ORIGINAL CLINICAL RESEARCH REPORT

Surgical, Obstetric, and Anesthetic Mortality Measurement at a Ugandan Secondary Referral Hospital

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BACKGROUND: The health care systems of low-income countries have severely limited capacity to treat surgical diseases and conditions. There is limited information about which hospital mortality outcomes are suitable metrics in these settings.

METHODS: We did a 1-year observational cohort study of patient admissions to the Surgery and the Obstetrics and Gynecology departments and of newborns delivered at a Ugandan secondary referral hospital. We examined the proportion of deaths captured by standardized metrics of mortality.

RESULTS: There were 17,015 admissions and 9612 deliveries. A total of 847 deaths were documented: 385 (45.5%) admission deaths and 462 (54.5%) perinatal deaths. Less than one-third of admission deaths occurred during or after an operation (n = 126/385, 32.7%). Trauma and maternal mortality combined with perioperative mortality produced 79.2% (n = 305/385) of admission deaths. Of 462 perinatal deaths, 412 (90.1%) were stillborn, and 50 (10.9%) were early neonatal deaths. The combined metrics of the trauma mortality rate, maternal mortality ratio, thirty-day perioperative mortality rate, and perinatal mortality rate captured 89.8% (n = 761/847) of all deaths documented at the hospital.

CONCLUSIONS: The combination of perinatal, maternal, trauma, and perioperative mortality metrics captured most deaths documented at a Ugandan referral hospital. (Anesth Analg 2021;133:1608–16)

KEY POINTS

- **Question:** Which mortality metrics are suitable surgical outcome measures at a Ugandan referral hospital?
- **Findings:** Perinatal complications, maternal complications, trauma, and gastrointestinal disease were the leading causes of death.
- **Meaning:** Perinatal, maternal, trauma, and perioperative mortality metrics are suitable measures of care.

GLOSSARY

C/D = cesarean delivery; **ICD9 – CM-3** = International Statistical Classification of Diseases, Ninth Revision, Clinical Modification, Volume 3; **ICD10** = Tenth Revision of the International Statistical Classification of Diseases and Related Health Problem; **ICU** = intensive care unit; **Mbarara SQUAD** = Mbarara Surgical Services Quality Assurance Database; **MMR** = maternal mortality ratio; **MRRH** = Mbarara Regional Referral Hospital; **MUST** = Mbarara University of Science and Technology; **PMR** = perinatal mortality rate; **POMR** = perioperative mortality rate; **SD** = standard deviation

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Five billion people worldwide do not have timely access to safe surgical and anesthetic care.[1] Most of these people live in low- and middle-income countries, where health care systems are characterized by low numbers of health care professionals, a lack of essential supplies and equipment, and limited physical infrastructure.

Surgical disorders include a diverse range of conditions and diseases, and treatment involves a variety of interventions across various professional disciplines. To appropriately guide the expansion of capacity and assess care delivery in this setting, suitable standardized measurements of the wide assortment of diseases and treatment interventions must be established.[2,3]

A suitable metric is valid, relevant, and feasible.[2] Validity means that the metric measures what it intends to measure. Relevance indicates a measure is meaningful and useful for intended purposes. Feasibility refers to the practicality of obtaining the data and calculating the metric.

The development of hospitals able to perform 3 Bellwether procedures—laparotomy, cesarean delivery, and management of open bone fracture—has been suggested as an approach to expanding capacity to deliver essential surgical and anesthetic care.[1] These facilities would therefore have the capability to manage surgical emergencies, obstetric complications, and trauma.

Hospital outcomes are frequently used as metrics of care delivery. The perioperative mortality rate (POMR) is a suggested standardized metric which helps compare hospital quality and safety in both high- and low-income countries.[1–5] However, there is limited information about which hospital and patient outcomes are suitable markers of surgical care in low-income countries.[2,4]

Uganda is an East African nation with a health system with limited capacity to deliver surgical care. Mbarara Regional Referral Hospital (MRRH) is a government-funded, secondary referral hospital in the rural south-western region of the country. We examined deaths documented on the surgical services at this hospital over 1 year. The aim of the study was to determine which mortality metrics are suitable outcome measures to guide and assess care delivery in a health system with severe structural constraints. As prior studies suggested that many surgical deaths did not involve operations,[6–8] we hypothesized that most admission deaths would be of patients who did not undergo an operation.

