

# High Elective Surgery Cancellation Rate in Malawi Primarily Due to Infrastructural Limitations

Meghan Prin<sup>1</sup> · Jessica Eaton<sup>2</sup> · Onias Mtalimanja<sup>3</sup> · Anthony Charles<sup>4</sup>

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## Abstract

**Background** The provision of safe and timely surgical care is essential to global health care. Low- and middle-income countries have a disproportionate share of the global surgical disease burden and struggle to provide care with the given resources. Surgery cancellation worldwide occurs for many reasons, which are likely to differ between high-income and low-income settings. We sought to evaluate the proportion of elective surgery that is cancelled and the associated reasons for cancellation at a tertiary hospital in Malawi.

**Methods** This was a retrospective review of a database maintained by the Department of Anesthesiology at Kamuzu Central Hospital in Lilongwe, Malawi. Data were available from August 2011 to January 2015 and included weekday records for the number of scheduled surgeries, the number of cancelled surgeries, and the reasons for cancellation. Descriptive statistics were performed.

**Results** Of 10,730 scheduled surgeries, 4740 (44.2%) were cancelled. The most common reason for cancellation was infrastructural limitations (84.8%), including equipment shortages (50.9%) and time constraints (33.3%). Provider limitations accounted for 16.5% of cancellations, most often due to shortages of anaesthesia providers. Preoperative medical conditions contributed to 26.3% of cancellations.

**Conclusion** This study demonstrates a high case cancellation rate at a tertiary hospital in Malawi, attributable primarily to infrastructural limitations. These data provide evidence that investments in medical infrastructure and prevention of workforce brain drain are critical to surgical services in this region.

✉ Meghan Prin  
mp3052@cumc.columbia.edu

Jessica Eaton  
jcnels02@louisville.edu

Onias Mtalimanja  
ofmtalimanja@yahoo.com

Anthony Charles  
anthony\_charles@med.unc.edu

<sup>2</sup> University of Louisville School of Medicine, Louisville, KY, USA

<sup>3</sup> Department of Anesthesiology, Kamuzu Central Hospital, Lilongwe, Malawi

<sup>4</sup> Department of Surgery, University of North Carolina at Chapel Hill, Chapel Hill, NC, USA

<sup>1</sup> Department of Anesthesiology and Critical Care, Columbia University Medical Center, Columbia University College of Physicians and Surgeons, 622 West 168th Street, PH-505, New York, NY 10032, USA

## Introduction

Surgical services are an essential component of health care systems, and the provision of even basic surgical care can improve population health [1]. The provision of quality surgical care requires the cooperation of prehospital systems with in-hospital systems. Any breakdown in these systems may compromise access to care. This study focuses on elective case cancellation, an oft-overlooked barrier to surgical care that can cripple an otherwise-strong surgical care supply chain.

Case cancellation has been defined as cancelling a planned surgery after the patient has been notified of the operation date, on the day of or the day preceding surgery, or cases that appeared in the definitive schedule list that ultimately were not performed [2–5]. Cancellation of elective surgeries occurs worldwide because of system-, provider- and patient-related factors. This leads to economic inefficiencies [6] and potentially patient harm. For example, recent data from the UK indicate that after elective case cancellations, 5.9–8.4% of patients did not receive the prescribed operative interventions within 28 days [7].

Low- and middle-income countries (LMICs) have both a disproportionate burden of global surgical disease and a shortage of health care resources; case cancellation has the potential to affect a large number of patients in these areas. Given the differences in health care resources and management worldwide, it is likely that the incidence and reasons for case cancellation are different between high-income countries and LMICs, but the literature describing these differences is scarce. Without understanding the underlying reasons for case cancellation in LMICs, realistic strategies to decrease cancellations cannot be established. The goal of this study was to describe the day-of-surgery scheduled case cancellation rate and the corresponding reasons at a tertiary public hospital of Malawi.

