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SURGICAL SYMPOSIUM CONTRIBUTION

Infrastructure Expansion for Children's Surgery: Models That are Working

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Abstract Children's surgical care is cost-effective and can avert mortality and long-term disability in children, with ramifications throughout life not only for the patient, but for the extended family and community as well. Considering the current gaps and limited capacity for children's surgery in low- and middle-income countries (LMICs), it is clear that without expanding and scaling up the infrastructure, World Health Assembly (WHA) resolution 68/15 targets and child-related targets of Sustainable Development Goals and Universal Health Care are unlikely to be met by 2030. The most promising models to expand infrastructure are those that include ongoing partnerships and capacity building by educating and training local surgeons and healthcare professionals who will not only provide care for children, but who will train future generations of surgical providers as well. Efforts to improve infrastructure necessarily include raising the standard of children's surgical care at all levels of the healthcare system, which will hopefully be guided by National Surgical, Obstetrics, and Anesthesia Plans and by the Optimal Resources for Children's Surgery document. The private sector can be effectively engaged to fill infrastructure and service gaps that cannot be met by government budgets. Ultimately, success of any infrastructure expansion initiative depends on strong advocacy to allocate ample funding for children's surgical care.

Introduction

Recent initiatives have highlighted the need for improving access to safe, affordable and timely surgical care [1–3]. Despite this increased activity, emphasis on children's surgical care has been limited. As a result, defining optimal infrastructure for improving children's surgical care in low- and middle-income countries (LMICs) is in dire need of attention.

The present report is intended to highlight existing children's surgery infrastructure in LMICs, including working models and ongoing innovations, as well as challenges and barriers to providing the required infrastructure.

Current realities and gaps

Having adequate human resources for the delivery of safe and high-quality children's surgery is critical to the success, functionality and sustainability of any infrastructure expansion efforts and initiatives, and this must include not only surgeons, but also anesthesiologists, pediatric subspecialists and nurses as well. Unfortunately, there remains an acute shortage of those providers in LMICs. In a recent report, the density of general pediatric surgeons and pediatric anesthesiologists in the most vulnerable parts of the

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world (Africa and Asia) was quite low (0–0.61 per 100,000 children below 15 years) [4]. Africa and Asia had deficits of general pediatric surgeons of 2792 and 5713, respectively, with some countries in these regions lacking hundreds of pediatric general surgeons [4]. At current rates of training, these countries are unlikely to meet the target of one pediatric surgeon per 100,000 children by 2030 and beyond. In contrast to Canada, where the pediatric surgery workforce is thought to be saturated due to static surgical volumes [5], in LMICs surgical volumes and unmet children's surgery needs are high and will continue to increase in the foreseeable future due to high birth rates. However, simply assuring an adequate number of healthcare providers will not effectively expand children's surgical capacity unless shortcomings in access and infrastructure are also addressed.

Patients in LMICs face extraordinary challenges in terms of access to children's surgical care. One study in the USA found that the average distance to the nearest pediatric surgical provider ranges from 27.1 miles for pediatric surgery to 100.9 miles for cardiothoracic surgery; for 5 of the 7 pediatric surgical specialties studied, approximately three-quarters of the under 18-year-old population live within a 1-h drive from a provider [6]. On the other hand, children in LMICs must travel long distances, often on poorly motorable roads and terrain to reach a pediatric surgeon. One survey of 2176 children in 2315 households in Uganda found the average distance to the nearest surgical center to be 9.30 miles (95% CI 7.02–10.49 miles); however, at the time of the study there was only one national referral hospital capable of performing complex pediatric surgery, located in the capital of Kampala. As a result, the median travel time to reach that tertiary care facility was 193.58 min (range 162.61–234.56 min) [7]. Another report from the same country on gastroschisis found that 61% of patients travelled 50 km or more for treatment [8]. This journey could take several hours, often without an ambulance and usually without any form of resuscitation, a situation which is common in many LMICs.

