Barriers to quality perioperative care delivery in low- and middle-income countries: A qualitative rapid appraisal study

Short title: Perioperative care pathways in low- and middle-income countries

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Abstract

Background: Provision of timely, safe, and affordable surgical care is an essential component of any high-quality health system. Increasingly it is recognised that poor quality of care in the perioperative period (before, during and after surgery) may contribute to significant excess mortality and morbidity. Therefore, improving access to surgical procedures alone will not address the disparities in surgical outcomes globally, until the quality of perioperative care is addressed. We aimed to identify key barriers to quality perioperative care delivery for three 'Bellwether' procedures (caesarean section, emergency laparotomy, long bone fracture fixation) in five low- and middle-income countries (LMICs).

Methods: Ten hospitals representing secondary and tertiary facilities from five LMICs (two upper middle income: Colombia and South Africa, two lower middle income: Sri Lanka and Tanzania, and one lower income: Uganda) were purposefully selected. We used a rapid appraisal design (pathway mapping, ethnography, and interviews) to map out and explore the complexities of the perioperative pathway and care delivery for the Bellwether procedures. The Framework approach was used for data analysis, with triangulation across different data sources to identify barriers in country and pattern matching to identify common barriers across the five LMICs.

Results: We developed 25 pathway maps, undertook over 30 periods of observations, and held over 40 interviews with patients and clinical staff. Although the extent and impact of the barriers varied across the LMIC settings, four key common barriers to safe and effective perioperative care were identified: 1) the fragmented nature of the care pathways, 2) the limited human and structural resources available for the provision of care, 3) the direct and indirect costs of care for patients, even in health systems where care is ostensibly free of charge and 4) patients' low expectations of care.

Conclusion: We identified key barriers to effective perioperative care in LMICs. Addressing these barriers is important if LMIC health systems are to provide safe, timely and affordable provision of the Bellwether procedures

Key points summary

- Question: What are the key barriers to delivering quality perioperative care for patients undergoing a Bellwether procedure in LMICs?
- Findings: We found four key barriers to the delivery of timely and safe perioperative care; fragmented care pathways, limited human and structural resources, the cost of care to patients and the patients' overall low expectations of care.
- Meaning: To improve the quality and safety of surgical care and patient outcomes, work is required to overcome the identified barriers in perioperative care.

Glossary of terms

HIC	High-income country
LMIC	Low- and middle-income country
NSOAP	National Surgical, Obstetrics, and Anaesthesia Plan
RAP	Rapid appraisal procedure

Introduction

Provision of timely, safe and affordable surgical care is an essential component of any health system irrespective of a country's development status. However, it is estimated that nine in ten people who live in low- and middle-income countries (LMICs) are unable to access essential surgical care [1, 2]. In many LMICs, the safety of surgical care is a serious concern, with surgical mortality being twice the global average, [3] increasing to 50- fold higher for procedures such as caesarean section,[4] despite this patient population being younger than the surgical populations of most high-income countries (HICs).[3]

Perioperative care encompasses all health system activities before, during and after surgery that ensure safe and effective surgery, including primary, secondary and social care (e.g. care provided by families).[5] The last two decades have seen significant attention on the inequalities in access to surgical services and the constraints of resources within the intraoperative space; limited beds, operating theatre space, skilled surgeons, and anaesthetic care. Internationally endorsed strategies to promote safer surgery,[6] and programmes to build anaesthesia and surgical provider capacity remain a priority globally.[1] However, there is emerging evidence that improving access to surgical healthcare alone does *not* result in improved health outcomes unless it is coupled with quality perioperative care.[7] An estimated 50 million deaths per year worldwide could be avoided by improving the quality of healthcare delivery[7]; death within 30 days of surgery is estimated at 4.2 million people worldwide, with half of these deaths occurring in LMICs. Multi-country research suggests that poor quality of care exists across the entire perioperative pathway, with most deaths occurring in the postoperative period.[3, 8] Therefore, research needs to focus on identifying barriers across the whole perioperative care pathway, rather than focusing solely on the surgical procedure itself, to maximise opportunities to improve patient outcomes.[3, 7] Access to facilities able to perform the three 'Bellwether procedures' (emergency caesarean, emergency laparotomy, treatment of open long bone fracture fixations) has been identified as indicators of the quality of essential surgical care in a country.[9]

Therefore, we aimed to identify key barriers to the delivery of safe, timely and affordable perioperative care across the three Bellwether procedures in five diverse LMIC settings (two upper middle income: Colombia and South Africa, two lower middle income: Sri Lanka and Tanzania, and one lower income: Uganda).

