

BMJ Open A cross-sectional survey of essential surgical capacity in Somalia

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ABSTRACT

Objective: To assess life-saving and disability-preventing surgical services (including emergency, trauma, obstetrics, anaesthesia) of health facilities in Somalia and to assist in the planning of strategies for strengthening surgical care systems.

Design: Cross-sectional survey.

Setting: Health facilities in all 3 administrative zones of Somalia; northwest Somalia (NWS), known as Somaliland; northeast Somalia (NES), known as Puntland; and south/central Somalia (SCS).

Participants: 14 health facilities.

Measures: The WHO Tool for Situational Analysis to Assess Emergency and Essential Surgical Care was employed to capture a health facility's capacity to deliver surgical and anaesthesia services by investigating four categories of data: infrastructure, human resources, interventions available and equipment.

Results: The 14 facilities surveyed in Somalia represent 10 of the 18 districts throughout the country. The facilities serve an average patient population of 331 250 people, and 12 of the 14 identify as hospitals. While major surgical procedures were provided at many facilities (caesarean section, laparotomy, appendectomy, etc), only 22% had fully available oxygen access, 50% fully available electricity and less than 30% had any management guidelines for emergency and surgical care. Furthermore, only 36% were able to provide general anaesthesia inhalation due to lack of skills, supplies and equipment. Basic supplies for airway management and the prevention of infection transmission were severely lacking in most facilities.

Conclusions: According to the results of the WHO Tool for Situational Analysis to Assess Emergency and Essential Surgical Care survey, there exist significant gaps in the capacity of emergency and essential surgical services in Somalia including inadequacies in essential equipment, service provision and infrastructure. The information provided by the WHO tool can serve as a basis for evidence-based decisions on country-level policy regarding the allocation of resources and provision of emergency and essential surgical services.

INTRODUCTION

Conditions that can be treated with surgery account for 11% of the world's disability-adjusted life years.¹ Despite recent data

Strengths and limitations of this study

- Provides insight into the surgical capacity of Somalia.
- Identifies significant gaps and areas for improvement towards evidence-based planning to improve surgical infrastructure, skills training and equipment and supplies.
- Does not capture data from every first-referral health facility of the country.
- In some cases, measures captured are estimates.

estimating the global volume of surgery at 234 million surgical procedures annually and significant disparities between procedures performed in high-income and low-income countries, global public health initiatives have traditionally neglected the necessity for the provision of surgical services.² Poor access to surgical services, particularly at rural facilities, results in excess morbidity and mortality from a broad range of treatable surgical conditions including injuries, complications of pregnancy, sequelae of infectious diseases, acute abdominal conditions and congenital abnormalities. Improving access to surgical services in low-income countries requires addressing gaps in infrastructure, training and skills of personnel, appropriate equipment and medications.

Background

Somalia's 21 years of war, armed conflict and insecurity have had a devastating effect on the health sector. The current situation is at its worst since the beginning of the civil war in 1991, with unprecedented levels of child malnutrition and internal displacement, as well as conflict and insecurity rife in parts of the country.³ Continuing conflict has left 90% of health infrastructure looted, damaged or destroyed.⁴ The low health workforce ratios before the war have depreciated through high levels of healthcare worker emigration, leaving an estimated 3 physicians per 100 000 population (total 253 physicians), 11 nurses per

100 000 population (861 nurses) and 2 midwives per 100 000 population (116 midwives) serving the whole country.⁵

Rates of death and disability from treatable surgical conditions continue to be unacceptably high. Somalia's maternal mortality rate is estimated to be 1044 per 100 000 live-births, one of the highest in the region.⁶ This corresponds to a lifetime risk of one maternal death for every 10 women. The leading causes of maternal death (antepartum and postpartum haemorrhage, obstructed labour and eclampsia) can all be addressed with appropriate emergency obstetric care, which often require surgical and anaesthetic interventions. Trauma, as a consequence of road traffic accidents, armed fighting and landmine explosions, is also common. In 2010 and 2011, WHO reported more than 7500 war-wounded civilians who were admitted to the three main hospitals in Mogadishu, one in five being children and one in three women (WHO. Emergency and Essential Surgical Care. 2013. <http://www.who.int/surgery/en/>).

