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Essential Surgery: The Way Forward

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Abstract

Introduction Very little surgical care is performed in low- and middle-income countries (LMICs). An estimated two billion people in the world have no access to essential surgical care, and non-surgeons perform much of the surgery in remote and rural areas. Surgical care is as yet not recognized as an integral aspect of primary health care despite its self-demonstrated cost-effectiveness. We aimed to define the parameters of a public health approach to provide surgical care to areas in most need.

Methods Consensus meetings were held, field experience was collected via targeted interviews, and a literature review on the current state of essential surgical care provision in Sub-Saharan Africa (SSA) was conducted. Comparisons were made across international recommendations for essential surgical interventions and a consensus-driven list was drawn up according to their relative simplicity, resource requirement, and capacity to provide the highest impact in terms of averted mortality or disability.

Results Essential Surgery consists of basic, low-cost surgical interventions, which save lives and prevent life-long disability or life-threatening complications and may be offered in any district hospital. Fifteen essential surgical interventions were deduced from various recommendations from international surgical bodies. Training in the realm of Essential Surgery is narrow and strict enough to be possible for non-physician clinicians (NPCs). This cadre is already active in many SSA countries in providing the bulk of surgical care.

Conclusion A basic package of essential surgical care interventions is imperative to provide structure for scaling up training and building essential health services in remote and rural areas of LMICs. NPCs, a health cadre predominant in SSA, require training, mentoring, and monitoring. The cost of such training is vastly more efficient than the expensive training of a few polyvalent or specialist surgeons, who will not be sufficient in numbers within the next few generations. Moreover, these practitioners are used to working in the districts and are much less prone to gravitate elsewhere. The use of these NPCs performing "Essential Surgery" is a feasible route to deal with the almost total lack of primary surgical care in LMICs.

Introduction

Academic interest in surgical care in low- and middle-income countries (LMICs) has surged in the last 10 years. In particular, there has been a steady increase in articles

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The essence of this article was presented at the International Surgical Society Congress, Helsinki, 28 August 2013, and won the Free Paper Prize of the Year.

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concerning LMIC surgical care [1] in the World Journal of Surgery since 2005.

The need for surgical care globally is self-evident. Surgical conditions make up 11–15 % of the total global burden of disease [2, 3], and 80 % of deaths from these conditions occur in LMICs [4]. Conditions amenable to surgical treatment account for up to 15 % of the 287,000 maternal deaths per year [5], and 38 disability-adjusted life years (DALY) are lost per 100 people in Sub-saharan Africa (SSA) compared to <9 in the developed world [6]. Mortality from injury in SSA rests at approximately double that in high-income countries (HICs) for unintentional injuries and ten times for intentional injuries [7]. An estimated 10–20% of deaths in young adults are due to conditions amenable to surgical care [8], and if simple surgical services were available, two-thirds of these could be prevented [9]. An estimated 2,000,000,000 people have no access to basic surgical care [10].

These are staggering statistics. But the problems of lack of access to surgical care are known and have been known for 40 years or more [11, 12]. Despite a wake-up call 20 years ago by the World Health Organization (WHO) Director-General Halfdan T. Mahler [13], there has not until now existed the political will to engender change [14] and so surgeons must all become lobbyists until surgical care is well established globally for the poor and rich alike.

Background: the situation in LMICs

Barriers to access to appropriate surgical care are usually due to lack of surgical providers, poor infrastructure, weather conditions, poor roads, no public transport, degraded medical facilities, complex bureaucracy, corruption, and high costs of treatment or fears of the same [15]. While some patients may preferentially see traditional healers because they are available locally for consultation, for surgical conditions the queues at hospitals are invariably long. The norm in district hospitals is of low technology centers with basic resources and high volumes of patients.

Published estimates indicate that of some 234 million surgical interventions performed globally per year, only 3.5 % are done on its poorest third [16]. The little that is done is performed mainly in the cities. In the government hospitals, this is necessarily dealing mainly with acute surgical cases [17], but in most private hospitals, little emergency and trauma work is done.

