



BMJ Open Challenges and solutions to providing surgery in Sierra Leone hospitals: a qualitative analysis of surgical provider perspectives

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ABSTRACT

Objective This study aimed to use qualitative interviews with surgical providers to explore challenges and solutions to providing surgical and anaesthesia care in Sierra Leone's hospitals.

Design Data were collected through anonymous, semistructured interviews. We used a qualitative framework approach to analyse interview data and determine themes relating to challenges that were reported.

Setting A purposive sample of 12 hospitals was selected throughout Sierra Leone to include district and referral hospitals of varying ownership (private, non-governmental organisation and government).

Participants The most senior surgical provider available during each hospital site visit participated in a semistructured interview. A total of 12 interviews were conducted.

Results Providers described both challenges and solutions relating to the following categories: equipment and supplies, access to services, human resources, infrastructure, management and patient factors. These challenges were found to affect surgical care in hospitals by delaying surgical care, decreasing operative capacity and decreasing quality of care. Providers identified not only the root causes of these challenges, but also the varied workarounds and solutions they employ to overcome them.

Conclusion Surgical providers can offer important insights into challenges affecting surgical services in hospitals. Despite working in challenging environments with limited resources, providers have developed innovative solutions to improve surgical and anaesthesia care in hospitals in Sierra Leone. Qualitative research has an important role to play in improving understanding of the challenges facing surgeons in low-income countries.

INTRODUCTION

In 2015, the Lancet Commission on Global Surgery highlighted the value of surgical care as an essential component of a functional health system.¹ The challenge of providing access to safe, affordable and timely surgical care is especially daunting in the region of Western sub-Saharan Africa, where it is

Strengths and limitations of this study

- Semistructured interviews with surgical providers provide diverse perspectives on the challenges affecting surgical and anaesthesia care in Sierra Leone's hospitals, as well as possible solutions to those challenges.
- The qualitative approach used in this study allows nuanced exploration into how and why certain factors act as barriers to the provision of surgical care.
- The views expressed by surgical providers are inherently biased and may not accurately reflect the experiences of patients or other healthcare staff.
- The purposive sample in this study, despite involving just 12 participants, encompasses a broad range of provider qualifications, geographic regions, urban and rural settings, hospital referral levels, and hospital ownership (government, non-governmental organisation and private).
- The results of this study are not triangulated with quantitative data and should be taken as a complement to other studies of surgical facilities and human resources in Sierra Leone.

estimated that only 15% of the need for safe, affordable and timely surgery is currently met.² In Sierra Leone, the legacies of colonialism, civil war, the Ebola epidemic, the COVID-19 pandemic and systemic global trade inequalities have impoverished many of the country's citizens and eroded its health system.^{3 4} Estimates of unmet surgical need in the country have reached as high as 91%.⁵ This high unmet need reflects a combination of high burden of disease,⁵ lack of access to care⁶ and low surgical capacity.^{7 8} Sierra Leone has just 2.7 surgical providers per 100 000 population,⁹ but the unequal geographical distribution of these providers means that surgical care is not available and accessible to the majority of the population.¹ Only 30% of hospitals in Sierra Leone are able to provide all three surgical Bellwether procedures

(caesarian, laparotomy and treatment of open fracture), which are benchmark procedures that indicate a functioning surgical hospital.¹⁰ Understanding the challenges faced by surgical providers in Sierra Leone's hospitals is key to implementing appropriate interventions to expand the country's surgical capacity.

Nearly all studies of Sierra Leone's surgical system have been quantitative assessments of the country's surgical human resources, hospital infrastructure and access to surgical care.^{7-9 11-13} These studies provide critical insights into the deficits affecting Sierra Leone's surgical system, but they also have limitations. Purely quantitative assessments are not always adapted to local contexts and may not provide explanations of how and why various factors affect the provision of surgical and anaesthesia care. If a hospital or provider faces challenges in providing surgical care that are not explicitly measured in a quantitative assessment, the assessment will be unable to capture those challenges.^{14 15} A growing body of work in global surgery has emphasised the importance of qualitative studies as a means of providing greater context and depth of understanding about the obstacles for access to quality surgical and anaesthesia care.¹⁶⁻¹⁹ Such studies are adaptive to local contexts through open-ended questions that elicit the views of respondents in their own words. The qualitative data provided by surgical providers, who have expertise and experience from working within the surgical system, can illustrate the complex dynamics in which various challenges affect the provision of surgery.¹⁷ The aim of this study is, therefore, to better understand the challenges in providing surgical and anaesthesia care in Sierra Leone's hospitals by interviewing surgical providers.

METHODS

Design

Anonymous, semistructured interviews were conducted with Sierra Leonean surgical providers at hospitals throughout the country from April to July 2017. A qualitative framework approach was used to analyse interview data and determine themes relating to challenges that were reported.

Setting

There are a total of 54 hospitals in Sierra Leone. A sample of 12 hospitals was selected through purposive sampling to provide variation in geographical region, facility ownership (government, non-governmental organisation (NGO) or private) and referral level (district or referral hospital).¹⁴ Three hospitals were included from each province: Western Area, Northern, Eastern and Southern. District hospitals in Sierra Leone are designed to provide primary surgical and obstetric care, while regional hospitals are typically located in major regional cities and provide specialty and complex surgical care.¹²

Participants

'Surgical provider' was defined in accordance with the Lancet Commission's definition to include any

healthcare provider, regardless of professional qualification, who provides surgical or obstetric care.¹ This definition included Surgical Assistant Community Health Officers (SACHOs), who are community health officers that have been trained by the Sierra Leonean Ministry of Health and Sanitation and the NGO CapaCare to perform general surgical and obstetric procedures under indirect specialist supervision.²⁰ Providers were identified for inclusion in the study using key contacts in hospital management. The most senior provider available during the site visit was interviewed. Written informed consent was taken from providers before conducting recorded, semistructured interviews. Respondent and hospital identifiable information were kept confidential but provider qualification and job title, as well as hospital ownership and referral level, were reported. Hospital geographical region was not reported along with respondent information to preserve anonymity.

