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Abstracts

Provision of safe, timely, and affordable surgical care in Uganda: a public sector surgical capacity assessment. *Katherine Albutt, MD, MPH; Maria Punchak, MSc; Peter Kayima, MMed; Didacus Namanya, MPH; Mark G. Shrime, MD, MPH, PhD.* From the Harvard University Program in Global Surgery and Social Change, Boston, Mass. (Albutt, Punchak, Shrime); the Mbarara University of Science and Technology, Mbarara, Uganda (Kayima); and the Ministry of Health of the Republic of Uganda, Kampala, Uganda (Namanya).

Background: Access to safe surgery is critical to health, welfare and economic development. In 2015, the Lancet Commission on Global Surgery (LCoGS) recommended that all countries collect 6 surgical indicators to lend insight into improving surgical care. No nationwide data exist for these metrics in Uganda. **Methods:** A standardized quantitative hospital assessment survey and semi-structured interview were administered to key stakeholders at 17 randomly selected public hospitals. Hospital walk-throughs and retrospective reviews of operative logbooks were completed. **Results:** This study captured information for public hospitals serving 64.0% of Uganda's population. On average, less than 25% of the population had 2-hour access to a surgically capable facility. Hospitals averaged 257 beds per facility, and there were 0.2 operating rooms per 100 000 people. Annual surgical volume was 144.5 cases per 100 000 people per year (55.8% cesarean sections). Surgical, anesthetic and obstetric physician (SAO) density was 0.3 per 100 000 people. Most hospitals reported electricity, oxygen and blood availability more than 50% of the time and running water more than 75% of the time. In total, 93.8% of facilities never had access to computed tomography. Sterile gloves, nasogastric tubes and Foley catheters, among other supplies, were frequently unavailable. Uniform outcome reporting does not exist, and the World Health Organization safe surgery checklist is not used. **Conclusion:** The Ugandan public hospital system does not meet LCoGS targets for surgical access, workforce or volume. Critical policy and programmatic developments are essential to build surgical capacity and facilitate provision of safe, timely and affordable surgical care. Surgery must become a public health priority in Uganda and other low-resource settings.

Challenges in the provision of safe, timely, and affordable surgical care in Uganda: a qualitative analysis of surgical capacity in the public sector. *Katherine Albutt, MD, MPH; Rachel Yorlets, MPH; Maria Punchak, MSc; Peter Kayima, MMed; Didacus Namanya, MPH; Mark G. Shrime, MD, MPH, PhD.* From the Harvard University Program in Global Surgery and Social Change, Boston, Mass. (Albutt, Punchak, Shrime); the Boston Children's Hospital, Boston, Mass. (Yorlets); the Mbarara University of Science and Technology, Mbarara, Uganda (Kayima); and the Ministry of Health of the Republic of Uganda, Kampala, Uganda (Namanya).

Background: Five billion people lack access to safe, affordable surgical and anesthesia care. Significant challenges remain in the provision of surgical care in low-resource settings. In Uganda, data from frontline providers were used to illustrate the specific barriers to surgical care in the public sector.

Methods: From September 2016 to November 2016, a mixed-methods countrywide surgical capacity assessment was completed at 17 randomly selected public hospitals in Uganda. Researchers conducted 35 semistructured interviews with key stakeholders to understand factors associated with the provision of surgical care. The framework approach was used for thematic and explanatory data analysis. **Results:** The Ugandan public sector continues to face significant challenges in the provision of safe, timely and affordable surgical care. These challenges can be broadly grouped into preparedness and policy, service delivery, and the financial burden of surgical care. Providers reported challenges, including 1) significant delays in accessing surgical care, compounded by a malfunctioning referral system; 2) supply chain difficulties pertaining to provision of essential medications, equipment, supplies and blood; 3) critical workforce shortages; 4) operative capacity that is limited by inadequate infrastructure and overwhelmed by emergency and obstetric volume; and 5) significant, variable and sometimes catastrophic expenditures for surgical patients and their families. Despite these challenges, providers continue to devise innovative strategies to deliver surgical care. **Conclusion:** Understanding current strengths and shortfalls of Uganda's surgical system is a critical first step in developing effective, targeted policy and programming that will build and strengthen its surgical capacity.

Increasing the number of anesthesia providers in Uganda: a novel approach to convergent training of physician and nonphysician anesthetists. *Fred Bulamba, MD; Adam Hewitt Smith, MD; Michael Lipnick, MD.* From Busitema University, Busitema, Uganda (Bulamba, Hewitt Smith); and the University of San Francisco, San Francisco, Calif. (Lipnick).

Background: There is a chronic lack of anesthetists in low- and middle-income countries. Uganda has 60 physician anesthetists (PAs) and 400 nonphysician anesthetists (NPAs) for 40 million people (2:100 000). This deficiency stems from low training capacity, lack of career progression and poor remuneration. PAs have taken the leadership, advocacy and teaching roles, while the NPAs are the backbone of clinical service in Uganda. Therefore, new training interventions should aim at developing both cadres concurrently. The objectives of this study were 1) to increase the number of PAs and NPAs in Uganda and 2) to improve the quality of NPAs and create a career pathway in Uganda. **Methods:** We have designed a PA-led, competence-based training model for NPAs: the Bachelor of Science in Anesthesia (BScA) integrated with MBChB training. The BScA will commence at Busitema University and later expand to 3 other public universities with multiple satellite sites. Extensive consultation has been undertaken with all key stakeholders both locally and internationally. The desired outcomes are 1) to have 4 universities, 12 satellite sites, 65 PAs trained and recruited as faculty, and 780 NPAs trained in the next 10 years; and 2) increased availability of skilled anesthesia providers, better pay and a clear career development pathway for NPAs. **Results:** We have finalized the BScA curriculum, set up a simulation laboratory and established partnerships with the University of California, San Francisco, Diamedica and the Royal College of Anaesthetists. **Conclusion:** We have designed a long-term initiative

to increase the number of skilled anesthesia providers in Uganda while providing career development opportunities. Ongoing efforts include establishing schemes of services and partnerships, pooling locoregional resources and evaluating NPA training programs across sub-Saharan Africa.

Using touch surgery to improve surgery education in low- and middle-income settings: a randomized controlled trial. *Juru Gisele Bunogerane, MD; Kathryn Taylor, MD; Yiban Lin, MD; Ainboa Costas-Chavarri, MD, MPH. From the University of Rwanda, Kigali, Rwanda (Bunogerane, Costas-Chavarri); and Harvard Medical School, Boston, Mass. (Taylor, Lin, Costas-Chavarri).*

Background: To address the severe surgical workforce shortage in Rwanda, new and innovative educational tools must be introduced to train residents and increase surgical capacity. Touch surgery (TS) is a smartphone application that allows users to practise steps of common operations. It has been used in surgical education in high-income countries; however, its effect in low- and middle-income countries is unknown. This study aims to determine if TS can improve surgery education in low-resource settings. **Methods:** We performed a randomized controlled trial with surgical residents at the University of Rwanda. Participants were randomized to textbook or TS for learning a tendon repair surgical technique. They performed tendon repair in a simulation laboratory, evaluated by blinded expert raters. Participants completed pre- and postsimulation questionnaires testing their cognitive knowledge of tendon repair. **Results:** Of 51 total surgical residents, 27 were enrolled. Participants were from the following specialties: general surgery (51.85%), orthopedics (40.74%) and urology (7.41%). TS users performing the tendon repair simulation scored 89.7% compared with textbook users, who scored 63.4% ($p < 0.001$). Postsimulation questionnaires showed a significant improvement in cognitive scores for TS users (38.6%, $p < 0.001$) compared with a nonsignificant improvement for textbook users (15.9%, $p = 0.304$). In total, 92.3% of TS users reported that TS represents a useful training tool. **Conclusion:** TS is a useful tool to improve both technical skills and procedural knowledge in low-resource settings. Further studies should be done to assess the feasibility of implementing this tool into a surgical academic curriculum in low-resource settings.