Malawi is a small country in central sub-Saharan Africa with a population of 18 million. It has a life expectancy of 63.8 years and ranks 171 out of 186 countries on the human development index scale of the World Bank. There are approximately 2 physicians per 100,000 people in Malawi (compared to 241 per 100,000 in the USA) [8]. Most clinical care in the country is provided by non-physician “clinical officers”, which has allowed the country to develop a cadre of trained health professionals while avoiding brain drain. Malawi is the third poorest country in sub-Saharan Africa and serves as a proxy for other low-resource countries in the region.

## Methods

This was a retrospective review of an administrative database created and maintained by the Department of Anesthesiology at Kamuzu Central Hospital (KCH) in Lilongwe, Malawi, from 2011 to 2015. KCH is a 600-bed tertiary public hospital with a catchment area of approximately 6 million people in the central region of the country. The hospital has four main operating theatres and two dedicated obstetric theatres. Hospital facilities include a 5-bed intensive care unit, a clinical laboratory for basic investigations (complete blood count, chemistry, microbiology), and radiology services (computed tomography, radiography, and ultrasonography). Approximately 3000 surgical cases are performed annually at KCH, where there are approximately 5 physician surgeons but no physician anaesthesiologists. “Appendix 1” details the three most common surgical procedures within each field of surgery.

The surgical caseload is determined the preceding day and communicated to the anaesthesia department. Patients requiring elective surgery are generally admitted or already in hospital the day before surgery and are notified of their scheduled surgery in person. There are no same-day elective surgery services. Data describing the surgical caseload were collected prospectively by clinical officers in anaesthesiology for all weekdays (excluding holidays). One clinical officer in anaesthesia is assigned to data collection each day; this person is responsible for recording of the number of scheduled surgeries, the number of subsequently cancelled surgeries, and the associated reason(s) for cancellation. The reason(s) for cancellation is determined by the designated officer. The data are then entered into the computer database. Although many patients have mobile phones, contact information is not routinely collected and the cost of patient contact is borne by the care providers and not the institution. Therefore, there is no system in place to notify patients of potential cancellations in advance. Likewise, there is no system in place to track whether patients ultimately receive the prescribed surgery, or the length in the delay of care.

The data were available for consecutive days (excluding public and hospital holidays) from August 8, 2011, to January 9, 2015. Missing records occurred over 4 weeks during this interval, accounting for 7.7% of scheduled surgery data and 9.9% of cancelled surgery data. Multiple imputation was performed using the weekday and the month to account for missing values.

Reasons for cancellation were grouped into three categories: patient, provider, and infrastructure related. Of note, descriptions of patient-related reasons for case cancellation rely heavily on clinical examination and there are no specific protocols for cancellation. Patient-related

reasons for case cancellation included medical conditions (e.g. acute respiratory infection or an acute cardiac arrhythmia) and patient elopement from the hospital. A detailed description of patient-related medical reasons for case cancellations is provided in “Appendix 2” section. Although preoperative medical conditions are classified under patient-related reasons in this study, inadequate preoperative medical optimization may contribute to these conditions and these cancellations may also be considered provider related. Provider-related reasons included a lack of available surgeon or surgical provider, anaesthesiologist or anaesthesia provider, and/or scrub or nurse circulator. Non-physician clinicians provide the majority of medical care in Malawi, and the terms surgical and anaesthesia providers refer to non-physician health care personnel also known as clinical officers [9]. Health care system reasons included infrastructural issues (e.g. lack of running water, inability to sterilize surgical instruments, inadequate sterile gowns and drapes, loss of electricity, lack of blood), missing laboratory measurements, and time constraints. Time constraints refer to (1) situations in which elective surgeries are postponed or cancelled secondary to emergent case volume occupying regularly scheduled surgical slots, or (2) the inability to complete scheduled elective cases within normal daytime working hours or prior to the end of daytime shifts (e.g. due to unanticipated case complexity). More than one reason could be listed for each case cancellation.