Semistructured interview

The interview questionnaire was developed based on existing surgical system assessment tools in the literature. Specifically, the WHO Tool for Situational Analysis, WHO's Service Availability and Readiness Assessment (SARA) tool and the Surgeons Over Seas Personnel, Infrastructure, Procedure, Equipment and Supplies tool were analysed to assess their major categories.^{8 10 21} The categories identified included access, staffing, physical infrastructure, equipment and supplies, and management. These categories formed the outline of the topic guide for the semi-structured interview. The interview questions used in a previous study were adapted to create a semi-structured interview that encompassed the above categories (online supplemental material 1).¹⁷ The questions were reviewed by the Sierra Leonean surgical residents on the research team (MMB, PG and AC) to ensure that they were context-appropriate and comprehensible to surgical providers in Sierra Leone. Open-ended questions were used to examine the major challenges to providing surgery, the workarounds or solutions to those challenges, and their root causes (figure 1). Further prompting questions explored content surrounding access, staffing, physical infrastructure, equipment, supplies and management.²² Interviews were performed by MMB and SW and were audiorecorded.

Data analysis

Interview data were analysed using a framework analysis qualitative approach. This approach uses the a priori theory and outline of the topic guide as an initial framework for qualitative analysis, but also incorporates concepts and meanings that emerge from participant responses.²³ The first stage of analysis involved a familiarisation stage, in which responses were read through to understand meanings, concepts, and ideas. Next, general themes that emerged at this stage were explored and formed the basis of a thematic framework. Interview data were then indexed based on the thematic framework

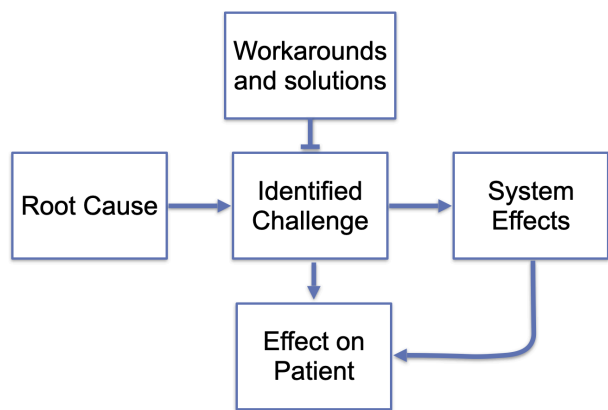


Figure 1 Conceptual diagram for analysis of challenges, root causes, workarounds and solutions, system effects and patient effects.

using NVivo V.12 software.^{23–25} The indexed data were organised into thematic charts for each category, using direct quotation where possible or a summary of the respondent’s meaning. Thematic charts were organised as matrices with rows of challenges and columns for the roots of the challenge, workarounds and solutions, the effect of the challenge on the health system and the effect on the patient. These themes were further mapped and interpreted to understand the broad pathways through which challenges impact surgical and anaesthesia care.²⁵ Researcher SW transcribed and indexed the data. Thematic charts were reviewed by AJML and SW and modified when necessary to clarify meaning or to better conform to interviewee responses.

Patient and public involvement

No patients involved.

RESULTS

Descriptive statistics

Site visits were conducted at 12 hospitals across the Northern, Eastern, Southern and Western regions. Three hospitals were visited in each region to provide geographical diversity in the sample. Descriptive statistics about hospital ownership, referral level and provider qualification level are displayed in [table 1](#). The final sample included two specialist surgeons, one specialist obstetrician-gynaecologist (OBGYN), one attending-level physician without specialist training, two registrars, two medical officers and four SACHOs. Interviews lasted between 28 min and 98 min, and average interview time was 57 min.

Challenges

Qualitative analysis revealed 48 distinct challenges described by surgical providers, which are reported below in [table 2](#).

Each challenge was reported by at least two different providers, suggesting that data saturation was attained. These challenges were indexed into a thematic framework (online supplemental material 2). There were six major categories of challenges: Equipment and Supplies, Access to Care, Staffing, Physical Infrastructure, Patient Factors and Management. These major categories differed from the framework informed by the topic guide in that a separate category of ‘Patient Factors’ emerged based on participant responses. The challenges in this category related to patient attitudes, beliefs and personal health backgrounds. Thematic mapping revealed three general pathways by which challenges affected the provision and outcomes of surgical and anaesthesia care: (1) delaying surgical care, (2) loss of operative capacity and (3) decreased quality of care. Selected solutions and workarounds reported by providers are displayed in [table 3](#).

Table 1 List of interview subjects and hospital characteristics

Interview	Region group	Provider qualification	Referral level	Setting	Facility ownership
A	1	SACHO	Referral	Urban	Government
B	1	Specialist surgeon	District	Urban	NGO
C	1	Registrar	District	Rural	Government
D	2	SACHO	Referral	Urban	Government
E	2	Medical officer	District	Rural	Government
F	2	Attending-level physician	District	Rural	NGO
G	3	SACHO	Referral	Urban	Government
H	3	SACHO	Referral	Rural	Government
I	3	Medical officer	District	Urban	Private
J	4	Registrar	Referral	Urban	Government
K	4	Specialist surgeon	Referral	Urban	NGO
L	4	Specialist OBGYN	District	Urban	Government

NGO, non-governmental organisation; OBGYN, obstetrician-gynaecologist; SACHO, Surgical Assistant Community Health Officer.