METHODS

We did an observational cohort study of patient admissions to the Surgery and the Obstetrics and Gynecology departments and of newborns delivered at MRRH from January 1 to December 31, 2014.

The Research Ethics Committee of the Mbarara University of Science and Technology (MUST) approved this study (Protocol 05/12-2016). As the study was of deidentified records, written informed patient consent was not required by the Committee. We registered with the Ugandan National Council for Science and Technology (Study reference SS3016). The Massachusetts General Hospital-Partners Institutional Review Board deemed the study exempt.

We extracted deidentified data from the hospital Surgical Services Quality Assurance Database (Mbarara SQUAD),[9] after obtaining permission from the hospital database oversight committees. We selected the year 2014 as the database of this period had the most complete and validated data from both the Surgery and the Obstetrics and Gynecology departments. We also allowed for an interval before publishing quality assurance data from an identified institution.

Study Setting

Mbarara Hospital is the teaching hospital of MUST. In 2014, the catchment area had a population of approximately 3 million people.[10] MRRH had 411 beds,[11] of which 94 were surgical and 67 obstetrics and gynecology. There were 4 operating rooms. There was an 8-bed, medical-surgical intensive care unit (ICU). Sporadic electricity and water outages occurred approximately twice a month. There were periodic shortages of essential supplies.

Hospital Staffing

During 2014, physician staffing included a maximum of 17 surgeons and 22 trainees in the Surgery and the Obstetrics and Gynecology Departments. These included 5 general surgeons, 1 neurosurgeon, 1 pediatric surgeon, 1 orthopedic surgeon, 2 otolaryngologists, and 10 surgical trainees, plus 7 obstetrician-gynecologists and 12 trainees. The Department of Anaesthesia and Critical Care, who staffed the operating rooms and ICU, included 5 anesthesiologists, 2 trainees, and 3 nonphysician anesthetists. The number of surgical, obstetric, and anesthetic specialists per 100,000 population was 0.7 (n = 22/3000,000[10]), similar to other parts of Africa,[12] but less than the suggested level[1,2] of 20/100,000 population. The ratio of surgeons to operating rooms[3] was 4.3:1; the ratio of anesthesiologists to operating room was 1.3:1.

Additional staffing included 12 midwives and 7 ICU nurses. Day-to-day physician, nursing, and ancillary staffing levels were intermittently lower due to employee leave periods and changes in employment.

Database Methodology

The Mbarara SQUAD is a computerized database derived from data collected from patient charts and ward admission, ward discharge, operating room, ICU, neonatal unit and morgue log books[9] from August 1, 2013 to January 31, 2017. Initial data were prospectively collected on the wards; a second systematic retrospective retrieval was made from the Medical Records Department. The completeness of population capture, the accuracy and completeness of data extraction, and the reliability of procedure coding were externally validated.[13–15]

The database is housed on a server in the hospital. Staffing included 5 data clerks/coders, an operations manager, and an information technology expert/statistician. The discharge diagnoses were coded using the Tenth Revision of the International Statistical Classification of Diseases and Related Health Problems (ICD10) 2016 Version.[16] The most prominent disease or condition was used as the primary discharge diagnosis for discharges with multiple diagnoses. The International Statistical Classification of Diseases, Ninth Revision, Clinical Modification, Volume 3 (ICD9 – CM-3) was used to code surgical procedures.[17] We grouped nonspecific laparotomy Procedure Codes 54.11-74 by admitting service, describing those procedures performed on the Obstetric service as Obstetrical procedures and those procedures performed on the Gynecology service as Operations on the female genital organs. Cesarean delivery (C/D) was coded as the primary operation if there were multiple procedures performed.

