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Surgical service monitoring and quality control systems at district hospitals in Malawi, Tanzania and Zambia: a mixed-methods study

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ABSTRACT

Background In low-income and middle-income countries, an estimated one in three clinical adverse events happens in non-complex situations and 83% are preventable. Poor quality of care also leads to inefficient use of human, material and financial resources for health. Improving outcomes and mitigating the risk of adverse events require effective monitoring and quality control systems.

Aim To assess the state of surgical monitoring and quality control systems at district hospitals (DHs) in Malawi, Tanzania and Zambia.

Methods A mixed-methods cross-sectional study of 75 DHs: Malawi (22), Tanzania (30) and Zambia (23). This included a questionnaire, interviews and visual inspection of operating theatre (OT) registers. Data were collected on monitoring and quality systems for surgical activity, processes and outcomes, as well as perceived barriers.

Results 53% (n=40/75) of DHs use more than one OT register to record surgical operations. With the exception of standardised printed OT registers in Zambia, the register format (often handwritten books) and type of data collected varied between DHs. Monthly reports were seldom analysed by surgical teams. Less than 30% of all surveyed DHs used surgical safety checklists (n=22/75), and <15% (n=11/75) performed surgical audits. 73% (n=22/30) of DHs in Tanzania and less than half of DHs in Malawi (n=11/22) and Zambia (n=10/23) conducted surgical case reviews. Reports of surgical morbidity and mortality were compiled in 65% (n=15/23) of Zambian DHs, and in less than one-third of DHs in Tanzania (n=9/30) and Malawi (n=4/22). Reported barriers to monitoring and quality systems included an absence of formalised guidelines, continuous training opportunities as well as inadequate accountability mechanisms.

Conclusions Surgical monitoring and quality control systems were not standard among sampled DHs. Improvements are needed in standardisation of quality measures used; and in ensuring data completeness, analysis and utilisation for improving patient outcomes.

INTRODUCTION

There is an urgent need to improve access to surgery to address the unmet global burden of surgical diseases.[1] However, as highlighted by the Lancet Global Health Commission on High Quality Health Systems, progress towards universal health coverage cannot be achieved without ensuring that quality of care is at the centre of service delivery,[2–4] maintaining the professional standards needed for optimal health outcomes.[4 5] In low-income and middle-income countries (LMICs), an estimated one in three clinical adverse events happens in non-complex situations and 83% are preventable.[6] Studies indicate that quality improvements could mitigate morbidity and mortality from anaesthesia,[7] surgical[8–10] and obstetric operative interventions.[11] Poor quality of care also leads to inefficient use of human, material and financial resources for health.[12 13] Addressing preventable medical mistakes and treatment of hospital-acquired infections accounts for over 10% of hospital expenditure.[12] Additional costs include lost productivity and diminished trust in the health system.[12]

The maintenance of quality standards in surgical care delivery, improving outcomes and mitigating the risk of adverse events, requires effective monitoring systems,[14 15] assessing service capacity, volume and outcomes.[16] Monitoring surgical activity, outputs and adherence to essential protocols are needed. Quality assurance approaches include surgical safety checklists (SSCs), infection