The majority of preventable deaths and disability fall into three specific areas of essential surgical need identified by the WHO: obstetric, trauma, and general surgical conditions [18], the latter mainly due to sepsis. Of the total workload, 60–80 % is of obstetrics and gynecology, 10–20 % trauma, and the remainder due to sepsis. Elective surgery contributes usually to <5 % of the surgical load [19].

On the obstetric front, pregnancy is a morbid condition for many women living in LMICs. One in 26 women in SSA die in childbirth [20]—as high as one in 4.8 live births in Sierra Leone, and one in six in Niger and Afghanistan. In comparison, rates in Europe are around one in 25,000 [21]. Cesarean section is the most needed type of surgery in LMICs, yet less than one in 200 of the poorest 20 % in 15 countries of the world manage to obtain this essential procedure when it was needed [22]. As a result, there are two to three million women living with untreated obstetric fistulas globally [23] and 10,000 new obstetric fistulas arise every year in Ethiopia [24].

Trauma, *a priori* a surgical problem, has become ubiquitous and is the second highest cause of death in young males [25]. Of approximately four million global deaths from unintentional injury annually [26], over 1.2 million deaths arise from road traffic accidents [27] and 90 % of those are in LMICs [28]. On average, approximately 3,300 deaths occur per 100,000 vehicles per year in Africa, compared to single figures in Europe. One vehicle in seven kills one person per year in Togo [29]. Most of these deaths arise not from severity of the injuries but from lack of basic needs and capabilities in treatment. Tragically, most of the young injured could withstand much trauma with just a little help such as airway management, hemostasis, and fluid replacement. However, they fail to get this and die unnecessarily. Owing to a poor public transport infrastructure, transfer to a distant tertiary facility causes delays that cannot be sustained by these trauma patients. Such a high mortality of those in their most productive years of life greatly impacts on the social structure and economy of a country.

The ability to provide emergency surgical interventions in LMICs is no different. Some 40–50 times as many people who need an emergency laparotomy do not get it

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done [15]; inevitably, most of them die. Surgical care for elective procedures is intermittent and irregular; for example, only one in ten of those needing a hernia repair get it done [16]. It is estimated that by 2020, these surgical conditions will outstrip other contributory causes of the total global burden of disease [30–32].

These surgical conditions, neglected in many settings, have reached proportions for which the public sector must now be involved in defining a solution. The framework for these conditions lies in defining the parameters while taking into account existing realities in many of the most affected countries. The 'essentials' argument in public health has been an existing strategy, and indeed, has garnered acceptance since decades past [33]. This paper therefore discusses a definition of Essential Surgery rooted in the concept of essential health care. Furthermore, a comparison of international recommendations for essential surgical interventions is presented and distilled into the basic categories of surgical interventions as a means of creating a basic package of essential surgical care. A review of current models of surgical care provision in LMICs is also presented and discussed.

Methodology

A series of expert discussions and three consensus meetings attended by stakeholders with a total of over 100 years of continuous service in LMICs were held between November 2011 and December 2013 to deliberate the concept of Essential Surgery and to set forth a definition. Field experience was collected during the same time frame through interviews and meetings with colleagues from Malawi, Nigeria, Tanzania, and India. Literature reviews on PubMed, EMBASE, and Google Scholar of studies and recommendations for essential surgical interventions and the history of non-surgeon training program were conducted using the search words 'nonphysician clinician,' Sub-saharan Africa', 'global surgery', 'essential surgery,' and 'surgical clinical officers'. Recommended priorities on essential surgical interventions from four groups were reviewed, tabulated, and compared (Table 1). Debas et al. drew from personal experiences and a WHO report [6]. Mock et al. discussed surgical interventions that were deemed to have priority over other interventions, guided by parameters such as disease burden, availability of procedures that can successfully treat a surgical condition, and cost-effectiveness [34]. The WHO Global Initiative for Emergency and Essential Surgical Care programme (GIEESC) lists basic interventions in the Primary Surgical Package [18]. Chu et al. suggests examples of surgical tasks that could be performed by health workers [35]. The 2010 Global Burden of Disease was reviewed for appropriate deaths and disability-adjusted life years (DALYs) caused by surgical conditions that the essential surgical interventions address and, where data were missing, was searched in the literature for the best available source of data.

