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BRIDGING NEUROSURGICAL TECHNOLOGY GAPS: LOW-COST MODELS FOR LOW AND MIDDLE INCOME COUNTRIES

Temitayo Ayantayo[1], George William Bukenya[2], Ngwao Ngwako[3], Tarig Fadalla[4], Musakanya Shituluka[3], Emmanuel Mukambo[5], Gideon Adegboyega[6], Olaoluwa Ezekiel Dada[7], Andrew Alalade[8]
[1]*RNZ Neuroscience, Lagos, Nigeria*
[2]*Case Western Reserve University, Cleveland, OH, United States*
[3]*Department of Research, Association of Future African Neurosurgeons, Yaoundé, Cameroon*
[4]*Soba University Hospital, University of Khartoum, Khartoum, Sudan*
[5]*Copperbelt University, School of Medicine, Zambia*
[6]*General Medicine, Addenbrookes Hospital, Cambridge University Hospitals NHS Foundation Trust, Cambridge, UK.*
[7]*College of Medicine, University of Ibadan, Ibadan, Nigeria*
[8]*Department of Neurosurgery, Royal Preston Hospital, Lancashire Teaching Hospital NHS Foundation Trust, United Kingdom*

BACKGROUND
Neurosurgery has advanced significantly in recent decades, enhancing patient outcomes through refined techniques and technology. However, low and middle-income countries (LMICs) lag behind due to limited infrastructure and resources. This study aims to highlight affordable neurosurgical alternatives in LMICs, improving patient care in lieu of costly models.

METHODOLOGY
We conducted a systematic search of PubMed and Google Scholar databases using keywords “neurosurgery”, “low-cost” “technology” “models” “LMICs”. The search results were analyzed and screened for relevance while using the extracted information to craft our discussion to align with this review's objectives.

RESULTS
Innovative, cost-effective neurosurgical models are now accessible across various stages of patient care. Pre-operatively, inexpensive checklists like Glasgow coma scale (GCS) assesses consciousness, while WHO surgical checklists ensure surgical safety. Furthermore, tailored checklists such as the C-spine rule checklist and Enhanced Recovery After Surgery(ERAS) checklists enhance care in specific clinical scenarios. These checklists are economical to print and provide incredible cost-benefit value. Intra-operatively, in resource-limited settings, intra-operative ultrasound can substitute costly neuro-navigation models. Some centers have innovatively merged sagittal smartphone images with pre-operative MRI to localize brain lesions via augmented reality(AR), while some have enhanced minimally invasive spine surgeries with portable 2D navigation systems to augment fluoroscopy. In the absence of surgical microscopes, makeshift exoscopes made using smartphones and other commonplace low cost materials achieve adequate magnification. Affordable immersive technologies using smartphones and cardboards to make AR/VR headsets have also been described to enhance for surgical outcomes, through remote tele-proctoring.

CONCLUSION
Substantial differences exist in neurosurgical practices between LMICs and more affluent regions, however, adept utilization of cost-effective neurosurgical options can narrow this gap. This study highlights such distinctions while discussing alternative technologies or options for LMICs to attain comparable clinical results to their more affluent counterparts in an affordable manner.

ESTABLISHING LAPAROSCOPY IN KENYA: A COMPREHENSIVE STUDY ON THE TRAINING OF LAPAROSCOPY SURGERY IN RURAL KENYA

Dr Gagandeep Bhogal[1], Dr Jay Yagnik[2], Dr Hamza Khawaja[1], Dr Nilkanth Jani[3], Prof Pankaj Jani[1]
[1]*University of Nairobi*

[2]*PCEA Kikuyu Hospital*
[3]*Mbagathi Hospital*

BACKGROUND
In LMICs, particularly in sub-Saharan Africa, access to surgical services faces significant challenges, with approximately five billion people lacking access. The burden of digestive diseases exacerbates this issue, resulting in an annual loss of 1.7 million disability-adjusted life years (DALY). LMICs primarily suffer due to limited resources like hospital beds, blood banks, and sanitation. Laparoscopic surgery is considered a transformative solution, offering benefits such as reduced blood loss, lower infection rates, and shorter hospital stays. However, its implementation encounters obstacles such as governmental support absence, supply shortages, and inadequate training. Gasless laparoscopy is suggested as a cost-effective alternative with potential advantages. Kenya's healthcare framework aims to reduce disability years by 25% by 2030, emphasizing the role of district hospitals. Strategic investments are crucial to ensure equitable access and prevent economic hardship. There is a severe shortage of trainers, and the few available have their time split among administrative work, consultancies, and patient care. While training more, paying better salaries, and improving working conditions are desirable solutions, they require significant time and resources to train surgeons and mentor them to become competent trainers of surge.

METHODOLOGY
Introducing gasless laparoscopy involves a strategic process. First, identify a champion hospital lacking laparoscopy services. Advocate for laparoscopy to hospital stakeholders and secure support through an MOU. Initiate comprehensive training, with Endotrainer skills for 5 SAGES tasks. Facilitate clinical integration by partnering with an experienced laparoscopy surgeon in a well-established hospital for hands-on learning. Ensure competence and safety through a skilled surgeon's visit to the trainee hospital. Finally, enhance sustainability by in leasing laparoscopy towers and instruments to support the newly established services in these hospitals. This approach aims to effectively implement and sustain gasless laparoscopy in healthcare settings

RESULTS
Laparoscopy both Gasless (GL) and Conventional (CL) established at 13 hospitals
202 doctors trained in CL and GL
64 out of 202 doctors actively performing GL and CL.
18 out of these 64 doctors had no prior Laparoscopy training, while 46 had some basic training
283 cases done from April 2023 - December 2023 at the 13 hospitals

CONCLUSION
Gasless laparoscopy, an alternative to traditional laparoscopy, is suggested for low-resource settings, eliminating the need for costly insufflators and continuous CO2 supply. Our training program ensures surgeon safety and competence. Laparoscopy introduction reduces patient costs through shorter post-op stays, fewer complications, and quicker return to work.

INNOVATING MEDICAL EDUCATION WITH SYNCHRONISED VIRTUAL REALITY: A UK-FIRST WITH GLOBAL IMPLICATIONS

Vijna Boodhoo[1], Johnny Odu[1], Clement Yong[2], Jagtar Dhanda[3]
[1]*Sheffield Teaching Hospitals, UK*
[2]*University College London Medical School, UK*
[3]*Queen Victoria Hospital, East Grinstead, UK*

BACKGROUND
Contemporary medical education is undergoing a transformative shift with the integration of extended reality (XR) technologies. We present the first UK-based teaching session using synchronised virtual reality (VR).

METHODOLOGY
Teaching sessions were conducted for groups of undergraduate medical students and early career doctors (a total of 75 individuals in 3 separate sessions) in Sheffield, UK. Topics included uterine inversion, laparotomy and orthopaedic procedures. Students initially attended a presentation on the topic before donning the VR headsets. These headsets

featured pre-recorded videos of cadaveric dissections and demonstrations of surgical procedures, filmed with six degrees of freedom (6-DOF). The audio, either explanatory audio from the video or live explanations from the workshop lead, was delivered directly to each participant via the VR headset. The workshop lead maintained control over video and audio selection and settings for all VR headsets.

RESULTS

While VR has been used in previous teaching instances (Pottle, 2019), this marks the UK's first synchronised VR teaching session, with all 25 learners in one session accessing identical content simultaneously through individual VR headsets. Synchronised VR represents a new era in medical education, particularly benefiting learners in resource-limited settings. The incorporation of cadaveric dissections with 6-DOF serves as a vital training tool for delivering high-quality surgical education, even in environments with limited access to traditional medical education resources. Moreover, the synchronisation feature enables standardised workshop delivery across geographical barriers, empowering multiple users in disparate locations to access the same educational content. This technology does not rely on internet connection, making such workshops accessible to areas with poor connectivity.

CONCLUSION

The innovative use of synchronised virtual reality in medical education could address existing barriers to medical and surgical education worldwide.

EXPLORING THE FEASIBILITY OF TRAINING FOR GAS INSUFFLATION-LESS LAPAROSCOPIC SURGERY (GILLS) IN UGANDA

Nadhirah Kahar[1], Johnny Odu[1], Mr Biju Islary[2], Anurag Mishra[3], Lovenish Bains[3], Jesudian Gnanaraj[4], Manish Chauhan[5], Noel Aruparayil[1.6], Peter Culmer[7], Robert Mugarura[8]

[1]*Sheffield Teaching Hospitals NHS Trust, UK*
[2]*Crofts Memorial Hospital, Assam*
[3]*Maulana Azad Medical College, New Delhi, India*
[4]*Karunya University, India*
[5]*University of York, UK*
[6]*University of Leeds, Speciality trainee in General Surgery*
[7]*School of Mechanical Engineering, University of Leeds, UK*
[8]*Kabale University, Uganda*

BACKGROUND

Gas Insufflation-Less Laparoscopic Surgery (GILLS) is a technique which can help address global challenges in the equitable provision of surgical care. GILLS brings the advantages of laparoscopic surgery in a form which is suited to low-resource settings. There is growing global interest in GILLS, particularly in sub-Saharan Africa. Wider uptake of GILLS has been limited by two factors; 1) lack of appropriate equipment 2) formalised training. Our research addressed these aspects in rural India, developing the RAIS lift-system for GILLS and the TARGET training course for structured surgical skill acquisition and competence.

Here we report a study exploring the potential to improve surgical access in Uganda through GILLS. Our study focuses on Kabale Regional Referral Hospital (KRRH) in south-western Uganda. KRRH is a government-funded hospital with 280 beds, serving a population of over 20 million people in the Kabale District. KRRH has strong links with Kabale University to support innovation but lacks surgeons with experience in laparoscopic surgery.

METHODOLOGY

A feasibility study was conducted through a 3-day GILLS training workshop at KRRH, recruiting from surgeons working in the local region. Ethical approval was obtained from Kabale University (MEEC 22-026). Training was delivered by a team of surgeons from India and the UK with experience in GILLS and training in basic and advanced techniques. Training was based on the TARGET training programme supported by digital technologies and was limited to pre-clinical simulation, appropriate to the scope of the feasibility study and responsible clinical practice. Each participant was evaluated using OSATS, MISTELS, GOALS and semi-structured interviews.

