**BRAZIL**

**National Assessment of Pediatric Surgeon Practice in Brazil**

Improving the quality of pediatric surgery in low- and middle-income countries (LMICs) remains a critical task for academic global surgery. Little is currently known about the state of pediatric surgery in LMICs, especially when it comes to providing surgical care to infants.

Brazil is a middle-income country with vast regional disparities encompassing surgical care that ranges from rural low-income status to high-income level surgical care in the urban Southeast. Thorough assessment of Brazil’s pediatric surgical outcomes and pediatric surgical workforce can act as a frame of reference for pediatric surgery globally with applications in LMICs across the globe. The purpose of this study is to assess regional practice differences among pediatric surgeons and identify factors associated with regional differences in perioperative infant mortality in Brazil. We seek to comprehensively evaluate, for the first time, the practice patterns of pediatric surgeons in an LMIC and compare to retrospective data on infant perioperative outcomes from all regions of Brazil in order to identify factors responsible for differences in infant surgical mortality.

**Measuring Surgical Quality in Low Resource Settings- A pilot in Amazonas**

Amazonas is the largest geographic state in Brazil, with 1.5 million km² encompassing 62 municipalities. The state is home to nearly 4 million inhabitants, of whom 1.8 million live in the capital, Manaus. The state itself and most cities within it are accessible primarily by boat or airplane, with only a scant few cities reachable by roads. For many, access to a secondary or tertiary level hospital is frequently days away, requiring high transportation costs that can be prohibitive for many.

Surgical quality is difficult to measure as current metrics designed for use in high resource settings are resource intensive, retrospective or rely on electronic medical records. Our team developed a tool to measure surgical quality in low resource settings and through a multi-institutional collaboration including Universiadade de Sao Paulo (USP), the Program in Global Surgery and Social Change (PGSSC) at Harvard Medical School, and Universidade Estadual do Amazonas (UAE), we are carrying out a pilot to test this too in Manaus, Amazonas. The results of this work will inform public health policies to improve quality of care in Amazonas.

**Knowledge, attitudes, and practice of obstetrics and gynecology (OBGYN) residents in modes of delivery**

Brazil continues to be one of the countries with the highest cesarean section (CS) rate in the world. The CS rate in the public-sector averages 35-45% while the private sector rate is as high as 80-90%. The rise in CS rate is complex and multifactorial. It cannot be solely explained by increasing preference of pregnant women for CS. In Brazil, there have been no studies to date assessing the knowledge, attitudes, and practices that OBGYN trainees have with respect to the rising CS rate. Since the CS rate has been rising for several years, there is concern that this has affected the practical experience that residents in obstetrics have managing labor, vaginal deliveries, and operative deliveries. Since the private sector has a much higher CS rate than the public sector, it is possible that trainees in private hospitals have been more affected. Lack of experience managing labor due to limited clinical exposure could make residents less comfortable offering vaginal deliveries to their patients when they become independent physicians. This, in turn, could perpetuate the vicious cycle of high CS rate in Brazil.

Thus, the aim of this study is to assess the knowledge, attitudes, and practices (KAP) of OBGYN residents in regard to the rising CS rate, management of labor, vaginal deliveries and CS. Furthermore, this study will serve to establish a methodology that can be used to assess the KAP of OBGYN residents in other LMICs where current studies are lacking. The survey results will be compared across training cadres from both high-income countries (HICs) and LMICs in areas of high, appropriate, and low CS rates.

**Access to Minimally Invasive Gynaecology Surgery in Brazil**

Minimally invasive hysterectomy for benign disease has been shown to have better outcomes than open surgery. The risks to the patients are decreased and the length of stay and cost are also lowered. As a result, there has been a significant increase in minimally invasive surgery (MIS) in high income countries. However, trends in gynaecological MIS in Brazil have not been studied.

In partnership with the Universiadade de Sao Paulo (USP) we aimed to describe the trends of gynecological MIS in Brazil in the last years as well as factors associated with access to MIS such as geographic region and health sector. The results of the survey will paint a picture of the evolving MIS field in Brazil to then advocate for more widespread and equitable access to this type of surgery.