Study Definitions

We counted deaths among admissions on the Surgery and the Obstetrics and Gynecology Services as the primary outcome. We defined an operation as a procedure that took place within the operating room. We used local definitions of urgency of procedure (elective or urgent/emergent). The thirty-day POMR was calculated as in-hospital deaths during or within 30 days of operation divided by the number of operations.[2–4]

We defined a birth as delivery at 28 weeks or more gestational age[18] or with 1000 g or more birthweight. We defined a stillbirth as a birth without signs of life (Apgar scores of 0). We used local clinical classifications of stillbirth (macerated or fresh still birth).[5]

We reported numbers of complete observations. If discharge diagnosis was undocumented, we used the postoperative diagnosis or the last documented diagnosis as the final diagnosis. We imputed hospital occupancy and census by allocating average length of stay by service (surgery, gynecology, obstetrics) and delivery method (obstetrics) to admissions missing discharge or admission dates. Hospital surgical capacity calculations were based on 2 staffed surgical ICU beds and 161 general ward beds. The total ICU occupancy calculations included medical and pediatric admissions based on 8 total bed capacity.

Data Analysis

Data were extracted in February 2019. Stata 14.2 was used for data analysis (Stata Corp, College Station, TX). Descriptive statistics were used to characterize the cohort.

RESULTS

There were 17,015 admissions and 9612 deliveries. A total of 847 deaths were documented: 385 (45.5%) admission deaths and 462 (54.5%) perinatal deaths.

Admission Demographics and Mortality

Table 1 presents the patient age and admitting service of admissions. By gender, 13,585 admissions were women (79.1% of total admissions, 31.6% of surgery service admissions). There were 468 (2.8%) repeat admissions. Imputed hospital occupancy was 107% of capacity (Supplemental Digital Content, Table, http://links.lww.com/AA/D670).

The admission mortality rate was 2.3% (n = 385/17,015). Mortality rates by admitting service (deaths/admissions) were surgery 6.5% (n = 327/5002), gynecology 1.2% (n = 26/2200), and obstetrics 0.3% (n = 32/9813). Mean age of death was 34.3 ± 22.1 years; 238 (62%) who died were men. Time to death from admission is shown in the Figure A.

Admission Mortality by Diagnosis and Operative Intervention

Admission mortality by primary discharge diagnoses, stratified by operative intervention during admission, is presented in Table 2. Less than one-third of admission deaths occurred during or after an operation (n = 126/385, 32.7%).

Head trauma accounted for 34.3% (n = 132/385) of admission deaths and 68.0% (n = 132/194) of trauma deaths. Nontraumatic intestinal perforation accounted for 6.8% (n = 26/385) of admission deaths and 43.3% (n = 26/60) of digestive system deaths.

Table 1. Demographics of Admissions

Department age (y)	Surgery	Gynecology	Obstetrics	Total
0–9	1017 (20.3)	18 (0.8)	0 (0)	1035 (1.4)
10–19	607 (12.2)	236 (10.7)	1413 (14.4)	2256 (13.3)
20–29	1006 (20.1)	1028 (46.7)	6363 (64.8)	8379 (49.4)
30–39	735 (14.7)	473 (21.5)	1875 (19.1)	3083 (18.1)
40–49	489 (9.8)	197 (9.0)	139 (1.4)	825 (4.9)
50–59	369 (7.4)	105 (4.8)	0 (0)	474 (2.8)
60–69	256 (5.1)	55 (2.5)	0 (0)	311 (1.8)
70–79	232 (4.6)	29 (1.3)	0 (0)	261 (1.5)
80–80+	117 (2.3)	11 (0.50	0 (0)	128 (0.8)
Missing age	174 (3.5)	48 (2.2)	23 (0.2)	245 (1.4)
Total	5002	2200	9813	17,015

