the surgery. This was a major modification emerging out of the short-term trip model, and one that has had a major influence on the provision and availability of cleft care.

1.2.3 Self-Contained Surgical Platforms

Self-contained surgical platforms like Mercy Ships, an international maritime surgical charity founded in 1978, The Orbis Flying Eye Hospital, an international eye surgery charity started in the mid-1970s, and Cinterandes Mobile Surgery Unit

which launched in 1990, are examples in the history of stand-alone missions that enter into communities with capacity to provide surgical care without relying on local resources [12–14]. Inspired by the work of an international hospital ship SS Hope, the size and number of port cities, and their faith, the founders of Mercy Ships purchased and refurbished an Italian cruise ship in 1978. They converted it to a 400-bed surgical facility and moved from port to port in the South Pacific, Central America, Caribbean, and Africa using volunteers to deliver surgical services. In 24 years, 18,800 surgeries had been performed on the first ship and other vessels were added to their fleet. Surgical equipment and operating conditions on the ships were similar to those available in HICs, however, the clinical presentation of pathologies encountered in LMICs was commonly at more advanced stages [12]. Several land, sea and air models of these self-contained platforms have been deployed. The convenience and efficiency of these historical intermediate models for surgical delivery must be weighed against cost effectiveness, sustainability and opportunities for training [7].

1.2.4 Specialty Surgical Hospital Missions: The Barsky Model

Specialty surgical hospital missions like those focused on vesico-vaginal fistulae, cataract surgery and post burn reconstruction were largely a focus in the 1990s and modeled a more long-term, sustainable, effective and efficient model [7]. A pioneer of this concept was Aurthur J. Barsky, professor of Plastic Surgery at Albert Einstein College of Medicine, New York. He established a children's Plastic Surgery program in post war Vietnam after a 1967 survey trip that established the need for children's plastic surgical care, a full-time training program, and a modern facility that would be handed over to locally trained surgeons [15, 16]. Funding was sourced by a novel charity—Children's Medical Relief Fund. Starting with a temporary unit and transiting to permanent structures in 1969, the unit was run by volunteers who trained indigenous staff [15]. By 1970, over 50 surgeries were being done every week by qualified plastic surgeons [16]. Current examples of these specialty hospital mission models include the CURE International, Neuro and Clubfoot Hospitals which focuses on pediatric orthopedic care in 14 countries, Aravind Eye Hospitals, Tamilnadu, India, the Danja Fistula Center, Danja, Niger, Babbar Ruga Hospital, Katsina, Nigeria and the Adayar Cancer Hospital, Chennai, India [7].

Criticism of these historical models has contributed to the trajectory of global surgery as we know it today. Evidence provided by research on short term surgical missions operative outcomes is limited and of low quality, supervisory regulatory systems are limited [17–19]. The rich history of surgical missions has cast doubt on the aptitude of local health care systems, disrupted local health facility functions, diverted resources from regular patient care pathways, and in some cases has promoted the 'savior mentality' and power imbalances [7]. Safety may also be overestimated as follow up reporting in these surgical missions is also generally of poor quality [7, 17, 18]. Though these criticisms are valid, medical missions are likely to continue to play a role in global surgery for years to come. Moving forward it is imperative to evaluate the ethical, clinical, and societal implications of these efforts.

1.3 Early Institutional Global Surgery Efforts

An appreciation of early institutional efforts in the field of global surgery is imperative to understanding the current global surgery movement. Here we describe the history of two institutions the International Committee of the Red Cross and *Médicine Sans Frontieres.*

1.3.1 The International Committee of the Red Cross

The International Committee of the Red Cross (ICRC), is the oldest existing humanitarian

organization, with over a century and a half of experience [20, 21]. As part of a larger movement consisting of the ICRC, International Federation of Red Cross and Red Crescent Societies, and numerous national societies, the ICRC focuses on victims of armed conflict based on fundamental principles of neutrality and impartiality among combatants [20, 22]. The ICRC works under the mandate of the Geneva Conventions, which also includes access to essential preventive and curative health care with standards that are universally acceptable. By legal status and mandate, it is distinct from an intergovernmental agency or a non-governmental organization [21].