Though these facts underscore the poor availability of surgeons and access to care, the infrastructure gap for children's surgical care is even more acute. In one survey of 37 hospitals in 10 West African countries (86.5% were public tertiary hospitals), 51% had no neonatal or general intensive care units, 65% had no apnea monitors, 57% had no pediatric ventilators, 65% had no CT scans, 54% had no endoscopes of any type, and 49% had no running water [9]. Furthermore, it appeared that having better economic indicators did not offer any advantage in the ability of countries in sub-Saharan Africa to deliver emergency and essential surgical care to children [10]; Nigeria, with a gross domestic product (GDP) approximately 25 times that of 17 other sub-Saharan African countries, had similar children's surgery infrastructure limitations and gaps. In short, surveys from several LMICs have indicated absent or insufficient infrastructure [11, 12]. Even when designated children's hospitals are created, many are overcrowded, non-functional or unable to deliver surgical care due to a lack of appropriate children's surgical care providers and ongoing support.

Expanding children's surgery infrastructure: critical considerations

The required infrastructure for delivery of safe, high-quality and accessible surgical care for children is dynamic and includes functional physical structures at all levels of the healthcare system—including not only the children's hospital, but the first-, second- and third-level hospitals as well. Utilities must be reliably available at all of these facilities, underscoring the importance of aligning healthcare infrastructure with other public improvements. Infrastructure also relies on an ongoing availability of equipment and supplies, as well as staffing and training to maintain these devices (Fig. 1).

As efforts are made by global health experts and policy makers to address the infrastructure gaps, several important factors need to be considered to ensure success, including facilities to expand manpower needs, infrastructure location, appropriate equipment and maintenance, costs, scalability, and research.

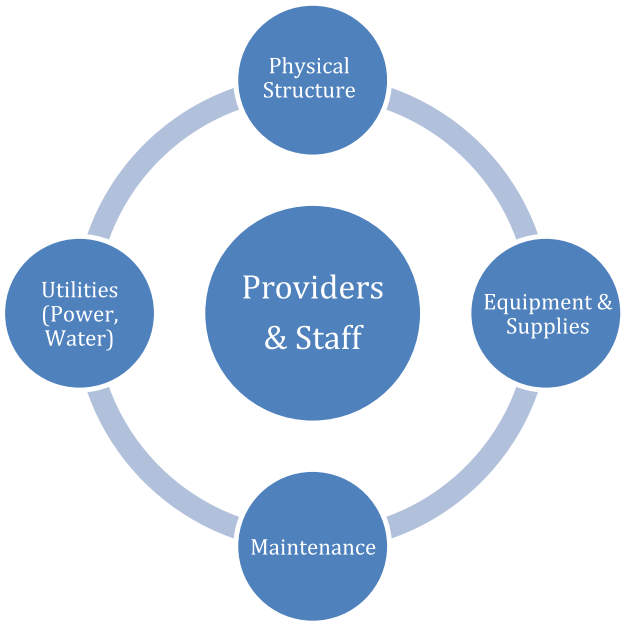

Fig. 1 Infrastructure for children's surgical care

Facilities to expand manpower needs

Addressing critical shortages of healthcare providers is paramount to improving children's surgical care in LMICs. Human resources include not only surgeons, but also the whole range of children's surgical care providers. Medical schools and training institutions for allied health professionals must be built and staffed to meet current needs and provide manpower for the future. However, simply assuring an adequate number of healthcare providers will not effectively expand children's surgical capacity unless shortcomings in infrastructure are also addressed.

Infrastructure location

The Lancet Commission on Global Surgery (LCoGS) recommended that patients have access to emergency and essential surgical care within 2 h [1]. It is therefore crucial that infrastructure for the delivery of common pediatric emergency and essential surgical conditions are similarly located within this 2-h window. Since large populations of children live in rural and semi-urban areas, efforts should be made to ensure that first-level hospitals, which are closer to these populations, have the infrastructure to care for pediatric Bellwether procedures, however they are defined for each subspecialty.