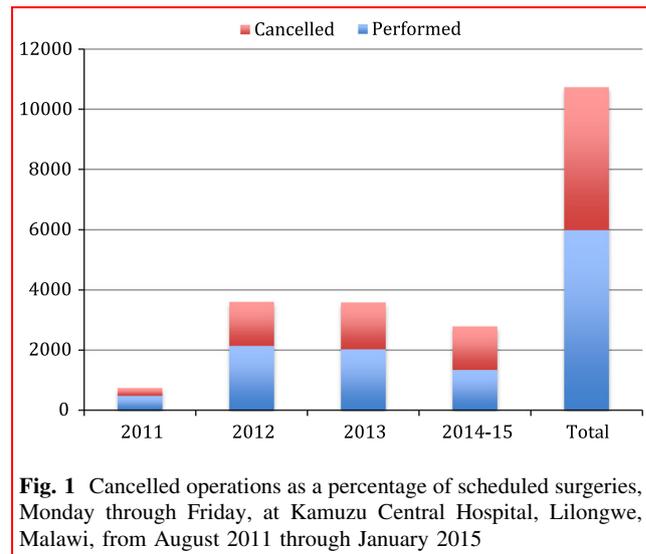
Descriptive statistical analyses were performed using Stata 14.2/SE (Stata Corps, College Station, TX). The National Health Sciences Research Council of Malawi provided ethical approval for use of these study data.

## Results

Of the 10,730 scheduled surgeries, 4740 (44.2%) were cancelled. The annual case cancellation rate increased every year and ranged from 35.3 to 51.9% (Table 1, Fig. 1). The overall cancellation rate was highest for general surgery (46.9%) compared to orthopedics (36.7%), urology (39.5%), or obstetrics and gynaecology (33.0%).

**Table 1** Cancelled operations as a percentage of scheduled surgeries, Monday through Friday, at Kamuzu Central Hospital, Lilongwe, Malawi, from August 2011 through January 2015

Time period	Scheduled surgeries, <i>n</i>	Cancelled surgeries, <i>n</i>	Cancelled as percentage of scheduled surgery (%)
Aug 8 to Dec 31, 2011	737	260	35.3
Jan 1 to Dec 31, 2012	3604	1465	40.6
Jan 1 to Dec 31, 2013	3585	1559	43.5
Jan 1, 2014 to January 9, 2015	2788	1449	51.9
Total	10,730	4740	44.2



**Fig. 1** Cancelled operations as a percentage of scheduled surgeries, Monday through Friday, at Kamuzu Central Hospital, Lilongwe, Malawi, from August 2011 through January 2015

The most common reason for cancellation was system limitations (84.8%), including equipment shortages (50.9%) and time constraints (33.3%). Provider limitations led to 727 (16.5%) of cancellations, and amongst provider cancellations, 44.3% were secondary to the need for an anaesthesiologist or anaesthesia provider. Inadequate patient medical optimization led to 26.3% of cancellations (Table 2).

## Discussion

Surgical care is an indispensable part of health care systems, and yet it is well established that patients in LMICs are disproportionately affected by poor access to surgical care [1]. This study demonstrates that over 4 years, 44.2% of scheduled surgeries at a tertiary public hospital in Malawi were cancelled. This exceeds reported case cancellation rates in Tanzania (21%) [10] and is similar to a recent prospective report from South Africa (44.5%) [11, 12]. Case cancellation rates in high-income regions are much lower, based on literature from the UK (0.7–1.1%) [7], Australia (7.2%) [13], Lebanon (4.4%) [14], and Korea

**Table 2** Reasons for cancellation of scheduled surgeries at Kamuzu Central Hospital, Lilongwe, Malawi, from August 2011 through January 2015

Reason for cancellation	<i>n</i> (%)
Infrastructure limitations	3746 (84.8)
Equipment	2249 (50.9)
Time constraints	1472 (33.3)
Laboratory measurements <sup>a</sup>	25 (0.6)
Staffing	727 (16.5)
Surgeon	275 (6.2)
Anaesthesiologist	322 (7.3)
Nurse	130 (2.9)
Patient factors	1163 (26.3)
Acute respiratory infection	41 (0.9)
Anaemia	151 (3.4)
Arrhythmia	19 (0.4)
Patient eloped	295 (6.7)
Resuscitation	13 (0.3)
Uncontrolled hypertension	155 (3.5)
Unspecified	489 (11.1)
Total <sup>b</sup>	4416 (100)