**ETHIOPIA**

**Safe Surgery 2020**

As part of the GE Foundation’s Safe Surgery 2020 initiative, the PGSSC has supported the Ethiopian Federal Ministry of Health (FMOH) in developing and implementing the national Saving Lives Through Safe Surgery (SaLTS) strategic plan since 2016. Additionally, the PGSSC is responsible for ongoing monitoring and evaluation of a suite of programs implemented by SS2020 partner organizations in ten hospitals in the Tigray and Amhara regions of Ethiopia.

*SaLTS Monitoring and Evaluation Plan*

The PGSSC collaborated with the FMOH to develop a SaLTS monitoring and evaluation plan, tools, and training materials. The Ethiopian Hospital Assessment Tool and fifteen surgery- and anesthesia-specific indicators, including five of six indicators from the Lancet Commission on Global Surgery, were developed to track change within the national surgical system.

The Hospital Assessment Tool was piloted by PGSSC in 2017 and subsequently implemented nationally by the FMOH. Of the fifteen SaLTS KPIs, nine were accepted for national-level collection in the newly revised Health Performance Monitoring and Improvement (HPMI) strategy based on relevance and ability to indicate change at the hospital level. These KPIs were introduced at a national HPMI training by PGSSC and the FMOH in December 2017.

*Data Intervention*

Following the national HPMI training, the PGSSC conducted training, mentorship, and supervised collection of the SaLTS KPIs using a revised surgical data collection and reporting system. This system was piloted in SS2020 hospitals in collaboration with the FMOH and Regional Health Bureaus (RHBs) beginning in February 2018. Informed by evaluations of current data collection systems, the revised system is intended to help address the national need for high-quality surgical data including the national SaLTS KPIs. With the FMOH, PGSSC revised seven registries that were introduced as part of this system: OR Scheduling Registry, OR Registry, Anesthesia Registry, Inpatient Admission/Discharge Registry, Surgical Ward Registry, Referral Registry, and Surgical Site Infection Registry. These registries include the data needed to calculate the SaLTS KPIs.

To increase hospital capacity for surgical data collection and reporting, PGSSC conducted eight weeks of activities in each region including: a two-day intensive training for all members of the surgical teams, a training-of-trainers course for local

clinical mentors, and seven weeks of on-site visits for supportive supervision and completion of research activities. A one-day workshop on data analysis and reporting practices was conducted with all surgical teams to conclude the intervention.

SS2020 hospitals are now able to report monthly data to the PGSSC and their respective RHBs using this system, enabling the calculation of selected KPIs. The FMOH has approved all registries for use nationally. This intervention also allowed the research team to assess best practices for quality data collection in the Ethiopian context in order to provide a plan for future scale-up.

*Safe Surgery 2020 Monitoring & Evaluation*

In November 2018, the PGSSC team conducted two weeks of endline assessments in both the Tigray and Amhara regions following the implementation of all SS2020 programs. The research team conducted focus groups with surgical teams at each of the ten designated SS2020 hospitals and re-administered the Ethiopia Hospital Assessment Tool. Analysis of collected data is in progress.

**GUINEA**

**Assessment of head-neck surgical capacity in guinea through measuring the impact of interventions by Mercy Ships’ Africa Mercy in Guinea**

Mercy Ships is a 38-year old international faith-based organization aiming to increase healthcare delivery throughout sub-Saharan Africa. Mercy Ships deploys the Africa Mercy, the world’s largest private hospital ship, to work with host nations to deliver transformative, life-saving healthcare and health services, whilst providing a training platform for healthcare professionals. To date, little is known about the impact of Mercy Ships on the local population. This prospective descriptive study seeks to:

1. Analyze the number, outcomes, and procedural costs of surgical head-neck interventions of Mercy Ships in Guinea
2. Estimate the counterfactual situation of head-neck surgical care in Guinea in the absence of Mercy Ships

For both components of this work, data will be collected through conducting a Financial Risk Protection Survey and exit interview aimed to assess health expenditure, financial risk protection, and asset wealth. Volume and outcomes of the interventions done by Mercy Ships will be assessed through operative logbooks, ward logbooks, and provider interviews to assess the number of procedures, diagnoses, and deaths.