The health sector faces overwhelming challenges in a country where two decades of lawlessness have resulted in the collapse of central government and three almost autonomously ruled zones: northwest Somalia (NWS), known as Somaliland; northeast Somalia (NES), known as Puntland; and south/central Somalia (SCS). Somalia's public health system is tiered, comprising regional referral hospitals, district hospitals, maternal and child health centres and health posts. However, hospitals and health facilities are limited in number, inadequately distributed, operate using vastly different standards and often cannot provide a minimum package of primary healthcare (PHC) services. As funders and public health experts adopt the expansion of primary healthcare services, the inclusion of surgical services at the first-referral level is critical. The purpose of this survey was to collect knowledge gained from comprehensive quantitative assessments of surgical capacity in Somalia in order to assist in planning strategies for universal access to life-saving and disability-preventing surgical services (WHO. Emergency and Essential Surgical Care. 2013. <http://www.who.int/surgery/en/>).

Similar studies using the WHO Situational Analysis tool have been conducted in Tanzania,⁷ Solomon Islands,⁸ Gambia,⁹ Liberia,¹⁰ Ghana,¹¹ Afghanistan,¹² Sri Lanka,¹³ Sierra Leone¹⁴ and Mongolia.¹⁵

OBJECTIVE

The objective of this study was to assess life-saving and disability-preventing surgical services (including emergency, trauma, obstetrics, anaesthesia) of health facilities in Somalia and to assist in the planning of strategies for strengthening surgical care systems.

The aim of the study was also to assess the current capacity for essential anaesthesia and surgical services in Somalia with the purpose of providing a benchmark for critical areas needing improvement.

METHODS

The WHO Tool for Situational Analysis to Assess Emergency and Essential Surgical Care (EESC) was employed to capture a health facility's capacity to perform basic surgical (including obstetrics and trauma) and anaesthesia interventions by investigating four categories of data: infrastructure, human resources, interventions provided and equipment availability. The tool queries the availability of eight types of care providers, 35 surgical interventions and 67 items of equipment.⁷ The answer 'available' was defined as 'fully available for all patients all of the time', while 'sometimes' was defined as 'available with frequent shortages or difficulties' (WHO EESC Situational Analysis Tool, 2012, http://www.who.int/surgery/publications/WHO_EESC_SituationAnalysisTool.pdf).

Facilities were also asked the size of the 'population served', intending to quantify the population living in the catchment area. This value represents the number of residents who might use the facility as their first-referral health facility, not the number of patients seen.

The WHO Tool for Situational Analysis to Assess EESC was distributed by the Ministry of Health and WHO Somalia to 20 first-referral level health facilities around the country and was completed at 14 health facilities representing 10 of the 18 regions of Somalia and all three administrative zones. The survey was extended to regional medical officers and facility administrators. Participation in the survey and reporting to the WHO was voluntary. The physical surveys were then obtained either by post directly to the WHO Somalia office (Nairobi, Kenya) or by site visits from the Somalia Ministry of Health (MoH), the WHO country office and members of the Global Initiative for EESC (GIEESC) between September 2011 and April 2012.

Despite efforts to standardise the reporting and collection of much of the data by site visits performed by agents affiliated to the authors, it must be noted that an inherent reporting bias may be present in the data, given that survey data were compiled by different agents at each site. Furthermore, in a limited number of cases, facilities did not respond to individual questions. Blank answers were considered as neither a positive or negative answer, but simply deemed as unreported.

The collected data were then entered into and analysed from WHO Global DataCol Database for EESC.

RESULTS

Data were gathered from 14 health facilities in 10 regions (of 18) across Somalia, as featured in [figure 1](#) and [table 1](#). The six facilities that received the survey but did not return information are also listed in [table 1](#). Non-reporting can be attributed to lack of consistent operation, inability to gather data, and pervasive political instability and high-security risk throughout the country, making the transmission of this data difficult and costly.