A consensus-driven list was created, guided by the principles of disease burden, resource requirement, cost-effectiveness, and potential or intended impact on averted premature mortality or disability from surgical diseases. The International Collaboration for Emergency Surgery (ICES)[1] [36] was found formally in December 2012 to push forward this concept. After much discussion and revision, a final list of 15 surgical interventions was devised based on best available data (Table 2). Cognizance is given not only as to the complexity of such interventions, but the near total impossibility to refer cases for immediate surgical assistance.

Results

Essential surgery

An acceptable understanding of 'surgical conditions' is "any condition that requires suture, incision, excision, manipulation, or other invasive procedure that usually, but not always, requires local, regional, or general anesthesia.''[6]. Qualifying this definition with a public health framework, we recommend a formal definition of Essential Surgery inspired by the WHO definition of Essential Medicines as "basic surgical procedures, which save lives and prevent permanent disability or life threatening complications. Such surgery should be of appropriate quality and safety, accessible at all times and affordable to the community." This concept is not new. It was introduced in the first edition of Tropical Doctor over 40 years ago [11] and Professor Eldryd Parry, doyen of Tropical Medicine, elaborated it in more detail in 1999 [33].

[1] ICES consists of a group of surgeons, international leaders, public health specialists, and educators who aim to promote the effective provision of safe, essential low-cost surgical care to deal with the significant burden of surgical disease in LMICs. The group strives to 1. Advocate and promote the need for essential surgery. 2. Identify essential surgical procedures that are cost-effective and indispensible to a community. 3. Promote and support education and training programs. 4. Identify local and regional training centers to coordinate essential surgical care delivery. 5. Support local surgical societies in training activities. 6. Encourage established surgical societies to include surgical care to poorly served communities within their mission statement. 7. Facilitate international cooperation for educational efforts, research, and advocacy in support of the essential, safe surgical for all initiative. 8. Work across health care networks to recognize essential surgery as a significant component of Public Health.

Table 1 Comparison of international recommendations for essential surgical interventions

Debas et al. [6]	Mock et al. [34]	Chu et al. [35]	WHO PSP [18]
Treatment and control of surgical infections	Incision and drainage (infection)	Incision and drainage of abscess	Incision and drainage of abscess
		Wound debridement	Suturing laceration, wound management
Head injuries	Trauma-surgical airway (threatened or obstructed airway)		Tracheostomy/cricothyrodotomy
Basic thoracic injuries	Thoracostomy tube placement (hemothorax, pneumothorax)	Thoracostomy	Chest tube insertion, needle decompression
Abdominal emergencies	Exploratory laparotomy (hemoperitoneum, pneumoperitoneum, bowel injury, acute abdominal condition)		Laporotomy for acute abdomen[a]
	Splenectomy, splenic repair, packing of hepatic injury, repair of small bowel perforation	Splenectomy bowel resection stoma creation	
	Appendectomy	Appendectomy	
	Bowel obstruction, Perforation	Repair of perforated gastroduodenal ulcer	
Uncomplicated general surgery for hernias	Hernia repair (umbilical, inguinal, femoral hernias)	Hernia repair	Hernia repair[a]
Emergency surgery for obstetric complications (obstructed labor)	Cesarean section	Cesarean section	Cesarean section[a]
Emergency surgery for obstetric complications (PPH)	Hysterectomy for postpartum bleeding and uterine rupture	Hysterectomy	Uterine rupture/ectopic pregnancy[a]
	D & C	D & C Manual placental extraction	D & C for retained products of conception
Simple orthopedic care for extremity fractures	External fixation, toileting of open fracture, closed management of most fractures	Closed fracture reduction Skeletal traction	Fracture immobilization fracture reduction[a]
Dislocations, clubfoot	Repair of clubfoot		Club foot repair[a]
Amputation		Limb amputation	Amputation[a]
Cataract extraction			
Burn care		Acute burn care	Burn management
	Split-thickness skin grafting	Skin grafting	Skin grafting & contracture release[a]
	Drainage of septic arthritis		
			Suprapubic puncture/cystostomy
			Biopsies & needle aspiration[a]
Uncomplicated general surgery for anorectal conditions			
Uncomplicated general surgery for biliary tract disease	Cholecystectomy (acute cholecystitis)	Cholecystectomy	
Hydrocelectomy	Hydrocelectomy		Hydrocoelectomy[a]
	Management of ectopic pregnancy	Exploratory laparotomy for ectopic pregnancy or ovarian torsion	
	Male circumcision	Circumcision	Male circumcision[a]
	Repair of isolated cleft lip		
			Venous cutdown
			Resuscitation (airway). Removal of foreign body local anesthesia ketamine anesthesia Spinal anesthesia general anesthesia (inhalation)[a]
			Curettage for chronic osteomyelitis[a]
Otitis media			