**Evaluation of the efficacy of a cash transfer voucher model to increase access to surgical care**

Although Mercy Ships provides surgical care free of cost, 20-30% of identified patients do not show up for surgery. Patients far away (from five to hundreds of kilometers) often cannot pay for transportation costs to arrive at the hospital and the associated opportunity costs for not being able to work and earn income. A cash transfer model is implemented to evaluate the impact of vouchers to cover financial expenses related to transport. The study will be the first-ever randomized control trial of cash transfers on patient follow-up in the field of global surgery.

**HAITI**

Our Haitian collaborators and colleagues represent some of the earliest founding relationships at the PGSSC. Current engagement in Haiti is focused on:

1. Assessing and supporting the development of surgical and neurosurgical capacity.
2. Identifying opportunities and barriers in the development of surgical, obstetrical, and anesthesia policy.
3. Promoting and collaborating on global surgery research, training, and education.

Our collaborative efforts are dependent on close working relationship with partners at the Ministère de la Santé Publique et de la Population (MSPP), Zanmi Lasante (ZL)/Partners in Health (PIH), St. Boniface Haiti Foundation (SBHF), among others.

**National surgical stakeholder analysis**: With only 824 annual operations (goal of 5,000) and 5.9 surgical, anesthetic, and obstetric providers (goal of 20) per 100,000 people, surgical capacity in Haiti requires coordinated national health policy. The surgical stakeholder analysis project seeks to describe the current state and political priority of surgery in Haiti using the Shiffman and Smith political priority framework. Capitalizing on the expertise and networks of Haitian leaders in surgery and health policy, this project aims to support the context for future national surgical planning initiatives.

**Neurosurgical stakeholder analysis**: Haiti has only four neurosurgeons for a population of approximately 11 million (0.038 providers/100,000 people). The social determinants of neurosurgical disorders and societal drivers of the current state of neurosurgical care in Haiti are not well understood. Using grounded theory methods, this study is designed to provide a better understanding of social barriers and opportunities for local capacity-building in the clinical neurosciences.

**Cost-effectiveness of renal replacement therapy**: It is estimated that 15-20,000 patients in Haiti require urgent hemodialysis due to end stage kidney disease. Recently, the Haitian government has supported the development of renal replacement therapies, including new dialysis centers, across the country. While kidney transplantation is widely accepted as the optimal clinical and cost-effective solution, low and middle countries (LMICs) like Haiti are often overlooked when planning for transplantation. This cost-effectiveness analysis seeks to provide a better

understanding of the resources required to provide RRT and to support the further development of a national renal replacement therapy strategy.

**Haiti surgical research equity**: The 2010 Haiti earthquake destroyed much of the country’s clinical infrastructure. Given the importance of local research initiatives in the development of local health care capacity, this collaborative effort seeks to better understand the surgical research needs in Haiti. Our work is principled on supporting local journals, local research training programs, and other key components of equitable research partnerships.

**FHADNNEC/WFNS 1st Annual Scientific Meeting**: Scheduled for January 2019, this inaugural meeting of the Fondation Hatienne pour le Developpement de la Neurologie et de la Neuro-Chirurgie (FHADNNEC) is co-sponsored by the World Federation of Neurosurgical Societies (WFNS) and will include didactic and practical courses in neurotrauma and emergency and essential neurosurgery. The course will run in Port-au-Prince and Fond-des-Blancs, and its target audience will include 50 Haitian senior residents in general surgery, orthopedics, and neurosurgery.