Recognizing that some pediatric problems require more sophisticated care, while ensuring that the first-level hospitals have the ability to deliver emergency children's surgical care, there should also be investments to develop the infrastructure for higher-level hospitals where children requiring more specialized and complex care can be treated.

The physical infrastructures should be flexible and as much as possible use the lean concept (using less to do more) [13]. The infrastructure should have the capacity for adaptation and future modifications as resources improve. Given the challenges with clean water and power supply in many LMIC settings, any infrastructure should be designed to use water and utilities efficiently.

Equipment, supplies, maintenance and training

A key limitation to the delivery of children's surgery in LMICs is lack of necessary supplies, including lifesaving equipment, even in large tertiary hospitals [9, 12]. Even when equipment is available it often is not appropriate for the available electric voltage or for harsh LMIC conditions, or it becomes unserviceable due to lack of maintenance. As a result, many hospitals are littered with such useless equipment.

Equipment in LMICs should therefore be carefully selected. When equipment is purchased, it is crucial to invest in biomedical engineering capacity, including reliable warranties and maintenance agreements that include training appropriate local personnel to perform repairs. It is more important than ever to innovate and engineer low-maintenance equipment that can withstand the LMIC environment. As much as possible, devices and equipment should be designed to be user-maintained.

It is because of this concern for wasted resources that the World Health Assembly (WHA) passed resolution 60/29 in 2007, encouraging countries to develop appropriate technologies for health [14]. In addition, the World Health Organization (WHO) published a compendium on innovative health technologies in 2015 [15]. This publication is an invaluable tool that provides information on effective technologies for low-resource settings. This document should be leveraged by policy makers and stakeholders when creating, renovating or expanding infrastructure for children's surgical care.

Cost considerations

Currently, the costs of instruments, equipment and devices for children's surgery are high and unaffordable in many LMICs. One report has noted that the limited market pressure in LMICs leads to superfluous designs and inflated costs [16], a problem that is compounded for children-specific devices due to even lower demand.

Low-cost, high-quality instruments, equipment and supplies that do not compromise safety are urgently needed. The model deployed by Lifebox to address pulse oximetry gaps has been successful [17]. In that model, collaboration between Lifebox, the World Federation of Anesthesiologists and the manufacturer of the device resulted in the production of affordable, safe and durable pulse oximeters. If equipment and instruments can be manufactured in LMICs where production expenses are lower, this could further drive down the costs; however, quality and safety must always be maintained.

Scalability and sustainability

Ideally, any infrastructure expansion model deployed should have the potential for scale up. This will help ensure that services can be provided for a larger population of children as more resources are deployed. Scaling up coverage of health care requires that several issues are considered including cost, constraints, equity, quality and identification of which key services would be delivered during scale up [18]. Consideration of these points is important in planning, funding and allocating resources, as well as developing mitigation plans to address constraints, barriers and challenges.

While it is recognized that delivering children's surgery in LMICs is cost-effective [19], there are little data and

information on the cost of scaling up children's surgical services. One model has estimated that US$300–420 billion will be needed worldwide, over the period 2012–2030, to scale up all surgical services to meet the LCoGS target of 5000 major operations per 100,000 population per year by 2030 in 88 LMICs [20]. This model was based on estimated costs for infrastructure building and developing using hospital construction data, distribution of functional operating rooms (ORs) per population, costs for cesarean section and incremental increase in the number of ORs from an average of 5.5 per 100,000 population to an average of 9.8 per 100,000 population. This study, however, was based on overall surgical needs, and there are presently no data or models specifically on scaling up children's surgical infrastructure. The distribution of ORs for children's surgery in LMICs has not been quantified, and the desired volume of surgery needed for scale up is lacking. Until these numbers are known, the cost of scaling up cannot be determined.

An important question always to consider is whether the infrastructure can be sustained in the long term. This should be considered as much as possible from the outset. It can be frustrating for families suddenly to realize that previously available services are no longer accessible. This can contribute to loss of trust in the health system by the population. Furthermore, the conditions that require multiple or staged surgeries and prolonged follow-up can become problematic if the infrastructure cannot be sustained.