<sup>a</sup>There are no standard preoperative laboratory measurements, but most patients' haemoglobin is measured preoperatively

<sup>b</sup>Total does not equal to 4740 because a reason was not documented for every cancelled case

(8.8%) [15]. The case cancellation rate may serve as a useful proxy for a hospital's capacity to provide surgical care. Current metrics include the number of available personnel and/or surgical volume [16], but the cancellation rate is a more direct measurement of the demand for care at a given hospital and its ability to meet that demand with the available resources.

The high cancellation rate in this study was primarily attributable to infrastructural limitations, including equipment shortages (50.9%) and time constraints (33.3%). This corresponds to the most common reasons for case cancellation in Tanzania: lack of theatre space (43%), theatre equipment (23%), and time constraints (8%) [10]. It also corresponds to Nigeria, where provider and equipment shortages are the most common reasons for surgery cancellation (41 and 17.5%, respectively) [17], and South Africa, where infrastructural limitations are the second most common reason for cancellations (11.3%). [12]. Although the database used for this study did not detail exactly which equipment was missing, in our experience power and water shortages often lead to an inability to sterilize surgical equipment. Furthermore, although all district hospitals in Malawi provide general anaesthesia for surgery, only half have a functioning anaesthesia machine and this is also an issue at the tertiary hospital level [9].

Another reason for increasing case cancellations secondary to infrastructural limitations may be the fact that health care in Malawi is completely dependent on foreign aid, especially from the UK. Over the study period (2011–2015), there was a significant decrease in foreign aid from the UK to Malawi [18]. This affected the government's ability to provide basic supplies across the health care system as a whole. Finally, increased case cancellations may be secondary to an increase in emergency case volume, which can lead to both unanticipated equipment shortages and an inability to complete scheduled cases during normal working hours (time constraints). This is the case in South Africa [12] and in our experience is also occurring in Malawi.

Reported reasons for elective case cancellation in high-income nations are more commonly patient related. In a prospective report from Korea, 81% of elective surgery cancellations were secondary to patient-related reasons (e.g. rescheduling, no-show, medical status change) [15]. A tertiary paediatric hospital in Australia attributed 67% of elective case cancellations to patients (e.g. patient medically unfit, patient absent), while only 0.5% of cancellations were secondary to equipment failures [13]. A single-centre report from the UK listed patient-related reasons as the most common reason for elective surgery cancellation (51%), while attributing 16% of cancellation to inadequate time and 9.4% to emergencies [19].

As global health efforts to strengthen surgery programmes grow, the importance of comprehensive perioperative medicine must be addressed. The Lancet Global Health Commission established Global Surgery goals for 2030 including the improvement in access to “timely essential surgery”, improving “surgical workforce density”, and protecting patients and patient families against “impoverishment” from medical fees [20]. All three of these tenets are critical to maintaining access to surgical care and preventing unnecessary surgical morbidity and mortality. However, homogeneous global policy may not be appropriate given that surgical services in LMICs are primarily challenged by infrastructural limitations while high-income nations are focused on patient-related barriers.

Infrastructural limitations can be partly addressed by investment in human resources. For example, a staffing shortage may lead to an inability to prepare the operating room for daily cases. Missing diagnostic laboratory results may stem from failure to reorder necessary equipment, which may improve if more personnel were available to oversee the laboratory. A functioning surgical team relies not only on medical staff but also on supporting personnel. Sub-Saharan African hospitals have shortages of personnel in all departments. In East, Central, and Southern Africa, there are approximately 0.53 surgeons per 100,000 population [21]. In Malawi, there are 0.03 anaesthesiologists per

100,000 population, and 92% of surgical care and 95% of anaesthetic care are provided by non-physicians, respectively [9]. The Lancet Global Surgery Commission set the 2030 goal for all countries to have 20 surgeons, anaesthesiologists, and obstetric physicians per 100,000 population by 2030. This goal cannot be reached without investing in medical education and, importantly, avoiding the exodus of highly trained workers from low-resource settings to high-resource settings [22].