The surgical interventions of the ICRC in arenas of war can be considered as part of the foundations of global surgery. The origin of the ICRC is traced to the battle of Solferino during the Second Italian War of Independence in 1859. The sight of over 40,000 dead and wounded men abandoned after the battle inspired a Swiss businessman, Henri Dunant, to take action that led to the founding of the ICRC [21]. He led an effort in impartial care of wounded soldiers by appealing to locals to tend the wounded while insisting on equal treatment of both Austrian and French soldiers. He subsequently published *A Memory of Solferino* with two solid appeals: the formation of relief societies in peacetime including nurses who would care for the war-wounded, and the protection of these recognized volunteers through an international agreement [21, 23]. A charitable association called the Geneva Society for Public Welfare pursued the realization of these ideals in 1863 [20, 21] This work led to the founding of the International Committee for Relief to the Wounded, which later morphed into the ICRC. On October 26th 1863, 16 nations and 4 philanthropist groups met and adopted the distinctive emblem still used by the ICRC today. Since then, four Geneva Conventions (adopted in 1949) and three Additional Protocols (adopted in 1977 and 2005) have been adopted by member states [22]. These are centered on protection and care for the war wounded, prisoners of war and other victims, and protection of civilians in wartime [21].

The ICRC was seen initially as essentially a reactive association until the first world war [21]. With resurgence of international violence and wars, it has since consolidated and restructured to be anticipatory and proactive while expanding field operations. It has been a major player in both historic and modern war surgery and has had large-scale surgical operations in civil wars (Nigeria, Angola, Mozambique, Nicaragua and El Salvador) and decolonization and national liberation wars (Eritrea, Rhodesia, East Timor, Namibia etc.) [21, 22]. Continuing warfare worldwide has widened the scope of ICRC activities to include support of existing health systems in addition to attending to the more urgent war surgery needs. This has included orthopedic rehabilitation activities added to emergency relief and training of expatriate medical staff and local doctors [21] The flagship Health Emergencies in Large Populations (H.E.L.P.) courses, publication of war surgery annuals, and contributions to professional journals are part of the international surgery education thrust [22].

1.3.2 *Médecine Sans Frontieres*—The Beginnings

Another early organized institutional surgical model is that of the *Médicine Sans Frontieres* (MSF) [24, 25]. The 1967 secession of Biafra, Nigeria's eastern region, prompted the gruesome Nigerian Civil war. Pictures from the war travelled near and far, and France was particularly sympathetic to the Biafran cause. Bernard Kouchner, a French Gastroenterologist, and Max Recamier visited the region in 1968 with a 50-person team as part of the International Red Cross [24–26] This team was forced to provide war surgery in hospitals regularly targeted by the Nigerian military. Reaction to the war and famine led to the founding of the *Groupe d'Intervention Medical et Chirurgical d'Urgence* [24]. These doctors began to lay the foundation for a novel and non-conforming brand of humanitarianism that would prioritize the welfare of suffering individuals and ignore political, economic

and religious boundaries. Their focus was on victims' rights over neutrality. In 1970, a disastrous cyclone and floods in Eastern Pakistan led to the demise of at least 625,000 people. A parallel response to this disaster by French medical journalist, Raymond Borel, led to the formation of *Secours Médical Français.* Both efforts were combined on 22 December 1971 by 13 founding doctors and journalists to form *Médicine Sans Frontiers* (MSF), known internationally as Doctors Without Borders [24]. Missions to Nicaragua, Honduras, Thailand and Cambodia followed in the 1970s [24–26]. MSF surgical activities have historically covered a range of general to specialized surgical care including obstetrics, fistula, trauma, orthopedics, and burn care in resource-poor, conflict, and post-conflict settings. The organization reorganized and expanded to 19 national offices and five operational sections. It now represents an international, humanitarian, non-governmental organization which conducts emergency medical activities in over 90 countries [27].

The beginnings of the movement were an attempt to emphasize equity and this has percolated to the mainstream global surgery movement. Prominent MSF interventions have occurred in situations of war and violence in Sudan, Liberia, Somalia, Bosnia, Rwanda, Sierra Leone, Kosovo, Chechnya, Haiti, India, Uganda, Congo, Cambodia, Libya and Yemen. Some organizations (such as Doctors of the World) have historically modified the MSF model within the humanitarian surgical space.