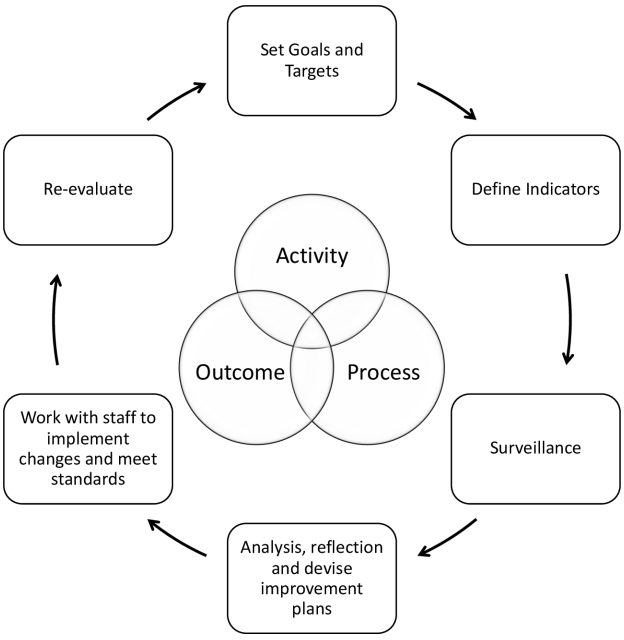

Figure 1 Guidelines for routine surveillance, evaluation and improvement of surgical quality systems (activity, processes, outcomes) at the district hospital. Adapted from WHO.[16 17]

prevention protocols and clinical practice guidelines.[4 14 17] Monitoring requires accurate and timely information,[4 18] good record-keeping and systematic surveillance of surgical activity, to demonstrate adherence (or lack thereof) to guidelines.[16 18] Effective oversight requires that surgical service monitoring is integrated into strong national health information systems capable of '*ongoing systematic collection, analysis, evaluation and dissemination of data*'.[16 19]

The World Health Organization (WHO) SSC is a low-cost method for reducing postoperative complications and mortality through monitoring the process of surgical care delivery, pre-operatively, peri-operatively and post-operatively.[20 21] Tracking healthcare outcomes, such as surgical site infections,[22] and undertaking morbidity and mortality reviews and audits of adverse events, encourage systematic reflection among surgical providers on the factors determining quality, notably team processes.[23] Integration of different surveillance approaches can strengthen overall quality of surgical care,[24 25] where measurement is linked to reflection on performance, feedback and identification of areas for improvement[26] (figure 1).

In practice, health information systems in LMICs are often undermined by inaccurate and incomplete data,[27–29] partly due to resource constraints.[30] The lack of standardised and reliable hospital data, particularly in sub-Saharan Africa (SSA), impairs assessments of the state of surgical delivery, which often rely instead on expert opinion,[31] precluding empirically derived strategies for quality improvement.[8 32–34] The implementation of basic quality measures in LMICs, where available, is also highly variable,[4] with inconsistent use of SSCs by hospitals,[35 36] poor adherence to clinical and practice guidelines[4] and substandard execution of clinical audits.[37]

Periodic assessments of surgical service quality at district hospitals (DHs), which are the entry point into surgical care for rural populations in SSA,[1 38] have had singular focuses on: inputs,[39] post-operative outcomes,[40–42] record keeping,[43 44] infection prevention control,[45 46] and SSCs.[35 47] We know of no studies which provide a comprehensive examination of surgical monitoring and quality control systems at the DH level including surgical activity, processes and outcomes.[48] There is also no consensus internationally on a standardised method for measuring surgical service quality in these settings.[1 4]

This paper aims to provide an empirically based understanding of surgical monitoring and quality control systems at DHs in SSA,[1 49 50] to inform context-appropriate standards and solutions for reducing the burden of avoidable surgical morbidity and mortality.[1] The mixed-methods cross-sectional study reported here was part of a situation analysis undertaken by the SURG-Africa project to inform an intervention aimed at strengthening district-level surgical care delivery in Malawi, Tanzania and Zambia.[51]

METHODS

Sample

Seventy-five surgically active DHs participated in the study: from the Northern Zone, Tanzania (30 of 35 DHs); the Lusaka, Central, Southern, Eastern and Western Provinces, Zambia (23 of 44 DHs) and country-wide in Malawi (22 of 24 government DHs) (see online supplemental file 1 for country breakdown of hospitals, hospital-type and staff included in the study). In Tanzania and Zambia, government and faith-based DHs were included. The study sampling strategy has been outlined in greater detail in a specific protocol publication.[51] Participants were purposefully sampled to include staff representatives from surgery, anaesthesia and nursing, with support from District Health Officers (study gatekeepers) at each DH.