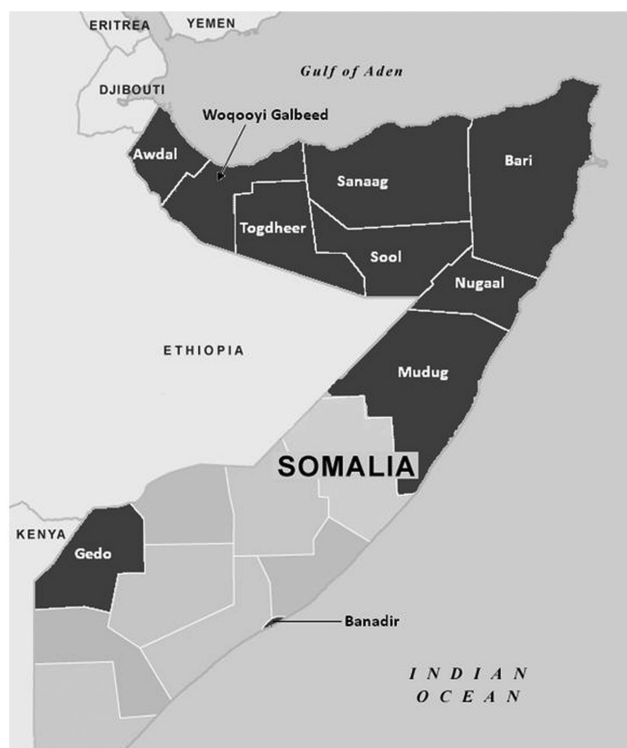


Figure 1 Participating regions of Somalia.

Health facility characteristics

Of the 14 facilities that responded to the survey, 5 were provincial hospitals, 5 were private/mission/NGO hospitals, 3 were general hospitals and 1 was a health centre. Each facility reported having at least 1 operating theatre, with a maximum of 11–20 operating theatres. The populations served by each facility ranged from 100 000 to 1 000 000 people, with the average population of the reporting facilities at 331 250 people.

Infrastructure

The emergency and surgical infrastructure of the 14 reporting facilities were largely inadequate, with only 22% of the health facilities having oxygen cylinder supplies consistently available. 28% of the facilities never or only sometimes had access to running water and only 50% had a consistently available electricity source. Only 50% of the facilities had fully available access to running water and electricity. Access to a functional anaesthesia machine was only present in 2 (15%) facilities, one of those facilities being a local health centre. Only three facilities reported access to a functioning pulse-oximeter.

Fifty per cent of the facilities had permanent areas designated for emergency care and only 38% of the facilities had the same for postoperative care.

A minority of facilities had formal management guidelines for emergency care (3/14=21%), surgery (5/14=36%), anaesthesia (4/14=29%) or pain relief (1/14=7%).

Table 2 depicts the key infrastructural elements available in the health facilities assessed.

Human resources

More data are needed to comment on human resources within healthcare in Somalia. In this section of the survey, blank answers to staffing questions impeded our ability to comment on the state of the workforce completely. We did, however, summarise the results of the survey questions to which all or a majority of facilities supplied data.

The 14 facilities together reported a total of 137 healthcare providers. Only 15 (11%) individuals were identified as full-time trained surgical specialists, located only at 9 of 14 of the facilities. A total of 14 (11%) were identified as obstetricians, and only 4 (3%) individuals were identified as qualified anaesthesiologists and were located in only 3 of the 14 facilities, with 27 (20%) unlicensed medical staff (nurses, medical assistants, etc) providing anaesthetic services.

Interventions

Of the 35 interventions queried, only abscess incision and drainage were offered at all 14 facilities. Acute burn management, wound debridement, hydrocoele treatment and male circumcision were widely provided by the surveyed facilities, being offered at 85–86% of all facilities. Caesarean section was offered at 93% of all facilities.