Methods

Study design

We used a qualitative rapid appraisal design to explore and understand the barriers to perioperative care across the three Bellwether perioperative care pathways. Rapid appraisals collect and analyse data in a targeted way within limited timeframes, combining two or more methods of data collection and then using triangulation from different sources as a form of data validation.[10, 11] In this current study, we utilised three forms of data collection: (1) perioperative pathway mapping, (2) observations of care, and (3) patient interviews. Our study group comprised investigators (clinical academics and social scientists) in each participating LMIC and in the United Kingdom. The study protocol was approved by the appropriate Institutional Review Board (IRB) in each research centre plus national research ethics committee approval where necessary. All aspects of the research were conducted in accordance with each nation's research governance framework, including written informed consent from all participants unless a local IRB waiver was granted. All data collected were anonymised, and research participants were not identified. This manuscript adheres to applicable Standards for Reporting Qualitative Research guidelines.[12]

Study setting

We conducted a multi-centre study in five LMICS (two upper middle income: Colombia and South Africa), two lower middle income (Sri Lanka and Tanzania, and one lower income: Uganda) representing a range of income levels and health systems, between April 2020 and March 2021.

Sampling strategy

Within each country, we purposefully sampled a range of healthcare institutions (between one to three hospitals per country), surgical clinicians and surgical patients to reflect a diversity of local populations and healthcare facilities, across urban and rural settings providing different levels of surgical procedure provision. We considered the providers involved in the delivery of care across the different pathways and included hospitals where different aspects of care would be delivered. Following a rapid appraisal design, our sampling approach was not designed to be exhaustive, but

capture a ‘snapshot’ of experiences in a short amount of time. We, therefore, combined the purposive sampling strategy described above with a convenience sampling strategy based on the research team’s access to the healthcare institutions.

Data collection

Data sources were the same in each country (unless indicated otherwise) and were categorised into the following categories: (1) pathway mapping, (2) observations of care, and (3) patient interviews.

1. Pathway mapping

Key clinical staff (e.g. nurses, surgeons and anesthesiologists) participated in a pathway mapping exercise for the three Bellwether procedures, led by the local research team. The mapping involved detailed descriptions of patients’ surgical journeys (pre-hospital, in-hospital, post-hospital), associated timelines and the clinical care team involved. A visual representation of each pathway (i.e. pathway ‘map’) was created as part of the main output of the exercise. The processes within these maps informed the scope, location and timing of both the structured observations and interviews.

2. Observations of care (qualitative data collection)

Observations were conducted in appropriate perioperative locations including emergency departments, surgical wards and postoperative recovery areas to document the patient pathway in practice for each procedure from start to finish. The purpose of these observations was to directly observe, understand and document team and patient-care provider interactions within the perioperative environment relevant to the care processes under evaluation. Verbal consent to attend each clinical area was obtained from a senior nurse or doctor in that area. A structured observation guide (Supplementary File 1) was used to record fieldnotes and ensure consistency in the collection of data across researchers and sites. Observations were not conducted in Colombia and South Africa due to ethics committee regulations for research activities during the COVID-19 pandemic. In other settings, guidance from local ethical committees pertaining to fieldwork during the pandemic were adhered to.

3. Interviews

Interviews were focussed on understanding the perioperative pathway from a staff and patient's perspective in relation to barriers in the delivery of effective care. Participants were sampled purposively to represent experiences across the different pathways from an interprofessional range of clinical stakeholders (e.g. nurses, surgeons and anesthesiologists) and patients. Keeping in line with the rapid appraisal design, patients were only interviewed at one time point. Patients were not approached until the end of their care period so as not to feel in any way obligated to participate or that their interview may jeopardise their care. The combination of purposive sampling, focused scope of inquiry defined by process mapping, and reflexive data collection informed by the pathway mapping, observations, and analysis as part of the rapid appraisal study design meant that the research aim was addressed with fewer than 10 interviews per site.

Data processing and analysis

Data collection and analysis occurred in parallel. A working document, in the form of a RAP (Rapid Appraisal Procedure; Supplementary File 1) sheet, summarised data originating from each source (interviews, observations and pathway maps) for each Bellwether procedure. The RAP sheet facilitated consistency in data collection across researchers and research sites and allowed us to identify when data saturation was reached. Data were analysed using a framework approach in which methods of qualitative content analysis are used to identify commonalities and differences in qualitative data, supporting the development of descriptive or explanatory themes to make sense of the data.[13, 14] The key foci set out in the RAP sheet facilitated a structured approach for using the framework approach for data analysis.[15] Two researchers (TS and GJB) cross-checked the coded data across all research sites. In line with best practice for the framework approach, triangulation of the findings from the data sources (pathway maps, observations and interviews) was undertaken to initially identify commonalities and differences in the key barriers to delivery of perioperative care for each Bellwether procedure. Further analysis was performed to refine or challenge each candidate barrier as more data were added.[11, 16] This process was undertaken by each LMIC's investigator team, with support from and discussion

with the methodological team (CV and TS), to identify systemic barriers in each country.

The results from each country were presented and discussed in online data meetings attended by researchers representing each LMIC and the UK based team. At these meetings, cross-country data analysis and pattern matching was done as a group, to identify similarities and variations in the barriers for each procedure across the different LMIC contexts and ultimately identify the overarching barriers across the five-country cohort.