D&C dilatation and curettage, *ERPC* evacuation of retained products of conception, *WHO PSP* World Health Organization Primary Surgical Package

[a] Procedures requiring advanced training skills

Table 2 Proposed categories of surgical conditions with global estimates of prevalence, deaths, DALYs, and cost-effectiveness. All deaths and DALYs data from the 2010 global burden of disease estimates unless indicated otherwise

Conditions	Intervention	Prevalence	Deaths [25]	DALYs [83]	Cost/DALY averted ($) [84]
Obstructed labor	Cesarean section symphysiotomy, assisted or manipulative delivery	6 million[a] 2–3 million with obstetric fistula[a]	10,900	1,792,000	10.93–304
Severe uterine bleeding	ERPC, B-Lynch suture, repair of uterine perforation	Hemorrhage: 25–30% of maternal deaths [85] 21.6 million unsafe abortions [86]	H: 58,300 UA: 37,100	H: 3,289,000 UA: 2,138,000	10.93–304
Surgical infections	Incision and drainage of abscess, fasciotomy, dental extraction, tympanotomy, bone drilling, arthrotomy	No data	39, 700[b]	2,869,000[b]	32.78–136[c]
Severe wounds (including burns)	Debridement, hemostasis, suturing, escharotomy, skin grafting	B: 7.1–11 million (2004) [87, 88] Inj: 50–100 million	B: 337,600 [87, 88] Inj: 5,073,300	B: 19,010,000 [87, 88] Inj: 278,665,000	32.78–136
Severe head injury	Management of head injury, cranial burr holes, elevation of depressed skull fracture				77.4–223[d]
Airway obstruction	Management of compromised airway, tracheostomy, cricothyroidotomy, removal of foreign body				77.4–223
Chest injury and infections,	Intercostal drainage, thoracostomy				77.4–223
Acute Abdomen	Emergency laparotomy including appendectomy		A: 34,800 IO: 148, 100	A: 1,483,000 IO: 3,729,000	32.78–136
Fractures and Dislocations	Reduction of fractures and dislocations, casting and splinting, external Fixation				77.4–223
Severe limb ischemia, sepsis and injury	Amputations				77.4–223
Urinary outflow obstruction	Suprapubic catheterization	924.5 million [89]	No data	No data	
Hernia	Hernia repair	20 million [90]	17,100	792,000	12.88–78.18
Cataract	Cataract extraction and IOL insertion	20 million[a]	3.1 % of deaths globally [91][e]	4,732,000	5–176
Clubfoot	Casting and splinting, tenotomy	1/1000 live births [92]	No data	No data	49
Simple cleft lip	Cleft lip repair	3.28/10,000 [93] Incidence: 1/1,000 live births[a]	3,700 4,992[a]	571,000	29–96.04

ERPC evacuation of retained products of conception, *H* hemorrhage, *UA* unsafe abortion, *Inj* Injury, *B* Burns, *A* Appendicitis, *IO* Intestinal Obstruction, *IOL* intraocular lens

[a] WHO estimates

[b] From Abscess, impetigo, and other bacterial skin diseases

[c] District Hospital with surgical services

[d] Trauma hospital

[e] directly or indirectly due to cataract, glaucoma, trachoma, and onchocerciasis

15 essential surgical interventions

Table 1 compares various published recommendations on surgical priorities. Three procedures were recommended by all groups: incision and drainage of abscess, intercostal drainage, and simple orthopedic care. Table 2 lists the proposed 15 essential surgical procedures and corresponding incidence/prevalence, deaths, DALYs, and cost-effectiveness.