Cesarean sections and obstetric surgery results by medical practitioners in Uganda. *Brendah Butali, Research Fellow. From Global Health Community Based Initiatives (GHCBI), Kalisizo, Uganda.*

Background: In the absence of medical officers, clinical officers perform much of the major emergency surgery in Uganda. The aim of this study was to validate the advantages and disadvantages of delegation of major obstetric surgery to non-doctors. **Methods:** Data from 2131 consecutive obstetric surgeries in 38 district hospitals in Uganda were collected prospectively. The interventions included cesarean sections alone and those that were combined with other interventions, such as subtotal and total hysterectomy repair of uterine rupture and tubal ligation. All these surgeries were conducted either by clinical officers or by medical officers. **Results:** During the study period,

clinical officers performed 90% of all straight cesarean sections, 70% of those combined with subtotal hysterectomy, 60% of those combined with total hysterectomy and 89% of those combined with repair of uterine rupture. A comparable profile of patients was operated on by clinical officers and medical officers. Postoperative outcomes were almost identical in the 2 groups in terms of maternal general condition, both immediately and 24 hours postoperatively, and in terms of occurrence of pyrexia, wound infection, wound dehiscence, need for reoperation, neonatal outcome or maternal death. **Conclusion:** Clinical officers perform the bulk of emergency obstetric operations at district hospitals in Uganda. The postoperative outcomes of their procedures are comparable to those of medical officers. Given the scarcity of physicians, clinical officers constitute a crucial component of the health care team in Uganda for saving maternal and neonatal lives.

Addressing operative volume of general thoracic surgery in Rwanda: a national health burden and challenge to surgical education. *Fidele Byiringiro, MD, MCS (ECSA); Adriana Gomez Ramirez, MD; Daniel Thomas, PhD; Nebil Nuradin. From the University Teaching Hospital of Kigali, Kigali, Rwanda (Byiringiro); and the University of Virginia, Charlottesville, Va. (Gomez Ramirez, Thomas, Nuradin).*

Background: The need and optimum operative volume to address thoracic surgical conditions is unknown in East Africa. Characterizing operative volume is crucial to understanding current efforts in addressing patients' needs. We examined the burden of thoracic surgery diseases and the impact of simulation training on access to surgery in Rwanda. **Methods:** General surgery procedures performed between January 2011 and July 2016 at 3 hospitals in Rwanda (university teaching hospitals of Kigali-CHUK, Butare-CHUB and King Faisal) were reviewed. Information included patient demographics, operative team, diagnosis and procedures performed. Thoracic cases involved the esophagus, pleural space and lung parenchyma. We used descriptive and bivariate analyses (Pearson χ^2 test) and multivariate logistic regression for statistically significant results. **Results:** In total, 460 (3.26%) thoracic cases (248 major) out of 14 130 general surgery procedures (CHUK $n = 8770$, CHUB $n = 2539$, and King Faisal $n = 2821$) were reviewed. The mean age of patients who were considered major cases was 29.8 ± 20.7 years, 102 of 247 (41.3%) were female, and 165 of 204 (80.9%) had private versus community-based health insurance. The number of major cases increased from 29 to 47.7 cases per year. Presence of foreign faculty (odds ratio [OR] 1.98, 95% confidence interval [CI] 1.40–2.56) and hospital location (OR 1.28, 95% CI 0.85–1.70) were associated with performance of major thoracic cases ($p < 0.0001$), and the association remained significant even after adjusting for patient demographics ($p < 0.0001$). The thoracic simulation training had no impact on the number of patients operated; it did not change the capacity of the surgical team to perform more thoracic operations. **Conclusion:** University partnerships increase the number of thoracic surgeries performed in Rwanda. Educational initiatives, such as simulation training, can serve as adjuncts to operative experience but cannot sustainably address the patient access need alone. Allocation of additional resources to thoracic surgery in Rwanda is needed.

A novel approach to developing a global health post-elective debriefing session in Canadian undergraduate medical education. *Ashley Cerqueira, MSc/BScN; Anna McCarthy, MD.* From the University of Ottawa, Ottawa, Ont.

Background: Global health electives (GHEs) benefit medical practice and have risks, including safety, occupational health, and ethical challenges. Reflection ensures well-being and integration back into medical training. The University of Ottawa is a national leader in preparing medical trainees through mandatory pre-departure training; however, what is needed is an effective post-GHE debriefing program. **Methods:** We undertook a scoping review related to GHE debriefing and examined current practices of North American medical schools. We used these results, with faculty and national guidelines, to develop a novel debriefing program for GHE. Post-GHE, trainees completed reflective essays and surveys. They submitted photo narratives from their GHE for a Photovoice project (PV). One week before debriefing, trainees received a list of reflective questions to be used as a guide during a semistructured group reflection period and examination of the PV. **Results:** Twenty-six trainees completed reflections and surveys; 19 made submissions for the PV, and 13 students attended a debrief session. Group reflection topics covered safety, poverty, language barriers and ethical challenges associated with limited resources and death. The PV (152 photos) had themes ranging from culture (32%), clinical experiences (23%), networking (10%), food (7%) and politics (4%), among others. Trainees found the session stimulating and valuable (3.9/4), safe for sharing honest or negative experiences (3.8/4) and reported that it provided constructive feedback (3.6/4). They felt the GHE would benefit future practice (4/4) and would recommend it to peers (3.8/4). **Conclusion:** Trainees rated the debrief session and group reflection as valuable. Our project reinforces the significance of teaching reflection in medical education and the importance of post-GHE debriefing.

Efficacy of preperitoneal continuous wound infiltration with bupivacaine for postoperative pain management after laparotomy in CHU-Kigali: a randomized clinical trial. *Jean Damascène Nyandwi, MD; Jean Bonaventure Uwizeza, MD; Franco Carli, MD; Théogène Twagirumugabe, MD.* From the Centre Hospitalier Universitaire de Kigali, Kigali, Rwanda (Nyandwi); the University of Rwanda, Kigali, Rwanda (Uwizeza, Twagirumugabe); and McGill University, Montreal, Que. (Carli).

Background: Major surgeries, such as abdominal procedures, produce major stress. Moderate to severe acute pain, regardless of site, can affect the function of nearly every organ and may adversely influence postoperative morbidity and mortality. Control of postoperative pain should therefore be of interest to surgeons, anesthetists and hospital administrators alike. In abdominal surgery, postoperative pain management in developing countries is challenging owing to shortage of intravenous medications limited to opioids and fear of their side effects among health care professionals, and other techniques like epidural administration are difficult to learn and costly. The use of a continuous bupivacaine infusion in the preperitoneal space after laparotomy may be a suitable alternative. **Methods:** We conducted a double-blind randomized controlled trial on patients who underwent a

midline laparotomy. Patients were allocated to receive a continuous infusion of either 0.125% bupivacaine or saline at a rate of 8 mL/h through a multiholed catheter inserted by the surgeon in the preperitoneal space. In the postoperative period, all patients received patient-controlled intravenous morphine analgesia. The end-points of the study were morphine consumption during the first 48 postoperative hours, pain intensity at rest and on coughing, incidence of nausea and vomiting and other side-effects of opioids, time to first sitting position, time of first flatus, duration of hospital stay and patient satisfaction. **Results:** Twenty patients in each group were evaluated. Both groups were comparable regarding demographics, length of surgical incision, surgical procedures, duration of surgery, duration of anesthesia and time of extubation (all $p > 0.05$). Patients allocated to bupivacaine infusion used, on average, 17.3 mg less morphine at 48 hours (95% confidence interval 7.32, $p < 0.001$) corresponding to a reduction of 57%. Significantly lower pain scores were observed in the bupivacaine group both at rest and on cough. Bupivacaine infusion was associated with a better satisfaction rate ($p < 0.001$), a significantly decreased time to first sitting position (13.3 hours earlier, $p = 0.001$), decreased time to first flatus (25 hours earlier, $p = 0.001$) and decreased hospital stay (2.8 days shorter, $p = 0.001$). Incidence of nausea and vomiting was statistically lower in the bupivacaine group ($p = 0.008$). No important postoperative complications were observed in either group. **Conclusion:** Preperitoneal continuous infiltration of bupivacaine provides effective analgesia and reduces morphine consumption and its side effects. It is safe to use and improves patient satisfaction and recovery.