Provision of anaesthesia services was severely lacking, however, with only 36% of facilities able to perform general anaesthesia inhalational procedures. Of the eight facilities that answered why they could not provide this service, one (Doolow Health Center) attributed it to lack of skill and four (Borama General Hospital, Doolow Health Center, Erigavo Regional Hospital, Burao Regional Hospital) to lack of supplies or drugs. One facility (Gardo General Hospital) attributed it to lack of skill and lack of equipment.

The ability of each health facility to provide basic surgical and anaesthesia procedures was assessed (tables 3 and 4).

Emergency equipment and supplies for resuscitation

Basic equipment access was also lacking. No facility had access to all basic and essential surgical equipment listed by the tool. Only one hospital always had adult resuscitator bag valves and masks available, and only 2 of 14 facilities reported the same for paediatric bag valves and masks. Sixty-four per cent of the facilities had access to oxygen only sometimes or never, and less than 30% had oropharyngeal airways always available for adults and children. Thirty-nine per cent of institutions were without an examination table.

Basic equipment such as suction catheters, intravenous cannulas and Foley catheters were consistently available in less than 30% of all facilities.

Fifty-seven per cent of the facilities did not have sterile gloves consistently available, and 64% reported the same for examination gloves. Only 64% of the reporting

Table 1 Surveyed health facilities (N=14)

Type of facility (self-identified)	Name of facility	Region	Number of beds	Operating theatres
General hospital	Garowe Hospital	Nugaal	51–80	11–20
	Gardo General Hospital	Bari	21–50	1
	Hergeisa Group Hospital	Woqooyi Galbeed	301–400	5–10
Provincial hospital	Borama General Hospital	Awdal	201–300	1
	Burao Regional Hospital	Togdeer	201–300	1
	Berbera Referral Hospital	Woqooyi Galbeed	101–200	2
	Erigavo Regional Hospital	Sanaag	81–100	1
	Sool Regional Hospital	Sool	81–100	1
Health centre	Doolow Health Centre	Gedo	5–10	1
Private/NGO/mission hospital	Galkayo Medical Centre	Mudug	51–80	3–4
	Galkayo Specialist Hospital	Mudug	3–4	1
	Medina Hospital	Banadir	201–300	5–10
	Maani Hospital	Banadir	21–50	1
	Manhal Specialty Hospital	Woqooyi Galbeed	51–80	5–10
Facilities not responding to survey	Shikh Hospital	Woqooyi Galbeed	NA	NA
	Puntland Regional Hospital	Bossaso	NA	NA
	General Medical Service Hospital	Mudug	NA	NA
	Wajed Hospital	Bakool	NA	NA
	Dinsor Hospital	Bakool	NA	NA
	Sama Hospital	Bay	NA	NA

NA, not available.

institutions had a steriliser available all the time. Seventy-one per cent did not have face masks available, and 86% were without consistent availability of eye protection. Availability of soap and wash basins was reported in less than two-thirds of the 14 facilities.

The availability of emergency equipment and supplies for resuscitation was assessed in each of the health facilities (depicted in tables 5–7).

LIMITATIONS

There are several limitations to this survey. It provides only a brief overview of the capacity for surgical care and cannot be used for detailed programme planning. Although not every first-referral health facility in Somalia was surveyed, the majority identified by the MoH and WHO Somalia did reply and this allows a credible insight into the surgical capacity of the country.

Table 2 Availability of infrastructure and health resources in Somalia, 2012 (N=14)

	Always	Sometimes	Not available
Oxygen cylinder	3	1	10
Running water	10	2	2
Electricity source	7	5	2
Operational power generator	2	2	9
Blood bank	5	3	6
Haemoglobin and urine testing	12	2	0
X-ray machine	8	4	2
Medical records	10	3	1
Pulse oximeter	3	0	8
Area designated for emergency care	5	1	7
Area designated for postoperative care	5	1	7
Management guidelines for emergency care	3	1	10
Management guidelines for surgery	5	0	9
Management guidelines for anaesthesia	4	1	9
Management guidelines for pain relief	1	3	10
Functioning anaesthesia machine	7	5	2

Number of facilities where element is always, sometimes or never available. Italicised items designate those that are specific to quality surgical care delivery (N=14).