Research

Innovative research is desperately needed for the creation of low-cost equipment and devices, as well as economically constructed hospital structures and training facilities. The opportunity is ripe for private–public partnerships to invest in long-term efficient construction.

Working models: past and present

Over the years, there have been several initiatives and efforts to provide appropriate infrastructure for surgical care in LMICs [21, 22]. Importantly, international non-governmental organizations (NGOs) and humanitarian surgeons have provided outreach surgical care for children in low-resource settings for several decades, in the form of disaster and crisis relief, short-term missions, specialty hospitals, capacity building and academic partnerships. These efforts have helped to bridge the gaps in the capacity to deliver children's surgical care in these settings.

Short-term missions

Short-term surgical missions, ranging from a single surgeon to "surgical brigades" of nurses, anesthesiologists and other personnel, result in annual expenditures of over $250 million [23–25]. Despite the benefits, many short-term missions do not effectively build infrastructure, because their sporadic nature makes it challenging to cultivate relationships with the local surgeons and expand local resources. There are often detrimental financial consequences for the local surgeon or hospital and inadequate follow-up for patients after departure of the visiting team [21]. In fact, a recent study of a program of visiting surgeons to a rural community in Haiti showed that the surgical volume per month actually decreased during their outreach efforts. After increasing the involvement of local surgeons, along with improving infrastructure, supply and transportation, the surgical volume per month doubled [26].

Because it is now recognized that training of the local surgeons is paramount, many organizations have altered their working models to ones that emphasize capacity building. Operation Smile, founded in 1982, originally brought teams of high-income country (HIC) providers to perform operations on large numbers of patients. Over time, the emphasis changed to teaching techniques to local surgeons and guiding post-operative care, so that by 2012, two-thirds of care was provided by local providers [21]. Smile Train, in fact, provides funding and equipment to local surgeons to provide cleft care, such that cleft surgeries are done entirely by local surgeons. The program has significantly expanded over the years to many LMICs. Since 1999, more than one million cleft surgeries have been performed through their program [27].

Sustainable partnerships

Over the years, several models of partnerships and platforms have been developed to provide surgical care in LMICs. Specialized hospital platforms appear more sustainable and more effective as they have their own infrastructure. Temporary platforms do not rely on local infrastructure as they have their own framework (e.g., Mercy Ships), but an important challenge with temporary platforms is that they do not leave any infrastructure behind and are often limited in the type of surgical care they can provide for children.

In pediatric cardiothoracic surgery, sustainable and effective partnership models have been developed between LMICs and HICs to provide care [28]. The key outcomes of these partnerships are that they enhanced infrastructure, resulting in decreased mortalities, increased volume of surgeries and increased capacity to deliver care.

Mobile surgical units

For many years, mobile surgical units operated by international charitable organizations or local organizations have been used to deliver surgical services in LMICs. In one recent review of the impact of charitable surgery in Uganda [29] charitable platforms for surgical oncology delivery were compared to government policies to improve healthcare access; two of the platforms (mobile surgical units and government policies that simultaneously addressed scale up, costs of surgery and cost of transportation) were able to provide simultaneous health and financial benefits efficiently and equitably; yet, only mobile surgical units were able to provide health and financial risk protection equitably.

In Ecuador, the Cinterandes Foundation has delivered surgical services to rural populations for many decades using mobile surgical units, with remarkable success [30]; however, how these impact children's surgery delivery is not clear. Smile Train has for some time provided mobile ORs using trucks so that local surgeons can deliver cleft surgery to rural populations, increasing access to cleft care, although this program is targeted only at a single surgical condition, and it remains to be seen whether this can be applied to a wider spectrum of surgical conditions.