Table 2 Challenges organised by category

Category	Challenges	Category	Challenges
Equipment and supplies	Lack of appropriate suture ^{a,b,d,e,g,h,i,j} Inadequate surgical instruments ^{b,c,d,e,g,h,i,l} Lack of equipment maintenance ^{b,c,d,h,j,k,l} Cost of drugs ^{a,b,d,e,f,g,h,j} Unavailable or expired drugs ^{a,b,c,d,h,j,l} Lack of diagnostic imaging ^{a,c,d,e,f,h,k} Lack of laboratory testing ^{a,c,e,h,k} Low sterilisation capacity ^{a,c,d,e,j} Oxygen unavailable ^{b,c,e,g} Lack of operating theatre equipment ^{a,c,d,e,j} Lack of surgical consumables ^{a,e,l} Lack of anaesthesia equipment ^{a,c,j}	Access to care	Unaffordable care ^{a,b,c,d,e,h,i,j} Low follow-up ^{a,b,c,g,i,k,l} Lack of critical care ^{b,c,d,e,g,k,l} Distance to care ^{b,d,e,f,j,k} Inadequate referral network ^{b,c,d,e,f,k} Poor road network ^{b,d,f,g,h} Delay in referral from primary facility ^{e,g,j,l} Cost of referral ^{a,d,e,h,k} No rehab or physical therapy ^{a,c,e}
Staffing	Lack of surgical providers ^{a,b,d,h,j,k,l} Lack of anaesthesia providers ^{a,e,i,j} Lack of support staff ^{a,c,h,j,l} Poorly trained support staff ^{a,c,e,f,j} Need for continuing education ^{d,e,j,l} Lack of specialist surgeons ^{a,b,e,h} Inadequately trained anaesthesia providers ^{c,d,k} Support staff volunteerism ^{a,e,j}	Physical infrastructure	Irregular electricity supply ^{a,d,g,h,j,l} Irregular water supply ^{a,b,d,e,g,l} Poorly designed operating theatre ^{a,c,d,g,l} Lack of surgical ward beds ^{a,e,h,k,l} Lack of operating theatres ^{a,h,j,l} Need for air conditioning in OT ^{a,d} Lack of space in surgical ward ^{g,l}
Patient factors	Lack of awareness of surgical disease ^{a,d,e,h,k,l} Patient and relatives' perceptions of surgery ^{c,d,k,l} Low blood supply ^{a,b,d,e,g,h,i,l} Use of traditional medicine ^{a,e,b,k} Patient baseline health status ^{i,k,l}	Management	Difficulty following guidelines and protocols ^{a,c,g,j,k} Lack of performance monitoring and evaluation ^{b,c,j,k} Need for staff accommodation ^{d,e,g,h} Poor supply requisition system ^{a,c,j} Budget constraints ^{a,b,e} Financial remuneration ^{e,h} Inability to discipline staff ^{b,c}

Equipment and supplies

Shortfalls in surgical instruments and other operating theatre equipment affect the quality of surgical care provided,^{b,j,l} lead to delays in care,^l and limit operative capacity.^{a,c,d} Providers report frustration in trying to perform surgeries with scarce, worn-down surgical instruments.^{b,c,d,e,g,h,i,l} Autoclave capacity is low in many hospitals, and, as a result, sterilisation of scarce surgical instruments can create delays in setting up the operating theatre.^{a,c,d,e,j} Autoclaves can also be inoperable during electricity outages,^{a,d,j} a challenge that one hospital overcomes with gas-operated autoclaves.^h Surgical providers struggle to make the best of what they have using suboptimal instruments, either compensating with operative technique or 'improvising' to reduce surgical trauma and complete the operation efficiently.^{g,j,k} Yet, as one provider notes:

When you improvise you are not doing the right thing. Any time you improvise, there is the tendency for complications to arise. That is what I was taught.^j

Operating theatres that do not have a full complement of surgical, anaesthetic, and monitoring equipment are

less safe for patients,^{c,d} may not be suitable for complex cases,^c and in some cases are entirely unusable.^{a,j} Diagnostic imaging and laboratory equipment can be in short supply as well,^{a,c,d,e,f,h,k} hindering diagnosis of surgical disease.^j

The roots of these equipment challenges include the equipment requisition system in government hospitals, equipment wear and overuse, funding constraints and corrosive sterilisation practices.^{b,c,d,e,i,l} Some hospitals depend on donations of equipment that may not be well suited to their actual needs.^{c,j} Respondents emphasise surgical provider involvement in equipment requisition as a solution to obtain more appropriate equipment,^{d,h,i} whether from government or from NGOs.^{e,h,k} The lack of equipment maintenance is another contributing factor to these equipment shortfalls.^{a,b,c,d,h,j,k,l} Maintenance is difficult to access in Sierra Leone because of the scarcity of biomedical technicians.^{c,j,k,l} Consequently, some potentially useful equipment is consigned to scrap.^c Some respondents were able to teach staff members to maintain equipment as a workaround to this challenge,^{d,k} while others had to bring in technicians from abroad or rely on NGO support.^{b,c,h,k} However, in hospitals without the

Table 3 Selected solutions and workarounds reported by providers, organised by category