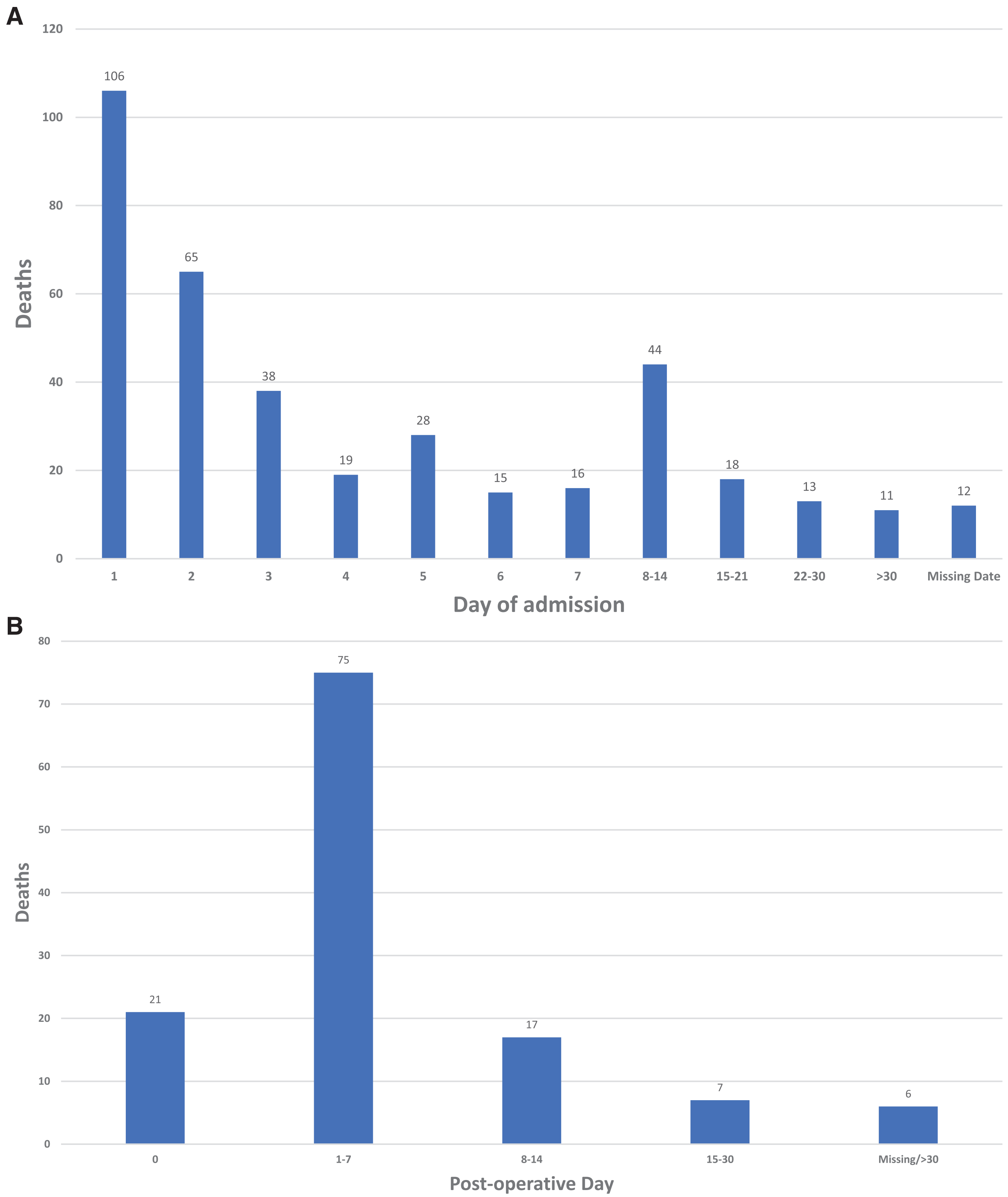

Figure. Mortality by time. A, Admission mortality by day of admission. B, Perioperative mortality by day from operation.

Admission Mortality by Operation

There were 5944 operations, of which 133 (2.2%) were follow-on operations. Mortality by operation is presented in Table 3. The Figure B presents time of death in relation to operation.

Four postoperative deaths had a missing date, and 2 occurred after 30 days. Six patients died intraoperatively. Day-of-surgery POMR[4] was 0.4% (n = 21/5940). The 30-day POMR was 2.0% (n = 120/5940). The total POMR was 2.1% (n = 126/5944).

Table 2. Mortality by Primary Discharge Diagnoses

Discharge diagnosis	Admissions n (%)	Nonoperative deaths n (%)	Perioperative deaths n (%)	Total deaths n (%)	Admission mortality rates (%)
Trauma	2616 (15.4)	154 (59.5)	40 (31.7)	194 (50.4)	7.4
Diseases of the digestive system	685 (4.0)	28 (10.8)	32 (25.4)	60 (15.6)	8.8
Pregnancy, childbirth, and the puerperium	10,754 (63.2)	25 (9.7)	24 (19.0)	49 (12.7)	0.5
Neoplasms	719 (4.2)	28 (10.8)	20 (15.9)	48 (12.5)	6.7
Other coded diagnoses	1745 (10.3)	24 (9.3)	10 (7.9)	34 (8.8)	1.9
Missing diagnoses	496 (2.9)	0 (0)	0 (0)	0 (0)	0
Total	17,015	259	126	385	2.3

Diagnoses are grouped by categories of the Tenth Revision of the International Statistical Classification of Diseases and Related Health Problems 2016 Version.