Data collection

Between July and November 2017, we administered a questionnaire at the 75 DHs. In each hospital, two to three members of the surgical team (see online supplemental file 1 for the breakdown) jointly discussed and provided an agreed response for each question. This consensus approach to the questionnaire was used to maximise validity and reliability of answers and to minimise recall bias. We also conducted semi-structured interviews with members of the surgical team from a subsample of 32 randomly selected DHs. Survey items and interview questions were developed based on a review of relevant literature and this consortium's previous research experience, detailed elsewhere.[51] Data collection tools are presented in

online supplemental file 2. Questionnaires and interviews were administered the same day by the research team face-to-face, in English. We then conducted a visual inspection of a cross-section of 1 month's operating theatre (OT) data from three randomly selected DHs per country.

Methodological approach

Monitoring and quality systems for surgical activity

The assessment of whether and how surgical activity at DHs was monitored followed the model of Juran *et al*,[52] which focuses on three domains: standardisation of data collection, record completeness and utilisation of surgical service records,[52 53] as follows:

1. Standardisation of data collection: number and type of registers at each DHs (*questionnaire*), and data collection practices of the surgical team (*interview*). The *visual inspection* of OT registers examined: register format, number and type of indicators recorded, consistency of indicator terminology used.
2. Completeness of records: was determined based on percentage of missing data in OT registers (*visual inspection*).
3. Data utilisation: data analysis and compilation captured through *questionnaire and interview*.

Monitoring and quality systems for surgical processes and outcomes

In the absence of comprehensive national guidelines for surgical quality process and outcome measures at district level, we adapted relevant WHO guidelines[48] for our study, as described in table 1.

The questionnaire assessed whether these five measures were in place and being used at surveyed DHs. The interview questions were developed to triangulate the questionnaire and OT data, so as to delve deeper into information management, surgical quality measures and perceived barriers to surgical quality monitoring.

Data analysis

Quantitative

Data were processed and analysed using SPSS-IBM V.24, generating descriptive statistics on variables of interest. Pearson's χ^2 and Fisher's exact tests were used to determine any country differences related to: number of OT registers used per hospital; and number of hospitals monitoring surgical quality (for each measure in table 1); as well as differences in monitoring surgical quality between government versus faith-based hospitals. The percentage of missing data in each sampled OT register was calculated as the number of a core set of data points for which no information had been recorded over the total number of those data points, per patient.

Qualitative

A hybrid of top-down and bottom-up thematic analysis was performed by the lead researcher, supported by two senior researchers. This followed standard practice[54]: reading and familiarisation with transcripts; generation of codes to capture emerging themes and analysts' observations; re-reading of transcripts and initial codes and a second round of coding, applied to all transcripts. Excel (V.16.16.11) was used to catalogue codes and transcript excerpts, which were grouped by emerging themes and subthemes.

Analytical integration of phases

The convergent mixed-methods study design was chosen to mitigate any weaknesses associated with qualitative and quantitative approaches, and to triangulate, that is, highlight any expansion or discordance between the results generated from both methods.[55 56] The methods were integrated in reporting and discussing the results.[57] The presentation of findings follows the Strengthening the Reporting of Observational Studies in Epidemiology reporting guidelines.[58]

RESULTS

Monitoring and quality systems for surgical activity

Data collection standardisation

Operating theatre registers

Over half of sampled DHs across the three countries used two or three registers to record surgical procedures performed in the major OT (as detailed in online supplemental file 3), typically a general surgical

Table 1 Surgical processes and outcomes quality control measures: type and description