Results

A descriptive summary of the participating hospital sites within each country, and the number of interviews and observations is shown in Table 1.

[insert Table 1]

Common barriers to safe and effective perioperative care

Mapped pathways for each procedure, in each LMIC are depicted in Supplementary File 2. Summary tables of barriers to care were extracted from RAP sheets, online team discussions, and review of pathways across all five LMICs for emergency caesarean section (Table 2), emergency laparotomy (Table 3) and long-bone fracture fixation (Table 4). From our dataset, four key themes were identified as major barriers to safe and effective care (Fig 1): 1) the fragmented nature of the care pathways, 2) limited resources for the provision of care 3) direct and indirect costs of care for patients and 4) patients' low expectations of care.

[insert Table 2]

[insert Table 3]

[insert Table 4]

[insert Figure 1]

The fragmented nature of the care pathways

Fragmented care was identified as the main barrier to effective perioperative care in all countries. However, the extent and nature of fragmented care varied between the three Bellwether procedures, between hospitals and across the five LMICs. Five aspects of fragmented care were identified as key barriers to effective perioperative care. First, lack of early condition identification substantially delayed the time to surgery across all three Bellwether procedures. In particular, a large proportion of emergency laparotomies were delayed because of patients presenting with diffuse and non-specific symptoms. This was especially problematic in Tanzania and Uganda where patients often had a circuitous journey to accessing a healthcare setting where definitive care could be delivered. Patients in these two countries frequently present at traditional healers, pharmacies or drug dispensing outlets, private clinics, or primary healthcare facilities where delays to diagnoses and misdiagnoses were frequent. The

use of traditional healers was perceived by healthcare providers to be a complicating factor, often leading to late presentation to the hospital.

Second, limited ambulance services and/or the need to pay for transportation services (see *Direct and indirect costs of care for patients* below) meant that transportation to and from healthcare facilities limited accessibility of perioperative care. Colombia and South Africa were the only settings with established ambulance services. In Sri Lanka, ambulance services were available in urban areas, but often provided by private companies and were not freely available to all patients. At the time of data collection, there were no formally established ambulance services in Tanzania and Uganda.

Last, in all countries and for all three procedures, preoperative care was poorly coordinated which substantially delayed time to surgery. Patients were often seen by several different healthcare providers; first for triage, then by emergency department physicians (who were often 'gate keepers' for emergency hospital admissions', following which they were reviewed by several grades of surgeons before the decision for surgery was made. Repeated assessment from various specialties resulted in delays to diagnosis and/ or surgical intervention. Further, patients were often physically relocated to multiple different departments within the hospital for assessment, re-assessment, and various diagnostic investigations e.g. radiology; further delaying time to surgery. Fourth, linking with poorly coordinated care, poor interdisciplinary communication was a common barrier to timely assessment and perioperative management of patients. Finally, limited postoperative care planning delayed discharge. However, given that patients in Uganda, Tanzania and Sri Lanka are frequently unable to access postoperative care, clinicians in these settings sometimes deliberately delayed discharge to facilitate postoperative recovery and prevent complications. All five LMICs provided limited data from the observations and interviews on the postoperative setting.

Limited resources for the provision of care

Limited resources for the provision of care were a barrier to effective perioperative care in all countries. Limitations in human resources (both in terms of skills or expertise and availability of various cadres of staff) and physical resources (including, but not limited to, theatre access, surgical equipment, and postoperative monitoring

equipment) were barriers in all three Bellwether perioperative care pathways, in all 5 LMICs. Limited human resources were evident by insufficient capacity of healthcare providers (e.g. intensivists, anaesthetists, obstetricians,
rehabilitation therapists). Further, levels of seniority and experience contributed to insufficient human resources. There were limited senior surgical team members in Uganda and Sri Lanka. In Uganda, junior surgeons and medical officers usually perform all emergency surgeries in the tertiary and secondary hospitals, respectively. In Sri Lanka, there were limited senior surgeons in the peripheral hospitals, but sufficient senior surgeons in the tertiary hospitals. Limited human resources often led to cancelled appointments (e.g. antenatal), and patients being transferred to other hospitals, which delayed time to surgery. To alleviate the problems of poor staffing, care was often provided by junior, less experienced staff members and, in some instances, students (e.g. Uganda).

Besides the limited human resources and provision of ambulance services (see above), limited surgical equipment, access to operating theatres, and insufficient availability of postoperative beds were major barriers to effective perioperative care. Availability of surgical equipment was particularly problematic in Tanzania and Uganda, where clinicians reported having insufficient availability of surgical implants for internal fixation of long bone fracture fixations. Further, in Tanzania, there was a lack of equipment required to monitor patients pre- and postoperatively and insufficient blood stocks for blood transfusions. Access to operating theatres was a barrier in all five LMICs.