**CAT-ASHAC trauma training course**: Developed by the Association Haïtienne de Chirurgie (ASHAC) in collaboration with the American College of Surgeons (ACS) and L’Hôpital Bernard Mevs/Project Medishare, the CAT-ASHAC trauma course is a training opportunity for surgeons across Haiti to develop skills in trauma surgery and management. With components that include principles from both general trauma surgery and neurosurgery, it is among the first efforts of its kind in Haiti.

**INDIA**

**Surgical Innovation Center**

*Single-site innovation center: Karunya Collaboration*

Over the past two years, we have developed a collaborative relationship with Karunya University and have helped create a “*Center of Excellence in Surgical Innovation*”. The PGSSC has delivered multiple conferences and workshops focusing on developing local, low-cost solutions for challenges faced by rural surgeons, and supported student-led projects through seed funding. The goal is to expose and engage local students and faculty in non-medical academic programs to surgically relevant and cost-effective innovations that can impact local and global communities which lack surgical care.

*State-wide, multi-institutional innovation conference: hosted by Saveetha University*

Owing to the success in Karunya and the growing need in India for university-level exposure to innovation science, the PGSSC has been requested to expand the existing program to a state-wide forum. This will enable a broader scope of students to benefit and, for the first time, will include a diverse range of academic disciplines, including medical, business, engineering, and design colleges from both urban and rural regions of Tamil Nadu with the goal of empowering Indian graduates to create and develop innovative solutions to meet the high burden of unmet surgical care both nationally and globally.

**Narayana Health – Boston Children’s Hospital: Vascular Anomalies Care Partnership**

Narayana Health, the foremost provider of low-cost, high-quality healthcare in India, has requested to collaborate with the Vascular Anomalies Center at the Boston Children's Hospital. Narayana Health is a chain of multispecialty hospitals with 14,000 employees, 23 hospitals, 7 heart centers, and 19 primary care facilities across India. The business model works on the "economy of scale" to use high volume surgery to increase the hospitals' buying power and subsidize rural and urban poor care. Narayana's mission is to deliver high quality, affordable healthcare services to the broader population in India. We will hold the first, national, interdisciplinary training workshop on vascular anomalies in India.

**STARS Program at Narayana Health**

Building upon the success of the inaugural 2017-2018 STARS program, the PGSSC will again partner with Narayana Health (NH) in Bangalore to organize the second annual STARS program for 2018-2019. STARS is an applied clinical research training program organized under the aegis of the PGSSC, which leverages the clinical

research resources of Narayana Health, one of India’s largest and most distinguished healthcare networks, to advance equitable global health research. For the upcoming year, we will again offer an intensive, immersion-based research training program for 4 students from low and middle-income countries (LMICs). This program remains centered on cornerstone principles of investigation, innovation, and implementation.

**Spinal Anesthesia Training Program**

The PGSSC, Boston Children’s Hospital, and local collaborators will continue to move forward the innovative pilot trail that is evaluating the ability of rural medical doctors to safely administer spinal anesthesia, allowing more rural surgeries to occur. In coordination with this program, the PGSSC has collaborated with the BCH Simulation Center to land a simulation training curriculum in 3 rural hospitals focused on improving the quality and coordination of care delivery by providers during anesthestic emergencies.

**MEXICO**

Compañeros en Salud (CES) has been providing medical care in the state of Chiapas since the mid 1990s and has focused on the provision of quality primary health care in the rural areas of Mexico. It has also collaborated closely with the government health system and large academic institutions such as the Tecnico de Monterrey to address gaps in care. CES has addressed the lack of access to quality primary care in rural areas and they have now identified lack of surgical care in the area of Jaltenango a gap. We are partnering with CES to build research capacity parallel to the scale up of the surgical care planned to take place at Hospital Basico Comunitario de Angel Albino Corzo (HBCAAC). Our objective is to build research capacity among trainees and local staff by strengthening partnerships to develop robust surgical data collection around surgical quality indicators and the six world development surgical indicators.