Measure	Type	Description
WHO Surgical Safety Checklist	Process	A set of surgical safety standards which cover the pre-operative, peri-operative and post-operative phase of surgical delivery in the operating theatre.[16]
Case reviews	Process	A review of clinical information and relevant procedures to assess if they were performed appropriately on a case-by-case basis.[75]
Supervision	Process	Supervisory visits by health professionals/specialists external to the hospital, or internal supervision of new staff by senior surgical staff to monitor and strengthen surgical skills.[4]
Surgical mortality and morbidity reports	Outcome	Facilitated discussions of clinical outcomes and surgical adverse events, so as to review the performance of the surgical team.[76]
Audits of surgical adverse events	Outcome	Structured approach for documenting, evaluating and providing regular feedback to staff regarding unwanted medical occurrences in patients, resulting from medical care (diagnosis and treatment), so as to improve future care.[77]

Table 2 Register format and percentage (%) of missing data from 1 month of operating theatre registers

Country	Hospital type	Register format	No. of register indicators	Total no. of data points	No. of missing data points	% data missing
Malawi	Government	P	18	2520	1146	**45.5**
Malawi	Government	P*	9	1251	135	**10.8**
Malawi	Government	H	10–12†	960	8	**<1**
Tanzania	Faith-based	H	16	608	0	**0**
Tanzania	Government	H	15	495	5	**<1**
Tanzania	Faith-based	H	13–14†	525	31	**5.90**
Zambia	Government	P	40	1369	207	**15.12**
Zambia	Faith-based	P	40	231	37	**16.74**
Zambia	Government	P	40	760	174	**22.62**

*A non-surgical printed register (P) which had been repurposed to record surgical data and handwritten register (H).
†In these hospitals, the number of indicators varied from page to page in the register as they were handwritten

register, anaesthesia register and procedure-specific registers (eg, for obstetric procedures). The proportion of DHs using more than one OT register was largest in Malawi (online supplemental file 3).

Data entry

Most interview participants reported that responsibility for manually entering information about surgical cases into OT registers lay with the lead surgeon, although nurses and anaesthetists sometimes contributed to data entry.

Data format

OT register formats were inconsistent across DHs (table 2). In Zambia, the three sampled hospitals used standardised printed registers developed specially for recording surgical OT procedures. In Malawi and Tanzania, most sampled registers were either repurposed from non-surgical registers, or were blank copybooks, where surgical indicators, patient and surgical information were handwritten. Some participants reported that the poor standard of data collection tools was due to lack of attention towards surgical departments.

> If you compare with other programmes like malaria, TB, still they have got all of their data capturing tools well designed, but in surgery you see…they start using a hard cover with a ruler (CO_MW_ 2.1)

Indicators

Table 2 presents the number of indicators recorded in each OT register, and table 3 presents categories of information, from basic patient demographics to outcomes of surgery, which were collectively recorded across all OT registers. There was large variability in the number of indicators included (between 9 and 40 indicators) per OT register.

In Zambia, the number of indicators was large (40) and consistent. Variability in Tanzania and Malawi indicates lack of standardised data collection across their DHs. There were also inconsistencies in the number of indicators recorded across pages, within the same OT register, where DHs used a '*pen and ruler*' handwritten approach.

Information categories and indicator formats used in DH OT registers differed within and across the three

Table 3 Type of information and indicators recorded across all operating theatre registers

Categories of information recorded	Sources of variation in indicator terminology
Patient demographics	Name Address Sex Age Ward Gravidity (number of pregnancies) Parity (number of viable births)
Diagnosis	
Type of procedure	
Category	Emergency/Elective surgery Major/Minor surgery
Patient status	American Society of Anesthesiologists physical status score Condition before operation
Anaesthesia	Type of anaesthesia (general/regional/local) Specific anaesthetic drugs used
Surgical team	
Post-operative observations	Vital signs Post-operative destination (ward patient is taken to)
Outcome of surgery	Performance (successful/not successful; good/fair/fine; satisfactory/or not) Complications Patient status on transfer to ward (dead/alive; stable/unstable)
Operative birth details	Time of delivery Baby outcome Baby weight Apgar score Sex Ward baby is taken to Condition of mother (stable/unstable)