Predictors of obstetric fistula repair outcome in Lubango, Angola. *Andrew Giles, MD; Sam Fabiano, MD; Laurence Bernard, MD; Sarah Hudgins, MD; Annelise Olson, MD; Robert Riviello, MD, MPH.* From the Harvard TH Chan School of Public Health, Boston, Mass. (Giles, Bernard); the Pan-African Academy of Christian Surgeons, Bongolo, Gabon (Fabiano); the Centro Evangélico de Medicina do Lubango, Lubango, Angola (Hudgins, Olson); and the Program in Global Surgery and Social Change, Harvard Medical School, Boston, Mass.

Background: Obstetric fistula, resulting primarily from complicated labour and lack of access to obstetrical services, has a significant impact on the women of Angola. Outcomes from 5 years of operative experience at Centro Evangélico de Medicina do Lubango (CEML) hospital in Lubango, Angola, were reviewed and analyzed to determine factors affecting success of fistula repair. **Methods:** In this retrospective study, data from all recorded operations performed between July 2011 and December 2016 were reviewed using electronic and paper records. Analysis of the data was carried out using parametric and nonparametric tests for group comparisons and logistic regression for outcome prediction. **Results:** In total, 407 operations were performed on 243 women. Of these, 224 women were diagnosed with a vesicovaginal fistula and 19 with a combined vesico- and rectovaginal fistula. A total of 381 (93.6%) vesicovaginal repairs were performed as well as 26 (6.4%) step procedures. The success rate was 42%. Among the operations, 172 (45.1%) were repeat operations, and 54.2% were rated as difficult repairs. Univariate analysis of variables affecting the

success of surgery showed that age at surgery (odds ratio [OR] 1.34, 95% confidence interval [CI] 1.08 to 1.68), duration of labour (OR 0.46, 95% CI 0.30 to 0.70), difficulty of repair (OR 0.28, 95% CI 0.20 to 0.38) and number of previous surgeries (OR 0.74, 95% CI 0.62 to 0.86) were significant factors. Difficulty of repair (OR 0.29, 95% CI 0.18 to 0.47) and number of previous surgeries (OR 0.63, 95% CI 0.42 to 0.88) remained significant in multivariate analysis. **Conclusion:** Success of obstetric fistula operative repair was generally low at 42% in a population with a high rate of difficult and repeat operations. These factors were shown to negatively predict success of the repair after adjusting for other factors. Greater reliability in data recording is required.

Is surgery always necessary in children with acute appendicitis? Even interval appendectomy is not needed in the majority of patients. *Abdul Hanif, MBBS, MS, MMed; Kaniz Hasina, MBBS, MS. From the FAIMER Institute, Philadelphia, Pa; and Dhaka Medical College and Hospital, Dhaka, Bangladesh.*

Background: The aim of this study was to reduce surgery, and thereby surgery-related morbidity, hospital stay, cost and emotional stress, among pediatric patients presenting with acute appendicitis. **Methods:** This prospective study was conducted in the department of pediatric surgery in Dhaka Medical College Hospital, Bangladesh, during the 2-year period from July 2009 to June 2011. In total, 296 patients aged 2–15 years of either sex with diagnoses of acute appendicitis based on modified Alvarado scoring system and investigations were included in the study. Patients with recurrent appendicitis, appendicular abscess, perforation and fecalith and/or worm in the appendix lumen were excluded and were treated surgically. Patients with uncomplicated appendicitis were treated by nil by mouth, intravenous fluid, antibiotics and analgesics. They were closely monitored every 6 hours. Appendectomy was performed in case of clinical deterioration. Patients improved clinically, and were discharged without any advice for interval appendectomy. They were followed-up clinically and radiologically after 1, 3 and 6 months and were hospitalized immediately in case of any recurrence. **Results:** Out of 296 patients, 234 were included in the conservative management group, and 62 were excluded and treated surgically. In total, 208 patients responded well to conservative management and were discharged within 5 days. On subsequent follow-up, 17 patients experienced a clinical recurrence, 3 had appendicular lump, and 4 had sonographic features of appendicitis with no clinical presentation. **Conclusion:** From this study, it can be concluded that appendectomy is not always essential in all children presenting with acute appendicitis. Conservative management reduces surgery and surgery-related complications.

Smile Train: making the grade in global cleft care. *Larry Hollier, MD; Matthew Louis, BS; Ryan Dickey, BM. From the Baylor College of Medicine, Houston, Tex.*

Background: The global medical and psychological burden of cleft lip and palate is large, especially in low- and middle-income countries. For decades, medical missions have sought to alleviate this burden; however, there are significant barriers

to providing sustainable, high-quality cleft care using the mission model. Smile Train, an international children's charity founded in 1999, has developed a scalable model that provides support to local partner hospitals and surgeons around the world. **Methods:** Smile Train partners with hospitals to support cleft care treatment across the developing world. Partner hospitals are held to strict safety and quality standards. Local or regional providers are used to train medical personnel. A quality-improvement process developed by the Smile Train medical advisory board is used to evaluate cleft cases and suggest additional review and training as needed. Surgical candidates are systematically evaluated and must meet specific medical criteria to ensure safety. Experienced anesthetists adhere to Smile Train's safety and quality protocols as well as the anesthesia guidelines. **Results:** Smile Train has sponsored more than 3000 hands-on training opportunities, 30 000 opportunities to participate in cleft conferences and 40 000 virtual cleft training opportunities using the Smile Train virtual surgery simulator. The local medical community is empowered through its partnership with Smile Train. **Conclusion:** Smile Train and its partners have provided more than 1 million safe, high-quality cleft surgical treatments since 1999. Through rigorous self-governance and its sustainable, scalable model, this organization has elevated the standard of cleft care in the developing world.

Validation of risk scores for postoperative nausea and vomiting in patients undergoing general anesthesia for elective surgery at University Teaching Hospital in Lusaka, Zambia. *Tuma Kasole, MD; John Kinnear, MBChB, MSc, MBA. From the University of Zambia, Lusaka, Zambia (Kasole); and the Southern University Hospital Foundation Trust, Education Centre, Essex, UK.*

Background: Postoperative nausea and vomiting (PONV) is a common complication of general anesthesia. Risk factors include female sex, nonsmoker, history of motion sickness, use of opioids and surgery lasting more than 60 minutes. There are scores that have been created and are used to predict which patients are at high risk of PONV. Different risk scores are universally used to predict PONV, but their validation has shown different outcomes in different settings. The objectives of this study were to validate the Apfel and Koivuranta risk scores and the incidence of PONV in adult patients at the University Teaching Hospital in Lusaka, Zambia. **Methods:** In total, 244 patients were sampled, and their age range was 18–80 years. Patients were recruited the day before surgery and were seen and interviewed at least 6 hours postoperatively. Any episode of nausea or vomiting was taken as PONV. Data analysis was done using SPSS version 22, and discrimination was used to validate the data. **Results:** The incidence of PONV was 25.4%. The receiver operating curves were 0.63 (Apfel) and 0.62 (Koivuranta) for nausea and 0.67 (Apfel) and 0.64 (Koivuranta) for vomiting. In original studies these risk scores were 0.70 and 0.72, respectively. **Conclusion:** The PONV risk scoring systems did not accurately predict patients at high risk of PONV in the population studied. Also, the incidence of PONV was much lower than in the derivative population. There is a need to develop a new or modified score that will suit our environment.

Creation and validation of a brief surgical procedure code list for outcomes research in resource-limited settings. *Peter Kayima, MBCbB; Charles Liu, MD; Johanna Riesel, MD; Martin Situma, MBCbB, MMed; David Chang, PhD, MPH, MBA; Paul Firth, MBCbB.* From the the Mbarara University of Science and Technology, Mbarara, Uganda (Kayima, Situma); Stanford University Medical Center, Stanford, Calif. (Liu); and the Massachusetts General Hospital, Boston, Mass. (Riesel, Chang, Firth).