1.4 Early Policy Milestones

Around the time early institutional efforts in international surgery were taking hold, the Declaration of Alma Ata was adopted in 1978, representing a major milestone in public health. Sponsored by the WHO and the United Nations Children's Fund, it convened 134 countries to reaffirm health as a fundamental human right and called for global action to address inequities through primary care [28]. As mentioned in the beginning of this chapter, in 1980 an address to the World Congress of the International College of Surgeons, WHO Director-General Halfdan Mahler stated that surgery must play a vital role in primary care, and the widespread lack of access to skilled surgical care was a symptom of deep social inequity [1]. However, despite the elevation of surgery and healthcare for all as priorities on these global platforms, policy-directed actions to improve surgical care were slow to develop. The WHO Global Initiative for Emergency and Essential Surgical Care was developed by the WHO Programme for Emergency and Essential Surgical Care in 2005 to serve as a forum for broad, interdisciplinary stakeholder engagement to share information and strengthen policy and education. More than 140 Member States have collaborated in this initiative and used various avenues to address surgical system gaps [29].

1.5 The Evolution of Academic Global Surgery

In comparison to the longstanding history of medical missions and institutional efforts dating back to the 1840s and 1940s respectively, the entry of academic institutions into the field of global surgery has been relatively recent. The history of academic global surgery correlates in time with the Declaration of Alma Ata in the late 1970s. Twinning programs, or partnerships between HIC institutions and LMIC institutions, were some of the earliest global surgery academic endeavors dating back almost 30 years ago [30].

In the 1980s Memorial Sloan Kettering Cancer Center (MSKCC) began a funded fellowship in which surgeons from LMICs came to MSKCC for a 3 month stay [31]. The University of Washington in Seattle and Kwame Nkrumah University of Science and Technology in Kumasi, Ghana have also had a 25-year collaboration focused on capacity building for research on injury prevention, trauma care, and surgical care. Another example of an academic partnership is the Vanderbilt University partnership with AIC Kijabe Hospital and BethanyKids at Kijabe

in Kenya. Unlike the aforementioned partnerships, this 10-year partnership has demonstrated how universities and faith-based organizations (FBO) in Africa can work together to improve access to surgical care. In addition, Operation Giving Back (OGB), the volunteer arm of the American College of Surgeons, developed guidelines for the formation of a consortium of Global Surgery programs whose focus is on development of the surgical workforce in Sub-Saharan Africa [31]. More recent than the establishment of twinning programs in global surgery has been the development of academic global surgery electives.

In 2010, a survey by OGB and Association of Program Directors in Surgery found a broad range of international activities among U.S surgical residencies, including 7 formal international rotations of the 55 programs that responded [30]. In 2011, the American Board of Surgery and Accreditation Council for Graduate Medical Education (ACGME) approved global surgery electives to count towards graduation requirements and the number of general surgery programs in the United States that offered global surgery electives increased from 13.3 to 34% of surveyed institutions [32]. In addition to global surgery electives, a number of surgical programs both in the United States and abroad have developed global surgery fellowships or global surgery tracts. These programs allow residents to dedicate one or two years to global surgery research, policy, and/or advocacy and often involve participants spending a significant amount of time working with surgeons in LMICs as part of the fellowship [33–35]. Finally, two medical student organizations have recently been formed in the academic global surgery space—the Global Surgery Student Association and InciSion—with a focus on supporting medical students interested in global surgery and global surgery advocacy, research and education worldwide.

As the interest in global surgery continues to rise in academic settings, a number of issues regarding ethics and sustainability will need to be addressed. This will ensure that academic partnerships are equitable, sustainable, and focused on what is needed by partners in LMICs rather than on the needs of HICs. For example, a majority of the U.S. global surgery electives consist of U.S. trainees traveling and working in LMIC surgical settings, but very few have any reciprocal option for trainees from LMICs to spend time in the U.S. In addition, when trainees or surgeons do visit the U.S, many U.S institutions and laws prohibit them from operating on or touching a patient. This is just one of the many ethical issues that presents itself in academic global surgery. Discussing ethics both in academic and global surgery as a whole has been a recent development in the field.