RESULTS
9 participants were initially recruited, 6 of whom completed the full workshop (drop-outs due to existing clinical commitments). Outcomes from OSATS demonstrated that each participant reached competency in use of the GILLS instrumentation, with MISTELS and GOALS scores indicating proficiency in using GILLS techniques in a simulation setting, with learning curves commensurate with previous studies.

CONCLUSION
Structured training was effective in enhancing laparoscopic skills knowledge and GILLS proficiency for Ugandan surgeons. These findings highlight the value of structured training approaches augmented with digital technology to improve surgical skills and enable wider use of GILLS.

COMPARING THE IMPACT OF LOW PRESSURE VERSUS STANDARD PRESSURE PNEUMOPERITONEUM AFTER LAPAROSCOPIC CHOLECYSTECTOMY

Dr. Akhilesh Dalal[1], Dr. Kuldeep Raj Sarangal[2], Dr. Jagdish Mutreja[3]
[1]Surgery Resident-3, SMS&R, Sharda University
[2]Professor & Head of the Unit, SMS&R, Sharda Hospital.
[3]Professor, SMS&R, Sharda University.

BACKGROUND
Post-laparoscopic pain syndrome, characterized by shoulder tip pain, is a common occurrence after laparoscopic cholecystectomy. This study compares shoulder tip pain frequency and intensity post-laparoscopic cholecystectomy in low-pressure (8-9 mmHg) versus standard-pressure (12-13 mmHg) pneumoperitoneum.

METHODOLOGY
Patients undergoing elective cholecystectomy were randomly assigned to two groups: group A (n = 100) received low-pressure pneumoperitoneum (8-9 mm Hg), while group B (n = 100) received standard-pressure pneumoperitoneum (12-13 mm Hg). Postoperative shoulder tip pain was assessed using the Visual Analogue Scale at 4, 8, and 24 hours after surgery. Statistical significance was set at $p < 0.05$. Additional data on increased analgesic requirement, surgeon satisfaction, intraoperative heart rate, and mean arterial pressure(MAP) was collected . Heart rate and MAP collected at :

- Baseline
- Immediately after insufflation.
- 15 min after CO2 insufflation
- 30 min after CO2 insufflation
- At exsufflation
- 30 min after CO2 exsufflation.

RESULTS
In Group A(Low Pressure), 12% patients experienced post-op shoulder pain vs. 38% in Group B(Standard Pressure). Mean pain intensity at 4, 8, and 24 hours was lower in Group A. Standard-pressure resulted in significantly higher pain incidence ($p < 0.01$). Additionally, patients in Group A required less rescue analgesics. Mean surgery time between groups was statistically nonsignificant. Group B caused more intraoperative heart rate and MAP changes with data being statistically significant. Surgeons reported lower satisfaction and more technical difficulties in Group A compared to Group B.

CONCLUSION
Low-pressure laparoscopic cholecystectomy significantly reduces the frequency and intensity of postoperative shoulder tip pain compared to standard-pressure pneumoperitoneum. Low-pressure pneumoperitoneum is ideal for laparoscopic cholecystectomy and minimizes the adverse hemodynamic effects of CO2 insufflation. It also reduces the need for postoperative analgesics and shortens hospital stay, ultimately enhancing early postoperative rehabilitation and quality of life.

INNOVATIONS FOR GLOBAL SURGERY – OVERVIEW FROM DELFT UNIVERSITY OF TECHNOLOGY

Jenny Dankelman[1], Arjan Knulst[2], Roos M. Oosting[1], Tim Horeman[1]
[1]*Delft University of Technology, The Netherlands*
[2]*Green Pastures Hospital, Pokhara, Nepal*

BACKGROUND
For widespread implementation of safe surgical care, appropriately adapted technical solutions are needed. In the past 5 years we addressed the engineering challenges to develop versatile, affordable, reusable, reliable and safe surgical equipment needed during surgical procedures in low-income countries.

METHODOLOGY
Together with PhD and master students from our Biomechanical Engineering department of the Delft University of Technology and with support from the Dutch Organisation for Scientific Research, the University Fund Delft, Delft Global Initiative, INF Green Pastures Hospital and Rehabilitation Centre, and Nick Simon Institute Nepal, several affordable and reusable prototypes and support systems have been developed and tested in different hospital settings. Different design methods, such as the Bare Minimum Design and Component Interaction Analysis were created to develop advanced surgical devices for challenging environments.

RESULTS
Examples of prototypes of reusable and affordable devices under development that will be presented are, a video laryngoscope, a vacuum delivery device, steerable MIS instruments, disinfector for laparoscopic instruments, a mould to shape ear implants, a negative pressure wound therapy device, an autonomic innervation assessment device, and a needle destroyer. Other types of innovation are training phantoms e.g. for vesicovaginal fistula repair, calibration devices, a MOOC (Free Massive Open Online Course) to educate to maintain and repair medical devices, and a hospital medical technology management system that are suitable for smaller hospitals in LMICs.

CONCLUSION
Our work shows that affordable high quality reusable medical devices can be developed. Hence, we need to stimulate collaboration between global surgeons and engineers to work together in this challenging field, because lack of working equipment is one of the essential factors hampering widespread implementation of safe global surgical care.

THE UNITED NATIONS GLOBAL SURGERY LEARNING HUB: INNOVATIONS IN DIGITAL SURGICAL EDUCATION

Jakub Gajewski[1], Francesca Vitucci[2], Eric O'Flynn[1], Ines Perić[1], Léa Simon[3], Geoffrey Ibbotson[4]
[1]*Royal College of Surgeons in Ireland Institute of Global Surgery*
[2]*Global Surgery Foundation*
[3]*United Nations Institute of Training and Research (UNITAR)*
[4]*Global Surgery Foundation and United Nations Institute of Training and Research (UNITAR)*

BACKGROUND
Many surgical, anaesthetic, obstetric and peri-operative nursing trainees, training programs and practitioners in low-resource settings lack access to appropriate training materials. Addressing this gap, the open-access SURGhub e-learning platform was launched in June 2023 to curate high-quality training resources suitable for low-resource contexts. Committees comprised of representatives from the global surgery community define project scope, content inclusion criteria, and technical standards. A review process ensures the quality and appropriateness of content.

METHODOLOGY
We interrogated platform data to understand learner characteristics such as location, speciality, and level of training. We also analysed usage patterns, learner behaviour and feedback.

RESULTS
As of February 14th 2024, SURGhub provided 52 open-access courses in surgery, peri-operative nursing, obstetrics and gynaecology and anaesthesia. Courses are both technical and non-technical, catering to different levels of training and expertise.

3,488 registered learners have completed 1,125 courses, with UN certificates of completion awarded. Learners are from 150 countries. Ethiopia (152 users), Nigeria (151), and Kenya (145) have the largest number of learners. Where speciality is indicated, learners - both in-service and in training - are predominantly surgeons (620), with significant numbers of general medical officers (350), nurses (191) and anaesthesiologists (190).

Feedback and usage analysis reveals a robust learning environment, with average course feedback of 4.7/5. Learners are committing significant study time – the most used course, "Surgical Foundations" by COSECSA has been used for 29,909 total hours of study time.

CONCLUSION
SURGhub has successfully broadened access to quality training material in low-resource settings worldwide. Evaluation, continuous evolution and partnerships with interested institutions are crucial to ensure SURGhub's effectiveness in meeting the diverse needs of low-resource setting learners.

AN AFFORDABLE MODULAR STEERABLE INSTRUMENT PLATFORM FOR LAPAROSCOPY IN LMIC

Tim Horeman[1], Koen Schouten[1], Masi Rahimi[2], Jenny Dankelman[1]
[1]*Delft University of Technology*
[2]*University Medical Centre Amsterdam / Amsterdam Skills Center*

BACKGROUND
Ever since the introduction of laparoscopic surgery, researchers have been trying to add steerability to instruments to allow the surgeon to operate with better reachability and less tissue interaction force. Traditional solutions to introduce this often use a combination of springs, cables, pulleys, and guiding structures, resulting in instruments that cannot be properly cleaned and thus are very costly to manufacture and maintain and therefore no viable solution for LMIC's. The aim of the study is to develop a novel affordable, sustainable, cableless, and fully steerable laparoscopic grasper, and to test its ease of assembly, disassembly, and use.

METHODOLOGY
A set of requirements was defined to ensure that the instrument can be handled efficiently at the sterilization unit and in the operating room. Based on these, a multisteerable, cableless 5 mm laparoscopic instrument that operates based on shaft rotations was developed. To test its assembly and disassembly, 10 participants were asked to fully dismantle the instrument and reassemble it a total of 60 times. In addition, ten medical students were asked to use the grasper in the LapRon box-trainer system on a 3D pick-and-place task, to determine the control effort based on learning curves of steering errors, task time, instrument path length, and maximum tissue interaction force.

RESULTS
All important design requirements were met. The recorded data indicates that ten engineering students were able to fully dismantle and reassemble the instrument shaft in 12 s (SD7) and 65 s (SD43) seconds at the sixth attempt. The learning-curve data indicates that three attempts were needed before the ten medical students started to use all steering functions. At the sixth attempt, on average only 1.25 (SD0.7) steering errors were made. The steepest slope in the learning curves for steering errors, path length, and task time was experienced during the first three attempts. In respect of the interaction force, no learning effect was observed.

CONCLUSION
The multi-DOF (degree of freedom) cableless grasper can be assembled and disassembled for cleaning and sterilization within an very short time frame. The handle interface proved to be intuitive enough for novices to conduct a complex 3D pick-and-place task in a training setting. A redesigned final version of the instrument will be further evaluated within a relevant context in South Africa.