Fig. 1 World map showing countries utilizing NPCs

Nonphysician clinicians

In SSA, 25 of 47 countries utilize NPCs to perform medical and surgical procedures, mainly obstetric and minor surgery [37], but there is little standardization of such training and very little monitoring, supervision, or evaluation mechanisms in place [38]. No coordination exists between countries as to how such training should proceed and there is no agreement as to best practice in low resource settings. The scope of activity and legal framework surrounding utilization of NPCs varies from country to country. Most NPCs have basic nursing training. However, in several countries they are de facto the mainstay of the surgical ground force (Figure 1).

Tanzania started training NPCs in 1963 [39]. Malawi's first medical school actually began by training Clinical Officers to carry out general surgical and emergency obstetric procedures in the 1980s. They are now trained in orthopedics, ENT, ophthalmology, and anesthesia [40]. Mozambique realized the need to train NPCs after the mass exodus of medical staff resulting from a long drawn-out civil war; their first *tecnicos de cirurgia* qualified in 1987 [41]. In that year in Zaire, nurses were trained to perform emergency obstetric surgery [42], and Niger followed suit in 1992 to train 'paramedic surgeons' and surgical assistant medical officers in 1994 [43]. Burkina Faso started a six-month Essential Surgery training program in 1994 [44], and Ethiopia started in 1999 to train general practitioners in emergency surgery and obstetrics where referral was impossible [45]. The same drive has been made in Senegal [46], Somalia [47], and South Sudan [48]. In September 2012, the All India Medical Council approved a program to train community health officers to treat common surgical conditions operatively [49]. Although much surgery was found to be done in an ad hoc basis in most rural areas in developing countries, clinical results of surgery done by trained clinical officers have been shown in several studies, including a meta-analysis, to be as good as their medically qualified counterparts [50–57].

As examples of NPCs who in their lifetime have become experts, mention should be made of Hamilton Naki, who left school at age 14, trekked to Cape Town, South Africa, from his rural home in Transkei, and was employed as a tennis court attendant attached to Groote Schuur Hospital. In 1954, he was asked to help with tests on a giraffe being dissected to see why it does not faint when stooping to drink. Initially taught by Robert Goetz and his Swiss wife, Vreni to assist in dissection of animals, then anesthetize them, he finally came to operate on them. Quoted as saying, "I stole with my eyes", he ultimately became the best and fastest dissector in the laboratory, teaching many future surgeons [58]. He developed techniques used in liver transplantation, and retired, officially still a laboratory technician, in 1991. He was awarded South Africa's highest civilian honor, as well as an honorary doctorate.

A living legend is Mamitu Gashe, who, illiterate from a remote Ethiopian village, came at age 15 to the Fistula Hospital in Addis. Surgically cured of her obstetric fistula, she had nowhere to go, having been expelled by her husband. She started making beds, then helping to clean the operating theater for 2 years, to assist cutting sutures, to assist at operations, and eventually to perform the operations herself. She is now a senior surgeon in her own right and is one of the world's most experienced obstetric fistula surgeons [59]. She never went to school.

These two persons (Figure 2), without a degree, without formal medical education, without high school, or in the case of Miss Gashe, without even primary education,

Fig. 2 Hamilton Naki (*left*) and Mamitu Gashe (*right*). Examples of NPCs who have excelled in providing surgical care for the world's poorest

achieved surgical greatness. They are examples of how there can be no real obstacle to train those with aptitude, regardless of their origin, status or degree of learning, as District Essential Surgeons.

Discussion

Most surveys of surgery in LMICs portray a uniform situation despite differences in climate, social conditions, population density, cultural traditions, and religion. The situation in Benin is comparable to that in Baluchistan or Borneo. Very many people who need surgery simply cannot get it done. Systems of referral to secondary and tertiary centers are very rarely functional.