1.6 History of Early Ethics in Global Surgery

Prior to 2015, global surgery literature was largely dominated by HIC authors. Most publications contained reflections on individual or institutional experiences during short- and long-term surgical missions. A large proportion of the organizational reflections were in the domain of plastic and reconstructive surgery reflecting the work of Operation Smile, Smile Train, InterPlast and other plastic surgery charities [36–38] Many cost effectiveness studies were published which strengthened funding rationale for short term missions, again with a cleft deformity surgery tilt [39–43]. However, published global surgery organizational audits found that complications rates were higher when patients were operated on by surgeons participating in surgical missions [44–46]. Evaluation of the academic benefits of surgical missions to HIC surgeons, residents and medical students uniformly suggested benefit to these participants, but whether these missions provided academic benefits to the local teams was not explored [47, 47–50]. Some of the literature gave advice on adequate preparation for missions and on possible improvisations (like alternative anesthesia) that may be needed during working trips to LICs [51, 52].

However, early lone voices began to challenge the status of ethics in surgical missions and suggest ways to correct power imbalances going

forward [15, 53–55]. Several ethical issues, such as informed consent on short term medical missions and the use of photographic images from international programs, have been raised [56]. On the side of surgical safety, Patel and colleagues challenged the lip service paid to surgical safety and variability in the use of the WHO surgical safety checklist during international outreach cleft missions [57].

Solutions to perceived ethical issues gave rise to the proposal of a diagonal care surgical delivery model as an alternative to the long-term horizontal approaches developed by the WHO or World Bank and the trending vertical models used by much of the global surgery community. In these vertical models, HIC surgeons would arrive, operate and leave the follow up to local surgeons, who may be more experienced than the foreigners and could be better served with more resources rather than more postoperative patients [57]. Horizontal inputs of faculty, financial support, research training, equipment and surgical care were to give way to residency programs, self-sustaining revenue, academic culture, infrastructure and local surgical capacity [57]. The Rwandan model of public sector, non-governmental organization and academic partnership for global surgery training was also described during this period [58]. Published calls for coordination and formation of networks within global surgery were made, noting fragmented international volunteerism. In particular, the need for a global pediatric surgery network was raised [59].

Prophetic voices heralding the birth of global surgery as a distinct discipline closed this 'pre-Lancet Committee of Global Surgery era' [60]. As global surgery approached its watershed; surveys of infrastructure and global surgical workforce were done by a few authors with a view to mapping international need in the buildup to work of the Lancet Commission on Global Surgery [61]. Some of this work confirmed a shortage of doctors and inadequacy of data [62]. Calling attention to the need for larger policy shifts aimed at addressing the lack of access to safe, timely, and affordable care worldwide.

1.7 Recent Global Surgery Policy Shifts

The most recent policy formation to improve surgical care was catalyzed in 2015 by several key events. The LCoGS published its seminal report, *Global Surgery 2030: evidence and solutions for achieving health, welfare, and economic development*. This report emphasized the need for research and data in global surgery and outlined major gaps in surgical care using a health-system approach. A framework was also presented for countries to overcome these gaps through strategic plans embedded in a broader strategy to improve health systems [3]. In keeping with this aim to improve surgical care through horizontal, interdisciplinary strategies, Resolution 68.15 was passed by the World Health Assembly, providing a mandate to WHO and Member States to strengthen surgical care and anesthesia as an essential component of universal health coverage (UHC). WHA 68.15 called for an intersectoral approach led by Ministries of Health that integrated data collection, education and training, infrastructure, finance, and quality of care. It also requested that the WHO Director-General promote sharing of information, technology, and skills among Member States, support policy development, and set aside resources from the approved WHO budget to assist Member States in achieving the objectives of the resolution [63]. Additionally in 2015, the third edition of *Disease Control Priorities* (DCP-3) published a volume dedicated entirely to surgical care. *Essential Surgery* provided a characterization of the global burden of conditions requiring surgical management, an assessment of the most cost-effective procedures, and characterization of surgical care delivery platforms. This exercise led to the development, by author consensus, of a package of essential surgical procedures. The package included 44 procedures, of which 28 are provided on an emergent basis, that should be available in all health systems and are designated to primary health centers, first level hospitals, and second or third level hospitals. In 2019, Pakistan became

the first country to develop plans to implement a surgical package based on the DCP-3 [64]. Of note, the LCoGS, WHA 68.15, and DCP-3 all placed an emphasis on building capacity of primary health centers and first-referral hospitals with the aim to increase population access by decentralizing services.