Background: Surgical data collection in resource-limited settings is hindered by the lack of a standardized system for classifying surgical procedures. The applicability of existing procedure coding systems in resource-constrained settings is limited by their size, complexity and cost of implementation. This has been a particular challenge at Mbarara Regional Referral Hospital (MRRH), one of Uganda's busiest public hospitals. A brief procedure code list could improve data collection at MRRH and beyond. **Methods:** We reviewed operating room logbooks to identify all surgical operations performed at MRRH between Jan. 1, 2014, and Dec. 31, 2014. Based on the documented indication for surgery and procedure(s) performed, we assigned each operation up to 4 International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) procedure codes. Each surgical procedure was assigned codes by 1 of 2 investigators independently, and 20% of procedures were coded by both investigators. **Results:** During the 1-year study period, 6464 surgical procedures were performed at MRRH; we assigned 7623 total and 435 unique procedure codes. The κ statistic representing interrater reliability was 0.7037. A total of 111 procedure codes represented 90% of codes assigned, 180 represented 95%, and 278 represented 98%. We assessed the ability of the intermediate-sized (180-code) list to describe surgical procedures performed at MRRH during the period Aug. 1, 2015, to Sept. 30, 2015. Our list described 89.2% of procedures performed during this validation period. **Conclusion:** An empirically generated procedure code list of 180 ICD-9-CM codes describes almost all surgical procedures performed at a Ugandan referral hospital. Such a standardized procedure coding system may enable better data collection for administration, research and quality improvement in resource-constrained hospitals.

Delayed access to surgery, backlog, and unmet burden of pediatric surgical disease in Africa. *Angela Lee, BSc; Yasmine Yousef, MD, CM; Elena Guadagno, MLIS; Dan Poenaru, MD, MHPE, PhD.* From McGill University, Montreal, Que. (Lee); Université de Montréal, Montreal, Que. (Yousef); McGill University Health Centre, Montreal, Que. (Guadagno); and the Montreal Children's Hospital, McGill University Health Centre, Montreal, Que. (Poenaru).

Background: Congenital anomalies (CAs) contribute between 25 million and 39 million disability-adjusted life-years (DALYs) worldwide; 94% of anomalies occur in low- and middle-income countries (LMICs). The purpose of this study was to estimate the prevalence of unmet surgically correctable CAs in pediatric populations within African LMICs. **Methods:** A retrospective study of the pediatric population surgically treated for cryptorchidism, isolated cleft lip, hypospadias, bladder exstrophy and anorectal

malformation at Myung Sung Christian Medical Center (MCMC) in Ethiopia from January 2012 to July 2016 and a scoping review of the literature describing the management of CAs in African LMICs were conducted. The frequency of surgery and age of included patients were collected to estimate mean surgical delay by country and prevalence of unmet need. **Results:** We included 210 procedures performed on 207 patients from MCMC. The scoping review yielded 43 data sets extracted from 36 publications and encompassing 11 countries. Findings were divided by CA and subdivided by country. Overall, the maximum surgical delay and prevalence of unmet need per condition, respectively, were 3.15 years and 332 823 DALYs for cryptorchidism, 5.95 years and 3088 DALYs for cleft lip, 4.17 years and 18 850 DALYs for hypospadias, 5.48 years and 2745 DALYs for bladder exstrophy, and 2.12 years and 758 DALYs for anorectal malformation. **Conclusion:** The advanced age at surgery for correctable CA reflects the limited and delayed access to surgical care, which generates a significant prevalence of unmet need, surgical delay and surgical backlog. The data support the need for increasing the pediatric surgical capacity in LMICs.

Assessing the impact of HIV status on outcomes among trauma patients presenting to two referral hospitals in Rwanda. *Allison N. Martin, MD, MPH; Fidele Byiringiro, MD; Robin T. Petroze, MD, MPH; Menelas Nkeshimana, MDDS, MMED; James F. Calland, MD; Jean Claude Byiringiro, MD, MMED.* From the University of Virginia, Charlottesville, Va. (Martin, Calland); the University Teaching Hospital of Kigali, Kigali, Rwanda (F. Byiringiro, Nkeshimana, J.C. Byiringiro); and the Montreal Children's Hospital, Montreal, Que. (Petroze).

Background: There is conflicting evidence regarding the impact of human immunodeficiency virus (HIV) status on trauma outcomes in low-resource settings. This study sought to evaluate the impact of HIV serostatus on trauma outcomes in Rwandan patients. **Methods:** Using the University of Rwanda trauma registry, all trauma patients presenting to Rwanda's 2 university teaching hospitals between March 2011 and July 2015 were evaluated. Confirmed HIV-positive cases were matched 1:2 with known HIV-negative controls using age, sex and district of primary residence. Postadmission morbidity and mortality were compared using logistic regression. **Results:** In total, 11 280 patients were recorded prospectively in the registry, including 166 HIV-positive cases and 323 HIV-negative controls ($n = 489$). There was no difference in delay of hospital presentation or time until surgery between the 2 groups ($p = 0.50$ and $p = 0.57$, respectively). Nearly 30% of all patients underwent surgery during admission ($n = 143$), and the rate of operative intervention was independent of HIV serostatus ($p = 0.251$). There was no association between development of any complication and HIV status ($p = 0.171$, unadjusted odds ratio [OR] 0.345, 95% confidence interval [CI] 0.076–1.58). HIV-positivity was associated with increased 30-day mortality ($p < 0.0001$, unadjusted OR 8.10, 95% CI 2.60–25.2), and this remained significant when controlling for confounders (i.e., age, sex, cause of injury, alcohol use, Glasgow Coma Scale score, and hospital, $p = 0.001$, OR 65.1, 95% CI 4.93–907, C-statistic 0.95). **Conclusion:** Although there is no association between HIV serostatus and delayed presentation or likelihood of operative intervention among trauma

patients, there is a significant association with early mortality. Further investigation regarding testing, treatment and outcome in HIV-positive trauma patients is warranted.

Factors affecting late complications of burns in children in low- and middle-income countries: a systematic review. *Fanyi Meng, MD; Kevin Zuo, MD; Alexandre Amar-Zifkin, MLIS; Robert Baird, MDCM, MSc, FRCSC; Sabrina Cugno, MD, MSc, FRCSC; Dan Poenaru, MD, MHPE, FRCSC.* From the McGill University Health Centre, Montreal, Que. (Meng); the University of Toronto, Toronto, Ont. (Zuo); the McGill University Health Centre Medical Libraries, Montreal, Que. (Amar-Zifkin); and the Montreal Children's Hospital, Montreal, Que. (Baird, Cugno, Poenaru).

Background: In low- and middle-income countries (LMICs), timely access to primary care following thermal injury is challenging, if not impossible. Children with deep burns often fail to receive specialized burn care until months or years postinjury, thus suffering long-term impairments from hypertrophic scarring and joint contractures. We sought to examine the correlation between limited access to care for acute burns and long-term disability in children in LMICs. Furthermore, we sought to identify specific factors affecting the occurrence of late burn complications. **Methods:** A literature search was conducted to retrieve articles on pediatric burns in LMICs in Medline, Embase, Cochrane, LILACS, Global Health, African Index Medicus, and others. Articles were independently assessed by 2 reviewers in a PRISMA-compliant screening/reporting process. **Results:** Of 2896 articles, 103 were identified for full-text review, and 14 met the inclusion criteria. A total of 647 children developed long-term burn sequelae affecting various regions of the body. Time from injury to consultation ranged from a few months to 17 years. Nonmodifiable factors associated with late complications included total body surface area, depth of burn and low socioeconomic status. Modifiable factors included limited infrastructure, perceived inability to pay, lack of awareness of surgical treatment, low level of maternal education and time elapsed between burn and corrective surgery. **Conclusion:** Lack of access to adequate care following pediatric burn injury in LMICs is associated with significant development of burn contractures. Overall, children in LMICs who present with debilitating burn sequelae had inadequate initial treatment of their burn injuries.