KETAMINE: ROLE IN IMPROVING ACCESS TO SURGICAL CARE AT A GENERAL HOSPITAL IN SEMI-RURAL ZAMBIA

Sufyan Ahmed Ibrahim[1,2], Bwalya Kafwembe[1], Shadreck Ndhlovu[1], Luther Ward[2], Michelson Padovany[2], Brad Feltis[2]
[1]*Department of Surgery, Monze Mission Hospital, Monze, Zambia*
[2]*Quillen College of Medicine, East Tennessee State University, Tennessee, USA*

BACKGROUND
Ketamine has been widely used as an anaesthetic drug for over five decades. Studies out of Kenya have shown its value in accessing emergency surgery where anaesthesia providers are few-the every second matters (ESM)-ketamine package. Our study aims to show its safety for minor surgical procedures with necessary monitoring and precautions in a ward setting and the economic impact of such an intervention.

METHODOLOGY
A retrospective analysis of a prospectively maintained database of patients undergoing procedures under ketamine sedation with atropine was analysed, from 1/09/2023 to 10/02/2024. Sex, age, indications for procedures, procedure type, ketamine (in milligrams) used, procedure duration, rate and type of complications and level of monitoring were studied.

RESULTS
A total of 229 procedures were performed of which 110 (48%) were fracture and dislocation manipulations. wound cleaning/debridement and abscess drainage were the next most common (30% and 12% respectively). Females constituted 28%, and the median age was 12 yrs (7months to 93 yrs). Mean procedure duration was 13.6 minutes (5-60 minutes) and an average of 49 mg of ketamine/patient was used (10-150mg). During the study ketamine, atropine and benzodiazepines valued at US$ 150 were used. Emergence phenomena were observed in 2% (5) of patients. Most manipulated fractures were discharged the next day. The procedures were largely performed by intern doctors on the wards supervised by registrars/consultants with 85% procedures monitored with pulse oximetry and BP. There was ready access to airway adjuncts and tank oxygen, though the need never arose.

CONCLUSION
Use of ketamine sedation has proven to be safe and has reduced waiting times for patients as interventions are done with minimal delays. Direct costs to patients and the hospital are thus reduced. ESM-ketamine package protocols could be upscaled in LMICs to improve access to safe and timely surgical care.

COMMUNITY HEALTH WORKER'S USABILITY AND ACCEPTABILITY OF A MOBILE HEALTH TOOL TO SUPPORT HOME-BASED POST-CESAREAN MONITORING IN RURAL RWANDA, 2023

Afra Jiwa[1], Bethany Hedt-Gauthier[2], J. Nkurunziza[3], M. Kubwimana[3], S. Nuss2[1], E. H. Estrada[2], R.R. Fletcher[5], A. Nakeshimana[6], L. Bikorimana[3], A. Niyigena[2], R. Riviello[2]
[1]*Program on Global Surgery and Social Change, Harvard Medical School, Boston, MA, USA*
[2]*Department of Global Health and Social Medicine, Harvard Medical School, Boston, MA, USA*
[3]*Partners In Health, Kigali, Rwanda*
[5]*Massachusetts Institute of Technology, Cambridge, MA, USA*
[6]*Insightiv AI, Kigali, Rwanda*

BACKGROUND
Postpartum follow-up at health centers is physically and financially burdensome for women delivering via cesarean in rural Rwanda; Yet, given the risk of postoperative complications, close monitoring of these women is essential. Here, we report on community health workers' (CHWs') usability and acceptability of a mobile health (mHealth) application designed to support home-based post-cesarean monitoring in rural Rwanda.

METHODOLOGY
In 2022, our team worked with technology partners at Insightiv AI (Rwanda) and MIT (USA) to develop an Android-

based mobile app with comprehensive screening questions and capacity to capture wound images and process a machine learning algorithm to diagnosis surgical site infections. Between March-May 2023, we tested the app with 30 CHWs from Kirehe District, Rwanda; the CHWs used the app when engaging with patient vignettes (3 vignettes/CHW) and then completed a Mobile Usability and Acceptability Tool questionnaire, adapted and validated for this Rwandan setting. Data were collected via RedCap and analyzed in Stata v.14.

RESULTS
In 90% of the vignette scenarios (81 out of 90), the CHW completed all ten assessment steps. In our sample of 30 CHWs, all CHWs (100%) reported agree or strongly agree on at least 16 out of 20 usability questions and 29 CHWs (96.7%) reported agree or strongly agree on all four acceptability questions. For all three metrics, we surpassed pre-defined thresholds for success in terms of usability and acceptability.

CONCLUSION
CHWs passed pre-defined milestones for usability and acceptability of an mHealth tool to supported home-based follow-up of women delivering via Cesarean in rural Rwanda. Future work will include a prospective validation of the mHealth tool and a randomized-control trial assessing the impact of the mHealth-CHW intervention on timely access to care in the context of Cesarean complications.

ANESTHESIA SAFETY IN WAD MEDANI, SUDAN: A PRE-WAR STATUS INDICATING A POST-WAR CRISIS

Alaa Mohamed[1,2], Sami Majoub Taha[1], Mohamed Bashir[2], Ahmed Obaid[2]
[1]*University of Gezira*
[2]*King Saud Bin AbdulAziz University for Health Sciences*

BACKGROUND
As the surgical burden grows, increasing patient safety during anesthesia and surgery becomes a major global public health priority. Anesthesia can be safely administered in higher-income countries, yet it is more challenging in third-world countries. This study focuses on Sudan, a third-world country, and its unmet anesthetic needs before the current war and how these needs might compromise the post-war status. The aim of this study is to compare Sudan's outstanding anesthesia requirements to the World Health Organization's safe anesthesia practice standards in terms of workforce, medications, equipment, and anesthesia conduct.

METHODOLOGY
This study was carried out in Wad Medani Public hospitals both the referral and the state-run. Each hospital from every category was identified using a convenience sampling technique. The World Health Organization-World Federation of Societies of Anesthesiologists International Standard and earlier regional African publications were used to determine the minimum predicted safe anesthesia needs.

RESULTS
The results of our study demonstrate that overall, the hospitals surveyed fulfilled the minimum standards set by the World Health Organization and the World Federation of Societies of Anesthesiologists (WHO-WFSA) for safe anesthesia practice by 73% with no significant difference in the safety of anesthesia practice between state and referral hospitals.

CONCLUSION
The state of safe anesthesia care in Wad Medani hospitals surveyed fell well short of the expected minimal criteria due to important requirements such as patient monitoring indicators, the inaccessibility of life-saving facilities such as defibrillators, and difficult intubation instruments. More importantly, the conduct of anesthesia was far below the standard.

MANUFACTURING QUALITY MEDICAL DEVICES FOR AFRICA-IN-AFRICA: NAVIGATING THE REGULATORY TERRAIN IN UGANDA WITH OUR LOCAL-COST GASLESS LAPAROSCOPE CALLED KEYSUITE

Julius Mugaga[1], Brian Matovu[1], Tamara Fitzgerald[2], Jenna Muller[3], Robert Ssekitoleko[4]
[1]*Makerere University Biomedical Research Centre, Makerere*
[2]*Duke University*
[3]*University of Maryland*
[4]*Makerere University, Biomedical Engineering*

BACKGROUND
Surgery is the foundation of cancer treatment and many other diseases, but patients in low- and middle-income countries (LMICs) have limited access to surgery due in part to shortages in equipment. Laparoscopic (keyhole) surgery is the standard of care in high-income countries for many operations in the chest and abdomen. It avoids large incisions by using a camera and instruments manipulated through tiny incisions, but is generally unavailable in LMICs, aside from limited tertiary centers. Each operating room requires a laparoscope, gas insufflator, viewing monitors and related equipment (~$215,000 for initial purchase in each room). Therefore, Laparoscopic surgery is rarely accessible in LMICs due to the high cost of installment, lack of maintenance personnel, unreliable electricity, and shortage of consumables. To address this unmet clinical need, we have developed a low-cost, durable laparoscopic system (KeySuite) for use in sub-Saharan Africa through a unique multi-disciplinary collaboration between engineers, surgeons, oncologists, global health regulatory and business experts. Our laparoscope can be built for $1500 (cost of goods) and does not require a constant supply of electricity or carbon dioxide.

METHODOLOGY
Through a multistakeholder engagement approach we sought to navigate the regulatory pathway to acquire a local certificate of Good Manufacturing Practice (cGMP) and the ISO 13485:2016. This is intended to manufacture an up to standard low-cost laparoscope in Uganda that would competitively meet the requirements of many countries in Africa particularly Sub-Saharan African countries. Specifically, we 1) explored the regulatory requirements for acquiring a local cGMP, 2) we navigated the process and requirements to secure an ISO 13485:2016 (required for medical devices) for a locally developed laparoscope.

RESULTS
Our study therefore, has developed a framework in form a flow diagram for the processes to secure both the cGMP and ISO 13485:2016 with a list of documents needed by the National Drug Authority and a notified body respectively. We have currently reached the last stage for the GMP and submitting for ISO 13485:2016 with the KeySuite and setting up a local startup to take-on the next stages for manufacturing in Uganda.

CONCLUSION
This process has provided lessons for manufacturing quality medical devices in Africa-for-African surgical problems.

ENHANCING SURGICAL TRAINING THROUGH AUGMENTED REALITY: A PILOT STUDY ON THE USE OF THE MICROSOFT HOLOLENS FOR LIVE-STREAMING FROM THEATRE

Rebecca Murphy Lonergan[1], Kallpana Dhas[1], Hira Sajjad[1], Brent Bartholomew[1], Andreas Naparus[1]

BACKGROUND
Reduced theatre exposure for trainees and students is increasingly detrimental to the surgical workforce. One potential solution is live-streaming from the operating theatre - the Microsoft HoloLens, a mixed-reality headset, facilitates immersive two-way audio and video stream from the perspective of the surgeon and uses augmented reality to enhance observers' learning. This pilot explores the use of the HoloLens to facilitate student and trainees' operative exposure and the impact of this on the operating surgeon.