Ultimately, appropriate public investment in surgical infrastructure will rely on structured evaluations of potential interventions within the context of low-resource settings. These studies have not yet been performed. A recent Cochrane review of interventions to reduce waiting times for elective surgery included 8 randomized controlled trials, none of which were conducted in LMICs [23]. Based on the data in this study, we suggest that investment in systems for surgical equipment sterilization and a national audit of functional anaesthesia machines may be a first step towards improving the provision of surgical care in Malawi. Furthermore, a re-evaluation of operating room human resources is needed to determine current usage of surgery and anaesthesia providers, scrub technicians, assistants, janitorial staff, and supplies personnel.

This study has several limitations. It is primarily limited by being a retrospective analysis of administrative data. Multiple clinical officers are responsible for contributing to the administrative record of case cancellations, and the data are not confirmed or validated by any central authority. Second, we were unable to account for major versus minor surgery. Advanced surgical techniques such as laparoscopy are not available in Malawi or many other low-resource settings, and as such, most procedures are performed via laparotomy. This is reflected in the medical records; rather than precise language (e.g. sigmoid resection, appendectomy) cases are recorded simply as laparotomy (“Appendix 1”). We were also unable to account for emergency surgery volume. Emergent case volume may limit hospitals’ ability to complete elective surgeries, and this may be particularly pronounced in low-resource settings where the emergency to elective surgery ratio is high. Future studies of case cancellations should take this into account.

## Conclusion

This study demonstrates an exceptionally high scheduled case cancellation rate at a tertiary hospital of Malawi. The majority of cancellations are secondary to health system

limitations, particularly infrastructural needs and human resource availability for both preoperative care and intra-operative care. Investment in surgical infrastructure is imperative to improve the delivery of surgical care in this region.

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**Authors’ contribution** MP contributed to project design, performed data collection and analysis, and helped write the manuscript. JE helped with the data collection and to write the manuscript. OM conceived of the project, helped with the data collection and helped to write the manuscript. AC helped with project design, data analysis, and to write the manuscript. All authors approved the final manuscript.

## Compliance with ethical standards

**Conflict of interest** All authors declare that they have no conflict of interest.

## Appendix 1

See Table 3.

**Table 3** Three most commonly performed procedures, by surgical specialty

Specialty	Most common procedures
General surgery	Exploratory laparotomy Wound debridement, skin grafting Mass excision, not otherwise specified
Orthopedics	Open reduction, internal fixation Debridement External fixation
Urology	Cystoscopy Laparotomy Mass excision, not otherwise specified
Obstetrics and gynaecology	Caesarean section Dilation and curettage/evacuation Abdominal hysterectomy

## Appendix 2

See Table 4.

**Table 4** Detailed definitions of patient-related reasons for scheduled case cancellation at Kamuzu Central Hospital, Department of Anesthesiology

Patient related	Definition	Details
Anaemia	Adult: haemoglobin <8.0 g/dL Paediatrics: haemoglobin <10.0 g/dL	Referred for preoperative blood transfusion, or patient guardians are solicited to make targeted donations for perioperative care; does not apply to patients presenting with acute haemorrhage
Hypertension	Diastolic blood pressure >105 mmHg	Referred to medical consult
Resuscitation/ Dehydration	Urine output <0.5 mL/kg/h Reduced skin turgor Hypotension with tachycardia	Preoperative fluid resuscitation recommended before proceeding with surgery
Arrhythmia	Irregular pulse palpation Irregular rhythm noted on 3-lead electrocardiogram in preoperative operating theatre assessment	Referred for 12-lead electrocardiogram and medical consult
Upper respiratory infection	Based on clinical examination, particularly cough and respiratory secretions; pulse oximetry assessed for some patients as available	Referred for medical consult and radiograph imaging; may not apply to patients in need of emergent surgery

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