Category	Solutions	Category	Solutions
Equipment and supplies	Surgeons buy suture ^{i,j} or drugs ^{d,g,i} themselves Provider-led supply requisition ^{d,h,i} Use of technique ^{d,i} or improvisation ^{g,k,j} to overcome equipment inadequacy Bring biomedical technicians from abroad ^{b,k} Train staff to maintain equipment ^{d,k} NGO support for equipment, ^{e,h,k} drugs, ^c and maintenance ^e Governmental support through the FHCI ^{d,e,h,k} Drug monitoring system to report shortfalls ^{f,h} Rely on clinical diagnostic skills ^{c,d} Gas-operated autoclaves ^h Ketamine ^c or local anaesthesia ⁱ when appropriate and available	Access to care	Payment deferment plans ^{a,j} and loans ^h Budget for emergent or vulnerable patients ^{c,e,j} Financial support from FHCI ^{e,i} or NGOs ^{e,h,k} for patient care or referral costs National free surgical care policies ^{c,j} Push patients ‘to the crunch’ until can pay for care ^c Long-distance ambulance service ^{c,d,f,k} First-aid posts ^k Counsel patients on importance of follow up ^{a,c,g,i,j} or provide discharge info cards ⁱ Outreach to primary facilities to reduce delay in referrals ⁱ
Staffing	Train more surgeons ^a and SACHOs ^h Expand post-graduate surgical training ^a Supervised on-the-job training during surgeries ^{f,k} Increase government salaries ^h and rural incentives ^c NGO-supported continuing education ^{d,g} ‘Refresher courses’ to train staff ^{a,f,h,i} Use specialists from foreign missions ^f Non-anaesthesiologist physicians take on anaesthesia responsibilities ^h Closely monitor ⁱ and develop rapport ^e with support staff volunteers	Physical infrastructure	Use of backup generators ^{a,c,e,h,i,k} and solar arrays ^{f,h} for electricity Headlamps ^{a,d,g,i} or mobile phone lights ^{i,l} in OT during outages Have manual alternatives (eg, suction, haemostasis) ^j Operating theatre renovations ^{c,i} Water reservoirs for stable supply ^{a,e,h,i} NGO-supported plumbing renovations ^{g,i} Enhanced recovery and early discharge pathways to free up beds ^b Refer patients to hospitals with beds ^k or better facilities ^c
Patient factors	Sensitise patients ‘on the air’ (eg, radio, television) about surgical disease ^f Educate patients on preventive care ⁱ Take time to counsel patients and family on risks and benefits of operation ^{a,d,g,i,k} Religious or tribal authority support to counsel patients and families about operations ^{k,l} ‘Sensitise’ about importance of blood donation ^{a,b,c,g,h,i} and educate on effects ^{d,g} Blood donation compensation ^{e,f,j,l} Mandatory donation: relatives ^h or patients after recovery ^{h,k} Counsel patients about the potential risks of traditional medicine ^{a,e} More conservative treatments for patients with poor baseline health ^k	Management	Use safe surgery checklist ^{b,g,i} Display guidelines on the walls in OT ^{d,h} Direct supervision by senior providers to monitor performance ^{a,d,e,f,h} Residency self-monitoring system ⁱ Case logs for surgical assistant CHOs ^{c,g,h} NGO mission reports to monitor performance (NGO hospital) ^k Financial support from NGOs ^{e,f} Morning meetings to communicate supply needs to management ^a Disciplinary committee ^c or rotating and firing employees for discipline issues ^{b,c,f}

For a complete list of solutions and workarounds, see online supplemental material 2.

CHO, community health officer; FHCI, Free Healthcare Initiative; NGO, non-governmental organisation; SACHOs, Surgical Assistant Community Health Officers.

equipment needed to make correct diagnoses, provide appropriate anaesthesia, and monitor and support vital functions, providers often feel that the safest solution is simply referral to another hospital.^{c,d} In effect, district hospitals lose the capacity to manage surgical cases because of basic equipment and supply shortfalls, which in turn increases the burden on referral hospitals.^c One provider working at a district hospital described it this way:

We have the beds here—(referral hospitals in Freetown) don’t have the beds. They have the

technical... you know... it’s there. They have the equipment. But again, they don’t have the capacity.^c

Drug and other supply shortfalls can further delay surgery and compromise the safety of surgical operations.^{a,d,e,g,h,l} The inappropriate use of chromic catgut—in many cases the only available suture material—in general and obstetric surgery can lead to poor wound healing, increased bleeding risk, and other operative complications.^{a,b,d,e,g,h,i,j} Relatives may be compelled to find and purchase expensive surgical drugs or supplies before the surgery can begin.^{a,c,d,g,h,j} For many, the costs

of these medications makes surgery prohibitively expensive,^{h,j,f} and pooling resources from family and community results in delays to care.^d

In government hospitals, providers attribute the root causes of drug and supply problems to high costs, national scarcity and a ‘push’ logistics system of providing equipment and supplies that does not use input or feedback from surgical providers.^{a,c,e,g,l} Solutions to drug and supply shortfalls are varied. Some surgical providers propose a provider-led supply requisition system as a replacement for the ‘push’ system of provisioning hospitals to better align supply and demand.^{d,i,h} When hospitals cannot afford sutures or maintain supplies of appropriate sutures,^{a,g,j} providers may have to purchase their own, convince patient relatives to buy them, or make use of the best available alternative.^{a,d,i,j} Providers can sometimes circumvent shortfalls of anaesthetic drugs and equipment by performing operations using ketamine for sedation, or spinal anaesthesia, although this makes certain operations more difficult.^{a,b,c} Other solutions include hospital cost-recovery initiatives, supply monitoring systems,^{f,h} dedicated funds for medications,^{a,g} or having the surgeon or anaesthetist pay for medications or supplies.^{d,e,g,j}

Access to care

The most common challenge that respondents cited affecting access to care was how unaffordable surgery is for most Sierra Leoneans.^{a,b,c,d,e,h,i,j} Deterred by the cost of surgery, many patients defer seeking treatment and present with emergent surgical conditions.^{c,f,j} Others live for years with non-emergent surgical conditions like hernias.^c As one provider posits:

Today, if I say I’m going to offer free surgery in the hospital, you’ll have thousands of [patients] coming. But they are not coming, because they have to pay, because it’s not free.^c

Providers report that the root causes of the unaffordability of surgery are the high rate of poverty and the fee-for-service payment model in Sierra Leone.^{c,j} Faced with budget constraints, hospitals struggle to find solutions to provide care for emergency surgical cases and destitute patients. Some hospitals and NGOs have set aside funds for these ‘vulnerable’ patients while others have management structures that allow for loans or deferred payments.^{a,c,e,h,j} In some cases, providers are forced to delay surgery to determine a patient’s ability to pay. By pushing the patient ‘to the crunch’ of a life-threatening surgical emergency, they can discern which patients are truly destitute.^c Rather than delay surgery at the risk of the patient’s life, some surgical providers instead elect to personally cover the cost of the operation.^{a,c,j} National policies to improve financial coverage for surgical care were proposed as systemic solutions to the unaffordability of surgery.^{c,j} Currently, some hospitals are financially assisted by NGOs,^{e,h,k} while others rely on the financial support provided to select patients covered in the government’s Free Healthcare Initiative (FHCI).^{e,l}