Fast-track surgery for abdominal surgery in Rwanda: a randomized controlled trial. *Leonard Ndayizeye, MD, MMed; Jennifer Rickard, MD, MPH; Ahmed Kiswezi, MD, FCS.* From the University Teaching Hospital Butare, Butare, Rwanda (Ndayizeye); the University of Minnesota, Minneapolis, Minn. (Rickard); and the University of Rwanda, Butare, Rwanda (Kiswezi).

Background: Fast-track surgery (FTS) was started in the 1990s initially for colorectal surgery, but later became applicable to other aspects of surgery. Core elements of FTS include optimal pain control with early initiation of mobilization and feeding. FTS in high-resource settings has been shown to be beneficial, with decreased hospital stay, reduced complications and lower costs. The aim of this study was to evaluate the impact of FTS

among patients undergoing abdominal surgery at a Rwandan referral hospital. **Methods:** Adult patients undergoing elective abdominal surgery were randomized to FTS versus conventional management. Interventions for FTS included early feeding, early mobilization, pain control and discharge planning. Primary outcome was length of hospital stay. **Results:** Sixty-two patients were enrolled in the study, with 31 patients randomized to FTS and 31 patients undergoing conventional management. A total of 97% of FTS patients received early enteral nutrition postoperatively compared with 48% of patients who received conventional management ($p < 0.0001$). In addition, 97% of FTS patients mobilized within 24 hours compared with 72.3% of patients with conventional management ($p < 0.0001$). Pain was adequately controlled with nonopioid medications in 77% of FTS patients. In the conventional management group, 84% of patients received opiates. The mean hospital stay for FTS patients was 2.1 days, and the mean hospital stay for patients with conventional management was 5.3 days ($p < 0.001$). There was no difference in complication rates between the groups. **Conclusion:** In a low-resource setting, implementing FTS management with early nutrition, mobilization and decreased opioid use reduces length of hospital stay without increasing complications.

An analysis of the global specialist surgical workforce proportion of physicians. *Karolina Nyberger, MD (candidate); Hampus Holmer, MD; Lars Hagander, MD, PhD, MPH; Swagoto Mukhopadhyay, MD, MPH.* From Lund University, Lund, Sweden (Nyberger); the Program in Global Surgery and Social Change, Harvard Medical School, Boston, Mass. (Nyberger, Mukhopadhyay); Department of Clinical Sciences, Surgery and Public Health, Lund University, Lund, Sweden (Holmer, Hagander); and the University of Connecticut Integrated Residency Programs, Storrs, Conn. (Mukhopadhyay).

Background: In 2015, the Lancet Commission on Global Surgery estimated that at least 20–40 surgical specialists are needed per 100 000 people, but how do countries prioritize surgery in the context of a general shortage of physicians and many unattended health problems? Thus far, no studies have described the association between density of specialist surgical workforce and the density of physicians. The aims of this study were to analyze the proportion of physicians who are surgical specialists in different countries and to explore how this proportion relates to national indicators of surgical output and health outcomes. **Methods:** We calculated the specialist surgical workforce proportion and assessed how it compared with national health system-related indicators for all countries with available data from the World Bank and World Health Organization (WHO), and the Organization for Economic Co-operation and Development (OECD). **Results:** We calculated the specialist surgical workforce proportion for 143 countries. The median was 17.4% (interquartile range 10.3–26.2). The specialist surgical workforce was significantly lower in countries with a lower density of physicians ($p < 0.001$) and in countries in general health workforce crisis ($p = 0.002$). The proportion correlated with gross domestic product ($p = 0.006$), health expenditure ($p = 0.0013$) and surgical volume ($p = 0.018$) and had an inverse correlation with maternal mortality ratio ($p = 0.028$), particularly for anesthesiologists ($p < 0.001$). **Conclusion:** Countries with fewer physicians had fewer

surgical specialists, both in absolute and relative terms. This indicates that surgery is of relatively lower priority in countries with a smaller physician workforce or that other cadres perform surgery in those countries.

Maternal predictors of neonatal outcomes after emergency cesarean section: a retrospective study in three rural district hospitals in Rwanda. *Naome Nyirababimana, BSc; Christine Ufashingabire, BSc; Yiban Lin, MD, MPH; Bethany Hedt-Gauthier, PhD; Robert Riviello, MD, MPH; Jackline Odhiambo, BSc; Joel Mubiligi, MD; Martin Macharia, MD; Stephen Rulisa, MD; Uwicyeza Illimineze, MD; Ngamije Patient, MD; Nkikababizi Fulgence MD; Nkurunziza Theoneste, BSc.* From Partners in Health Rwanda, Kigali, Rwanda (Nyirababimana, Mubiligi, Macharia, Theoneste); University of Rwanda, Kigali, Rwanda (Ufashingabire, Rulisa); Harvard Medical School (Lin, Hedt-Gauthier); Brigham and Women's Hospital, Boston, Mass. (Riviello); Partners in Health, Boston, Mass. (Odhiambo); and the Ministry of Health, Kigali, Rwanda (Illimineze, Patient, Fulgence).

Background: Neonatal mortality after cesarean delivery in sub-Saharan Africa is higher than the global average. This study aimed to assess maternal predictors for poor neonatal outcomes after emergency cesarean delivery in 3 rural district hospitals in Rwanda. **Methods:** This retrospective study included a sample of 441 neonates born between Jan. 1, 2015, and Dec. 31, 2015. We described mothers' demographic and clinical characteristics using frequencies and proportions. Using backward stepwise multivariate logistic regression, we assessed the association between maternal characteristics and poor neonatal outcomes, defined as death within 24 hours or Apgar score less than 7 within 10 minutes of birth. **Results:** Among the 441 neonates, 40 (9.0%) had poor outcomes. Three maternal factors were significantly associated with poor neonatal outcomes. Neonates born to mothers who had 4 or more prior pregnancies (odds ratio [OR] 3.01, 95% confidence interval [CI] 1.23–7.35, $p = 0.015$), neonates whose mothers came from health centres with ambulance travel time of more than 30 minutes to the district hospital (for 30–60 minutes: OR 3.80, 95% CI 1.07–13.40, $p = 0.012$; for more than 60 minutes: OR 5.82, 95% CI 1.47–23.05, $p = 0.012$) and neonates whose mothers had very severe indications for cesarean section, (OR 2.24, 95% CI 1.11–4.52, $p = 0.023$) were significantly likely to have poor outcomes. **Conclusion:** Long travel time to the district hospital was a leading predictor of poor neonatal outcomes after cesarean delivery. We recommend the improvement of referral systems, ambulance availability and road network to reduce delays in reaching district hospitals for surgical care. Improving diagnostic capacity at the health centre level could improve early detection of cesarean section indication for early interventions.

Refashioning of circumcision in Nigeria: ketamine or ketamine plus propofol. *Ajuzeogbu Obinna, MD; Amucheazi Adaobi, MD.* From the University of Nigeria Nsukka, Enugu campus, Nigeria.

Background: Male circumcision is a common neonatal practice in southeast Nigeria. Traditional birth attendants and midwives often carry out the procedure. When complications arise,

patients are referred to the pediatric surgeon. The procedure of refashioning of circumcision is carried out as a day surgery under both local and/or general anesthesia. The objective of this study was to compare the quality of anesthesia in children who received ketamine alone or ketamine plus propofol. **Methods:** Eighty children who were American Society of Anesthesiologists physical status I–II, aged 2–10 years and undergoing refashioning of circumcision were recruited into this randomized, double-blind study. An intramuscular injection of 3 mg/kg of ketamine plus 0.02 mg/kg of atropine was used for premedication. Patients were randomized to receive either ketamine alone, or propofol plus ketamine (group P) as a sedative agent for the procedure. A caudal block was instituted for analgesia. Intraoperative peripheral capillary oxygen saturation sedation scores, pulse rate and blood pressure were monitored. Wake-up times (Ramsay Sedation Scale scores) and home readiness were also assessed at the end of the procedure. **Results:** Intraoperative pulse rate, systolic and diastolic blood pressures were higher in the ketamine group than the ketamine plus propofol group ($p < 0.05$). Wake-up time and home readiness were better in the ketamine plus propofol group than in the ketamine group (45 minutes v. 80 minutes, $p < 0.05$). **Conclusion:** Ketamine plus propofol resulted in better hemodynamic stability and earlier home readiness than ketamine alone.