1.8 National Surgical, Obstetric, and Anesthesia Plans

Since 2015, National Surgical, Obstetric, and Anesthesia Plans (NSOAPs) have been used by a growing number of countries as a method to comprehensively improve surgical care. The NSOAP process is based on an adaptation of the WHO health system building blocks and uses the domains of infrastructure, workforce, information management, service delivery, finance, and governance [65, 66]. The development of a NSOAP is carried out using a framework applied in a context-specific manner, typically consisting of the following stages: Ministry of Health ownership, situational analysis, stakeholder engagement and priority setting, drafting, monitoring and evaluation system development, costing, governance, and implementation [67]. NSOAPs have been recognized as an important strategy to achieve widely accepted agendas, such as the Sustainable Development Goals and Universal Health Coverage (UHC) [68, 69]. To date, NSOAPs have been developed in several countries, including Ethiopia, Madagascar, Nigeria, Rwanda, Senegal, Tanzania, and Zambia, and dozens of other countries have begun the NSOAP process or have expressed a commitment to developing a plan [66].

1.9 Regionalization of Surgical Strategy

With the recent prioritization of surgical care by countries around the world, several areas have taken a regional approach to the planning process. The Southern African Development Community passed a resolution in 2018 recognizing surgical care as a critical component of primary care and UHC. This regional agreement extends to 16 Member States and provides additional political leverage to embark on the NSOAP process [70]. Several regional political bodies in the Western Pacific have also endorsed a commitment to improving surgical care. The 2019 Pacific Health Ministers Meeting led to a commitment to NSOAPs as part of regional efforts to achieve UHC [71]. An initial group of 5 countries are collaborating to fulfill this commitment and develop a model for strategic planning in the region [72]. These efforts are aligned with a resolution passed by the WHO Western Pacific Regional Committee Meeting in 2020 to endorse an Action Framework for Safe and Affordable Surgery (2021–2030). This framework provides a guide for Member States and the WHO Western Pacific Regional Office to use a region-specific approach to strengthening surgical care while achieving UHC and previously set regional priorities for 37 countries and areas [73, 74].

1.9.1 Standardization of Metrics and Data Collection

To date, a lack of reliable data on surgical care access and outcomes has led to the development and adoption of standardized metrics. The Lancet Commission on Global Surgery proposed six core surgical indicators and targets to evaluate surgical systems [3]. These include proportion of a population able to reach a facility providing the Bellwether procedures (laparotomy, cesarean delivery, and open fracture repair) within two hours, surgical specialists per 100,000 population, surgical procedures per 100,000 population, perioperative mortality rate, risk of impoverishing expenditure, and risk of catastrophic expenditure. Four of these indicators (surgical workforce, procedure volume, and risk of impoverishing and catastrophic expenditure) have been adopted by the World Bank as World Development Indicators (WDI). At the time of incorporation into the WDI dataset in 2016, more than 170 countries had data available for each indicator [75]. Another system for collecting and monitoring population health

data is the Demographic and Health Surveys (DHS) Program, which analyzes and disseminates health information from more than 90 countries [76]. In 2018 Zambia became the first country to include surgical data in its DHS and used the LCoGS indicators as a basis for this decision [77]. Five questions were added to the survey to assess surgical volume and timely access to surgery, and the results of this assessment were reported in 2020.

1.10 Conclusion

In the year 2020 global surgery has emerged as a clear component of global health.

- Medical missions and early institutional efforts still play a role in addressing the need for safe, affordable and timely surgical care.
  - It is important to evaluate the ethical, clinical, and societal implications of these efforts
- Recently a rise in interest in global surgery and academic partnerships has emerged.
  - We need to ensure that these are equitable and sustainable in the years to come.
- Secondary to significant global policy shifts surrounding global surgery, national and regional plans are being developed that aim to improve access to surgical care on a country level the worldover.
  - The development, implementation, and evaluation of the effectiveness of these plans will be a large part of the future of global surgery.

Acknowledgements We would like to acknowledge the efforts of Dr. Scott Corlew for their assistance in the compilation of data and editing of this document.

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