countries. Whereas patient demographics, diagnosis, procedure, surgical team and type of anaesthesia used were commonly recorded in DHs, using similar indicators across countries (table 3), there was variation in recording surgery outcomes. This comprised inconsistent terminology and failure to record outcomes, particularly in Malawi and Tanzania where standardised registers were not used. Printed registers from Zambia included indicators to record post-operative observations of vital signs, such as heart rate, blood pressure, temperature as well as on outcomes (performance and complications) of the surgery. However, some groups of indicators such as category of surgery, patient status and post-operative observations and outcome of surgery were not recorded in all OT registers.

The printed register from Malawi collected data on outcomes (performance, complications and comorbidity) and on post-operative mortality status on transfer to theatre. However, none of the handwritten/re-purposed OT registers from Malawi and Tanzania included indicators to record elective or emergency category of the surgery, or the American Society of Anesthesiologists score (table 3). They lacked substantive data on post-operative observations, and three of these OT registers did not record data on outcomes of surgery.

Data completeness

The percentage of missing data for 1 month of OT register records ranged from 0% to 45.5% (see table 2). Tanzania had the lowest proportion of missing data; Zambia had consistent trends of 15%–22% missing data and Malawi DHs had the highest proportion of missing OT data. Percentages of missing data were higher in printed versus handwritten OT registers. However, the former included twice the number, and a greater range of categories than handwritten OT registers from Malawi and Tanzania. Incomplete information in printed registers in Zambia and Malawi were more often for additional categories such as patient status and post-operative observations.

Some participants from Malawi and Zambia confirmed problems with record keeping, notably: incomplete data entries, lost registers, lack of a designated personnel for data entry and failures to enter data into OT registers. Omissions were sometimes due to pressure for the surgical team to quickly prepare for another surgery:

> …We have a challenge whereby surgeons rush, whenever they finish a procedure, rush out of the theatre forgetting recording the cases into the register (Nurse_MW_2.01)

Surgical data utilisation

Most interview respondents reported that basic summaries of surgical OT register data (total volume of cases by type of procedure performed) were compiled at regular frequencies for the DH administration, to facilitate budgetary planning, including procurement of supplies and equipment for theatres.

> We send [the data] to the district and it is most useful for them, especially in terms of planning (ML_ZW_1.12)

> "[the administration] are taking for, you know, to see how much we have in our budget (Anaes_TZ_3.3)

Despite sharing data with the DH administration, the reporting surgical departments noted that they were seldom involved in the analysis nor receive feedback. Additionally, <50% of DHs across the sample conducted reviews of monthly surgical reports: 22% of surveyed DHs in Malawi (n=5/22), 48% (n=11/23) in Zambia and 53% (n=16/30) in Tanzania.

Each hospital is also required to integrate their data into the national Health Management Information System (HMIS) to facilitate high-level management and planning of the country's health system.[19 59] But as explained by respondents, the transfer of data from the original files to the electronic HMIS is challenging:

> We don't have necessary registers, we usually improvise so keeping of data is a problem. And I have noted the theatre data is not entered into the HMIS system at the district hospital (…) The HMIS would not pick from those registers because we use a ruler, draw a line… (CO_MW_2.1)

As is the capacity of data entry clerks and/or administration at the hospital to decipher the information provided by the surgical team:

> [The analysis] is done by non-medical people. So, you find that some data, because they do not know what it is or cannot read what it is, they skip it (Anaes_ZW_1.4)

Monitoring and quality systems for surgical processes and outcomes

Table 4 reports the number and percentage of DHs within each country that use quality control measures for the purpose of monitoring processes (surgical safety checklists, supervision, case reviews) and outcomes (morbidity and mortality reports, and audits of adverse events) of surgical service delivery.