Table 3. Perioperative Mortality

Primary procedure	Procedures n (%)	Deaths n (%)	POMR (%)
Operations on the digestive system	655 (11.0)	55 (43.7)	8.4
Operations on the nervous system	174 (2.9)	24 (19.0)	13.8
Obstetrical procedures	3788 (63.7)	14 (11.1)	0.4
Operations on the female genital organs	482 (8.1)	12 (9.5)	2.5
Other operations	845 (14.2)	21 (16.7)	2.5
Total	5944	126	2.1

Operations are grouped by categories of the Ninth International Statistical Classification of Diseases, Clinical Modification, Volume 3, with adjustments for admitting service.
Abbreviation: POMR, perioperative mortality rate.

The most common operation was C/D (n = 3661/5944, 61.6% of procedures). The 30-day POMR by procedure was C/D 0.3% (n = 12/3661); other procedures were 4.7% (n = 108/2279).

The classification of the urgency of operation (n, %) was urgent/emergent 4918 (82.7%), elective 918 (15.4%), and unclassified 108 (1.8%). The classification of the urgency of C/D was urgent/emergent 3465 (94.7%), elective 147 (4.0%), and unclassified 49 (1.3%). The classification of the urgency of all other operations was emergent/urgent 1453 (63.6%), elective 771 (33.8%), and unclassified 59 (2.6%).

The decision-to-incision time for emergent/urgent CS (mean ± standard deviation [SD]) was 4.4 ± 5.4 hours (n = 2073) (maternal survivors: 4.4 ± 5.4 hours, n = 2060; maternal nonsurvivors: 3.0 ± 4.7 hours, n = 13). The time to first operation for emergent/urgent operations on the surgical service from the day of admission to the day of first operation (mean ± SD) was 2.2 ± 4.0 days (n = 1306) (survivors: 2.2 ± 4.0 days, n = 1219; nonsurvivors: 2.2 ± 4.4 days, n = 87).

Admission Mortality and ICU Use

Of total admissions, 0.8% (n = 136/17,015) were admitted to the ICU (by admitting service: surgery 2.2%, n = 108/5002; gynecology 0.5%, n = 11/2200; obstetrics 0.2%, n = 17/9813). Including 45 medical/pediatric admissions, the average daily census was 2.5 patients. Occupancy was 33.7%.

Of 120 postoperative deaths, 39 patients (32.5%) died after ICU admission, while 81 patients (67.5%) died on general wards without ICU admission. Mortality after ICU admission (death/admission) was 41.9% (n = 57/136) (postoperative 37.1% [n = 39/105]; nonoperative 58.1% [n = 18/31]).

Perinatal and Maternal Mortality

The delivery methods of 9612 deliveries were noninstrumental vaginal deliveries 60.4% (n = 5801/9612), instrumental vaginal deliveries 0.4% (n = 34/9612), and cesarean delivery 39.3% (n = 3777/9612). The mean gestation age was 39 ± 2.5 weeks (age ≥37 weeks, 88.1% [n = 5633/6396]; age <37 weeks, 11.9% [n = 763/6396]); mean weight was 3.1 ± 0.57 kg (weight <2.5 kg, 10%, n = 947).

Perinatal mortality by delivery method and newborn classification is presented in Table 4. All neonatal deaths occurred within 7 days of delivery. The perinatal mortality rate (PMR) was 48.1/1000 (4.8%, 462 of 9612 births).

There were 9369 admissions for delivery, and 884 admissions for pregnancy with abortive outcomes. The maternal mortality ratio (MMR) was 533/100,000

Table 4. Perinatal Mortality by Time of Death and Delivery Method

	Delivery method		
Type of death	Vaginal n (%)	Cesarean n (%)	Total n (%)
Early neonatal death	20 (7.4)	30 (15.5)	50 (10.9)
Fresh still birth	112 (41.6)	32 (16.6)	144 (31.2)
Unspecified still birth	57 (21.2)	28 (14.5)	85 (18.4)
Macerated still birth	80 (29.7)	103 (53.4)	183 (39.6)
Total deaths	269	193	462

(0.5%, 49 maternal deaths per 9200 live deliveries). Twenty-three women died during or after childbirth, and 26 died of abortive pregnancies, malaria during pregnancy, or other complications related to pregnancy.