Much surgically treatable disease can however be dealt with simply, and a population survey in Sierra Leone suggested that 25 % of respondents had a condition possibly needing surgical attention and 25 % of deaths in the previous year might have been averted with improved access to surgical services [60]. In this country, the WHO estimates that there is a need for 80–100 surgeons [61]; however, in 19 hospitals, there were 10 surgeons currently in post, with only 5 working in hospitals accessible to the poor [62]. This situation is mirrored in Burundi (15 surgeons for 10 million people) and Rwanda (50 surgeons for 11 million people) [63]. Malawi has no specialist surgeon in any district hospital [64] and only 22 % of those performing surgery in Southern Nigeria had any surgical training [65]. Only six of Zambia's 44 surgeons are working in the rural areas—all of them missionaries [66]. All procedures done in eight district hospitals in Mozambique, Tanzania, and Uganda were performed by surgical and anesthetic practitioners who were not doctors [67]. This is in contrast to the USA, which has about 135,800 surgeons (2009) for 300 million people (45/100,000 people) [68], and Switzerland, which has 5,212 surgeons for 8 million people (65/100,000) [69].

Assuming no surgeon will ever depart elsewhere, nor fall ill, nor retire, nor die, it will take Burundi about 100 years to reach an official minimum capacity of surgeons, given a steady supply of four surgeons per year. Furthermore, even if sufficient numbers of specialist surgeons are trained, it is unlikely that they will settle in remote rural areas, which have the greatest need. Reasons for this maldistribution are well known and include inadequate income, lack of educational opportunities for children, poor working conditions, poor transportation, all of which contribute to the 'brain drain' both externally, to other countries, and internally to the cities and the private and non-governmental sectors. Traditional programs for surgical trainees last 13 and 15 years in the US and UK, respectively. Such huge investment is unaffordable in LMICs. Several countries struggle to train a few surgeons only for them to quit after qualification [70]. A total of 9,152 doctors practicing in the UK in 2005 were trained in SSA [71] and yet 28 countries in Africa and Asia were at crisis point in 2010 being desperately short of doctors (<0.2 per 1,000 people) [72].

The global shortage of health workers is a reality and the expansion of healthcare services is impossible without giving a major role to non-surgeons, especially in deprived and rural areas [73–75]. Watters and Bayley found that 86.4 % of 21,245 surgical procedures done in eight hospitals in Zambia in a year were not complicated and could be taught to non-surgeons [76]. Reid, et al. documented 7,209 surgical procedures in 19 rural hospitals in South Africa and found that 89 % were general surgical and obstetric procedures, with a single doctor acting as both anesthetist and surgeon in between 48–61 % of all procedures done [77]. Due to the varied nomenclature surrounding non-surgeons performing basic surgical care, we propose formalizing the use of the term for non-doctors to NPCs and the non-surgeon physician (NSP), who is a medically qualified officer with a limited level of surgical training. NPCs tend to stay in their home areas, doing what they can, as best they know how; they often work unsupervised, unmentored, and uncertified. In very many places, there is no one else who will do the surgery, and if they do not do the surgery in the Districts, it just will not get done. Indeed, a prospective study in Tanzania revealed that 70 % of 7,370 surgical patients seen at the tertiary center had bypassed the local district hospital, citing in 96 % of cases their reason for doing so being the absence of trained expertise locally [78]. Training in the realm of Essential Surgery is narrow and strict enough to be possible for NPCs and NSPs. Their training in surgical care needs to be competency based, with a strictly defined area of practice [79]. Such training is also required by medical practitioners

whose experience in practical surgical care is rudimentary and necessitates establishing a surgical base [80]. An analysis of general surgical and obstetric procedures performed in rural South Africa stresses that an attitude of "You can do it" rather than "Only a specialist can do this" is vital in terms of empowerment of trainees [77].