METHODOLOGY
Plastic surgery operative day case lists were live-streamed to an audience of trainees and medical students using the

HoloLens device and platform Remote Assist on two separate occasions. This activity was incorporated into an existing course on plastic surgery aimed at postgraduate medical trainees. Written consent was gained and later verified from the patient, to live-stream the procedure for educational purposes. Recording was prohibited. Evaluation of the experience was obtained from the surgeon and observers (n=12) via a post-procedure focus group and anonymous written feedback. Qualitative analysis of feedback was performed by generative AI.

RESULTS

Observers cited that learning was facilitated by excellent image and audio quality, close communication with the surgeon and improved visibility of the procedure from the operator's perspective. They also cited interactive audience discussion with other observers and increased comfort as benefits over traditional scrubbed theatre time. There was a positive correlation between juniority and rating of experience. Learning was disrupted by technical delays and hardware unreliability. The device also blighted the surgeon's visual field, comfort and initial confidence in theatre, although this improved with sequential operations.

CONCLUSION

Overall, we demonstrate the value of the HoloLens in increasing surgical exposure, with myriad of observer perceived benefits to traditional theatre observation, likely at the surgeon's expense. Live streaming from theatre introduces the possibility to share expertise between centres, particularly of rare or complex cases. No analysis of patient's experience was made in this study.

GLOBAL SURGERY COMMUNITY OF NURSES, NEWCOMERS, EXPERTS IN ALLIED FIELDS, CLINICIANS, AND TECHNICIANS (CONNECT)- A VIRTUAL COMMUNITY OF PRACTICE (COP)

Priyansh Nathani (on behalf of Global Surgery CONNECT)[1], Isaac Alty[1], Radzi Hamzah[1], Roopa Rawat[2], Anurag Mishra[3], Bhakti Sarang[4], Gabriella Hyman[1], Monty Khajanchi[5], Nakul Raykar[1,6], Nobhojit Roy[7], Anita Gadgil[7]

[1]Program in Global Surgery and Social Change, Department of Global Health and Social Medicine, Harvard Medical School, Boston, MA

[2]WHO Collaborating Centre for Emergency & Trauma Care (WHO CCET), New Delhi, India

[3]Maulana Azad Medical College, New Delhi

[4]Terna Medical College and Hospital, Navi Mumbai

[5]The George Institute of Global Health, India

[6]Brigham and Women's Hospital, Harvard Medical School, Boston, MA

[7]The George Institute of Global Health, India

BACKGROUND

With 5 billion people lacking access to safe surgical care, primarily in low- and middle-income countries (LMICs), the disparity in global surgical services is stark. Despite global surgical operations exceeding 313 million annually, a meager 6% occur within LMICs, with an even lesser proportion in their rural areas. These regions significantly fall short of the Lancet Commission's recommendation of at least 20 surgical providers per 100,000 population. The challenge of providing surgical care is exacerbated in resource-limited settings, where isolation—both academic and professional—compounds the difficulties faced by surgical care providers. This isolation leads to delays in treatment, unnecessary referrals to tertiary centers, significant drain on the resources of patients, and lower retention rate of local practitioners. We initiated the Global Surgery CONNECT – a virtual community of practice aimed at fostering collaboration and continuous learning among surgical care providers without hierarchical, regional and educational barriers to alleviate these challenges.

METHODOLOGY

CONNECT, an ongoing initiative, was developed as a continuous 24/7 digital support network by leading healthcare institutions and grassroots surgical care providers. The platform integrated a WhatsApp group led by faculty-student buddy pairings and a user-friendly website to ensure immediate, informal, and respectful interaction. CONNECT was designed as a hybrid synchronous-asynchronous safe learning space with dedicated discussion threads, educational webinars, research opportunities, and anonymous, complex case discussions using de-identified patient information. Topics covered clinical, ethical, legal, and administrative issues. Weekly themed newsletters capturing community exchanges and progress were shared. Pilot launch of CONNECT was carefully managed with thorough onboarding for members, consistent updates and moderation by the community administrators.

RESULTS
During the pilot phase, CONNECT engaged 50 active participants and established 15 surgical care-themed WhatsApp groups. The official website hosts newsletters and resources generated from CoP discussions.

CONCLUSION
By embodying the motto "Never practice alone again", CONNECT redefines global surgery practice, ensuring frontline providers are linked together and with the academic community. By promoting inclusivity, support, and safe environment, it offers immediate benefits to its members and presents a scalable solution for similar challenges in other medical fields. Future studies can focus on implementation evaluation and quality improvements.

ACCESS TO REVERSE SHOULDER ARTHROPLASTY IN SOUTH AFRICAN PUBLIC HOSPITALS AND STRATEGIES USED BY SURGEONS TO PLAN FOR STRUCTURAL GLENOID DEFECTS.

Pududu Archie Rachuene[1,2], Roopam Dey[3], Sudesh Sivarasu[3], Steve Roche[2]
[1]*University of Cape Town Divisions of Global Surgery and Orthopaedics,*
[2]*University of Pretoria Department of Orthopaedics*
[3]*University of Cape Town Divisions of Orthopaedics and Biomedical Engineering*

BACKGROUND
This study aimed to evaluate the availability of reverse shoulder arthroplasty (RSA) for individuals reliant on the public healthcare sector in South Africa. Specifically, it focused on the geographical distribution of hospitals capable of performing RSA in relation to the population, the characteristics of healthcare facilities, the availability and distribution of sub-specialised shoulder surgeons, and the obstacles to accessing this procedure.

METHODOLOGY
The study employed a combination of methodologies to assess the availability and ease of access to reverse shoulder arthroplasty in the public healthcare sector of South Africa. A survey questionnaire was administered to sixty individuals employed in public institutions at the secondary and tertiary levels in all nine provinces of South Africa, in order to assess the level of availability. We received feedback from 33 respondents (55%). Using a conceptual framework, we examined the capacity and utilization of healthcare institutions, the geographical and timely accessibility of reverse shoulder arthroplasty, and the availability of skilled surgeons and operating facilities.

RESULTS
Of those surveyed, almost 52% worked in tertiary or quaternary level hospitals, and 55% of their facilities had an operating theater specifically reserved for elective orthopaedic procedures. Urban locations largely hosted tertiary level hospitals, which accounted for 94% of the institutions equipped to provide RSA. Conversely, rural areas saw a significant scarcity of these services. The study findings suggest the country had around 0.5 sub-specialist shoulder surgeons per 1,000,000 residents. The main obstacles identified for the limited availability of the procedure were a scarcity of skilled individuals (48.5%), insufficient allocation of operating room time (45.5%), and inadequate operating room facilities (33.3%). In addition, 21.6% of respondents mentioned that RSA prosthesis was not included in the provincial tender system, while 45.5% pointed out the lack of a proper referral facility.

CONCLUSION
This study underscores disparities in RSA access in South Africa, emphasizing the need for strategic interventions to address geographical inequalities, enhance surgical capacity, and overcome barriers hindering access to this vital procedure.

UNMET NEEDS OF GLOBAL SURGERY FUELLING SURGICAL INNOVATIONS: A SCOPING REVIEW

Dr Deepa Kizhakke Veetil[1], Dr Princy Gupta[2], Dr Anurag Mishra[2], Dr Lovenish Bains[3]
[1]*Max Healthcare, Delhi, India*

[2]Maulana Azad Medical College, Delhi, India
[3]Maulana Azad Medical College, India

BACKGROUND
Categorizing the unmet needs into the domains of workforce, training, infrastructure, service delivery, information system, finance and economics can help innovators choose the area of their interest and come up with innovative context specific solutions to the problems of Global Surgery.

METHODOLOGY
PubMed, Embase, Cochrane Library, Web of Science, Scopus, Globus Indus Medicus, Google Scholar, Bioline, and BASE databases were searched for publications from 1st January 2012 to 31st December 2022 using Medical Subject Headings (MeSH) terms according to the Population-Context-Concept strategy: General surgery, Anaesthesia, essential surgical procedures as per Disease Control Priority (DCP-3) list, LMICs according to WHO World Bank classification and for needs assessment and capacity building. The unmet needs extracted were classified according to the LCoGS (Lancet Commission of Global Surgery) working domains: Workforce, training, service delivery, information and management, finance and economics, and Infrastructure.

RESULTS
PubMed, Embase, Cochrane Library, Web of Science, Scopus, Globus Indus Medicus, Google Scholar, Bioline, and BASE databases were searched for publications from 1st January 2012 to 31st December 2022 using Medical Subject Headings (MeSH) terms according to the Population-Context-Concept strategy: General surgery, Anaesthesia, essential surgical procedures as per Disease Control Priority (DCP-3) list, LMICs according to WHO World Bank classification and for needs assessment and capacity building. The unmet needs extracted were classified according to the LCoGS (Lancet Commission of Global Surgery) working domains: Workforce, training, service delivery, information and management, finance and economics, and Infrastructure.

CONCLUSION
Categorizing the top unmet needs into the domains of workforce, training, infrastructure, service delivery, information system, finance and economics can help innovators choose the area of their interest and come up with innovative context specific solutions to the problems of Global Surgery.

ICIGS 2024 – Poster Presentations

TRANSLATION OF THE LEVE CPAP SYSTEM TO UGANDA FOR LOCAL PRODUCTION, MAINTENANCE AND CLINICAL USE

Prof Peter Culmer[3], Dr Robert Ssekitoleko[1], Brian Matovu[1], Kigenyi Douglas[1], Benedict Mulindwa[1], Joan Birungi[1], Dr Edith Namulema[2], Ms Racheal Musasizi[2], Dr William Davis-Birch[3], Dr Ian Waters (alumni)[3], Prof Nik Kapur[3]
[1]School of Biomedical Engineering, Makerere University, Uganda
[2]Mengo Hospital, Uganda
[3]School of Mechanical Engineering, University of Leeds

BACKGROUND
During the COVID pandemic, a team from University of Leeds developed a low-cost device for respiratory support, the LeVe CPAP system. Collaboration with a team from Mengo Hospital (Uganda) evaluated the system's safety and efficacy, before moving to clinical studies with adult and paediatric populations. This collaboration was instrumental in developing the LeVe CPAP system and understanding where it has best clinical utility. The outcomes from these studies, combined with in-extremis use at Mengo, indicate that the LeVe CPAP system can provide life-saving respiratory support in a frugal low-resource form. There is consequently demand for more LeVe CPAP systems and a need to translate this technology into a commercial version for wider clinical use.