Other challenges to timely surgical care include limited road networks and long distances to care.^{b,c,d,e,f,g,h,k} Patients from rural areas sometimes must cover long distances over rugged terrain or cross obstacles like rivers to reach the hospital.^{d,f,h} As a result, many patients present to facilities delayed and in a ‘moribund state’ with poor prognoses.^{b,d,f,k} Similar issues affect referral to and from hospitals. Travel time to referral hospitals can be significant, and patients have to cover the fuel costs.^{a,c,e,d,h} Referral is costly for other reasons as well: patients are separated from relatives, must find accommodation and food, and face even more costs for further diagnostics and treatments.^{a,c,d} When they reach the referral facility there is no guarantee of a bed—or even that the facility has been informed of their case.^{e,i,l} Given the difficulties with communication and travel, it is no surprise that many patients are lost to follow-up after referral or discharge from the hospital.^{a,b,c,g,i,k,l}

The roots of these transport and referral challenges are the transportation infrastructure in Sierra Leone, geographical obstacles, distance between hospitals, and communication systems.^{f,h,i,j} Some patients have no means of transportation and ambulances are scarce.^{c,f,j} Patients can be held up at primary health facilities that delay referral.^{e,g,j,l} Even when patients are capable of returning for follow-up, many believe it is unnecessary to return to their doctor unless they are experiencing obvious problems.^{d,g,i,j,k} To address this problem, providers counsel patients on the importance of follow-up,^{a,c,g,j,i} provide them with instruction cards,ⁱ or supply dressings for home care.^c Outreach to district hospitals and rural health posts is one solution that has been used to improve referral communications.^l Some hospitals have found solutions to improving patient access through first aid posts that extend the reach of the hospital^k or ambulances that are equipped to handle rough terrain.^{c,d,f,h} However, ambulances can still present cost barriers to patients, with the fuel and transport costs only covered for pregnant or nursing mothers and young children in the FHCI system.^c

Patient factors

Providers report that there are distinctive patient factors in Sierra Leone that present challenges to surgical and anaesthesia care. One patient factor cited as a challenge is that patients have low levels of awareness of surgical disease, such as symptoms of a surgical illness or signs of a surgical emergency.^{a,d,e,g,h,l}

A patient with a distended abdomen, an acute abdomen, will just say, it’s because I have not passed stool. That’s why the abdomen is distended. Not because maybe their typhoid perforation’s leaking.ⁱ

Patient perceptions of surgical facilities affect their decision to seek care. When hospitals are perceived to be deficient in diagnostic and treatment capacity, patients may feel there is ‘no point in asking why’ they feel ill, as one provider stated.^k When patients reach the hospital, they may delay in consenting to an operation due to fear, lack

of understanding, or because they ‘have to seek opinions’ from relatives.^{a,d,h,k,l} Treatment can also be complicated by prior intervention from traditional healers, which may delay patients or even cause a severe wound infection.^{a,b,e,k} One consultant surgeon describes the potential consequences:

There are patients with gangrenous limbs ... because maybe it’s a condition that is following a trauma that was treated by a herbalist or so. And they applied cow dung, herbs... and the patient ends up with a gangrene.^k

Providers do their best to counsel and educate patients and their relatives when a condition is urgent, even to the point of requesting assistance from a religious leader or tribal chief.^{f,a,d,g,j,k,l} One provider leverages radio and television broadcasting to sensitise patients about surgical disease and preventive care ‘over the air.’^f Providers also make a point of discussing the potential risks of traditional medicine with their patients.^{a,c}

Another patient factor that is reported as a challenge is the low rate of blood donation. The low rates of blood donation relate to fears about the consequences of blood donation and cultural taboos surrounding the practice.^{a,b,c,d,g,l} One OBGYN at a referral hospital describes the challenge in patient and family perceptions of donation in this way:

But here, people are not coming out because some patients’ relatives will say, ‘oh, you want to [...] take my blood,’ it’s as if you’re going to drain him of all of his blood. Here, they don’t understand it’s just a pint and it’s just, I think, a mentality of the average Sierra Leoneans about the blood, it’s like a taboo.^l

High demand for transfusion is another reason for the low availability of blood. Patients may have baseline anaemia due to malaria or poor nutritional status.^{e,k,l} This in turn can be exacerbated by delayed presentation after a traumatic accident, or bleeding caused by the inappropriate suture or instruments.^{b,g,h} Several hospitals in the sample have increased their donation rates through ‘sensitising’ public awareness campaigns^{a,b,c,g,h,l} and compensation for blood donors with money or free care.^{e,f,j,l} Two hospitals successfully instituted a policy of mandatory blood donation (either by patients or relatives) to replenish supplies after patients have been treated, thereby maintaining a continuous supply of banked blood.^{h,k}

Other reported patient-specific factors include compromised patient immunity, which can predispose to infection, and nutritional status, which can cause anaemia and worsen wound healing.^{k,l}

Physical infrastructure

The irregular electricity supply was a frequently cited challenge relating to hospital infrastructure in both urban and rural areas, and it is an issue that affects many other aspects of the surgical system.^{a,d,g,h,j,l} The effects

of this challenge are cross-cutting, impacting quality of care, timeliness of care, and operative capacity. Power outages can have devastating consequences for the intubated surgical patient or the intensive care unit patient, as noted by a resident at a referral hospital:

...[One] man about 45 years of age was walking along the road coming from the mosque, and he was hit by a car ... In fact, along the way he vomited, so he aspirated to some extent. He came, SpO₂ was 84, his GCS was 8—that patient needs ventilation. He was there, we placed him on oxygen via facemask, and unfortunately the light went off. By the time they put on the high flow oxygen, he was dead.^j

Electricity outages can also cause delays to surgery while staff wait for power to return to lights, equipment, and monitors.^{a,j} The inability to use electric autoclaves during outages compounds issues around surgical instrument shortfalls to further delay surgery.^{a,d,j}

The roots of the irregular electricity supply are that the power supplied by the power company is unreliable or dependent on seasonal variations in hydroelectric power.^{a,d,g,h,j,l} To work around the challenge of irregular electricity supply, providers use backup generators,^{a,c,e,h,i,k} gas-operated autoclaves,^h and solar arrays,^{h,f} although in some cases generators can be too expensive to fuel or prone to breaking down.^{a,d,j,l} Some providers ensure that they have access to headlamps in case of power outages,^{a,c,e,h,i,k} while others use mobile phone flashlights in emergent cases.^{j,l} For hospitals without consistent generator power, complex procedures requiring general anaesthesia are too risky to undertake.^{a,g,h} Water supply, while also inconsistent,^{a,b,d,e,g,l} can be guaranteed with the use of drums to store water or plumbing renovations supported by NGOs.^{a,e,g,h,l}

Poorly designed and constructed operating theatres can increase the risk of breaking the sterile field.^{a,c,j} In operating theatres without air conditioning, providers struggle to maintain a sterile environment while sweating profusely and may have to rotate staff in and out of the operating theatre as a workaround.^{a,d} NGO-supported renovations have improved the design and function of operating theatres.^{c,j} Providers recommend adding operating theatres and ward beds as a solution to many infrastructure challenges.^{a,e,h,j,k,l} Another infrastructure challenge is lack of surgical beds and physical space in surgical wards.^{a,e,g,h,k,l} Hospitals that were initially built for fewer patients strain to accommodate more patients and surgical cases, which leads to overcrowding and delays to care.^{e,g,h,l} One provider was able to implement enhanced recovery protocols to assist with early discharge and successfully reduce overcrowding on wards.^b

Staffing

The commonly repeated challenge regarding staffing is that hospitals are simply understaffed relative to admitted patients. In particular, the number of surgical providers in hospitals is perceived to be inadequate.^{a,b,d,h,j,k,l} The

roots of these deficiencies are low salaries,^l emigration of trained providers,^k and low incentives for specialists, especially in rural areas.^c Consequently, few specialist surgeons are available in district hospitals, or even some regional referral hospitals, greatly limiting the capacity to perform complex procedures in these areas.^{b,k} Providers in district hospitals feel overworked as a result of their low numbers, which feeds back to negatively affect provider retention.^{c,d,l} The training and recruitment of SACHOs is a solution that has helped to reduce this work burden.^{f,h} Improving rural incentives to recruit providers to rural, district hospitals is another reported solution.^c

Aside from surgical providers, other staff are in short supply as well. Anaesthesia providers are scarce and specialist training for anaesthetists only recently became available.^{a,e,i,j} Most anaesthetic providers are trained as nurse anaesthetists, which limits the complexity of anaesthesia that can be provided.^{a,c,d} Surgical support staff, such as perioperative nurses and scrub nurses, are also few in number, which affects hospital surgical capacity.^{a,c,h,j,l} Volunteers who are not on the government payroll sometimes join the hospital ranks, but present their own set of challenges.^{a,e,j} Because volunteers have no official compensation structure, they are difficult to hold accountable for the work they perform.^{a,j} Surgical providers find workarounds to staff deficits by taking on more responsibility for patient care themselves,^d delegating responsibilities to housestaff,^j and prioritising surgical cases.^c One provider, noting that support staff tended to leave by the afternoon, scheduled major surgical cases in the morning.^j Ultimately, training more providers and staff and retaining them with better salaries are reported as necessary solutions to address the root causes of understaffing.^{a,h,l}

Providers report a significant need for formal continuing education programmes to minimise complications, expand surgical capacity and ensure proper use of equipment.^{b,d,g} For surgical providers, NGO-supported training sessions and grand rounds have been solutions to provide continuing education.^{d,g,j} For support staff, weekly educational sessions and ‘refresher courses’ were suggested as feasible solutions for maintaining skills.^{a,f,h,l}

Management

Hospital management faces challenges due to budget constraints that amplify other challenges related to staffing, equipment and access, particularly at hospitals that depend on patient fees for revenue.^{a,b,e} Funding constraints limit hospitals’ ability to care for vulnerable patients, both in government hospitals and NGO hospitals, and may result in more costs being passed on to patients.^{b,c,e,f,j} Budget issues are also linked with other key challenges in staff remuneration, motivation and discipline. Government employee remuneration and hiring are handled by the Ministry of Health and Sanitation, so government hospitals have less control over salaries and incentives.^{h,j} Similarly, hospital managers struggle to discipline employees when they do not have full control over

hiring and firing of staff or volunteers.^{a,j} Low salary is an issue for providers, in particular SACHOs, who report that they have not received a salary increase since completing their surgical training.^{e,h} When asked how this affects staff motivation, one interviewee responded:

You know, a hungry man is an angry man [...] when nature is not kind, you know the mind is always distant.^h

In government hospitals, the lack of hospital-provided accommodation presents another challenge for providers, who may have to live some distance from the hospital.^{d,e,g,h}