Direct and indirect costs of care for patients

The direct and indirect costs of medical care for patients and their families were identified as barrier to affordable perioperative care, especially when out of pocket payments were required, but this cost burden varied across the five LMICs. Out of pocket payments were required for transport to healthcare facilities in all settings. The risk of incurring out of pocket costs for direct medical care was worst in Uganda and Tanzania even though healthcare is ostensibly free at the point of care for everyone or through application for an exemption. In these two countries, costs incurred often related to a lack of stock such as medicines or dressings which forced patients to buy these from outside the hospital to continue their care. Further, patients in Uganda and

Tanzania were denied long-bone fracture fixation until they could afford to cover the costs of the surgical implants. Fear of incurring substantial healthcare costs were reported as a cause of late presentation to hospital. In Colombia, the insurance-based system was found to contribute to substantial delays while payments were awaiting authorisation. In all five LMICs, indirect costs in the form of lost income during hospital admission was experienced by patients.

Patients' low expectations of care

Patients' low expectations of care were identified as barriers to effective perioperative care. Where observations of care did take place, it was noted that there was a disparity between the quality of observed care (from the researchers' perspective) and patients' reported satisfaction of care. Overall, patients reported being satisfied with care despite being poorly informed about their medical plan. However, whilst patients in Colombia, South Africa and Sri Lanka reported being satisfied with their perioperative care, they also recognised that problems existed in their care pathways.

Discussion

We identified four major barriers to perioperative care delivery for the Bellwether procedures across five LMICs perioperative health systems: 1) fragmented nature of the perioperative pathways, 2) limited resources for the provision of perioperative care 3) direct and indirect costs of perioperative care for patients and 4) patients' expectations of care. The extent and severity of these barriers varied across the study cohort but there was sufficient commonality that they represent four key areas for further the health system research focussed on improving perioperative care for emergency surgical procedures in LMICs.

Fragmented care presents numerous interlinked barriers to safe and efficient perioperative care. Accessing care was frequently delayed due to patients spending time and/or money seeking assistance from traditional healers who had unestablished referral and communication channels with emergency allopathic care providers. Establishing effective referral pathways between traditional healers and allopathic healthcare providers and educating the public about services offered by both traditional healers and allopathic care providers are both opportunities for public health interventions to reduce delay to appropriate management of Bellwether procedures. Once a patient was receiving perioperative care, co-ordinated care could be improved through effective interdisciplinary communication. Effective planning, including establishing clear and agreed care management pathways using an interdisciplinary team approach could reduce the redundancies across the perioperative period thus reducing the time to surgery. Further, inefficient interdisciplinary communication may contribute to perioperative mortality due to a delay in the identification of, and escalation of care needed in patients with physiological decline. There was limited preoperative monitoring for physiological deterioration. Further, limited postoperative care planning was identified in all five LMICs. There were very limited data collected on the postoperative period from observations and interviews. This may indicate a lack of focus on postoperative care. A recent study investigating postoperative complications in surgical patients in Africa reported that 95% of deaths occurred in the postoperative period.[3] Further research is needed to thoroughly investigate the drivers of and strategies to reduce this high mortality rate in the postoperative period, including adapting early warning scores for LMIC settings.[17] It appears that there is an urgent

need to improve interdisciplinary communication and collaboration among perioperative healthcare providers, to reduce the fragmentation of the care pathway.

The second barrier that was identified was limited resources for the provision of perioperative care. These limited resources can be defined as inequalities in access and or availability of resources to provide perioperative care. In this current study, limited resources included both insufficient human resources to provide sufficient surgical care, and physical resources (e.g. surgical equipment, theatre space) to conduct necessary surgical and perioperative procedures. Lack of monitoring equipment and / or access to critical care beds was a major barrier for effective pre- and postoperative monitoring in most countries in particular for emergency laparotomy patients, who may also be considered at highest risk of postoperative complications. Our finding of insufficient human resources is unsurprising given that by the median number of specialist physician surgical, anesthesia and obstetric providers is 68 (49–90) per 100 000 in high-income countries, 24 (11–55) per 100 000 in upper-middle-income countries, 4 (2–15) per 100 000 in lower-middle-income countries, and 0.7 (0.4–1.7) per 100 000 in low-income countries.[18, 19] This is substantially lower than the recommended 20 – 40 specialists per 100 000 people needed to reduce perioperative mortality.[1]

Further, in our current study, patients were denied surgical interventions due to a lack of surgical equipment and supplies. In an African intensive care study, interventions offered to patients were 7 – 14 times lower than what was required.[20]. Clearly, there is an urgent need to build human resource capacity and availability of surgical equipment and supplies in LMICs.[21] This barrier can only be overcome through a financial commitment to train and employ more healthcare professionals, investment in their life-long learning, and sourcing sufficient surgical equipment and supplies needed for the surgical aspects of universal health coverage. Ensuring the most essential care is provided to sick patients, such as that recently specified as Essential Emergency and Critical Care could assist in prioritisation decisions when resources are limited.[22 23]