**PAKISTAN**

**National Vision for Surgical Care 2025**

Halfway through 2018, four countries have developed National Surgical, Obstetric, and Anesthesia Plans (NSOAPs) to strengthen surgical care on a country level. All four countries (Senegal, Ethiopia, Zambia, and Tanzania) are located in Africa, and no country beyond the African Region had started the NSOAP process. Pakistan, a lower-middle income country in South Asia with a population of 205 million people, is the first country to start the process through developing the *National Vision for Surgical Care 2025 (NVSC2025)*, a *pre-“provincial SOAP”* (provincial plan) guiding as a guiding federal document for individual provinces creating their own provincial plans.

On November, 15th and 16th, national and international stakeholders from the ministries, government, professional societies, civil society, and academic and health care institutions came together to discuss and draft the NVSC2025 document. The PGSSC is part of the Technical Working Group catalyzing the process on a national and provincial level, building on experiences in the Zambian and Tanzanian NSOAPs.

*Assessment of the strength of Pakistan's Surgical System: tracking the Lancet indicators for Global Surgery*

The purpose of this study is to track the six global surgery indicators recommended by the Lancet Commission on Global Surgery (LCoGS). Results from this study will measure and reflect the ability of the Pakistani surgical system to provide safe and timely care to patients in need of an operative procedure. This work allows full assessment of the strength of the surgical system and seeks to identify priority areas for system improvement and a step forwards towards the NVSC2025 and supporting SDG 3.8. Consequently, this data can and hopefully will be used as a backbone from which to invest in Pakistan’s surgical system - financially, programmatically, and at a policy-level.

**PERU**

**Quality improvement Project at Sergio Bernales Hospital in Lima**

Concerns with timely access to surgical care in a large tertiary public hospital in Peru led to our partnership with Partners in Health (Socios en Salud) and the Hospital Nacional Sergio E. Bernales. The team aims to use quality improvement methodology to develop a strategy to reduce surgical waiting times, increase surgical volume and increase patient satisfaction.

After baseline data collection and extensive process mapping and stakeholder consultations, the project’s core strategy was developed to optimize the triage process and implementation of an electronic database of patients with abdominal surgical conditions requiring elective surgery, most commonly hernia repair, cholecystectomy, and skin lesion removal. After adoption of the intervention, we will conduct the final data collection to evaluate the effectiveness of the intervention.

**Referral patterns for surgical management of patients with multidrug resistant tuberculosis in primary health care centers**

Some patients with multidrug resistant tuberculosis are no longer candidates for medical management alone. For these cases, surgery serves as a complementary therapy. In Peru, the *National Strategy for Tuberculosis* has developed a system to refer potential candidates by primary health care providers for further evaluation. Our project is a qualitative study to understand what the current practices and referral patterns are at primary health care centers in Northern and Eastern Lima. This will serve to guide future policies around surgical referrals and management of multidrug resistant tuberculosis.

**RWANDA**

**Surgical site infections machine learning project**

Using PGSSC-generated data collected from Rwanda, one of the PGSSC Research Associate meets with an MIT-based research team on a weekly basis to explore opportunities focusing on post-operative surgical site infection (SSI) rates using text-based and image-based analysis. Technologies that are being used include machine learning and computer vision approaches.

**Using mHealth technology to identify and refer surgical site infections in Rwanda** Randomized controlled trial focused on improving surgical follow up post-operatively. We developed an mHealth application to assist community health workers (CHW) to identify surgical site infections. The trial is evaluating the effectiveness of the app and comparing return-to-care between three arms (standard of care = i.e. no follow up, home visits by CHW with the mobile app, and CHW calling patients using the mhealth app). We are evaluating the impact on timely and appropriate return-to-care of patients with surgical site infections in Rwanda to improve patient outcomes and reducing healthcare costs.

**Non-Operative Technical Skills for Surgeons (NOTSS) in variable resource settings**

NOTSS are cognitive and interpersonal skills aimed to complement surgeons’ technical skills in the operating room to ensure adequate teamwork and optimal patient outcomes through mitigating risks and facilitating open communication in the operating room. NOTSS are built on four pillars (situation awareness, decision making, communication and teamwork, and leadership), all of which are essential to achieve the projected outcomes. The framework has further been adapted to variable resource contexts (VRC) to implement in low- and middle-income countries.