Table 3 Availability of surgical (including obstetrics and trauma) interventions

General surgery and trauma	Available	
Resuscitation (airway, haemorrhage, peripheral percutaneous intravenous access, peripheral venous cut down)	11	
Cricothyroidotomy/tracheostomy	10	
Chest tube insertion	9	
Removal of foreign body (throat/ear/eye/nose)	11	
Acute burn management	12	
Incision and drainage of abscess	14	
Suturing (for wounds, episiotomy, cervical and vaginal lacerations)	13	
Wound debridement	11	
Caesarean section	13	
Dilation and curettage (gynaecology/obstetrics)	12	
Obstetric fistula repair	7	
Appendicectomy	11	
Hernia repair (strangulated, elective)	10	
Hydrocoele	12	
Cystostomy	9	
Urethral stricture dilation	11	
Laparotomy (uterine rupture, ectopic pregnancy, acute abdomen, intestinal obstruction, perforation, injuries)	12	
Male circumcision	12	
Congenital hernia repair	9	
Neonatal surgery (abdominal wall defect, colostomy imperforate anus, intussusceptions)	5	
Cleft lip repair	10	
Clubfoot repair	9	
Contracture release/ skin grafting	10	
Fracture treatment	Closed	Open
	10	8
Joint dislocation treatment	9	
Drainage of osteomyelitis/septic arthritis	9	
Amputation	11	
Biopsy (lymph node, mass, other)	8	
Tubal ligation/vasectomy	9	
Cataract surgery	4	

Number of facilities at which the procedure is available (N=14).

Some of the data was taken after the WHO IMEESC toolkit was implemented in the country, and results should be qualified by the possibility of interpretation constraints of the survey.

DISCUSSION

Surgically treatable diseases are among the top 15 causes of disability,¹⁶ and conservative estimates show that 11% of the world's disability-adjusted life years (DALYs) stem from surgically treatable conditions.¹ In 2004, South East Asia and Africa accounted for 54% of the global burden,¹⁷ and since then the burden of surgical disease is thought to be increasing.¹⁶

More than two billion people globally are without access to surgical care.¹⁸ Of the 243 million surgical procedures performed globally each year, 34.8% of the world's population living in low-income countries only has access to 8.1 million (3.5%) of such procedures.² As a result, rates of maternal mortality are high, minor surgical pathologies become lethal and treatable trauma progresses to death.

Despite the great, unmet need and inclusion in policy-level dialogue on primary healthcare, the delivery of emergency surgical care has long been sidelined in global financing and policy debates, largely due to perceived complexity and cost. Human resources, metrics and science focused on global surgery, and sustained financing mechanisms for surgical infrastructure lag behind other public health priorities, despite the growing need for access to surgical care.¹⁹

Enormous shortfalls in infrastructure, supplies and procedures undertaken are common at district-level health facilities in LMICs.²⁰ Every \$1 spent

Table 4 Availability of anaesthesia interventions

Anaesthesia	
Regional anaesthesia blocks	6
Spinal anaesthesia	13
Ketamine intravenous anaesthesia	13
General anaesthesia inhalational	5
Number of facilities at which the procedure is available (N=14).	