The third barrier identified was direct and indirect costs of care for patients. All five LMICs included in this study have healthcare systems that profess to provide

affordable care at the point of entry; however, we found that costs associated directly and indirectly with the perioperative care pathway were significant barriers to perioperative care. These financial barriers were particularly problematic in Uganda and Tanzania. In these two countries, ambulance services are non-existent, and patients often must travel far travel distances to hospitals with significant out of pocket expenses. Furthermore, surgical procedures were delayed where patients could not fund necessary surgical supplies. For example, long-bone fracture fixation was denied until patients could cover the costs of the surgical implants. In contrast in Colombia where insurance funding was available, regulatory systems were slow to approve funding for long-bone fracture fixation procedures, thus delaying time to surgery. It is unknown whether financial barriers influence the quality of perioperative care in these five LMICs. We recommend this be explored in future studies.

A further confounding factor is poverty. An extended absence from work and subsequent loss of income could have a significant impact on patients and their communities, and this could contribute to delayed presentation by family 'breadwinners'. To achieve universal health coverage, health financing requires about USD 100 per capita to achieve an essential package of 218 interventions, and USD 50 per head for a basic package of 108 "highest priority interventions".[24] The surgical component per capita for providing 80% essential health coverage for surgery is USD 5.10 in low-income countries and 7.40 in lower-middle-income countries.[25] Currently, lower-middle income countries spend about USD 58 per capita and low-income countries about USD 9 per capita on health.[24] LMICs do not spend enough on health, yet the necessary contribution for safe surgery is important and relatively small.

The fourth barrier was patients' low expectations of care. Poor quality of care contributes to more than eight million deaths in LMICs per year.[26] In this current study, patients reported being generally satisfied with their perioperative care despite being poorly informed about their medical plan, reporting poor pain management, and experiencing long waiting times. There may be an expectation of poor quality care, and hence a lack of visible dissatisfaction, as the Commission on High Quality Health Systems reported that less than 25% of patients in LMICs believed their healthcare system to work well, in comparison to 50% of patients in HICs.[26] Importantly, quality of

care has previously been reported to be worse in patients from vulnerable groups (e.g. impoverished, less educated, adolescents, and those with stigmatised conditions).[26] This is important as these vulnerable groups are common in LMICs. However, more data are required to explore whether vulnerable groups report being satisfied with their care despite receiving objectively inadequate care in LMICs. Civil society needs to drive improvement in perioperative care,[26] as patient outcomes will improve if the healthcare system is held accountable. Therefore, we recommend public health messaging focuses on improving health literacy, for example educating populations on common conditions and surgical treatments, to facilitate patient empowerment.

Strengths and Limitations

Whilst the barriers to effective care found in this study have been identified in other areas of health-services research in LMICs, none have focussed on the perioperative journey specifically. Greater worldwide access to surgical care will not necessarily result in better patient outcomes unless these procedures are nested in safe and effective perioperative care pathways. Hence, we designed this study to stimulate and focus the research agenda in this area. Rapid appraisals (or evaluations) are characterised by intensive, team-based investigation that uses multiple methods of data collection; which has an iterative process for collection and analysis; and follows the principles of participatory action in order to quickly develop a holistic understanding of a program from the perspectives of key stakeholders.[15] Standard quality checks were integrated into the study, such as the use of structured tools (i.e., RAP sheet, structured observation guide, framework analysis) to maintain consistency in data collection and analysis, triangulation across all data sources and data meetings with investigators from across the study cohort. There are limitations in this work. Our study was not designed to directly investigate and / or quantify the impact of the identified barriers on patient outcomes and further research, informed and focussed by this study, will be required to do so. It is important to consider that there can be a huge difference in the care of patients in an urban/tertiary/university hospital compared to hospitals in rural areas. Where possible, local teams selected more than one study site to mitigate against this risk but logistical considerations during the COVID-19 pandemic meant this was not always possible. The pandemic also meant that in two

countries observations of care could not be performed. The pragmatic nature of rapid appraisals which develop understanding of a program from the perspectives of key stakeholders also presents limitations, despite the RAP sheet providing a structure for data collection. For example, some details of which specific groups contributed to ‘staff shortages’ were missed and most teams collected only limited data about the postoperative phase. This suggests a systematic failure to appreciate the importance of good quality postoperative care, leading to complications and unnecessary mortality.

In conclusion, to improve perioperative care in these LMICs, we need to address the fragmentation of the care pathways, focus on increasing resources for the provision of perioperative care, provide strategies to prevent undue cost to patients for essential care necessary for universal health coverage, and provide education which explains how to access care, and what should be expected as acceptable care.

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References

Figure 1 Generic patient pathway highlighting presence of barriers in the preoperative, intraoperative, and postoperative stage at each study setting.

Table 1: A descriptive summary of the hospital sites within each country, and the number of interviews and observations.