Knowledge, attitude and barriers to evidence-based medicine among surgeons and their trainees in southwest Nigeria. *Kehinde Oluwadiya, FMCS (Orthop), FACS; Olusola Akanbi, FWACS; Temitope Esan, FWACS; Laide Agodirin, FMCS; Johnson Ogunlusi, FMCS (Ortho).* From Ekiti State University, Ado-Ekiti, Nigeria (Oluwadiya, Ogunlusi); the Lautech Teaching Hospital, Osogbo, Nigeria (Akanbi); Obafemi Awolowo University, Ile-Ife, Nigeria (Esan); and the University of Ilorin, Ilorin, Nigeria (Agodirin).

Background: Evidence-based medicine (EBM) is not integrated into undergraduate or postgraduate medical education in Nigeria. EBM training is based on ad hoc programs. The present study aims to quantify the knowledge, attitude and barriers to EBM and compare these to competence in EBM. **Methods:** A composite questionnaire consisting of the McAllister knowledge and attitude questionnaire, the Zwolsman barriers questionnaire and 5 questions from the competence in EBM Berlin questionnaire (BQ) were administered among 185 surgeons and trainees in 5 hospitals in southwest Nigeria. **Results:** In total, 169 of the questionnaires were deemed suitable for inclusion in the study. The respondents were 57 surgeons and 112 trainees; of these, 122 were EBM users (always/often use EBM in their practice) and 47 were nonusers (rarely/never use EBM). The majority of both groups still use traditional sources of information in their clinical practice; however, EBM users scored significantly higher on the BQ (28.0% v. 23.8%), but there was no difference in their performances on the McAllister and Zwolsman questionnaires. Paradoxically, those with previous training in EBM were not more likely to be EBM users than those with no previous training. They also scored significantly lower on the knowledge/skills domain of the Zwolsman questionnaire than those without prior training, and there were no significant differences in their performances on the BQ. **Conclusion:** This study shows that EBM usage by surgeons in southwest Nigeria

is poor, the quality of EBM training in the region is poor, and there is a need for its reappraisal.

Family medicine training to improve quality of care in surgery and obstetrics. *Sumanda Ray, MBBS FFPH[UK]; Farai Madzimbamuto, FRCA. From the University of Zimbabwe, Harare, Zimbabwe.*

Background: Caesarean sections are a common surgical procedure in low- and middle-income countries and an essential service provided at district hospitals in most African countries. Research in Zimbabwe has demonstrated associations between still-births, maternal deaths and c-sections. Medical officers are posted to district or mission hospitals with little specific training for the functions they are expected to perform. They carry out surgical and anesthetic procedures without supervision and without the skills to manage complications that may arise. They may also lack the experience to support middle-level health workers and nurses when they run into difficulties. Patients may also be inadequately resuscitated before referral to higher-level care. **Discussion:** African countries have embarked on post-graduate family medicine training, which ensures that future family physicians achieve competencies appropriate for district hospital-level services in obstetrics, anesthetics and management of surgical emergencies. Achievement of clinical and cost-effectiveness within constrained resources are priorities including improved teamwork with other health professionals. The program proposed for Zimbabwe includes use of quality improvement methods, such as root cause analysis, to identify avoidable factors and weaknesses in the health system so that each catastrophic event (e.g., maternal or newborn death or near miss) becomes a learning exercise. **Conclusion:** Family medicine training is currently underresourced but has the potential to radically improve the lives of poorer populations through its location in areas of greatest need and ability to benefit from health interventions. In addition, the family medicine model of decentralized health care would benefit undergraduate medical training.

A national surgical plan for South Africa: building the pathway to equitable surgical care. *Sarab Rayne, FCS(SA); Sule Burger, MBChB; Stephanie Van Straten; Bruce Biccard, PhD; Mathume Joseph Phaahla, MBChB; Martin Smith, FCS(SA). From the University of Witwatersrand, Johannesburg, South Africa (Rayne, Van Straten, Smith); the Tembisa Hospital, Olifantsfontein, Tembisa (Burger); the University of Cape Town, Cape Town, South Africa (Biccard); and the South African Department of Health, Cape Town, South Africa (Phaahla).*

Background: Internationally, governmental and health communities are recognizing safe surgical care as an indivisible part of improving global health care. South Africa is a middle-income country with an inequitable distribution of health care resources both geographically and between the public and private sectors. It has no current national surgical plan. Following a national forum on surgery and anesthesia held to bring together the various stakeholders, including government, clin-

icians and societies, this study explores the current position of surgery in South Africa. **Methods:** Using presentations from the forum and reports from its breakaway sessions, combined with an electronic literature review, abstracts from local congresses and expert clinicians' experience, the landscape of surgical care in South Africa was explored and future strategies toward equitable access were determined. **Results:** The first essential building block in this pathway is the national setting of standards through high-quality interdisciplinary collaborative research and audit. Second is the need to recognize that improved surgical provision requires shaping a diverse workforce tailored to the country's specific needs, based around a primary health care model and the district hospital, and supported by government and academic organizations. Finally, there is an essential place for health care managers locally and nationally to partner with clinicians in reform and to identify surgical care to the National Treasury as an area for specialized budget allocation. **Conclusion:** In the pathway to strengthened and reformed surgical care provision in South Africa this report comprehensively summarizes the fundamental problems and advances solutions grounded in collective years of experience in this field.

A diagnostic and clinical trial on measures to mitigate cervical cancer cases in Uganda. *Mbidde Robertson, MMed. From the Research International Consult Uganda (RICU), Mukono, Uganda.*

Background: This study examines the safety and efficacy of 2 screening and treatment measures for cervical cancer prevention that were designed to be more resource-appropriate than conventional cytology-based screening programs. **Methods:** A randomized clinical trial of 6555 nonpregnant women aged 35–65 years who were recruited through community outreach was conducted between June 2000 and December 2002. All patients were screened using human papilloma virus (HPV) DNA testing and visual inspection with acetic acid (VIA). Women were subsequently randomized to 1 of 3 groups: cryotherapy if she had a positive HPV DNA test result, cryotherapy if she had a positive VIA test result, or delayed evaluation. **Results:** The prevalence of high-grade cervical intraepithelial neoplasia and cancer (CIN 2+) was significantly lower in the 2 screen-and-treat groups at 6 months after randomization than in the delayed evaluation group. At 6 months, CIN 2+ was diagnosed in 0.80% (95% confidence interval [CI] 0.40%–1.20%) of the women in the HPV DNA group and 2.23% (95% CI 1.57%–2.89%) in the VIA group compared with 3.55% (95% CI 2.71%–4.39%) in the delayed evaluation group ($p < 0.001$ and $p = 0.02$ for the HPV DNA and VIA groups, respectively). A subset of women underwent a second colposcopy 12 months after enrolment. At 12 months the cumulative detection of CIN 2+ among women in the HPV DNA group was 1.42% (95% CI 0.88%–1.97%), 2.91% (95% CI 2.12%–3.69%) in the VIA group and 5.41% (95% CI 4.32%–6.50%) in the delayed evaluation group. Although minor complaints, such as discharge and bleeding, were common after cryotherapy, major complications were rare. **Conclusion:** Screening and treatment measures are safe and result in a lower prevalence of high-grade cervical cancer precursor lesions compared with delayed evaluation at both 6 and 12 months.

Preventability of near miss and mortality in Rwanda: a case series. *Stephen Rulisa, MD; Christophe Benimana, MD.* From the University Teaching Hospital of Kigali (CHUK), Kigali, Rwanda.