Table 5 Availability of capital outlays for resuscitation

Capital outlays	Always	Sometimes	Never
Resuscitator bag valve and mask			
Adult	1	7	6
Paediatric	2	5	7
Oxygen	5	4	5
Stethoscope	9	3	0
Batteries for flash light	8	2	4
Suction pump	11	3	0
Blood pressure monitoring equipment	10	3	1
Thermometer	10	3	1
Scalpel handle with blade	9	4	1
Retractor	7	6	0
Scissors straight 12 cm	8	5	1
Scissors blunt 14 cm	7	6	0
Oropharyngeal airway			
Adult	4	6	4
Paediatric	4	5	5
Forceps Kocher no teeth	5	7	1
Forceps, artery	8	6	0
Kidney dishes stainless steel	6	6	1
Capped bottle, alcohol-based solutions	2	5	3
Gloves (sterile)	6	7	1
Gloves (examination)	5	8	1
Needle holder	9	5	0
Steriliser	9	5	0
Nail brush, scrubbing surgeon's	7	5	1
Vaginal speculum	9	2	3
Bucket, plastic	4	4	4
Drum for sterile compresses, bandages, dressings	8	4	1
Examination table	8	4	1

Number of facilities where element is always, sometimes or never available (N=14).

strengthening local surgical capacity generates \$10 through improved health and increased productivity.²¹ In 2008, the Copenhagen Consensus Center's research identified strengthening surgical capacity, particularly at the district hospital level, as a highly cost-efficient solution to global diseases. Notably, strengthening local surgical capacity is an approach that would provide a high degree of financial protection to populations and address the DALYs in a cost-effective manner.¹ In fact, the benefit–cost ratio for expansion of surgical capacity at district hospitals was found to be 10:1.²² Furthermore, due to the implementation of 'vertical' programmes in public health (ie, child health, maternal health, cancer and trauma), in which most programmes contain some surgical component, strengthening surgical services may improve the health system overall.²³

This study provides an overview of the capacity for surgical care representing health facilities in all three administrative zones of Somalia, including 10 of the 18 regions and demonstrates the significant gaps in infrastructure, life-saving and disability-preventing surgical interventions and essential equipment. Of the 14 reporting health facilities, 12 identified as full hospitals, serving an average patient population of over 300 000

people, further indicating the need for surgical care system strengthening.

Of the 35 basic surgical and anaesthesia interventions queried, most hospitals were unable to provide all of the basic surgical services. Major essential procedures such as caesarean section, appendicectomy, elective hernia and hydrocoele repair and laparotomy were offered at a majority of hospitals, but this conflicted directly with the continuous availability of basic and necessary supplies and infrastructures. Only three facilities had consistent access to oxygen cylinders, and even less reported access to tubing, valves and masks.

Necessary procedures including resuscitation and airway management were offered at a majority (79%) of the facilities. Facilities that weren't able to provide resuscitation, however, all reported provision of major surgical procedures. Such surgical procedures require provision and knowledge of resuscitation in order to be carried out safely. The facilities in question could not be contacted for confirmation.

Many facilities lacked access to key elements such as provisional oxygen equipment, oropharyngeal airways and intravenous cannulas. Only two facilities reported access to functional anaesthesia machines, and few facilities noted the ability to provide general anaesthesia

Table 6 Availability of renewable supplies for resuscitation

Renewable			
Suction catheter sizes 16 FG	2	5	6
Tongue depressor wooden disposable	3	7	3
Nasogastric tubes 10–16 FG	2	10	2
Light source (lamp and flash light)	4	9	1
Intravenous fluid infusion set	3	9	2
Intravenous cannulas	4	8	2
Scalp vein infusion set	3	7	3
Syringes 2 mL	4	9	1
Syringes 10 mL	4	10	0
Disposable needles	5	8	1
Sharps disposal container	5	8	1
Tourniquet	4	8	1
Sterile gauze dressing	3	8	2
Bandages sterile	3	7	3
Adhesive tape	3	9	1
Needles, cutting and round bodied (for suturing)	4	8	2
Suture synthetic absorbable	4	6	3
Splints for arm, leg	2	8	4
Towel cloth	2	8	3
Absorbent cotton wool	2	10	1
Urinary catheter Foleys disposable #12, 14 and 18 with bag	3	7	3
Sheeting, plastic for examination table	4	7	3
Waste disposal container	4	8	2
Face masks	4	8	2
Eye protection	2	5	7
Apron, plastic reusable	3	9	2
Soap	5	9	0
Wash basin	4	8	1