Proposed framework for sustainable global surgical care delivery

An essential surgical intervention list, while not being prescriptive, can provide guidance to both trainers and government bodies alike when setting priorities for improving surgical care capacity. Continuous investment in training programs for NPCs and NSPs, a significant cadre in LMICs, has been shown to be a valuable, cost-effective, life-saving, and disability-preventing strategy in rural areas where there are no surgeons [75]. Such programs must be in line with existing realities and guided by local conditions. In these environments, a practitioner will often need to improvise and be expected to work with what is available. To achieve this goal, structured training needs to be established to ensure that practitioners acquire both the competence and confidence to provide adequate surgical care. To improve safety, accountability, and promote continuous quality improvement, governments and policy makers need to provide on-going support in training and mentoring and opportunities for career growth to this cadre, not just train and abandon medical personnel to learn tasks through trial and error.

The 15 recommended essential surgical interventions represent a distillation of expert consensus, review of literature of original studies conducted in LMICs, and is a base to which these interventions, shown to account for more than 80 % of the needs of a surgical population [76], should be validated. The list serves as a guide to ministries of health and all other groups wishing to increase access to surgical services in LMICs by investing in training and increasing health service delivery. It is acknowledged that some LMICs have an expanding surgical workforce and therefore can continue to train more specialists while being able to meet the basic surgical needs of a population. The recommendation to train NPCs and NSPs is therefore limited to situations where the need demands their utilization. The training of NPCs is an option that is not necessarily a temporary, suboptimal, or stopgap measure. Instead, it is a viable solution to both short- and long-term surgical needs in LMICs. If "Essential Surgery" may be termed a "Tier One" surgical need, dealing with this primary need remains the initial concern and goal in LMICs. The few and overstretched existing surgical providers may then better concentrate on "Tier Two" surgical needs, the more complex demands of surgical care. Thus, there is no real threat to local surgical leaders and teaching institutions, but a call to them to become proactive in the training and regulation of this cadre of surgical practitioners.

Limitations in this study include lack of a multi-country study to validate each of the 15 interventions although a review of the literature and comparison of international recommendations by various groups show remarkable parallelism. Limited data exist on the unmet burden of disease from a population perspective and will need to be conducted by trained professionals. Localization and prioritization may be a challenge for local surgeon leaders and policymakers. Nevertheless, with growing awareness of the dire need, increased attention, and existence of groups wishing to collaborate and establish links, a base of support is available.

Conclusion

There is a practical, professional, and ethical urgency to make essential surgical care available and safe to all across the globe. Inevitably, because of logistics mentioned, this means that such essential surgical care will need to be carried out at District Hospital level. The notion of a "can do" list may best define what is expected surgically at the District level. Furthermore, this expertise is potentially well within the orbit of the NPC and the NSP. Indeed, it has been shown that the status of rural hospitals rises exponentially if they are also offering adequate surgical care [9]. These centers are the ones who will provide the backbone to essential surgical care for the poor.

Currently, global efforts to improve the quality of surgical care in developing countries through training non-surgeons remain disparate with little coordination and little evaluation of its efficacy. However, no other external non-indigenous solution to fill the surgical void will prove effective in the short to middle term. While this has been called 'task-shifting' [35], "task-sharing" is a better term [81] because local surgeons and supporting institutions are needed to motivate, mentor and nurture these trainees.

We postulate a modular program whereby each trainee gains proficiency in at least one of the 15 elements of Essential Surgery. The International Federation of Surgical Colleges (IFSC), an organization in official relations with the WHO [82], is prepared to certify such training. Other National Surgical Colleges would be encouraged to follow suit.

A basic package of essential surgical care interventions is imperative to provide structure for scaling up of such training. NPCs require training, mentoring, and monitoring. The cost of such training is vastly more efficient than the expensive training of a few polyvalent or specialist surgeons, who will not be sufficient in numbers within the

next few generations. Moreover, NPCs are used to working in the districts and are much less prone to gravitate elsewhere. The use of these practitioners as well as NSPs performing "Essential Surgery" is the only feasible route to deal with the huge lack of primary surgical care in LMICs particularly in sub-Saharan Africa, as well as elsewhere.

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