Background: The aim of this study was to assess the primary causes and preventability of maternal near misses (MNM) and maternal mortality (MM) at Kigali University Teaching Hospital (CHUK), the largest tertiary referral hospital in Rwanda. **Methods:** We reviewed records for all women admitted to CHUK with pregnancy-related complications between Jan. 1, 2015, and Dec. 31, 2015. All maternal deaths and near misses, based on World Health Organization near miss criteria were reviewed. A committee of physicians actively involved in the care of pregnant women in the obstetrics–gynecology department reviewed all maternal near misses/pregnancy-related deaths to determine the preventability of these outcomes. Preventability was assessed using the Three Delays Model. Descriptive statistics were used to show qualitative and quantitative outcomes of MNM and MM. **Results:** We identified 121 MNMs and maternal deaths. The most common causes of MNM and maternal death were sepsis/severe systemic infection (33.9%), postpartum hemorrhage (28.1%) and complications from eclampsia (18.2%) or severe preeclampsia (5.8%). MNM and maternal deaths occurred in 87.6% and 12.4%, respectively. Facility-level delays (diagnostic and therapeutic) through human error or mismanagement (provider issues) were the most common preventable factors accounting for 65.3% of preventable MNMs and 10.7% of maternal deaths, respectively. Lack of supplies, blood, medicines, intensive care unit space and equipment (system issues) were responsible for 5.8% of preventable MNMs and 2.5% of preventable maternal deaths. Delays in seeking care contributed to 22.3% of cases, and delayed referral from home resulted in 9.1% of MNMs and deaths. Cesarean delivery was the most common procedure associated with sepsis/death in our population. History of prior cesarean section (24%) and obstructed/prolonged labour (13.2%) contributed to MNM and MM. **Conclusion:** The most common preventable causes of MNM and MM were medical errors, shortage of medical supplies and lack of patient education/understanding about their condition. Reduction in medical errors, supply/equipment availability and patient education in the early recognition of pregnancy-related danger signs will reduce the majority of delays associated with MNM and MM in our population.

Surgical outreach program: achieving surgical care for all by using peripheral hospitals in South Africa. *Imraan Sardiwalla, MBChB; Yaesh Sardiwalla, BSc.* From Sefako Makgatho Health Sciences University, Pretoria, South Africa (I. Sardiwalla); and Dalhousie University, Halifax, NS (Y. Sardiwalla).

Background: South Africa is a middle-income country with a 2-tiered health care system facing unique challenges. In South Africa's public sector, surgical care outside of tertiary hospitals is generally restricted owing to the perceived cost burden. This has resulted in extensive wait times for simple but necessary general surgery cases, resulting in suboptimal care. Our group explored better utilization of surgical resources in peripheral hospitals, offering a proposed outreach program as

a solution. **Methods:** The outreach program aimed to provide hernia repair surgeries at a peripheral hospital. Necessary resources and education to personnel (surgical teams and recovery units) was provided. A retrospective analysis of 103 patients undergoing hernia repair between June 2014 and November 2015 at the peripheral hospital was conducted to evaluate feasibility. All included patients had a normal surgical risk profile. Surgeries were performed under spinal or local anesthesia, using lightweight meshes, basic surgical packs and suture material. **Results:** Hernia repairs included 99 inguinal hernias, 3 umbilical and 1 epigastric ($n = 103$, patient age range 16–88 years, median 28 years). Surgical risk profiles and complications were comparable to those at the tertiary centre. **Conclusion:** South Africa faces challenges accessing operating room time. We have demonstrated that more effective resource allocation is possible. Commencement of the outreach program was met with resistance. Transparent communication and continued education increased confidence and skill acquisition among the team. The outreach program facilitates both teaching and service delivery in order to provide high-quality patient-centred care.

The postpartum obstetric blood requirement in Bihar: a novel modelling methodology to estimate population-level need and providers' perspectives on barriers and solutions to meet need. *Rachita Sood, BA, BS; Saurabh Saluja, MD, MPP; Nakul Raykar, MD, MPH; Remya Menon, DGO, MBBS; Rachel Yorlets, MPH; Hillary Jenny, MPH; Irsbad Mobammad, BE, ISE; Hemant Shah, MS, MBBS, MSc; Mark Shrimme, MD, MPH, PhD; Nobhojit Roy, MS, MBBS, MPH.* From the University of Miami Miller School of Medicine, Miami, Fla. (Sood); the Weill Cornell Medical College, New York, N.Y. (Saluja); the Beth Israel Deaconess Medical Center, Boston Mass. (Raykar); CARE India, Uttar Pradesh, India (Menon, Mohammad, Shah); Boston Children's Hospital, Boston, Mass. (Yorlets); the Icahn School of Medicine at Mount Sinai, New York, N.Y. (Jenny); Harvard Medical School, Boston, Mass. (Shrimme); and BARC Hospital Mumbai, Mumbai, India (Roy).

Background: One-fifth of the world's maternal mortality occurs in India, up to 38% of which is from obstetric hemorrhage. An inadequate blood supply and banking system restricts access to blood. This mixed-methods analysis aimed to estimate and contextualize the blood need in the Indian state of Bihar, a populous and poor state with maternal mortality above the national average. **Methods:** We developed a 3-step model to estimate 1) postpartum hemoglobin distribution, 2) hemoglobin thresholds and blood requirement, and 3) population-level blood need. Sensitivity analyses yielded a range of estimates. From February 2016 to May 2016, researchers conducted semi-structured interviews with 19 obstetricians, using snowball sampling to reach thematic saturation. Following immersion into deidentified texts, an analyst completed topical coding, confirming reproducibility with a second analyst. **Results:** An estimated 764 555 to 1 302 985 blood units are required annually for vaginal and cesarean delivery postpartum in India, with 63 080 to 120 018 units required in Bihar alone. Obstetric providers report that pervasive banked blood shortages force hospitals to require replacement donation, but patient families often cannot

(e.g., unable to afford long trip) or will not (e.g., fear weakness or death) donate. Providers wait 1 to 6 hours for blood, depending on blood bank proximity and stock and the patient's ability to navigate the system. In emergencies, providers feel forced to refer patients, even if survival during transport is unlikely. **Conclusion:** The blood drought in Bihar is largely resource-dependent and contributes to maternal mortality. Successful intervention requires accurate estimation of need and an understanding of context-specific barriers.

Structural bottlenecks facing the surgical and anesthesia health sector in Uganda. *Maxi Mbidde Ssenyondo, MMed. From the Crusade for Environmental Health Awareness Agency (CEHAA), Rakai, Uganda.*

Background: Surgical services in Uganda have remained relatively inaccessible as a result of inadequate medical capital, equipment, human resources deficits, unreliable drug supply chain, logistical impediments and budgetary deficits. The survey explored determinants of inefficient surgical and anesthesia clinical systems in the Ugandan health sector. **Methods:** A standardized survey tool was administered via interviews with Ministry of Health officials and key health practitioners at 14 public government hospitals throughout the country. Descriptive statistics were used to analyze the data. **Results:** There were a total of 107 general surgeons, 97 specialty surgeons, 124 obstetricians/gynecologists, and 17 anesthesiologists in Uganda, for a rate of 1 surgeon per 100 000 people. There were 0.2 major operating theatres per 100 000 people. Altogether, 53% of all operations were general surgery cases, and 44% were obstetrics/gynecology cases. In all, 73% of operations were performed on an emergency basis. All hospitals reported unreliable supplies of water and electricity. Essential equipment was missing across all hospitals, with no pulse oximeters found at any facilities. A uniform reporting mechanism for outcomes did not exist. **Conclusion:** Huge human resources deficits coupled with poor infrastructure makes it hard to provide quality surgical services at health centres. International collaborations with key government health sectors in capacity building and systems strengthening need to be undertaken to improve surgical services.