METHODOLOGY
Following principles of responsible global health innovation, we formed a collaborative partnership with biomedical engineering experts at Makerere University (Uganda) to develop a locally produced version of the LeVe CPAP system. This collaboration builds on our existing partnership with Mengo Hospital and ensures the system is developed in accordance with local needs and manufacturing capabilities, considers supply-chain management and obtains the appropriate regulatory approvals from the National Drugs Authority of Uganda, a body mandated to regulate medical devices in the country.

RESULTS
The translation process is built around close collaboration. A development workshop held in Leeds (with the Uganda team attending) will map the current methods of manufacture and opportunities optimisation in Uganda. Stakeholder workshops will be convened in Uganda to map local user needs and requirements (to include healthcare professionals, government and regulatory bodies). Sample units will then be produced in Uganda for testing in support of Ugandan regulatory approval. A final dissemination workshop will then be held at Makerere University to showcase the locally produced LeVe CPAP system, embedding semi-structured interviews to gather stakeholder feedback. Within this process, commercial opportunities will be mapped to support local commercial production of the LeVe system.

CONCLUSION
This project showcases a process for co-development and translation of frugal medical technology for global health. It demonstrates that local partnerships are essential not only during development, but also to sustain responsible commercial provision of innovations in healthcare.

UNVEILING THE ENIGMA: BURKITT LYMPHOMA INDUCED ILEOCOLIC INTUSSUSCEPTION IN A 7-YEAR-OLD CHILD

Dr. Akhilesh Dalal[1], Dr. Ayaz Ahmad Bhat[2], Dr Suresh Kalyansundar[3], Dr. Kuldeep Raj Sarangal[3], Dr. Jagdish Mutreja[4]
[1]*Surgery Resident-3, SMS&R, Sharda University*
[2]*Senior Resident, SMS&R, Sharda University*
[3]*Professor & Head of the Unit, SMS&R, Sharda University*
[4]*Professor, SMS&R, Sharda University*

BACKGROUND
Burkitt lymphoma, an aggressive B-cell neoplasm, is rare in children but accounts for 8-10% of all childhood tumors. It presents with rapid growth and malignant behavior, often affecting the abdomen and commonly found in regions of non-endemic Burkitt lymphoma. However, its association with ileocolic intussusception, though infrequent, can result in life-threatening complications. This study aims to explore this rare occurrence and its clinical implications in pediatric patients.

METHODOLOGY
A 7-year-old male presented with abdominal pain, vomiting, and red currant jelly stools. Examination revealed a palpable lump in the umbilical region. Imaging confirmed ileocolic intussusception, prompting emergency laparotomy. Histopathological examination revealed Burkitt's lymphoma stage 3. Treatment involved segmental resection followed by chemotherapy.

RESULTS
Intraoperatively, intussusception was identified with a 5*5 cm tumor in the terminal ileum extending into the caecum. Resection with 5 cm margin and ileo-ascending anastomosis with 20 cm proximal ileostomy was performed. Histopathology confirmed Burkitt's lymphoma without lymph node involvement. Chemotherapy yielded favorable outcomes, with stoma reversal performed at 6 months.

CONCLUSION
Burkitt lymphoma, though rare, can lead to serious complications like ileocolic intussusception in children. Timely diagnosis and aggressive management, including surgical resection and adjuvant chemotherapy, are crucial for optimal outcomes. Enhanced awareness among clinicians about this atypical presentation is essential to ensure prompt intervention and improve patient prognosis.

UNVEILING THE RARITY: SPONTANEOUS SPLENIC RUPTURE SECONDARY TO SPLENIC TUBERCULOSIS - FROM CRISIS TO RECOVERY.

Dr. Akhilesh Dalal[1], Dr. Shilpi Bhattacharya[2], Dr. Shashank Rai[3], Dr. Kuldeep Raj Sarangal[4], Dr. Jagdish Mutreja[5]
[1]*Surgery Resident-3, SMS&R, Sharda University*
[2]*Senior Resident, SMS&R, Sharda University*
[3]*Assistant Professor, SMS&R, Sharda University*
[4]*Professor & Head of the unit, SMS&R, Sharda University*
[5]*Professor, SMS&R, Sharda University*

BACKGROUND
Tuberculosis (TB), caused by Mycobacterium tuberculosis, remains a significant public health challenge, especially in developing countries. While pulmonary TB is predominant, approximately 15% of cases manifest as extra-pulmonary TB, including the rare occurrence of splenic tuberculosis, often associated with miliary TB and immune deficiency.

METHODOLOGY
We present a case of a 39-year-old Indian male initially presenting with diffuse abdominal pain, later diagnosed with peripancreatic cyst and loculated ascites, managed conservatively. Subsequent admission for similar symptoms, coupled with increasing anemia, prompted further investigation, revealing splenic infarct with subcapsular collection and hemoperitonium. He provided negative traumatic history.

RESULTS
As Patient's hemodynamic status suddenly deteriorated despite resuscitative efforts, we suspected spontaneous rupture of spleen. He underwent emergency laparotomy. The findings were staggering: Intra abdominally peritoneum, mesentery, serosa of the small bowel, spleen were all studded with multiple small tubercle suggestive of splenic and peritoneal tuberculosis, a shattered lower pole of the spleen, and hemoperitoneum. Emergency splenectomy was performed to rescue the patient from this crisis. Post operative remained uneventful, he made full recovery, was started on anti tubercular therapy and discharged on postoperative day 08.

CONCLUSION
Splenic tuberculosis, though rare, often coexists with abdominal TB and immune compromise. Clinical diagnosis of splenic rupture poses challenges, emphasizing the need for prompt investigations. Timely intervention in cases of hemoperitoneum with hemodynamic instability is crucial for patient survival. Enhanced awareness of the diverse presentations of TB is indispensable for the medical fraternity. Let us fortify our resolve and elevate our collective consciousness to combat the myriad faces of tuberculosis.

DEVELOPMENT OF A FREE ONLINE TRAINING COURSE ON BIOMEDICAL EQUIPMENT: REPAIR, MAINTENANCE AND HEALTHCARE TECHNOLOGY MANAGEMENT

Jenny Dankelman[1], Anna M.E. Worm[2], Arjan J Knulst[3]
[1]*Delft University of Technology, The Netherlands*
[2]-
[3]*Green Pastures Hospital, Nepal*

BACKGROUND
The main drivers for unavailability of medical equipment in low and middle income countries (LIMCs) is the lack of trained biomedical engineers / technicians as well as a deficiency in the proper management and prioritisation of the maintenance of these devices. Therefore, in a close collaboration with different institutes active in LIMCs, we developed a freely accessible online training course on repair, maintain and management of medical devices.

METHODOLOGY
Two Massive Open Online Courses (MOOCs) were developed. In the first MOOC learners develop the skills required to effectively maintain, repair and troubleshoot of 18 hospital-based devices to increase their availability and usage in hospitals (diagnostic, therapeutic and analytical devices). The second MOOC focus on advancing and strengthening

the knowledge of healthcare management professionals in effective methods of managing the life cycle of biomedical equipment in challenging low-resource environments (procurement, budgeting, keeping an inventory and methods of disposal of the biomedical devices). Both courses have a mixture of reading, videos, background material, discussion boards, and quizzes. The courses are freely accessible, for USD50 a verified track is offered to receive a certificate, with 95% discount for learners applying for financial support. Access can be obtained through: https://www.edx.org/learn/biomedical-engineering/delft-university-of-technology-biomedical-equipment-repairing-and-maintaining-biomedical-devices
https://www.edx.org/learn/biomedical-engineering/delft-university-of-technology-biomedical-equipment-a-practical-approach-to-healthcare-technology-management

RESULTS
The first MOOC started in May 2022 and had over 10.000 enrolled learners from over 160 countries across the world. The second MOOC, open since September 18th 2023, had over 700 learners enrolled. For these courses, around 10% is verified. From all learners, ~20% had high school or lower degree, ~60% a college degree, and ~20% an advanced degree, of which 70%/30% was male/female. Future runs will be launched every year. Student feedback is very positive. More than 95% found the course unique, interesting and useful. The difficulty was graded about right by 80%.

CONCLUSION
The free online courses so far successfully reached over 10.000 biomedical enthusiasts in more than 160 countries across the world, including many LMICs. The high number of learner enrollment indicates a clear need for these courses which aims to increase the availability of working medical equipment in hospitals.

IMPROVING ACCESS TO MEDICAL OXYGEN POWERED BY CLEAN AND RESILIENT ENERGY SUPPORTED BY LOCAL BIO-MEDICAL AND ENERGY TECHNICIANS

Dr. Sister Sarah Deogratius[1], Dr. Friar Steve Chobo[1], Dr. Laura Valerian Chewa[1], Mr. Robert N. Tyrrell[2]
[1]Cardinal Rugambwa Hospital Dar es Salaam Tanzania
[2]3 Element Energy Amsterdam Netherlands

BACKGROUND
Tanzania holds a 'Most Favored Nation' (MFN) tariff on the import of Pressure Swing Adsorption (PSA) oxygen plants for the central oxygen supply system of medical grade oxygen. However the demand for oxygen has not been reached, as PSA systems are installed in higher level facilities only. PSA systems pressurize air forcing it through a molecular sieve (i.e., zeolite) that prevents nitrogen from pushing through, which the oxygen can cross the zeolite barrier. The resulting volume of output air able to pass through the sieve is 20% to 25% pressurized incoming air. Conversely, Vacuum Swing Absorption (VSA) systems draw a vacuum on the output side of the molecular sieve resulting in a much lower volume of air that needs to be moved. Compared with PSA, the VSA system is considerably more efficient; only requiring 50% of the energy that a PSA system needs to achieve the same volume of generated oxygen. Despite this better energy efficiency, the dominant oxygen generation system is PSA. In response to the Covid-19 Pandemic, Tanzania received 49 million USD from the Global Covid-19 Response Mechanism (C19RM). The funding procured 25 PSA plans, only.