In Ghana, the Gye Nyame Mobile Clinic, working from a base in a mission hospital, has been providing children's surgical services in western and Ashanti regions of the country [31]. Their model has been so successful that they have scaled up and expanded to include establishment of a pediatric surgery unit in a new teaching hospital as well as a neonatal unit in a mission hospital. They are currently looking to expand to other LMICs.

Due to their ability to reach remote populations, these mobile surgical units should be supported by funding from international agencies to help in their scale up and expansion. Hopefully with time, as infrastructure improves at all levels of the healthcare system, these mobile surgical units will no longer be needed.

Faith-based initiatives

Faith-based organizations have over the years helped to support the fragile healthcare infrastructure in LMICs. In 2006, the WHO estimated that 30–70% of health infrastructure in Africa is owned or operated by faith-based organizations [32, 33]. There have been several successful efforts with regard to providing the infrastructure for children's surgery, including the support of children's hospitals and specialty hospitals.

In Kenya, the BethanyKids hospital in Kijabe has delivered surgical and rehabilitation care for children for many years [34]. As well as providing services, the hospital has become a training site for the College of Surgeons of East, Central and Southern Africa (COSECSA) and Pan African Academy of Christian Surgeons (PAACS) and provides teaching and training for pediatric surgery. Some graduates from the program have returned to their home countries to establish surgical services for children. Such initiatives, though they may be expensive, should be encouraged to expand children's surgery infrastructure in LMICs.

Faith-based organizations have helped to create hospitals dedicated to the specialized care of specific surgical conditions in children. This has been done for orthopedic, neurosurgical and plastic surgical conditions. The CURE hospitals have provided treatment for clubfoot, bowed legs, clefts, untreated burns and hydrocephalus in some of the most underserved parts of the world with success [35]. While the spectrum of children's surgical conditions treated by such hospitals is limited, they provide highly specialized care, which would otherwise not be accessible in these settings. In conjunction with third-level hospitals, they can also serve as training centers for children's surgery specialties.

Other models

Other efforts to build infrastructure have included NGO construction and staffing of specialty hospitals for cleft lips and palates, neurosurgery, orthopedics, cardiac surgery and ophthalmology (for example, the Aravind Eye Hospitals in India), but these hospitals are not always integrated into the countries' public health plans or endorsed by the Ministries of Health. Nonetheless, reported outcomes in these centers approach those in HICs, playing an important role in building infrastructure in LMICs [21]. Less formal centers of excellence have risen in the area of colorectal surgery for anorectal malformations, by HIC visiting surgeons "training the trainers" in hospitals in Ghana and South Africa, after which these institutions become regional training centers for surgeons in neighboring countries [21, 36].

Innovations

Several innovations in recent years have bolstered capacity and expanded infrastructure of children's surgery in LMICs, including the initiation of National Surgical, Obstetrics, and Anesthesia Plans (NSOAPs), development of an Optimal Resources for Children's Surgery (OReCS) document, the construction of fully equipped operating theaters by KidsOR and the promotion of public–private initiatives.

Table 1 Models of private sector engagements in public–private partnerships in health care (adapted from the World Bank [45])

PPP Model	Common terms	Characteristic
Health services only	Operating contracts Performance-based contracts	Private sector operates and delivers publicly funded health services in a publicly owned facility
Accommodation only	Design, build, finance, operate (DBFO) Build, own, operate, transfer (BOOT)	Public agency contracts private sector to design, build, finance and operate a hospital facility; health services within the facility are mostly provided by the government
Health services and accommodation	Joint venture Franchising Private finance initiative	Private operator builds and leases a facility and provides free or subsidized health services to a defined population

NSOAPs

Following the unanimous adoption of WHA resolution 68/15 in 2015 [37], the Harvard Program in Global Surgery and Social Change (HPGSSC) partnered with the Zambian Ministry of Health to help design an implementable NSOAP [38]. With the Zambian NSOAP as a model, other countries are working to establish plans of their own, including Ethiopia, Tanzania and Nigeria, and the HPGSSC provides online resources to guide planning [39]. Like the Zambian plan, however, many countries working on their NSOAPs either do not address children at all, or any inclusion is limited and unlikely to help in expanding infrastructure for children's surgery. Recognizing this shortcoming, Nigeria, Pakistan and other countries are now including a significant focus on children in their NSOAP projects.