Tight hospital budgets are further strained by the high costs of providing care to vulnerable patients^{c,e,j} and the costs of transportation and fuel.^k At NGO hospitals, the reliance on foreign donors for funding and supplies can be a source of stability or a challenge, depending on the stability of the funding source.^{b,e,f} As noted previously, the ‘push’ supply chain in government hospitals exacerbates material scarcity resulting from budget constraints by failing to respond to the needs of hospitals.^{a,c,j} Government hospitals have found solutions to budget constraints by developing partnerships with NGOs^c and instituting auditing systems to track the use of hospital funds.^c To prevent shortfalls of critical drugs and supplies, one provider developed a close working relationship with management to communicate needs,^a while others rely on close monitoring of drug stocks by hospital pharmacists.^f Providers at NGO and private hospitals, which have control over hiring and firing employees, report fewer challenges with staff motivation and discipline. The use of employee handbooks and disciplinary committees are other solutions that have been effective in improving staff discipline.^{b,c,f}

Other commonly reported hospital management challenges relate to quality and patient safety issues such as care guidelines, protocols, and performance evaluation of staff. Surgical practice guidelines are sometimes not available in hospitals.^{j,l} Even when guidelines are available, providers may not have the recommended equipment and supplies needed to adhere to them.^{c,d} In hospitals where guidelines are used most effectively, they are adapted to local contexts or displayed on the wall of the operating theatre.^{d,h,k} Providers point to the WHO Safe Surgery Checklist as a guideline solution that has worked well.^{b,g,j} Performance monitoring of staff is only present on an informal basis in many government hospitals.^{a,d,e,f,h} Some solutions that are in place include the use of log books for trainees and SACHOs^{c,e,g,h} and self-evaluation systems for trainees.^j

DISCUSSION

Surgical providers in Sierra Leonean hospitals supplied a range of perspectives about the challenges they face in providing surgical care to their communities. High out-of-pocket surgical costs, human resource deficiencies and inefficiencies, and critical shortfalls in infrastructure,

equipment and supplies all limit access to surgery, constrain surgical capacity and impair quality of care. Despite working in severely resource-limited environments, surgical providers have implemented innovative solutions and workarounds to improve surgical and anaesthesia care in hospitals. There was considerable overlap between providers, regions, and hospital types in the challenges and solutions that were discussed, but no two providers faced the exact same set of challenges. The categories of challenges in this study generally support the structure of prior surgical system assessments in Sierra Leone.^{7–9 12} However, the category of ‘Patient Factors,’ which describes both the beliefs and baseline health status of patients, has not been specifically included in previous surgical assessments in Sierra Leone. The category of patient factors underscores the importance of further study of community beliefs, values, and knowledge as they relate to the surgical system.^{19 26}

Respondents offered insights about how the challenges they face limit and delay patient access to surgical and anaesthesia care. The delays experienced by Sierra Leonean patients are best understood using Thaddeus and Maine’s ‘three delays’ access framework, in which patients face delays in seeking care, reaching care and in receiving care.^{27 28} When patients anticipate that transportation and care at a healthcare facility will be costly, they may delay seeking care until they can afford it or they have no other option.^{27 29} In areas where traditional healers are more affordable and accessible than hospitals, patients may be more likely to first seek care from these practitioners.^{29 30} As a consequence, surgical providers first see patients at more advanced stages of disease, requiring more intensive interventions with poorer postoperative outcomes. Low levels of surgical disease awareness among patients also emerged as an important factor causing delay in seeking care, a finding that has also been observed in qualitative studies in Uganda and Tanzania.^{18 31} Surgical providers in this study engage in patient education and public surgical health awareness campaigns as solutions to reducing the first delay.

Other major challenges reported in this study relate to the second delay.²⁷ Patients are delayed by the distance to the hospital and geographic challenges such as rivers and rough terrain. Limited road networks slow motor vehicle transport. These challenges were cited by providers in both urban and rural hospitals. Because some urban hospitals are in relatively remote cities surrounded by rural areas, they may encounter similar access and supply issues as those in rural areas. These findings are consistent with estimates that suggest just 70% of Sierra Leone’s population lives within 2 hours of a surgical provider. Though this is higher than several other countries in sub-Saharan Africa, rural areas in Sierra Leone have very low numbers of surgeons per capita.³² Providers point to ambulances as a solution to reduce delays in care, although costs of transportation may deter patients with limited resources.^{27 29} Studies of motorcycle ambulances at rural health centres in Sierra Leone and elsewhere in

Sub-Saharan Africa have demonstrated that they can be an effective means of prehospital transport at a fraction of the cost.^{33 34}

The third delay in receiving care is the result of a confluence of challenges at the health facility. Medical personnel at primary facilities can inadvertently delay definitive surgical care by waiting too long to refer patients to a higher level of care or referring to a facility that is not equipped to provide surgical care.^{18 35} On arrival at a surgical hospital, surgery can be delayed for a number of reasons: lack of capacity in operating theatres or wards, lack of instruments or other equipment, or a lack of staff to undertake the surgery.^{7 8 12} Each of these challenges is further exacerbated by the impact of the irregular electricity supply.^{16 36}

The cost of surgery in Sierra Leone is another cross-cutting issue that delays or inhibits access to surgical care.^{26 29} The FHCI was started in Sierra Leone in 2010 to provide healthcare free of user fees to pregnant and lactating mothers and children under five—including surgical care.^{37 38} Surgical patients not covered through this programme typically pay for drugs, supplies and care out of pocket.^{7 26 39 40} Sierra Leone has among the highest out-of-pocket healthcare expenditures as a fraction of per capita GDP in the region and the world,⁴¹ and a recent household survey found that out-of-pocket payments were the greatest reported barrier to receiving medical care.⁶ Providers emphasise national healthcare financing for surgical care as a solution to these cost-related barriers and delays. Community-based health insurance schemes and government sponsored insurance plans have been successfully used to increase surgical access and reduce catastrophic expenditure in countries like Rwanda and Ghana.⁴²