Standardized Metrics of Mortality

Collectively trauma deaths, maternal deaths, and perioperative deaths constituted 79.2% (n = 305/385) of admission deaths (154 nonoperative trauma deaths, 25 nonoperative maternal deaths, and 126 perioperative deaths; Table 2). Excluding 6 perioperative deaths not recorded within 30 days of operation, the overlapping combination of the trauma mortality rate, MMR, and 30-day POMR captured 77.7% (n = 299/385) of admission deaths. As all neonatal deaths occurred within 7 days of delivery, the PMR captured all of the 462 perinatal deaths. The combination of these 4 metrics captured 89.8% (n = 761/847) of all deaths documented by the surgical services at the hospital.

DISCUSSION

This study examined mortality documented by surgical departments at a Ugandan secondary referral hospital. We found that perinatal and maternal complications, trauma, and diseases of the digestive system were the leading causes of death. Among admissions to these departments, more than two-thirds of patients who died did not undergo an operation.

Although the POMR directly measures a minority of deaths, this method of assessing mortality has specific strengths and uses. As the preoperative clinical presentation of some surgical diseases may be nonspecific, the definitive diagnosis may require an operation. Measurement of mortality by procedure, rather than by diagnosis, is therefore a more valid method of standardized outcome assessment for disease groups such as intra-abdominal disorders. Since digestive system diseases are a prominent cause of death in this setting, the POMR is a suitable metric due to strong validity.

As pre-, intra-, and postoperative management affect perioperative mortality, the POMR has relevance as a metric of perioperative systems of care. The overall 30-day POMR of 2.0% at this hospital was similar to multicenter reports from other Sub-Saharan African countries[12,19,20] but approximately twice as high as estimates of the global average POMR.[4,21]

The Three Delays model[22] suggests that delays in deciding to seek care, delays in reaching a health care facility, and holdups in receiving care once in the facility collectively contribute to mortality.[2,22] On the obstetric service, approximately 1 in 300 women died after C/D. The mean time from decision-to-incision for C/D for women who died was 3 hours. Delayed in-hospital access to potentially life-saving surgery may contribute to the high maternal POMR after C/D.

On the surgical service, there was a mean of more than 2 days from admission to primary emergent/urgent operations on patients who died. As the time of decision to operate was infrequently documented in the patient record on the surgical service, we could not assess whether this period was due to an appropriate therapeutic observation period, a delay in diagnosis, or lack of access to operating room. However, preoperative facility delays may also increase the POMR of other operations beside C/D.

Prolonged in-hospital preoperative delays can also contribute to death before potentially life-saving operations, particularly in cases of acute intra-abdominal diseases. The difficulty in consistently determining whether the disease or patient condition warranted operation limits the validity of nonoperative death rate as a standardized measure of access to operative care. However, examination of the management of individual cases may be an important part of quality improvement process.

A failure to rescue patients from perioperative complications may increase the POMR.[23] The ICU is a site for the provision of ventilation, inotropic support, and focused critical care to treat advanced sepsis and other acute, correctable complications.[6,7] Most perioperative deaths occurred within the week following operation, and the majority occurred without ICU admission. Early recognition of perioperative problems, prompt treatment, and transfer to the ICU, if necessary, may improve postoperative outcomes.

While mortality by operation therefore provides a standardized and valid metric to examine perioperative systems of care, the POMR has constraints. Cesarean delivery, which accounted for 61.6% of operations, differs profoundly from other surgeries at this hospital in that there are comingled indications and outcomes: maternal and fetal (Table 4). In addition, definitive obstetric care may involve nonoperative delivery and interventions. The POMR therefore has restricted validity as a metric of care for most operations and limited relevance as a measure of a substantial proportion of in-patient care.