OReCS

In further efforts to identify what might be needed to raise the standard of children's surgical care, the leadership of the Global Initiative for Children's Surgery (GICS) queried LMIC surgeons who convened at meetings in London and Washington, D.C., in 2016. These surgeons identified the need for a document that listed resources needed at each of the hospital levels identified in the Disease Control Priorities, Third Edition [40]. Through a series of breakout sessions and subsequent working groups, the consensus OReCS document was written, which listed human resources, skills, infrastructure and equipment needs at primary care centers, first-, second-, third-level and national children's hospitals [41]. One of the key components of the OReCS document is the recommendation that each country have at least one national children's hospital, where complex surgery can be performed with the entire array of supporting services and pediatric subspecialties. The hope is that in the future, the WHO will adopt the OReCS document as guidelines to aid the development of NSOAPs in LMICs. The mainstay of GICS is involvement of LMIC providers from all of the children's surgical subspecialties, as well as nursing, critical care and anesthesia. The hope is that consensus can assure success in improving the infrastructure in LMICs.

KidsOR

One recent initiative that has reaped tangible results in an effort to raise the standard of surgical care in LMICs is a UK-based charitable organization named KidsOR. The aim of KidsOR is to deliver fully equipped operating theaters for children's surgery in low-resource settings. KidsOR partners with existing surgical teams and monitors their impact on surgical outcomes. Currently, KidsOR has completed projects in Rwanda, Tanzania and Malawi, and projects are under consideration elsewhere in the world [42]. Prior to developing the model, its cost-effectiveness was studied in Uganda, projecting a cost of $6.39 per disability-adjusted life year (DALY) averted, or $397.95 per life saved based on the average life expectancy in 2015 [43].

Public–private initiatives

It has been generally agreed that the private sector can play an important role in health systems [44]; however, it is crucial to identify the specific gaps that the private sector can effectively address. To help characterize the nature of private sector engagement in health systems, the World Bank has defined the structure of these engagements [45] to include selective engagements, facility financing and combinations of the two (Table 1).

Public hospitals in LMICs often have severe infrastructure limitations, especially for the safe delivery of children's surgery, but the providers for children's surgery are usually employed in these hospitals. On the other hand, private hospitals in these settings usually have better infrastructure, but the costs of care is often beyond the reach of most families. Furthermore, the private hospitals may lack the specialized staff for delivery of children's surgery. Leveraging the strengths of these two systems through public–private initiatives can help address these infrastructure gaps. Working with equipment and instrument manufacturers and vendors can also help provide needed equipment and maintenance. Furthermore, harnessing capital, managerial capacity and expertise from private organizations outside the health sector has the potential to scale up and expand the infrastructure for children's surgery in LMICs.

Some sub-Saharan Africa countries have embarked on such initiatives to help improve their healthcare systems. Nigeria published a public private partnership policy document in 2005 [46]. Since then, the initiative has helped to strengthen the infrastructure of public hospitals. However, the program is threatened by poor implementation and monitoring [47]. To revitalize the initiative, the Nigerian government recently convened a health summit with over 150 private health sector leaders, resulting in the establishment of a task force to unlock the market potential of the private health sector as well as engage the private sector beyond health, in order to improve access to health services [44]. It is hoped that this initiative will favorably impact the infrastructure for delivery of children's surgical care.

Challenges and barriers

The first challenge in addressing the unmet surgical care of children is to acknowledge the disparity in access and outcomes between HICs and LMICs, so that advocacy efforts can be directed toward global investment in cost-effective interventions to prevent and treat surgical conditions such as congenital anomalies, cancer, trauma and the sequelae of infections. It is only through the recognition of unmet needs in children's surgical care that political will can be swayed and funding obtained to build the necessary infrastructure. As the surgical care infrastructure improves, however, it will become even more critical to address deficiencies in transportation and pre-hospital care.