Surgical safety checklists

As shown in table 4, <40% of surveyed DHs used SSCs, with least use in Malawi and significantly greater use in faith-based (58%) versus government hospitals (17%): p=0.002. As reported by one participant from Tanzania, the Christian Social Services Commission provided high-level support and guidance on quality control to faith-based health facilities:

> …Those are the people who are really taking care of these faith-based organisation facilities (…) they have given us some information and also we have

Table 4 Per cent of district hospitals monitoring surgical quality in Malawi, Tanzania and Zambia

N (% within country)	Malawi n=22 (%)	Tanzania n=30 (%)	Zambia n=23 (%)	Government n=29 (%)	Faith-based n=24 (%)
Surgical Safety Checklists	3 (14%)	10 (33%)	9 (39%)	5 (17%)	14 (58%)*
Supervision					
Internal	20 (91%)	25 (83%)	17 (74%)	24 (83%)	18 (75%)
External	10 (46%)	0 (0%)	2 (9%)	2 (6%)	0 (0%)
Case reviews	11 (50%)	22 (73%)	10 (44%)	11 (38%)	21 (88%)†
Morbidity and mortality reports	4 (18%)	9 (30%)‡	15 (65%)	9 (31%)	15 (63%)§
Audits of surgical adverse events	2 (9%)	2 (7%)	7 (30%)	4 (14%)	3 (21%)

*P=0.002 proportions of hospitals using surgical checklist: faith-based versus government.
†P=0.0001 proportions of hospitals undertaking case reviews: faith-based versus government.
‡P=0.003, proportions of hospitals producing regular reports across the three countries.
§P=0.02 proportions of hospitals producing morbidity and mortality reports: faith-based versus government.

been attending different meetings about the quality. If you look on our booklet or the consent form of the patient, everything the patient has to be informed on (Surgeon_TZ_3.11)

Surgical supervision

External supervision by visiting surgical specialists was not done in Tanzania and in only 9% of DHs in Zambia, compared with 46% in Malawi (see table 4). Internal informal supervision by senior staff was more common, conducted in over 70% of DHs in each country. This comprised overseeing junior colleagues in operations; monitoring their skills in surgery before they were allowed practice unsupervised and orienting staff on relevant surgical protocols (eg, aseptic practice within the OT). Some hospitals established more formal arrangements in an effort to enhance quality of service delivery:

> To improve, three months ago we decided to do any major operation operating with two doctors […] because when you have two doctors you can give each other experience and skills (Anaes_TZ_3.11)

Surgical case reviews

As reported in table 4, 73% of DHs in Tanzania conducted surgical case reviews, compared with less than half of DHs in Malawi and Zambia; and were significantly more frequent in faith-based than government hospitals: 88% vs 38%, p=0.0001. Case review frequency varied across hospitals: from daily, weekly to monthly; or were ad hoc, for example, when a difficult case arose. Case reviews were used to reflect on staff surgical performance, for managing difficult inpatient cases or to bring staff together to discuss surgical technique.

> [Case reviews are] a good system where we analyse the cases and discuss how better we can surgically help our patients (CO_MW_2.11)

Surgical morbidity and mortality reports, audits of adverse events

As outlined in table 4, surgical morbidity and mortality reports were done in 65% of DHs in Zambia, but less commonly in Tanzania and Malawi (<30%); and were significantly more frequent in faith-based than government hospitals: 63% vs 31%, p=0.02. Audits of surgical adverse events were infrequent, performed in 7%, 9% and 30% of hospitals in Tanzania, Malawi and Zambia, respectively; and were more frequently done for maternal cases.

District-level teams' perceptions of obstacles to surgical monitoring and quality systems

The qualitative analysis provided insights into the reasons for inconsistencies in the use of monitoring and quality control measures at DHs. Multiple interview respondents stated there was no formal system for surgical monitoring and quality control at their hospitals:

> We don't do [quality systems] there. It's very rare (Nurse_TZ_3.4)

Some respondents reported that selected quality control measures were in use at their facility (as outlined in table 1), but that there was no institutional support nor team approach, reinforced by managerial practices within DHs, to inform the use of such measures.