Additional valid measures of maternal and perinatal mortality can provide further comparative metrics of care. The MMR of 0.5% (533 maternal deaths/100,000 live births) and the PMR of 4.82% (48.2 perinatal deaths/1000 births) in this referral hospital population were similar to sub-Saharan African national population measures but were respectively over 20 times and 4 to 7 times higher than those of high-income countries.[24–27]

As the MMR captures operative and nonoperative mortality (Table 2), it is a relevant measure of the entire spectrum of maternal care. Almost half of maternal deaths occurred during or after delivery, while half occurred earlier in pregnancy. Improved systems of both acute obstetric[28] and critical care[6,7] may be institutional changes to enhance maternal outcomes.

As the PMR includes fetal demise that occurs before hospital admission, mortality reflects overall care across the health care system. Although prehospital demise accounted for a substantial proportion of perinatal mortality, many intrapartum deaths may have occurred in-hospital. Early hospital detection of intrapartum complications, timely and appropriate vaginal or cesarean delivery, labor analgesia, and effective neonatal resuscitation and care[29] may collectively improve overall perinatal outcomes.

An additional limitation of the POMR is that it only directly measures patients who undergo operations. Most admissions did not involve surgery, and most admission deaths were of nonoperative patients. Trauma mortality rates can be validly measured without the need for operation or investigation to accurately define the population. Trauma and maternal mortality metrics capture over two-thirds of nonoperative deaths, while trauma alone causes more than half of admission fatalities.

Recording trauma mortality is relevant to assess the burden of disease, to develop quality improvement processes, and to assess the effect of interventions.[30,31] Head injury, frequently caused by motor bike and other road traffic accidents, was the most common cause of traumatic death. Public health measures, such as the enforcement of traffic safety regulations and motorbike helmet use, may prevent avoidable mortality. Integrated systems of primary and in-hospital trauma care, with a focus on the management of hemorrhage and head trauma, may improve survival rates.[32]

While no single metric encompasses all groupings of mortality relevant to care delivery, the combination of the 30-day POMR, MMR, PMR, and trauma mortality rate directly measures 89.8% of deaths documented at the hospital. Collectively, these metrics suggest that obstetric care, timely access to the operating room, and integration of critical care systems are broad areas of relevance to patient outcomes.

Structural factors[33] that affect outcomes include staffing levels, the availability of essential medical supplies and equipment, and functional physical infrastructure. Process factors[33] impacting outcomes involve systems of care, such as interdepartmental communication, operative case scheduling, and the coordinated availability of surgical, anesthetic, and nursing staff. The structural limitation of low anesthetic staffing levels, in particular, has systemic impact due to inadequate labor analgesia to facilitate the active management of labor and instrumental vaginal delivery, restricted operating room access, and diminished supervision of the ICU.

Institutional changes since the year under examination have included increased staffing levels; continued expansion of training capacity; more regular provision of electricity, water, and oxygen; enhanced systems of acute resuscitation; introduction of a postanesthetic care unit; planned scheduling of repeat cesarean deliveries; and development of departmental quality assurance committees and initiatives. Improved patient registration and record keeping has resulted in a more accurate patient census, associated with better matching of patient volume with financing and provision of medical supplies.

A possible limitation of this study is that, as this setting is an academic referral center, the conclusions may not be relevant to other hospitals. However, large obstetric volume,[12,19,34] high perinatal and maternal mortality,[11,18,24–26,35,36] a heavy burden of trauma,[19,37] limited perioperative care,[12,19] and constrained anesthetic, operative, and critical care capacity[38,39] are widely reported in low-income countries. Another potential shortcoming is that some diagnoses may be incomplete without definitive investigations or operation. However, the 4 standardized metrics use values that can be determined without the need for precise diagnoses.

The use of quality assurance data based on existing clinical practice further demonstrates the feasibility[2] of the metrics and the generalizability of the study.[40] As the data and measurements are derived from the current hospital medical record system, it would be possible to collect these metrics in a sustainable fashion. Aggregating the metrics of multiple hospitals is a potential method of assessing population-wide outcomes of surgical care.

Future study should examine specific subpopulations and interventions in more detail to determine which other factors affect outcomes. Risk-adjusted outcome measurement should quantify, guide, and promote timely access to surgical, obstetric, and anesthetic care.

In conclusion, the combination of standardized perinatal, maternal, trauma, and perioperative mortality metrics captured most deaths documented at a Ugandan referral hospital. These metrics are valid, relevant, and feasible measures to guide the expansion of capacity and assess care delivery.

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DISCLOSURES

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