Political will for implementation of OReCS

Many local and international efforts have gone into identifying the gaps in children's surgical care in LMICs. OReCS has now been created to guide countries in addressing infrastructure gaps for the delivery of children's surgical care. A key challenge will be for countries to generate the political will among policy makers and stakeholders to implement the infrastructure recommendations of OReCS. To facilitate the implementation, children's surgical care needs to be prioritized into NSOAPs and child healthcare policies as well as national strategic health plans. This would allow for the provision of budgetary allocations for the development and expansion of infrastructure for children's surgery.

Funding

The next challenge to be addressed will be to gain the necessary funding to raise the standard of children's surgical care at all levels in the LMIC healthcare system. While countries should be encouraged to budget for children's surgical care, the overall budget for health care in LMICs is often quite low. In April 2001, heads of state of African Union countries met and pledged to set a target of allocating at least 15% of their annual budgets to improve the health sector [48]. Despite this declaration, most countries have not made progress, and the budgetary allocation to health care in most sub-Saharan African countries remains below 10%. The total expenditure on health as a percentage of gross domestic product in low-income countries is at an average 5%, below the global average of 9.2% [49]. Given this budgetary gap, it is unlikely that government funding would meet the required need. It is crucial that the international community assists in the funding for infrastructure expansion. As NSOAPs are developed in LMICs, it is incumbent on the surgical community to advocate for funding of the plans by showing the cost-effectiveness and value of surgical care, particularly when there is competition for funds for the treatment of other health issues, including communicable diseases.

Transportation

The transport system in many LMICs is weak, and roads are difficult to navigate in the rural areas. Currently, most health facilities that have the infrastructure for the delivery of children's surgical services are located in urban areas. Until facilities in rural areas can deliver children's surgery, large populations of children will continue to find it difficult to access surgical care in a timely manner. Even if first-level hospitals are able to deliver such care, the provision of specialized care will still be limited to the third-level hospitals and children's hospitals, which are typically in cities. Though outside the realm of health care per se, as hospital facilities and equipment improve, there will be a

point where further progress cannot be made without parallel improvements in transportation, utilities and communication.

Pre-hospital care and trauma systems

Traumatic injuries alone account for 90% of childhood deaths over the age of five in LMICs, claiming more deaths in African children over five than HIV, tuberculosis and malaria combined [50, 51]. While 95% of all childhood injury deaths occur in LMICs [52], for traffic deaths alone, mortality in LMICs is 50/10,000 vehicles, compared to 1.7/10,000 vehicles in HICs [53]. It is estimated that by 2030 road traffic injuries will be the 5th leading cause of death in the world [54]. Pre-hospital transportation is often left to families, police or taxi drivers, with little or no training on primary resuscitation for trauma patients. As infrastructure improves at the hospital level, it will be critical to ensure that pre-hospital care improves and trauma systems develop as well, so that the morbidity and mortality of injured children can improve.

Summary

- Children's surgical care is cost-effective and can avert mortality and long-term disability in children, with ramifications throughout life not only for the patient, but for the extended family and community as well.
- Considering the current gaps and limited capacity for children's surgery in LMICs, it is clear that without expanding and scaling up the infrastructure, WHA resolution 68/15 targets and child-related targets of Sustainable Development Goals and Universal Health Care are unlikely to be met by 2030.
- The most promising models to expand infrastructure are those that include ongoing partnerships and capacity building by educating and training local surgeons and healthcare professionals who will not only provide care for children, but who will train future generations of surgical providers as well.
- Efforts to improve infrastructure necessarily include raising the standard of children's surgical care at all levels of the healthcare system, which will hopefully be guided by NSOAPs and the OReCS document.
- The private sector can be effectively engaged to fill infrastructure and service gaps that cannot be met by government budgets.
- Ultimately, success of any infrastructure expansion initiative depends on strong advocacy to allocate ample funding for children's surgical care.

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