	Colombia		**South Africa**		**Sri Lanka**	**Tanzania**			**Uganda**	
Number of hospitals	2		2		1	3			2	
Hospital category	Tertiary	Tertiary	Tertiary	Secondary, specialised maternity hospital	Tertiary	Secondary, Regional Referral Hospital	Secondary, Regional Referral Hospital	Primary, District Hospital	Tertiary	Secondary
Approximate number of inpatient beds	394	210	900	132	1314	350	365	150	400	100
Surgical specialists availability	General, Orthopaedic, Obstetric	General Orthopaedic, Obstetric	General, Orthopaedic	Obstetric	General, Orthopaedic, Obstetric	General, Orthopaedic, Obstetric		General, Obstetric	General, Orthopaedic, Obstetrics	None
Location and populations served	Urban and rural		Urban		Urban and rural	Urban			Urban and Rural	Rural
Theatre availability	24/7		24/7		24/7	24/7*			24/7†	
Healthcare fee structure	Insurance based healthcare.		Government funded with patients paying a proportion, according to income.		Government funded with free healthcare services.	Payments required for healthcare (Insurance or out-of-pocket). Many groups can apply for payment exemptions ‡			Government funded with free healthcare services§	

Number of interviews and/or observations conducted	Patients: 2 per pathway Clinical staff: 1-3 per pathway Observations: 0	Patients: 2 per pathway Clinical staff: ~4 per pathway and 2 patient interviews. Observations: 0	Patients: 2 emergency caesarean; 1 emergency laparotomy; 2 long bone fracture fixation Clinical staff: 15 emergency laparotomy; 8 emergency caesarean; 15 long bone fracture Observations: 2 emergency laparotomy; 8 emergency caesarean; 3 long bone fracture	Patients: 6 emergency caesarean; 5 emergency laparotomy; 4 long bone fracture fixation Clinical staff: 28 across all pathways Observations: 5	Patients: 4 emergency caesarean; 6 emergency laparotomy; 2 long bone fracture Clinical staff: 3 emergency laparotomy; 2 emergency caesarean; 2 long bone fracture fixation Observations: 16 emergency laparotomy; 13 emergency caesarean; 7 long bone fracture

* *District hospital does not provide orthopaedic surgical services.*

† *Emergency laparotomy and long bone fracture fixation: 12pm - 8pm from Monday - Friday; 8am-5pm on weekends. For non-emergency fracture fixation: 2 days per week 8am - 5pm Monday and Friday).*

‡ *Most patients pay out-of-pocket, few have and use health insurance. Government waivers for the old and children.*

§ *Most patients' care should be government funded; however, in reality there are out-of-pocket payments required for most care.*

Table 2: Summary of emergency caesarean section barriers to care, extracted from the RAP sheets, online team discussions, and review of the pathway maps.

Barriers	Colombia	South Africa	Sri Lanka	Tanzania	Uganda
Pre-hospital					
Emergency medical services	No barrier(s) identified.	Overwhelmed emergency medical services.	No barrier(s) identified.	No established emergency medical services. Patients required to use personal transport.	No established emergency medical services. Patients required to use personal transport.
Referral and/or transfer between facilities	No barrier(s) identified.	Inappropriate referrals. Overwhelmed facilities results in transfer to another facility. Overwhelmed patient transport services can result in a delay to transfer between facilities.	No barrier(s) identified.	No established patient transfer services.	No barrier(s) identified.
External	No barrier(s) identified.	Patient may present unbooked and to the incorrect facility (e.g. presenting at a tertiary facility when their condition only requires a primary care facility).	No barrier(s) identified.	No barrier(s) identified.	No barrier(s) identified.
Preoperative					
Limited resources and/or expertise	No barrier(s) identified.	No barrier(s) identified.	No formal triage system for patients awaiting surgery.	Limited medical equipment at all levels of healthcare facilities.	Poor access to laboratory services and blood banks. Delayed access to specialist care.
Financial	No barrier(s) identified.	No barrier(s) identified.	No barrier(s) identified.	Patients are responsible for the costs of surgical care.	No barrier(s) identified.
Communication between healthcare workers and handover	No barrier(s) identified.	No barrier(s) identified.	Inadequate communication between healthcare workers about patients' labour progression.	Hiatus in theatre services during nursing staff shift handover.	Hiatus in theatre services during nursing staff shift handover.
Intraoperative					
Limited resources and/or expertise	Overwhelmed theatre services. Most surgeries are performed by inexperienced, junior doctors.	Insufficient number of theatre staff.	Insufficient number of theatre staff.	Insufficient number of theatre staff. Overwhelmed theatre services.	Insufficient number of theatre staff. Most surgeries are performed by inexperienced, junior doctors.
Postoperative					