METHODOLOGY
Online document analysis of PSA systems to help answer: (1) location of the installed medical oxygen generation plants? (2) The power source of the plants (i.e., main grid, solar, diesel generator, or combination of both)?

RESULTS
Demand for oxygen in Tanzania has increased dramatically after multiple COVID-19 outbreaks. Tanzania installed PSA medical oxygen production plants at its largest national hospitals. The plants can fill 200 oxygen cylinders a day. The sites include Muhimbili National Hospital* – Located in Dar es Salaam, it's the largest and one of the most well-equipped public hospitals in Tanzania, which includes an oxygen plant; Benjamin Mkapa Hospital* – Situated in Dodoma, this hospital is relatively new and has modern facilities, including an oxygen generation plant; KCMC Hospital (Kilimanjaro Christian Medical Centre)* – This is a referral hospital in Moshi which also has oxygen production capabilities; Bugando Medical Centre* – Located in Mwanza, this hospital serves as a referral center for the Lake Zone and is known to have oxygen plant facilities; and, Mnazi mmoja hospital- Located in Zanzibar, serves as the main

regional referral center in Zanzibar. Each system is connected to the national grid. The grid production is insufficient and unreliable. To close these gaps the PSA plants are backed by diesel generators. Generators incur high costs for fuel while increasing air pollution in and around the hospitals.

CONCLUSION
Tanzania is able to improve its planetary health outcomes by choosing to install VSA systems that are powered by clean and resilient energy sources. Doing so can provide infrastructure that strengthens its surgical system; increases the skills of its workforce, who can be trained to operate and maintain the bio-medical and energy equipment; can put more funds into the delivery of care that are currently diverted to pay for diesel fuel; and, with reliable energy and onsite technical support, more resources can be allocated for more specialized medicine, surgery, and nursing.

TECHNOLOGY ENHANCED SURGICAL SUPERVISION IN RURAL AFRICA. LESSONS FROM MALAWI, ZAMBIA AND TANZANIA

Jakub Gajewski[1], Gerald Mwapasa[2], Eric Borgstein[2], Ruairi Brugha[3], Chiara Pittalis[3]
[1]*RCSI Institute of Global Surgery*
[2]*Malawi College of Medicine*
[3]*RCSI Institute of Global Surgery*

BACKGROUND
Estimates show that around 95% of people living in rural areas of sub-Saharan Africa (SSA) lack access to safe surgery. District-level hospitals (DLHs) should offer surgical care for rural populations but lack capacity. This intervention aimed to strengthen the surgical capacity of DLHs in Malawi, Tanzania and Zambia through in-service training, supervision and mentoring.

METHODOLOGY
The intervention comprised regular training and supervisory visits to 31 DLHs by specialists from referral hospitals over 24 months and the establishment of a mobile phone-based network for real-time surgical consultation between surgical specialists in tertiary hospitals and DLHs surgical providers. A mixed-methods controlled design was used to monitor changes in a range of indicators. Ethical approval was duly received.

RESULTS
The visits improved surgical output (numbers and range of major cases) and surgical, anaesthesia and nursing skills of the local surgical teams in most participating facilities - detailed analysis underway. The mobile-phone-based consultation network reduced surgical referrals by 30% (stopping unnecessary referrals) and improved the quality of case management (two consultants advising on every case posted). In 75% of cases discussed remotely with surgical supervisors, management decisions were reached within less than one hour. The use of this network has now become mandatory in Southern Malawi and has been approved by the ministry of Health.

CONCLUSION
Rural populations in Africa lack access to surgical specialists, who mainly practice in urban areas. Periodic visits by surgical specialists to DLHs, enhanced with regular contact via the consultation network, are producing substantial patient-level and population-level benefits. In the immediate term, this innovative service delivery model can offer a sustainable solution to improve access to care for underserved populations. The team engages with local actors aiming for a national scale-up of the model. Lessons learned will be transferred to the wider region.

A SINGLE CENTER EXPERIENCE OF IMPLEMENTING ROBOTIC SEMI-MECHANICAL STAPLED ANASTOMOSIS IN TOTALLY ROBOTIC IVOR LEWIS ESOPHAGECTOMY

Ewout Kouwenhoven[1], Marc van Det[2], Henk Jan Mantel[2]
[1]*Ziekenhuisgroep Twente, Department of Upper Gastro-Intestinal Surgery, Department of Thoracic Surgery, Almelo, The Netherlands*
[2]*Ziekenhuisgroep Twente, Department of Upper Gastro-Intestinal Surgery, Almelo, The Netherlands*

BACKGROUND
Robotic Assisted Minimally Invasive Esophagectomy Ivor Lewis (RAMIE-IL) is becoming the preferred surgical procedure for surgical treatment of esophageal cancer. One of the most common, yet feared, complications is an anastomotic leakage. However, an optimal technique for the intrathoracic anastomosis during the robotic procedure is not yet defined. The conventional circular stapled is widely used in RAMIE-IL. Alternatives that are used are linear stapled and hand sown anastomoses. After the introduction of the robotic linear staplers in 2017, we started the implementation of this new technique in our high volume center. The aim is to evaluate results of a standardized RAMIE-IL with a robotic stapled anastomosis.

METHODOLOGY
All RAMIE-IL from March 2018 until January 2024 were included. The procedure includes a four-arm Da-Vinci Xi®, with assistant port. The side to side anastomoses was created by using the robotic Sureform R 30mm. The stapler entrance in esophagus and gastric conduit was closed with 4.0 V-lock running sutures and reinforcement 4.0 PDS stitches. RAMIE-IL included routine pyloroplasty, and feeding jejunostomy.

RESULTS
A total of 275 patients were included. The average of patients were 66.1 (±9.0) years and 215 (78.1%) patients were male. Most patients had a (y)pT stage 3 (N=136, 49.5%). The average procedure time was 370 minutes (±72.0) with an average blood loss of 130 cc (±210). Median ICU stay was 1 day (IQR 1-2) and median length of stay in hospital was 8 days (IQR 7 – 11). Postoperative course was complicated with 13 (4.7%) cases of anastomotic leakage, 69 (25.1%) cases of pneumonia and 20 (7.2%) cases of chyle leakage. The median number of resected lymph nodes was 29 (IQR 24-35). Complete radical resection was achieved in 264 (96%) patients. The 30-day and 90-day postoperative mortality rate was N=3 (1%) and N=7 (2.5%) respectively.

CONCLUSION
The use of a robotic side to side semi mechanical staple technique in a high volume center is a safe procedure. The anastomotic leakage rate is lower than described in most literature. Implementation of this technique might be considered when performing a RAMIE-IL.

BRINGING QUALITY HEALTHCARE TO RURAL KUMAON

Kavikumar Nagarajan[1], Samiran Tripathi[1], Dr Pankaj Tewari[1]
[1]*Aarohi*

BACKGROUND
Public health priorities have shifted towards surgical conditions globally, recognizing their broader impact. Aarohi, serving the Himalayan communities, prioritized essential surgeries with the AAA approach - Affordability, Accessibility, and Availability since 2006. While initially patient-focused, it now emphasizes public health benefits. Despite limitations in emergency surgery, Aarohi's model includes Mobile Medical Units (MMU) visiting villages with diagnostic tools and community health frameworks. Questions regarding data quality, prevention interventions, and optimal surgical practices were addressed through detailed analysis and literature review.

METHODOLOGY
This review identified four broad groups of labour/resource-intensive operations (i) Pelvic operations in females (hysterectomy and repairs), (ii) Gall bladder operations, (iii) Urological interventions for urolithiasis (iv)Inguinal hernia repairs.
A literature review on global surgical health also established what surgical interventions were most cost-effective, especially in LMICs. A focused literature review was then performed in each area. The intention was to identify any improvements in population approaches that could reduce morbidity in these four areas.
Considering the demographic/geography of the patients Aarohi serves, the review attempted to answer the following questions:
1. Is the Aarohi surgical data of high enough quality to demonstrate that Aarohi is performing operations appropriately in its resource-constrained environment?
2. Are there any community or patient-based prevention interventions that could reduce or prevent surgical morbidity from these conditions?

3. Are there any surgical interventions that should be used less often than at present
4. Are there any surgical interventions that should be used more often than at present

RESULTS
The review concludes that Aarohi effectively addresses surgical needs in resource-constrained settings by providing affordable, quality interventions. It advocates for tailored treatments, conservative management, and judicious use of diagnostics to maximize public health benefits.

CONCLUSION
Regarding surgical morbidity, it appears that Aarohi responds to patients with essential surgical needs by providing affordable and quality interventions in resource-constrained environments. This should be a standard method of delivering healthcare in areas with limited resources, especially when surgical teams provide the surgical provision. This review has shown that:
• By avoiding the 'problem = surgery' paradigm through tailored treatments and judicious use of 'wait and see' and conservative management, Aarohi will ensure that the public health benefit of surgery is maximized.
• Appropriate utilization of diagnostics such as - POCT, POCUS, and other low-cost, quality testing mechanisms, along with conservative treatment, is critical to maximize the public health benefit.
• Introducing appropriate public health interventions such as - early identification, prevention, and promotion are essential to reduce the need for specific surgical interventions and increase others in low-cost, effective, and rural health-appropriate conditions.
• Effective data recording for quality improvement is essential for those with surgical needs to optimize surgical resources and verify to themselves and funders that surgical resources are best used.

AMPLIFYING LOCAL VOICES: MEETING ESSENTIAL SURGERY NEEDS, DRIVING GLOBAL INNOVATIONS

Priyansh Nathani[1]
[1]*Innovations in Global Surgery consortium*

BACKGROUND
The challenges faced by the frontline surgical workforce in resource-limited environments, particularly in low- and middle-income countries (LMICs) remain in need of further exploration and documentation in published literature. We aim to assess the unmet needs and proposed solutions within the surgical workforce of LMICs, for essential surgical care provision.