Number of facilities where element is always, sometimes or never available (N=14).

inhalation. Oxygen and anaesthesia are essential medicines, (WHO Model List of Essential Medicines, WHO, 2013. http://www.who.int/medicines/publications/essentialmedicines/18th_EML_Final_web_8Jul13.pdf) and the existing deficit limits the safety and efficacy of life-

Table 7 Availability of supplementary equipment for resuscitation

Supplementary equipment			
Magills forceps			
Adult	3	2	9
Paediatric	1	2	10
Endotracheal tubes	1	2	10
Intravenous infusor bags	1	2	10
Chest tubes insertion equipment	1	3	9
Laryngoscope			
Adult	3	3	7
Paediatric	1	3	9
Cricothyroidotomy set	1	1	11

Number of facilities where element is always, sometimes or never available (N=14).

saving surgeries in Somalia. It can also result in significant complications or patient suffering when these medicines are not available.²⁴

A surprisingly low number of facilities reported having access to equipment necessary for prevention of HIV transmission and other infection control. Less than half of the facilities reported access to sterile gloves, waste disposal containers, face masks, eye masks, aprons and even soap, all key components in the reduction of HIV transmission (WHO Prevention of Transmission of HIV, 2007, <http://www.who.int/surgery/publications/HIVprevention.pdf>)

A majority of the facilities lacked any formal guidelines for the management of emergency care, surgery, pain relief or anaesthesia, providing a significant barrier to the strengthening of emergency and surgical care services and severely limiting their ability to respond to large-scale disaster and crisis situations.

The severe gaps in infrastructure and capital are also obstacles for the delivery of basic primary care in these facilities. Absence of key infrastructural elements such as water, electricity, and oxygen was common in the surveyed facilities. Lack of sterilisation tools and supplies for infection prevention was also a common feature. Establishing management guidelines for surgical infrastructure and targeting strategies to address the aforementioned lacks in infrastructure is a priority. This would not only increase the quality of surgical services, but also that of basic primary care services offered by these facilities.

Strengthening of surgical systems will reduce the disease burden of surgically related issues and increase progress towards achieving the 2015 Millennium Development Goals (MDGs). Strengthening surgical care delivery can help achieve MDGs 1 (eradication of poverty),¹⁸ 4 (child health), 5 (maternal health) and 6 (HIV/AIDS prevention).²² Investing in oxygen and basic infrastructure, such as electricity and running water, will also serve to benefit patients suffering from a range of conditions.

To meet the needs of LMICs, the WHO EESC programme, with its partners worldwide, developed the *Integrated Management for Emergency and Essential Surgical Care* (IMEESC) toolkit (WHO IMEESC Toolkit: <http://www.who.int/surgery/en>). This toolkit guides policies, research for evidence-based planning (WHO EESC Situation Analysis Tool to assess emergency, trauma, obstetrics, anaesthesia and surgical services, WHO EESC Global Database), training, best practice protocols monitoring and evaluation of the progress of surgical care systems. The IMEESC toolkit provides guidance for policy-makers, managers and providers at various levels of care. It also includes instructional videos, training modules on emergency and trauma for frontline health workers, disaster management resources and monitoring and evaluation.

This study provides insight into the surgical capacity of Somalia, using the WHO Tool for Situational Analysis to

Assess EESC. Addressing the gaps identified in this study is needed not only to strengthen surgical care, but also holistic health systems in Somalia.²⁵ Further research is needed to determine the burden of surgical disease in Somalia and to determine the cost–benefit of specific interventions to improve surgical services.