Limited resources and/or expertise	No barrier(s) identified.	Insufficient availability of ward beds. Overwhelmed psychological support services. Inadequate referral to non-governmental psychological support services.	No barrier(s) identified.	Limited medical equipment, specifically vitals monitors, and medical supplies. No access to intensive care units.	No barrier(s) identified.
Financial	No barrier(s) identified.	No barrier(s) identified.	No barrier(s) identified.	Patients are responsible for costs of medication and postoperative wound care supplies.	No barrier(s) identified.
Medical complications	Patients' comorbidities.	No barrier(s) identified.	No barrier(s) identified.	Sepsis. Inadequate pain management.	No barrier(s) identified.
Discharge and follow-up	Inadequate access to public transport to attend follow-up assessments.	No barrier(s) identified.	Administration delays with discharge. Inadequate communication between healthcare workers from which the patient is discharged and at which the patient will follow-up.	No barrier(s) identified.	No barrier(s) identified.
Patients' needs and expectations					
	No barrier(s) identified.	One patient reported having been separated from her infant for two days after she was transferred to another healthcare facility for escalated care.	One patient reported experiencing inadequate explanations of their medical conditions and why surgery is required. Patients reported that they would have preferred for their partner to be in the room during delivery. One patient reported experiencing inadequate communication from the nursing staff about her infant's medical condition.	No barrier(s) identified.	Patients reported experiencing inadequate explanations of their medical conditions and why surgery is required.

Table 3: Summary of emergency laparotomy barriers to care, extracted from the RAP sheets, online team discussions, and review of the pathway maps.

Barriers	Colombia	South Africa	Sri Lanka	Tanzania	Uganda
Pre-hospital					
Emergency services	Overwhelmed emergency medical services. Patients are frequently located far from healthcare facilities.	No barrier(s) identified.	Overwhelmed emergency medical services. Delays common specially from rural areas.	No established emergency medical services. Patients required to use personal transport.	No established emergency medical services. Patients required to use personal transport.
Referral and/or transfer between facilities	No barrier(s) identified.	Overwhelmed patient transport services resulting in a delay to transfer between facilities, especially patients travelling from healthcare facilities located in rural areas.	No barrier(s) identified.	Delays in referral to surgical disciplines.	Delays in referral to surgical disciplines.
External	No barrier(s) identified.	Late presentations due to: - Patients first seeking help from traditional healers; and/or - Patients hoping for resolution of symptoms.	Late presentations due to: - Patients first seeking help from traditional healers; and/or - Patients hoping for resolution of symptoms.	Late presentations due to: - Patients first seeking help from traditional healers; - Patients hoping for resolution of symptoms; - Cost of care deterring patients from accessing healthcare; and/or - Patients first seeking help from private clinics and/or pharmacies.	Late presentations due to: - Patients first seeking help from traditional healers; - Patients hoping for resolution of symptoms; - Cost of care deterring patients from accessing healthcare; and/or - Patients first seeking help from private clinics and/or pharmacies.
Preoperative					
Limited resources and/or expertise	Overwhelmed radiology department.	Limited expertise at the primary care facilities contributes to inappropriate assessment, treatment and/or referral. Overwhelmed radiology department. Insufficient number of CT scanners, and limited expertise on appropriate referral for CT scan.	Limited expertise at the primary care facilities contributes to inappropriate assessment, treatment and/or referral.	Limited expertise at the primary care facilities contributes to inappropriate assessment, treatment and/or referral. Reduced access to radiology and laboratory services – these services are located separate to the healthcare facility.	Limited expertise at the primary care facilities contributes to inappropriate assessment, treatment and/or referral. Reduced access to radiology and laboratory services – these services are located separate to the healthcare facility.
Financial	Delays with national health insurance approving surgery.	No barrier(s) identified.	No barrier(s) identified.	Administration delays with the payment process.	Patients are responsible for the costs of surgical care.

Communication between healthcare workers and handover	No barrier(s) identified.	Hiatus in theatre services during nursing staff shift handover.	No barrier(s) identified.	Hiatus in theatre services during nursing staff shift handover.	Inadequate communication between different departments within the healthcare facilities.
Intraoperative					
Limited resources and/or expertise	Overwhelmed theatre services. Most surgeries are performed by inexperienced, junior doctors.	No barrier(s) identified.	No barrier(s) identified.	Overwhelmed theatre services. Insufficient number of theatre staff.	Theatres are not operational at night. Most surgeries are performed by inexperienced, junior doctors.
Postoperative					
Limited resources and/or expertise	Insufficient availability of ward beds. Insufficient availability of intensive care beds.	Insufficient availability of ward beds. Insufficient availability of intensive care beds.	Insufficient availability of intensive care beds.	Limited medical equipment, specifically vitals monitors, and medical supplies. No access to intensive care units. Insufficient number of ward staff.	No barrier(s) identified.
Financial	No barrier(s) identified.	No barrier(s) identified.	No barrier(s) identified.	Patients are responsible for costs of medication and postoperative wound.	Patients are responsible for costs of medication and postoperative wound.
Medical complications	No barrier(s) identified.	No barrier(s) identified.	No barrier(s) identified.	Sepsis.	No barrier(s) identified.
Discharge and follow-up	Inadequate access to public transport to attend follow-up assessments.	No barrier(s) identified.	Administration delays with discharge. Inadequate access to public transport to attend follow-up assessments.	No barrier(s) identified.	No barrier(s) identified.
Patients' needs and expectations					
	Patients reported experiencing delays to surgery, inadequate explanations of their medical conditions and why surgery is required, problems with financial administration. Patients reported that their needs were met, and they were satisfied with their care.	No barrier(s) identified. Patients reported that their needs were met, and they were satisfied with their care.	Patients reported experiencing delays to surgery and inadequate pain management before surgery. Patients reported that their needs were met, and they were satisfied with their care.	Patients reported experiencing delays to surgery. Patients reported that their needs were met, and they were satisfied with their care.	No barrier(s) identified. Patients reported that their needs were met, and they were satisfied with their care.