METHODOLOGY
We employ an ongoing cross-sectional e-survey and registry, targeting surgical workforce across diverse healthcare settings in LMICs as per World Bank 2020 classification. We are collecting real-time data on unmet needs and proposed solutions through a mixed methodology of qualitative and quantitative analysis.

RESULTS
By March 2024, we received responses from 273 participants across 32 countries.The respondents represent a full spectrum of surgical care providers including different training levels, urban and rural and across healthcare facility tiers. Workforce challenges included understaffing (32.8%) and a lack of trained personnel (25.4%). Infrastructure gaps encompassed insufficient radiology services (43.3%) and operation theatres (25.4%). Procedure challenges surfaced in paediatrics (4.5%) and obstetrics and gynaecology (4.5%). Equipment concerns encompassed availability (38.8%) and maintenance issues (11.9%), while supply shortages involved specific surgical supplies (14.9%) and generic supplies (13.4%). Leadership and management issues (4.5%) were other key unmet needs. Key proposed solutions were workforce training (34.2%), human resource planning (23.7%), and improved funding opportunities (21%).

CONCLUSION
We underscore the urgent need for context-specific interventions in LMICs' surgical care, advocating for a neglected grassroots-driven approach. The proposed solution areas must be well defined a priori, rooted in the identified needs and experiences of the surgical workforce. The delivery of essential surgical services can be enhanced by fostering

sustainable South-South multidisciplinary collaborations, cross-learnings and supporting the development of tailored innovations in global surgery for long-standing challenges.

EVALUATION OF OPERATING THEATRE TURNOVER TIME BY PROCESS MAPPING AND TIME STAMPING : A MULTICENTRIC OBSERVATIONAL STUDY

Priyansh Nathani (on behalf of INDSURG Collaborative Consortium)[1]
[1]WHO Collaborating Centre (WHOCC) for research in surgical care delivery in LMICs, India

BACKGROUND
Operating theatres (OTs) play a critical role in hospital functionality and revenue, yet inefficiencies often lead to surgical cancellations and increased costs. This study aims to identify peri-operative processes leading to OT time overruns in secondary and tertiary care hospitals in India, seeking to improve OT efficiency and reduce surgical cancellations.

METHODOLOGY
We conducted this multicentric prospective observational study between March 2023- March 2024 across secondary and tertiary care hospitals in India. Spearheaded by the 'IndSurg' consortium and the WHOCC for Surgical Care Delivery in LMICs, it involved both public and private facilities. Data was collected over pre-decided one month using a digital KOBO form, capturing preoperative, intra-operative, and post-operative timelines and hospital workforce data. Surgeries were categorised based on urgency and wound classification system for analysis. All patients undergoing surgeries in selected OTs during routine working hours were included and each of the processes were followed for these patients. Statistical analysis was performed using SPSS and Microsoft Excel.

RESULTS
In our analysis of 684 records across six hospitals, we observed considerable variability in multiple dimensions, such as patient demographics, types of surgery, anaesthesia methods, and procedural timings. We found significant variability in surgical durations and anaesthesia times, which directly influenced OT efficiency. Distinctions emerged between elective and emergency procedures, timings of surgeries, and the experience of the surgical team, revealing critical points of delay. Preoperative preparations and OT complex cleaning time were identified as pivotal phases affecting OT turnover times.

CONCLUSION
We highlight the importance of streamlining perioperative processes to reduce OT time overruns. By addressing identified inefficiencies, hospitals can significantly improve OT utilisation, decrease surgical cancellations, and enhance both patient and staff experiences. We advocate for developing targeted interventions to optimise surgical services in the complex healthcare landscape of India. Adopting flexible and tailored operational strategies with operational management principles—focusing on process optimization and managing variability—emerges as crucial for elevating surgical process efficiency in healthcare. Future research should explore these findings across broader settings, leveraging mixed methods and theoretical frameworks to inform decision-making and enhance OT performance comprehensively.

WHO OPERATIVE CARE COURSE: SURGICAL CARE AT THE DISTRICT HOSPITAL 2.0

Priyansh Nathani (on behalf of SCDH WHO Collaborating Centre for research in surgical care delivery in LMICs, India team)[1]
[1]WHO Collaborating Centre for research in surgical care delivery in LMICs.

BACKGROUND
The global surgical care disparity is stark, with the poorest half of the world's population having access to merely 20% of surgical specialists. The 76th World Health Assembly in 2023, Resolution WHA 76.2 underscored the necessity of integrating emergency, critical, and operative care into universal health coverage and enhancing readiness for health emergencies. In response to the Lancet Commission on Global Surgery's (LCoGS) urgent call to expand the surgical

workforce by 2030, we aimed to update the World Health Organization (WHO) Surgical Care at the District Hospital (SCDH) 2.0 program in collaboration with international surgery experts, local providers, and partnerships between faculties and medical students.

METHODOLOGY
We developed a free surgical training course by combining digital accreditation and certification, self-paced learning, facilitated sessions, and live digital instruction, accessible on mobile and web platforms. Target population being surgical care providers of all training levels in resource limited settings, we used modern learning methods and simulation-based education. We focused on critical care techniques, including limb or life-saving procedures and local/regional anaesthesia, prioritising emergencies common in district hospitals. User-friendly, portable learning labs were designed based on priority needs assessments. We included competency-based assessments, catering to both formally trained and task-shifted providers.

RESULTS
SCDH 2.0, developed over 14 months, combined educational strategies, equitable authorships, and weekly feedback from rural surgical providers in LMICs and global experts. The curriculum includes 12 operative care and 10 organisations of operative care modules, with 26 backpack-based portable learning labs for practical learning. It was piloted in 5 district hospitals and rural centres in India and Liberia, using a training-of-trainers approach with several facilitators. Efforts for quality improvement and community practice for scaling implementation are in progress.

CONCLUSION
SCDH 2.0 provides a scalable, interactive, high-quality program, enhanced by a supportive community of practice. It prepares learners to tackle local challenges, reduce unnecessary referrals, and help alleviate poverty. The current success of SCDH 2.0 underscores the critical need for global, multidisciplinary partnerships to invest in and co-create to further enhance and develop the course, with the goal of meeting global surgery targets.

RISK FACTORS FOR SURGICAL NON-RESECTION OF GASTRIC ADENOCARCINOMA IN SOUTH AFRICA: A NATIONAL CANCER REGISTRY ANALYSIS

Naeelah Parker[1], Mazvita Muchengeti[2], Wenlong Chen[2], Cameron Gaskill[3], Gayla Chinnery[4], Jeanne Lubbe[5], Kathryn Chu[5]
[1]*Division of Surgery, Faculty of Medicine and Health Sciences, Stellenbosch University, Cape Town, South Africa*
[2]*National Cancer Registry, Division of National Health Laboratory Service, South Africa*
[3]*Department of Surgery, University of California Davis, Sacramento, California*
[4]*Department of Surgery, University of Cape Town, Cape Town, South Africa*
[5]*Division of Surgery, Faculty of Medicine and Health Sciences, Stellenbosch University, Cape Town, South Africa*

BACKGROUND
Gastric cancer is the eighth-highest cause for cancer mortality in sub-Saharan Africa. Access to surgical oncology is limited in South Africa, where health inequity is high. To describe surgical non-resection of gastric adenocarcinoma in South Africa and determine risk factors for non-resection.

METHODOLOGY
This was a national retrospective study of gastric adenocarcinoma from 2015 – 2020 in South Africa using the National Cancer Registry. Risk factors for non-resection were modelled using logistic regression.

RESULTS
4406 individuals were diagnosed with gastric adenocarcinoma between 2015-2020. 2912 (66.1%) were male and 1841 (41.8%) were uninsured. 3919 (89.0%) were gastric biopsy confirmed. 819 (18.6%) individuals underwent surgical resection including 257 (5.8%) who did not undergo pre-operative biopsy. Risk factors for non-resection included female gender (odds ratio [OR] = 1.2, p = 0.08), Black race (OR = 1.8, p <0.001) and the uninsured (OR = 2.7, p <0.001).

CONCLUSION
Only 18.6% of gastric adenocarcinoma in South Africa were resected, and female gender, black race, and the uninsured

were at greatest risk for non-resection. Additional qualitative research focussing on barriers to surgical oncology care, including access to early diagnostic and surgical services, is recommended.

IMPROVING ACCESS TO CLEAN WATER AT HEALTHCARE FACILITIES IN MALAWI BY HARVESTING RAINWATER: PROTOCOL AND PRELIMINARY FINDINGS

Chiara Pittalis[1], Christabel Kambala[2], Kevin McGuigan[1], Jakub Gajewski[1]
[1]*RCSI University of Medicine and Health Sciences, Ireland*

BACKGROUND
Safe and readily available water and adequate sanitation and hygiene are critical to the provision of essential health services. However, in 2020, 2 billion people – 26 % of the world's population – had no access to uncontaminated water. Every year over 17 million women in the least developed countries give birth in facilities that are without adequate water and hygiene measures, putting their lives and their babies at risk of preventable infections. Malawi is one of those countries where access to water for healthcare services remains a challenge and has a negative impact on both patients and providers. The aim of the SURG-Water project is to address the poor access to water in health clinics in rural Malawi by testing a new, low-cost technology to treat harvested rainwater using renewable solar UV.

METHODOLOGY
SURG-Water's proposed solution centres on the development and demonstration of the potential of a large volume (> 150 L) transparent batch solar water disinfection (SODIS) reactor, deployed to treat harvested rainwater collected on-site in healthcare facilities in Malawi. It will be tested at 2 sites in Southern Malawi in order to be tailored to the needs of district facilities and the rural context. The goal is to ensure that access to a safe water supply is maintained and can withstand extreme weather events and mains water supply breakdowns. A pre-post, mixed-methods study will be used to evaluate the feasibility, adoption and effectiveness of the SURG-Water technology for improving the reliability of clean water supply at district health facilities.