> We don't have the standards, so we are used to the way that he or she learned at college. (CO_MW_2.12)

Multiple factors contributed to the absence of a culture for quality control in surgery at the DH.

Reliance on individuals

Respondents reported that any surgical monitoring and quality systems approaches used in their hospitals were largely dependent on the abilities and initiative of individuals. The major contributing factor was the lack of formal protocols to guide the work of surgical teams.

> [Quality is] up to an individual, the surgeon and the team involved, they are responsible for that. But we don't have a system in place. (CO_MW_2.2)

Working in isolation

The situation was exacerbated by the absence of relevant training or continuous professional development opportunities available to district surgical teams. Respondents highlighted that such opportunities would help them to become familiar with best practices on surgical monitoring and quality control approaches.

> [Staff] are just working continuously and we don't receive much external help, like a mentorship from outside…so you find that they are losing out on certain information and training. (Anaes_ZM_1.15)

According to respondents, the consequence of working in isolation and lack of formal supervision at DHs was the inability to compare their practices with others (including external surgical teams), leading to missed opportunities for improvement in quality standards.

> I was thinking if there can be feedback from others, like they see how you are doing it and they tell you 'no this is not actually how you are supposed to do it, this is how you do it'. Maybe that would be best (MO_ZM_1.3)

Lack of accountability

Lastly, a small number of DH staff reported inadequate oversight mechanisms. Some respondents outlined that their hospital had committees or quality assurance teams responsible for hospital-wide standards, but which were not very active and not surgery-specific.

DISCUSSION

This study provides evidence on current practices and measures used for monitoring and quality control in surgical activity, processes and outcomes in a sample of 75 DHs in Malawi, Zambia and Tanzania. We found lack of standardisation in monitoring and quality control practices across surgically active sampled DHs in all three countries.

Multiple registers sometimes recording the same procedure were consistent findings across hospitals and countries. The use of handwritten registers in Malawi and Tanzania contributed to inconsistencies in the number and range of indicators recorded. As other studies from the region have demonstrated, lack of standardisation contributes to duplication of patient records,[60] increased staff workload[61] and inaccuracies and inefficiency in reporting into the national HMIS.[60 61] Incomplete, damaged and lost hospital records in Malawi and Zambia are consistent with published literature,[8 34 44 60 62] although low proportions of missing data in our sample of Tanzanian OT registers contrast with previous studies.[63 64] Likely contributory factors for missing data were lack of oversight and direction from higher levels; and because data utilisation, where it happened, focused on its value for informing procurement and budgeting, rather than on analysing and improving the quality of surgical patient care. Less than half of surgical teams in our sample reviewed data on their own performance. This is in line with findings from other studies, which report that neither district healthcare nor administrative staff are adequately trained in data collection and analysis activities.[60 61 63 65]

Perioperative mortality rate (POMR) is an important indicator of surgical quality.[66] The absence of standardised data on outcomes and risk stratifiers of surgery, often because the OT register format does not capture such information, impacts on the extent of retrospective data available to calculate POMR.[67] As reported elsewhere, lack of such data and missing data impair capacity to monitor and compare performance within and between countries, so as to improve the delivery of surgical care.[66 68] This is also likely to impact negatively on the effectiveness and efficiency of planning processes, resource allocation and performance assessment, both at hospital and health system levels.[1]

It is difficult to conclude whether the low proportion of DHs using the WHO SSCs were to be expected, as published literature reports checklist implementation in hospitals between 12% and 100%.[20 47 69] However, SSC utilisation in our study fell far short of recommended standards for hospitals internationally,[16] as well as the target for SSC implementation at all levels of hospitals in Tanzania.[50] Barriers to the use of checklists, which were not explored in this study, include: staff turnover, poor work-flow practices, staff resistance and lack of knowledge; and lack of resources, particularly in LMICs,[20 47] all of which could be addressed.[70] However, the significantly higher proportion of faith-based hospitals (largely from Tanzania in our sample) that use SSCs and undertake surgical case reviews suggests that supportive oversight can achieve improvements.