Table 4: Summary of long bone fracture fixation barriers to care, extracted from the RAP sheets, online team discussions, and review of the pathway maps

Barriers	Colombia	South Africa	Sri Lanka	Tanzania	Uganda
Pre-hospital					
Emergency services	Overwhelmed emergency medical services. Patients are frequently located far from healthcare facilities.	No barrier(s) identified.	Overwhelmed emergency medical services.	No established emergency medical services. Patients required to use personal transport.	No established emergency medical services. Patients required to use personal transport.
Referral and/or transfer between facilities	No barrier(s) identified.	No barrier(s) identified.	Overwhelmed patient transport services can result in a delay to transfer between facilities.	No barrier(s) identified.	No barrier(s) identified.
External	No barrier(s) identified.	No barrier(s) identified.	Late presentations due to - Patients first seeking help from traditional healers.	Late presentations due to: - Patients first seeking help from traditional healers.	Late presentations due to: - Patients first seeking help from traditional healers; - Patients fearful of a risk of amputation at allopathic healthcare facilities; and/or - Cost of care deterring patients from accessing healthcare.
Preoperative					
Limited resources and/or expertise	Overwhelmed radiology department.	No barrier(s) identified.	Insufficient number of specialised healthcare workers, especially with expertise in anaesthesia, orthopaedic, and intensive care.	Poor access to radiology –services are located separate to the healthcare facility.	No barrier(s) identified.
Financial	Delays with the national traffic insurance approving surgery.	No barrier(s) identified.	No barrier(s) identified.	Patients are responsible for the costs of surgical care. Administration delays with the payment process.	Patients are responsible for the costs of surgical care.
Communication between healthcare workers and handover	No barrier(s) identified.	No barrier(s) identified.	Inadequate communication between different departments within the healthcare facilities. Administration delays with referring patients to different departments.	No barrier(s) identified.	No barrier(s) identified.
Intraoperative					

Limited resources and/or expertise	Overwhelmed theatre services.	Overwhelmed theatre services. Long-bone fracture fixations frequently performed at night.	Overwhelmed theatre services; orthopaedics only have access to theatres 2 days a week. Long-bone fracture fixations frequently performed at night. No vascular surgeon in the province.	Overwhelmed theatre services. Limited medical equipment, specifically surgical implants and other medical supplies. Insufficient number of theatre staff.	Overwhelmed theatre services; orthopaedics only have access to theatres 2 days a week. Limited medical equipment, specifically surgical implants and other medical supplies. Insufficient number of theatre staff, especially with anaesthesia expertise.
Postoperative					
Limited resources and/or expertise	Insufficient availability of ward beds. Limited access to rehabilitation services.	No barrier(s) identified.	No barrier(s) identified.	Insufficient availability of ward beds. Limited access to rehabilitation services. Limited medical equipment, specifically vitals monitors, and medical supplies.	Insufficient availability of ward beds. Limited access to rehabilitation services. No access to radiological services in the ward e.g. C-arm.
Financial	No barrier(s) identified.	Patients are responsible for costs of assistive devices (in certain provinces).	Patients are responsible for costs of assistive devices.	Patients are responsible for costs of medication, postoperative wound care supplies, and assistive devices.	Patients are responsible for costs of medication, postoperative wound care supplies, and assistive devices.
Medical complications	No barrier(s) identified.	No barrier(s) identified.	Sepsis.	Sepsis.	No barrier(s) identified.
Discharge and follow-up	Administration delays with discharge. Inadequate access to public transport to attend follow-up assessments.	Administration delays with discharge.	Administration delays with discharge.	No barrier(s) identified.	No barrier(s) identified.
Patients' needs and expectations					
	No barrier(s) identified.	Patients reported experiencing inadequate explanations of their discharge plan. Patients reported that their needs were met, and they were satisfied with their care.	Patients reported that their needs were met, and they were satisfied with their care.	Patients reported experiencing delays to surgery, and needing to source cheaper medications from other healthcare facilities. Patients reported that their needs were met, and they were satisfied with their care.	Patients reported that their needs were met, and they were satisfied with their care.