Another pathway through which challenges were found to affect patients in this analysis is the limitation of potential surgical capacity, particularly at the district hospital level.^{43 44} Challenges related to infrastructure and the availability of surgical and anaesthetic equipment were heavily emphasised as limitations to performing more complex procedures.^{7 8 41} Staffing challenges further limit surgical capacity, especially in rural district hospitals where specialist surgical and anaesthesia providers are scarce.⁴⁵ In this study, providers attribute the scarcity of rural surgeons to the lack of accommodation, perceived low compensation, and high workload.⁹ Previous efforts to recruit healthcare workers to rural areas through allowances have not been sustained by Sierra Leone’s Ministry of Health due to funding issues.⁴⁶ In district hospitals that otherwise have the capacity to treat more patients, providers have no choice but to refer to tertiary surgical hospitals that are already at or over capacity.⁴⁷ These findings support arguments for investment in district hospitals and their surgical staff as an effective way to increase surgical access and capacity while offloading referral hospitals.^{1 30 44 48}

Respondents in both government and NGO hospitals recognise that NGOs have an important role to play in



bolstering surgical capacity through equipment and maintenance support, renovations, continuing education programmes and financial support.¹ They also reinforce the importance of surgical provider engagement to ensure that equipment is fit for purpose and NGO involvement is directed towards the areas of greatest need. One NGO-based human resources solution noted by respondents is task-sharing, in which non-physician surgical providers such as SACHOs are credentialed to perform surgery with specialist supervision.⁴⁹ A prospective study found that each SACHO could perform about 170 operations per year without any increase in complications or mortality, potentially augmenting Sierra Leone's overall surgical capacity without compromising patient safety.²⁰ Ensuring appropriate supervision, continuing education and increases in compensation commensurate with level of training will be key steps to effectively recruit and use SACHO surgical providers.⁴⁹

The final systemic effect of the challenges described in this study is a decrease in the quality and safety of surgical and anaesthesia care. Providers work in challenging operating theatre environments that complicate sterility, lighting and surgical technique. Issues like power outages cause further deviation from standard procedure.⁴³ Preoperatively, challenges relating to diagnostic errors, delayed presentation and inadequate referral communication increase the risk of errors before the patient is even on the operating table.^{50 51} Providers make use of the WHO's Safe Surgery Checklist to reduce intraoperative errors, an intervention that has been associated with reduced peri-operative mortality in low-income settings.⁵² Yet, in the few hospitals where providers have clear safety guidelines and checklists, they find them difficult to adhere to without proper equipment and supplies.⁵³ Efforts to improve the culture of surgical quality and safety in Sierra Leone must be attentive to the resource limitations that impact adherence to established guidelines and protocols.

The qualitative approach used in this study generated novel findings that have not been reported in quantitative studies of Sierra Leone's surgical system. For example, the 2017 SARA reports that suture is available in 98% of Sierra Leone's hospitals.¹² In contrast, while providers in this study do not report a scarcity of suture per se, the inappropriate chromic catgut suture that is available has a deleterious impact on surgical complications. Through interviews, providers tell a more complete story that illustrates the interconnectedness of challenges. For example, interviews explain why in the dry season, hydroelectric power shortages lead to more frequent outages, prevent autoclave use, exacerbate instrument deficiencies, render operating theatre equipment inoperable and lead to delayed surgical care and more difficult operations. This also explains why solar cells may provide a particularly adept electricity solution for certain hospitals in Sierra Leone. Challenges related to patient factors, staff volunteerism and shared decision making have not been

explored in prior quantitative assessments, nor have the creative workarounds and personal sacrifices made by surgical providers.

Limitations of this study

This study has important limitations that must be considered in interpreting its results. The small sample size of this study is a limitation and may not be fully representative of private hospitals, for which there was just one interview. Though only one provider was interviewed from each hospital, the selection of the most senior provider available provided a range of qualification levels. This sampling approach was also felt to be more representative of the providers actually available for patients presenting with acute surgical conditions.

The interview data analysed in the study are limited to those concepts, ideas and issues that are most salient to surgical providers. Interview data are inherently subject to the biases of respondents. Providers may overstate the importance of challenges that impact them directly, such as working conditions and salary, relative to other challenges in the surgical system. Interview data were not directly triangulated with other data sources from the hospital; although site visits were made, direct measurements and observations were not performed. As such, the statements made by respondents in this study can only be corroborated through comparison with each other and with prior studies. An exploration of the challenges affecting hospital management, support staff, anaesthesia providers and patients was beyond the scope of this study, but these groups could provide valuable insights to further qualitative studies.

Bias can be introduced by the study team as well. Though questions were open-ended, the use of a topic guide can influence the focus of respondents and direction of the interview. Interviewers can also introduce bias during the interview itself, particularly when there are differences in culture and dialect, but the presence of a Sierra Leonean researcher on the interview team mitigated this bias. Study respondents may not have been comfortable discussing certain topics with interviewers, despite assurances of anonymity. The study team can also introduce bias through the process of data analysis and reporting, though this was mitigated through adherence to established qualitative methods.¹⁴

CONCLUSION

The qualitative approach in this study yielded novel insights into the challenges facing Sierra Leone's surgical system as well as the solutions and workarounds in place at hospitals throughout the country. Providers trace the root causes of these challenges to structural issues relating to poverty, medical resource scarcity and health system financing in Sierra Leone. These findings can be used by researchers, policy-makers and civil society organisations to generate practical interventions that improve surgical capacity

and quality in hospitals. Surgical providers should be actively involved in systems of supply and equipment provision, whether through government or NGOs, to ensure that supplies are fit for context and purpose. Expanded training of surgical providers, including SACHOs, can greatly augment the surgical capacity of the country, particularly if providers are incentivised to work in rural district hospitals. Barriers to patient access delay patients prior to seeking care, in transit and at the hospital, but healthcare financing solutions that reduce surgical costs have the greatest potential to expand access. Finally, nearly every challenge reported in this study had a solution or workaround in place in at least one hospital. Hospitals and surgical providers within Sierra Leone have much to learn from one another by sharing and publicising their most effective approaches to overcoming challenges. Qualitative research has an important role to play in improving understanding of the challenges facing surgeons in low-income countries.

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