RESULTS
A rapid situation analysis in three district hospitals and three health centres confirmed shortages of water in healthcare facilities in Malawi. In all assessed facilities water was not available uninterruptedly, and in one, water has not been available onsite at all for the last two years leading to the need for pregnant women to carry buckets with water to be used for the delivery of the babies. In the maternity wards there is no water, so expectant mothers fetch it in buckets to meet their sanitary needs. Clinicians compromise infection prevention protocols due to lack of water, leading to an increased risk of infections.

CONCLUSION
In Malawi, there is a currently untapped potential to harvest rainwater and treat it with UV sunlight. Low-cost solutions such as SODIS can help clinicians and patients use the solar-disinfected harvested rainwater to meet their daily water needs related to personal hygiene, infection prevention measures and provision of essential health care. The full results of the evaluation will be available in 2024.

EVALUATION OF DUAL DYE TECHNIQUE FOR AXILLARY REVERSE MAPPING AND SENTINAL LYMPH NODE BIOPSY TO ASSESS AXILLA IN PATIENTS WITH BREAST CANCER

Bhanu Pratap Reddy[1]
[1]*Vardhman Mahavir Medical College and Safdarjung Hospital, Delhi*

BACKGROUND
SLN : first draining lymph node from a regional lymphatic basin.
SLN Biopsy(SLNB) : feasible alternative to LN clearance in node negative patients to avoid morbidities associated with ALND.
Axillary Reverse Mapping(ARM) : helps in tracing arm lymphatics present in axilla.
Objectives:

To evaluate identification rate, false negative rate of SLNB using methylene blue dye.
To evaluate identification rate of reverse axillary mapping using fluorescein dye and map their position with respect to uppermost ICBN.

METHODOLOGY
Inclusion criteria: Biopsy confirmed breast cancer cases scheduled for MRM/BCS
SLNB technique: blue nodes identified and isolated. Sent for frozen section for final histology of axillary nodes.
ARM technique: arm lymphatics visualised under fluorescent lamp and sent in different container for histology.

RESULTS
Sample size: 30
No adverse reaction noted to either dye.
Identification rate of SLN and arm lymphatics: 100%
Fluorescent node positive for malignancy: 0%
False negative rate of SLNB: 4.17%
Arm lymphatics were above superior most intercostobrachial nerve: 86.6% cases

CONCLUSION
Present study concludes that SLNB using methylene dye alone is more reliable and accurate for staging axillary nodes in carcinoma breast.
The study demonstrates the utility of fluorescein dye for mapping arm lymphatics.
As all the fluorescent lymph nodes were negative for malignancy, they can be spared during ALND however studies with larger sample size would be required to establish a definitive role of ARM.

AFFORDABLE LAPAROSCOPY MODULE FOR LOW-RESOURCE SETTINGS

Anita Samia[1], **Augustine Waswa**[1], Bazil Masabo[1], June Madete[1]
[1]*Kenyatta University*

BACKGROUND
Laparoscopic surgery is a minimally invasive procedure where the surgeon operates on the patient through one or more incisions on the abdomen. Laparoscopic surgery is more effective to open surgery in numerous capacities, but the acquisition cost of the equipment is a major barrier in low-resource countries. In order to solve this problem, a compact laparoscopy module that integrates a light source and visualization features with improved ergonomics and cost-effectiveness has been designed. The module intends to provide hospitals in resource-constrained areas, such as rural Kenya, with an easily accessible substitute.

METHODOLOGY
The module utilizes a web camera to capture images, then uses image manipulation techniques to edit them, such as brightness, white balance, auto focus, and auto zoom. It has an LED light source that is environmentally friendly, as well as a microprocessor for processing, acquiring, and storing images and videos. The apparatus is designed to work with an insufflator or standard laparoscopic equipment in gasless environments.

RESULTS
The module's viability in a low-resource environment was evaluated in a pilot study conducted at the Kenyatta University Biomedical Engineering Laboratory. Results showed that by improving laparoscopic camera head ergonomics, the integrated module reduced the overall system footprint. Because of its lightweight design, the camera head casing minimized user fatigue during lengthy procedures. Additionally, its 3D printed design enhanced user comfort and control by enabling the customization of grips and contours. The light source module also provided the recommended 7500K light beam for surgical lights.

CONCLUSION
The affordable laparoscopy module satisfies medical-grade standards by effectively integrating light source and visualization systems with locally sourced components. Hospitals and healthcare facilities can find this to be a financially feasible solution as it not only lowers costs but also improves user experience. This novel strategy is

designed to work with an insufflator or standard laparoscopic equipment in gasless environments thus makes laparoscopic procedures more accessible in settings with limited resources, which promotes better surgical outcomes and patient care.

THE ROLE OF INDIGENOUS KNOWLEDGE IN TREATING SURGICAL CONDITIONS IN THE EASTERN CAPE OF SOUTH AFRICA

Neha Sangana[1], Kathryn Chu[2], Khaya Tshabalala[2], Paolo Rodi[2], Ethan Bell[3]
[1]*UT Southwestern Medical Center*
[2]*Centre for Global Surgery, Stellenbosch University*
[3]*Stanford University*

BACKGROUND
Indigenous Knowledge Healers (IKHs) provide alternative health care to formal health services in rural South Africa but little is known about their treatment of surgical conditions. This study aims to evaluate the extent of IKH surgical care, as well as to understand their perspective of the dual health system.

METHODOLOGY
A survey of IKH in the Madwaleni area of the Eastern Cape Province of South Africa was conducted. Participants were recruited through snowball sampling. Questions covered five main themes i) 7 types of surgical conditions treated (abscess, burns, infected wounds, fractures, breast Lumps, umbilical hernias, and thyroid goiter), ii) limitations to the type of conditions treated, iii) treatments used, iv) disease origin beliefs (what was the cause of the disease) and v) barriers and facilitators to working with the formal health sector to improve surgical care.

RESULTS
36 IKHs were recruited and 35 completed the survey. 91.7% of healers included in the study provided treatment for at least one surgical condition. The most common form of treatment was application of an ointment on the affected site (88%) followed by oral medication (82%), hospital referral (63%). Operative treatment was only done for abscess (33%). A major limitation of IKH surgical care was their lack of training and resources to perform operations. The major benefit of IKH surgical care was the treatment of the spiritual aspect of the disease. 100% of IKHs were interested in closer collaboration with the formal health sector.

CONCLUSION
IKHs treat surgical conditions but refer the majority after giving topical or oral medications, and their primary limitation is being unable to perform operations. They are interested in a referral system for their patients into the formal health sector to improve care. We are planning focus groups with community members, surgical patients, and healthcare staff to better understand their views on IKH treatment of surgical conditions. Finally, a collaborative workshop with all stakeholders will be held to improve surgical care by incorporating both indigenous and formal health services.

THE CLEFT LEADERSHIP CENTRE: USING GLOBAL AND LOCAL STRATEGIES FOR CHALLENGES WITH NUTRITION IN CLEFT PATIENTS IN INDIA

Dr Sanjana Ashik Shetty[1], Dr Supreet Grover[2], Dr Krishnamurthy Bonanthaya[2]
[1]*Hull Royal Infirmary, UK*
[2]*The Cleft Leadership Centre, Bhagwan Mahaveer Jain Hospital, Bangalore, India*

BACKGROUND
Nutritional deficiencies are a common issue for children worldwide with cleft lip and palate as they suffer from structural oral defects which causes challenges when feeding, leading to insufficient intake. In combination with subsequent reconstructive surgery on the lip and palate, this results in a reduced growth rate, weakened immune system and poor wound healing.

METHODOLOGY
The Cleft Leadership Centre at Bhagwan Mahaveer Jain Hospital in Bangalore India aims to identify the challenges in feeding cleft patients and establish the importance of long-term nutrition in improving outcomes by providing education to parents. The multi-disciplinary team uses a combination of global resources with a tailored approach which accounts for differences in local languages and cultural practices to overcome these barriers.

RESULTS
Strategies implemented at the unit include training from an in-house nutritionist on expressing and storing breast milk, education on specialised feeding bottles, anthropometric growth assessment using WHO growth charts, use of oral and nasogastric feeding tubes for prevention of aspiration pneumonia and inpatient admission when necessary. The unit has specifically tailored some of its strategies to address local barriers by providing assessments in a variety of local languages, leaflets with illustrative instructions in colour, feeding counselling that incorporates local feeding aids such as katori and spoon, pallada and feeding obturators, use of fortnightly online follow up to reduce travel costs and provision of nutritional supplements free of cost.

CONCLUSION
The use of both global and local strategies for nutrition in cleft patients in India provides a personalised approach to support adequate weight gain and establish physiological reserve for the stress of surgery whilst subsequently promoting improved post-operative healing and reduced infection rates.

AN EQUITY LENS TO INNOVATION IN SURGERY

Waruguru Wanjau[1], Salome Maswime[1]
[1]*UCT*

BACKGROUND
Surgical innovation is growing and is fundamental to improving surgical care overall. Over the last decades new surgical innovations such as nanotechnology and robotics have transformed the way clinical care is delivered. Over time surgical innovations have improved patient outcomes, reduced complication rates and length of hospital stay, and have decreased morbidity and mortality. At the same time, globally access to surgical care is limited. 67% of the world's population do not have access to safe, affordable, and timely surgical care. As innovation in surgery grows there is a risk of innovations increasing inequity in access to surgical care.

METHODOLOGY
A literature review on innovation in surgery, access to surgery and equity was conducted to show evidence and trends in innovation in surgery, access to surgery and equity

RESULTS
Surgical innovation is increasing with the introduction of new technologies such as robotics, Artificial intelligence (AI), nanotechnology and 3D printing. A majority of the new technology innovation in surgery occurs in high income settings. As these new technologies are integrated into standard care there is a risk of access to highly differential surgical care in differently resourced settings.

CONCLUSION
Innovation in surgery (introduction to new technologies) continues to increase.. New technology innovation in surgery can be approached with an equity lens by considering affordability and adaptability to lower resourced settings from the initial design of the new surgical technology. Embedding an equity lens in new technology surgical innovation can ensure that the innovations in surgery increase access to surgery as opposed to creating more disparities in access to surgical care globally.