The higher proportions of DHs in Zambia conducting surgical audits and completing morbidity and mortality reports, compared with DHs in Malawi and Tanzania, may be due to the Zambia Quality Assurance Programme which emphasised the use of outcome data for DH performance monitoring,[71] again pointing to the potential of national initiatives. Overall, our results reflect other retrospective studies from the region, including at higher levels of care, which report the absence of surgical audits.[8 37] Poor data collection systems and sporadic implementation of other quality measures could be attributed to lack of external supervision in most surveyed hospitals. COST-Africa, a clinical officer surgical training programme in Malawi and Zambia, implemented DH in-service

training and supervision, delivered by referral hospital specialist surgeons, from 2013 to 2016, which demonstrated improvements in DH surgical productivity.[72 73] External supervision, with the exception of an NGO-financed supervision captured in our survey, had been phased out by 2017 in Malawi. External supervision was not conducted in the surveyed DHs in Tanzania, and was conducted in only two surveyed DHs in Zambia.

The development of standardised country and international surgical information systems is undermined by the lack of consensus on the minimum set of indicators necessary to inform evidence-based monitoring of health service delivery,[4] as well as absence of clear guidelines for standardised surgical indicators, data collection methodology and how to integrate such measures into national and international databases.[52] Accordingly, the National Surgical, Obstetric and Anaesthesia Plans in Tanzania and Zambia have emphasised the need to strengthen national surgical information systems and quality practices in hospitals at all levels.[49 50 74] However, national plans alone will be insufficient. A district perspective is essential, as is regular oversight and engagement with DH surgical teams, strengthening their capacity and understanding of the value of well-collected and analysed patient-related data for improving surgical quality of care.

Limitations

Several limitations were identified in this study. First, although data reported in this paper have been triangulated using mixed-methods, data were still predominantly self-reported, introducing a potential bias. Second, we did not interview DH information officers. Therefore, reports from participants that hospital administration did not fully understand, or share data with surgical departments, could not be cross-checked. Further research is needed, which was beyond the scope of this study, to investigate how surgical information is used by DH information officers, which would allow assessment of other aspects of data quality such as accuracy, reliability and integration into existing health information systems. Finally, there are limits to the generalisability of results in Zambia and Tanzania because our study only covered a selected geographical area. Also, we focused specifically on district-level surgical care delivery, so further research is needed to compare surgical monitoring and quality control practices across all care levels to draw a more complete picture of the national situation in each country.

CONCLUSION

In conclusion, our results indicate potential for improvements in embedding monitoring of the delivery of surgical care and quality control systems' measures as part of routine delivery of surgical care at district hospitals, which are the entry points to essential surgical services for rural populations in SSA. In particular, improvements are needed in standardisation of data collection practices; and in ensuring data completeness, analysis and utilisation for improving patient outcomes.[4 48] The study highlights the need for stronger national oversight of district-level surgical quality of care; resources and capacity strengthening of district surgical teams to analyse and use the surgical data they produce and the incorporation of surgical quality indicators into national health information systems.

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Contributors MCl: this author helped conceive the original idea and study design; helped with data acquisition, analysis and interpretation and helped review the literature, write the first draft of the manuscript and approve the final manuscript. CP: this author helped conceive the original idea and study design; helped with data acquisition, analysis and interpretation and helped critically appraise and approve the final manuscript. LB, MI, HB: these authors helped with data interpretation and critically appraise and approve the final manuscript. MCh, GM, AJ, GL: these authors helped with data acquisition and critically appraise and approve the final manuscript. EB, CL, JK, NM, KC, RB, JG: these authors helped conceive the original idea and study design and critically appraise and approve the final manuscript.

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