In Rwanda, the PGSSC has conducted NOTSS-VRC training workshops twice during the past two years, equipping entire surgical teams with the necessary non-operative technical skills to function as a team in the OR. In 2019, teams in district hospitals will be taught, in addition to the yearly course for incoming surgery, OBGYN, orthopedics, ENT, and anesthesia residents in Kigali.

**Operational Research Training**

Partnership with Partners in Health to carry out a year-long research training program for local staff and health care providers. These include three training sessions of one week each, with mentorship for data collection and analysis, and manuscript preparation in between.

**TANZANIA**

**Safe Surgery 2020**

*Monitoring and Evaluation of SS2020 interventions*

In Tanzania, 19.3% of deaths and 17% of Disability-Adjusted Life Years (DALYs) are attributable to diseases amenable to surgery. The quality of healthcare services, surgical provider capacity, as well as data collection and reporting quality have been identified as priorities, through feasibility assessments and literature reviews. Surgical site infections (SSIs) and maternal sepsis have been shown to be major causes of morbidity and mortality in Tanzania.

To strengthen surgical services in Tanzania, the GE Foundation has partnered with the Tanzanian Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDEC) as well as the President's Office, Regional Administration and Local Government (PORALG) to launch the Safe Surgery 2020 (SS2020) initiative. Under the project management of the Dalberg advisory group, the SS2020 partners are Jhpiego, Assist International, and the Program in Global Surgery and Social Change.

Interventions by Jhpiego and Assist International (training and mentorship, safe caesarean birth training, sterilization training, safe obstetrics training course, data quality improvement intervention, and others) are currently being implemented in 10 intervention health facilities in the lake zone region in Tanzania.

The PGSSC’s role has been to evaluate the impact of the implementation of SS2020 interventions on addressing the top surgical priorities of the health facilities. The PGSSC and partner organizations have designed a quasi-experimental, mixed-method study with 10 intervention and 10 control sites to study the impact of these interventions on surgical quality, utilization, surgical, anesthesia and obstetric provider capacity, as well as data collection and reporting capacity.

*Data Quality Improvement Intervention*

Accurate data collection has been and is key in helping to ensure that the impact of the SS2020 interventions are thoroughly captured. The data quality improvement intervention has been designed by the PGSSC in an effort to strengthen local capacity to collect quality prospective data on indicators selected as SS2020 process and outcome measures related to the surgical safety checklist, surgical site infections (SSIs), post-operative sepsis and maternal sepsis. The intervention is being implemented through Jhpiego’s mentorship program.

**UGANDA**

The PGSSC’s engagement in Uganda is primarily neurosurgically focused and based in the city of Mbale at the Cure Children’s Hospital of Uganda (CCHU). The focus of the research revolves around the improvement and implementation of “in-country” neurosurgical education. The CCHU is unique in that it hosts a visiting fellowship for practicing neurosurgeons from other Low- and Middle-Income Countries (LMICs) to spend several months learning important techniques in the treatment of pediatric hydrocephalus. Much of the current research being facilitated by the PGSSC is focused on evaluating the efficacy and sustainability of this training paradigm as well as gathering important epidemiologic and outcomes data from surrounding partner sites. As a result of its commitment to training other LMIC neurosurgeons a network of pediatric neurosurgeons has gradually developed, particularly in Southeast Asia and other parts of sub-Saharan Africa. The goal of current PGSSC research efforts are to utilize this network to increase our knowledge on the efficacy of the current surgical training paradigm, evaluate surgical outcomes, and better understand disease epidemiology using the broad data availability from prior Uganda trainees. The ultimate goal of this project is for well-grounded and sustainable surgical education to occur entirely within the LMIC setting, ultimately allowing for other training sites to develop in addition to Uganda.