Surgical education e-collaborative: launching a new resident-driven global surgery collaborative. *Michael Stein, MD; Laurence Bernard, MD; Andrew Adamczyk, MD, MDC; Praveen Sravanam, MD, MPH; Vatsal Trivedi, MD; Samuel Faviano, MD. From the University of Ottawa, Ottawa, Ont. (Stein, Bernard, Adamczyk, Trivedi); the Catholic University of Health and Allied Sciences, Mwanza, Tanzania (Sravanam); and the Pan African Academy of Christian Surgeons, Fayetteville, N.C. (Faviano).*

Background: There is a growing need for low-fidelity global surgery initiatives to give surgical trainees an option to remain engaged in global health in a meaningful and sustainable way over the course of their residency. There is also increasing concern that surgical training has become increasingly dependent on tertiary hospitals, with decreasing emphasis on developing surgical skills in low-resource settings. **Methods:** We propose a low-cost, resident-driven, global health collaboration that culti-

vates relationships between surgical residents in diverse medical settings. A pilot was established for online, case-based discussions between surgical residents in both developed and developing institutions. Meetings included 7 attendees: 3 surgical residents from Ottawa, 3 surgical residents from a distributed university in Tanzania and Gabon, and 1 staff surgeon moderator from either institution. Each presented case was written by a resident and approved by a staff surgeon. **Results:** An informal survey among surgical residents at the University of Ottawa demonstrated an overwhelming interest to participate in simple, low-commitment, and longitudinal global health projects. After implementation of this initiative, feedback from both developed and developing institutions was overwhelmingly positive, with reports of increased awareness for diagnostic tools, surgical procedures and social barriers to accessing surgical care. **Conclusion:** A low-cost, resident-led online collaborative is an excellent avenue to cultivate relationships between surgical residents in diverse international medical settings. It encourages residents to approach surgical problems with varying resources, increases awareness for the social and institutional barriers for delivering surgical care, and promotes future long-term clinical and research collaboration between members.

The blood drought in India: availability of blood products and utilization of whole blood transfusion among rural surgeons. *Brian Till, BA; David Llungman, MD, PhD; Swagato Mukhopadhyay, MD; Simone Sandler, MBBS; Ravindranath Tongaonkar, MD; Nobhojit Roy, MD MPH; Mark Shrime, MD, MPH, PhD. From the University of Vermont College of Medicine, Burlington Vt. (Till); Lund University, Lund, Sweden (Llungman); the Harvard Program in Global Surgery and Social Change, Boston, Mass. (Till, Llungman, Mukhopadhyay, Sandler, Shrime); the University of Connecticut, Storrs, Conn. (Mukhopadhyay); BARC Hospital, Mumbai, India (Roy); and Tongaonkar Hospital, Maharashtra, India (Tongaonkar).*

Background: There is limited availability of blood products in low- and middle-income countries (LMICs). As a result, whole blood transfusions account for at least 22% of transfusions in middle-income countries. In rural Indian settings, the illegal practice of unbanked direct whole blood transfusion (UDBT) is believed to be widespread. We sought to quantify blood availability and practices in rural India. **Methods:** We performed a convenience sample survey of 39 rural Indian surgeons and obstetrician/gynecologists from 8 of 29 states. Hospital sizes ranged from 12 to 290 beds, with 14 respondents reporting in-facility blood banks. **Results:** On average, blood was available from the nearest facility 64% of the time. Those with in-hospital banks reported modestly improved blood availability (71% v. 60%) and reported using blood more often for emergent or urgent laparotomy cases (26% v. 16%, $p = 0.002$). Average time to blood bank by car was 47 minutes (range 15–180 minutes). Availability did not differ significantly between public and private banks, nor did cost (\$19 v. \$23 USD). When blood was unavailable, 54% reported performing UDBT, 21% transferred patients, and 8% said patients went untransfused. All respondents performing UDBT reported testing blood for infectious diseases at the maximum frequency the survey tool allowed. **Conclusion:** Despite illegality, many rural Indian providers are reliant on UDBT owing to significant

blood shortfalls. Providing a regulatory framework to govern the use of UDBT as a last-resort practice is an important step in providing safe and timely access to blood products in India and likely other LMICs.

Pattern of mortality in the surgical intensive care unit of Tikur Anbesa Hospital, Ethiopia. *Rediet Workneh, MD.* From Addis Ababa University, Addis Abba, Ethiopia.

Background: The surgical intensive care unit of Tikur Anbesa Hospital, the largest and number 1 referral hospital in Ethiopia, has been running as the primary intensive care unit for mainly surgical and obstetrics patients for many years. Although the unit faces enormous challenges in terms of skilled manpower and equipment, it's serving the Ethiopia community at large. One of the ways of addressing problems in the surgical intensive care unit is by identifying the causes of mortality among admitted patients. With the identified causes, one can act upon and look for solutions that help in the betterment of the service given to patients. The objective of this study was to assess the pattern and explain the most common causes of death in the surgical intensive care unit. **Methods:** A 1-year retrospective study was conducted in the surgical intensive care unit of Tikur Anbesa Hospital, Addis Ababa, Ethiopia. All patients who died in the surgical intensive care unit during the study period were included in the study. A structured questionnaire was used for data collection from chart review. Data entry and analysis was done using SPSS version 21. **Results:** Fifty-eight patients died in the surgical intensive care unit of Tikur Anbesa Hospital during the 1-year period. The total number of patients who were admitted was 300, making the mortality rate 19.33%. Thirty-six (62.9%) of the patients who died were male and 22 (37.9%) were female. Most (24.1%) of the patients were aged 18–30 years. The highest percentage of patients who died in the unit were neurosurgical patients (34.5%). Forty-four (75.9%) patients were supported by mechanical ventilation. Hospital-acquired infections were noted in 7 (12.1%) patients. Sepsis was the cause of death for 24 (41.4%) patients. Road traffic accidents contributed to death in 22 (37.9%) cases. Among the patients who died, dialysis was required by 12.1%, but only 3.4% received it. **Conclusion:** Neurosurgical patients accounted for the highest mortality in the surgical intensive care unit, thus emphasis should be given to such patients. Road traffic accidents are significantly associated with mortality, so focus should be given to development of prevention strategies. A significant number of patients died from sepsis, thus management guidelines should be updated.

The Global Initiative for Children's Surgery and optimal resources. *Yasmine Yousef, MDCM; Laura Goodman, MD, UC; Guy Jensen, MD; Sarab Greenberg, MC; Emmanuel Ameh, MD; Steve Bickler, MD; Diana Farmer, MD; Kokila Lakhoo, MD; Keith Oldham, MD; Doruk Ozgediz, MD, MSc; Dan Poenaru, MD, MHPE.* From the Université de Montréal, Montreal, Que. (Yousef); the University of California, Davis, Davis, Calif. (Goodman, Jensen, Farmer); the Medical College of Wisconsin, Milwaukee, Wis. (Greenberg, Oldham); Ahmadu Bello University, Zaria, Nigeria (Ameh); University of California, San Diego, San Diego, Calif. (Bickler); Oxford University, Oxford, UK (Lakhoo); Yale University, New Haven, Conn. (Ozgediz); and McGill University, Montreal, Que. (Poenaru).

Background: Despite the progress and increased recognition of the key role of surgery in global health, the unique conditions and care requirements of children have not received significant international attention. The Global Initiative for Children's Surgery (GICS) is an inclusive conglomerate joining children's surgical providers from both low- and middle-income countries (LMICs) and high-income countries (HICs). GICS was created to identify priorities for children's surgical care and match them with existing resources with the aim of improving access and quality of children's surgical care in LMICs. **Methods:** Ninety-four participants representing 76 institutions from 38 countries (30 LMICs) met for 2 days in Washington, D.C., to develop a policy document: The Optimal Resources for Children's Surgery (OReCS). Travel and accommodation expenses were provided for attendees from LMICs through funds raised from professional, academic and charitable organizations. **Results:** Seventeen working groups divided by surgical subspecialty, chaired by care providers from LMICs, developed the OReCS document based on 5 levels of care for children's surgery: primary health centre; first-, second-, and third-level hospital; and national children's hospital. OReCS was stratified by surgical subspecialty and level of health care facility. It delineates ideal personnel and equipment needed for each level of hospital. Training, research and quality-improvement components are also included for each level of care. Once finalized, the document will be submitted for ratification by the World Health Organization. **Conclusion:** A collaborative, multidisciplinary effort centred on low-resource settings and involving their providers has generated the structure and materials needed for a global improvement in children's surgical care.