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REFERENCES

1. Debas HT, Gosselin R, McCord C, *et al.* Surgery. In: Jamison D. ed. *Disease control priorities in developing countries*. 2nd edn. New York: Oxford University Press, 2006:1245–59.
2. Weiser TG, Regenbogen SE, Thompson KD, *et al.* An estimation of the global volume of surgery: a modelling strategy based on available data. *Lancet* 2008;372:139–44.
3. World Health Organisation. *Regional office for the Eastern Mediterranean, Cairo. Country cooperation strategy for WHO and Somalia 2010-2014*. 2010.
4. UNICEF. *The private sector and health: a survey of Somaliland private pharmacies*. 2008.
5. UNDP. Population projections. 2007.
6. UNDP. Millennium Development Goals Report for Somalia. 2007.
7. Penoyar T, Cohen H, Kibatala P, *et al.* Emergency and surgery services of primary hospitals in United Republic of Tanzania. *BMJ Open* 2012;2:e000369.
8. Natuzzi ES, Kushner A, Jagilly R, *et al.* Surgical care in the Solomon Islands: a road map for universal surgical care delivery. *World J Surg* 2011;35:1183–93.
9. Idriss A, Shivute N, Bickler S, *et al.* Emergency, anaesthetic and essential surgical capacity in the Gambia. *Bull World Health Organ* 2011;89:565–72.
10. Sherman L, Clement P, Cherian M, *et al.* Implementing Liberia's poverty reduction strategy: an assessment of emergency and essential surgical care. *Arch Surg* 2011;146:35–9.
11. Choo S, Perry H, Hesse AA, *et al.* Assessment of capacity for surgery, obstetrics and anaesthesia in 17 hospitals in Ghana using a WHO assessment tool. *Trop Med Int Health* 2010;15:1109–15.
12. Contini S, Taqdeer A, Cherian M, *et al.* Emergency and essential surgical services in Afghanistan: still a missing challenge. *World J Surg* 2010;34:473–79.
13. Taira BR, Cherian MN, Yakandawala H, *et al.* Survey of emergency and surgical capacity in the conflict-affected regions of Sri Lanka. *World J Surg* 2010;34:428–32.
14. Kingham TP, Kamara TB, Cherian MN, *et al.* Quantifying surgical capacity in Sierra Leone: a guide for improving surgical care. *Arch Surg* 2009;144:122–7.
15. Cherian MN, Noel L, Buyanjargal Y, *et al.* Essential emergency and surgical procedures in resource-limited facilities: a WHO workshop in Mongolia. *World Hosp Health Serv* 2004;40:24–9.
16. Farmer P, Kim J. Surgery and global health: a view from beyond the OR. *World J Surg* 2008;32:533–6.
17. Johnson WD. Surgery as a global health issue. *Surg Neurol Int* 2013;4:47.
18. Funk LM, Weiser TG, Berry WR, *et al.* Global operating theatre distribution and pulse oximetry supply: an estimation from reported data. *Lancet* 2010;376:1055–61.
19. Smith-Rohrberg Maru D, McGee HM, Brady JS, *et al.* Global Surgical Care in 2030: Metrics and Strategies for Expansion in Access and Quality. 2013. <http://www.worldwewant2015.org/file/298623/download/323967>
20. Kushner AI, Cherian MN, Shokohmand AS, *et al.* Addressing the millennium development goals from a surgical perspective: essential surgery and anaesthesia in 8 low- and middle-income countries. *Arch Surg* 2010;145:154–9.
21. United Nations. *A new global partnership: eradicate poverty and transform economies through sustainable development: the report of the high-level panel of eminent persons on the post-2015 development agenda*. United Nations Publication, 2013.
22. Jamison D, Jha P, Bloom D. Diseases—disease control. In: Lomborg B. ed. *Global crises, global solutions*. 2nd edn. New York: Cambridge University Press, 2009:129–63.
23. Ozgediz D, Jamison D, McQueen K. The burden of surgical conditions and access to surgical care in low- and middle-income countries. *Bull World Health Organ* 2008;86:646–7.
24. Cherian MN, Merry AF, Wilson IH. The World Health Organization and anaesthesia. *Anaesthesia* 2007;62:65–6.
25. Hedges JP, Mock CN, Cherian MN. The political economy of emergency and essential surgery in global health. *World J Surg* 2010;34:2003–6.