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Global General Pediatric Surgery Partnership: The UCLA-Mozambique Experience

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Abstract

BACKGROUND/PURPOSE—There has been increasing recognition of the disparities in surgical care throughout the world. Increasingly, efforts are being made to improve local infrastructure and training of surgeons in low-income settings. The purpose of this study was to review the first 5-years of a global academic pediatric general surgery partnership between UCLA and the Eduardo Mondlane University in Maputo, Mozambique.

METHODS—A mixed-methods approach was utilized to perform an ongoing needs assessment. A retrospective review of admission and operative logbooks was performed. Partnership activities were summarized.

RESULTS—The needs assessment identified several challenges including limited operative time, personnel, equipment, and resources. Review of logbooks identified a high frequency of burn admissions and colorectal procedures. Partnership activities focused on providing educational resources, on-site proctoring, training opportunities, and research collaboration.

CONCLUSION—This study highlights the spectrum of disease and operative case volume of a referral center for general pediatric surgery in Sub-Saharan Africa, and it provides a context for academic partnership activities to facilitate training and improve the quality of pediatric general surgical care in limited-resource settings.

Keywords

Academic; Partnership; Pediatric; Surgery; Mozambique

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Level of Evidence:
Level IV

1. Introduction

There has been increasing recognition of the disparities in surgical care throughout the world, but the attention to pediatric surgery has been relatively limited.[1] Increasingly, pediatric surgeons are working to improve local infrastructure and training of surgeons in low-income settings.[2] In 2007, the David Geffen School of Medicine at the University of California, Los Angeles (UCLA) established an academic partnership with the Universidade Eduardo Mondlane (UEM) and its affiliated teaching hospital, Hospital Central Maputo (HCM), in Maputo, Mozambique, with the goal of improving training and delivery of pediatric care. The partnership was expanded to include pediatric surgical training in 2010.

The Mozambican health care system has suffered greatly, in large part due to an exodus of health care workers during independence from Portugal in 1975, and a 15-year civil war from 1977-1992.[3] In 2007, at the genesis of the UCLA-UEM academic partnership, there were only 10 Mozambican pediatricians and only one Mozambican practicing general surgeon dedicated to the surgical care of children. Approximately half the population of 25 million is under 18 years of age.[4] In 2011, Mozambique ranked 184 of the 187 countries in the world on the human development index (United Nations Development Programme), which is a metric used to assess the social and economic development levels within countries. The goal of our partnership was to strengthen the health care system through the development of a pediatric general surgery training center.

The purpose of this study was to review the first 5-years of our global academic pediatric general surgery partnership. By systematically describing resource distribution and limitation, the spectrum of disease, operative case volume, and partnership activities, we hope to illustrate the challenges and accomplishments that can be expected of academic medical partnerships in other global health settings.

2. Methods

2.1 Hospital Needs Assessment

A mixed-methods approach was utilized that involved both quantitative and qualitative data collection, including key informant interviews with local and visiting physicians and surgeons, to perform an ongoing needs assessment of the pediatric general surgery service.

2.2 Evaluating Spectrum of Disease and Operative Volume

In order to evaluate the spectrum of disease and operative case volume, we reviewed logbook data for pediatric general surgical ward admissions and operative cases performed in both the elective and emergency settings for the entire year of 2012. All age groups that presented to the pediatric ward were reviewed. Data were summarized by grouping discharge diagnoses and operative procedures into categories. Admission logbooks included the following data: age, length of stay, diagnosis, and city of origin. Operative logbooks included location of procedure (urgent operating room versus elective operating room), age, gender, and province of origin. We calculated the proportion of patients originating outside of the Maputo province for each diagnostic and operative category. Results for each category

were compared with those from all other categories combined using Wilcoxon rank sum test for continuous variables and Fisher's exact test for categorical variables.

Partnership activities from the period 2010 to 2015 were reviewed and summarized thematically.

3. Results

3.1 Resources

Hospital Central Maputo is a 1,500 bed teaching hospital with an average daily census that expands to over 3,000 during the rainy season. The Department of Pediatrics is housed in its own building on campus with 300 beds, of which 32 beds in 6 patient rooms are dedicated to pediatric surgical patients on a dedicated ward. None of the patient rooms has a faucet or sink for hand washing. Alcohol-70% and gloves are usually available for patient examination. There is one dedicated room for procedures (e.g. incision and drainage, suture removal, and dilations) that has a faucet and sink but limited towels to dry hands. The procedure room does not have oxygen or monitoring capacity so conscious sedation is not performed. Burn wound care facilities and pain management are limited. The operating rooms are located in a separate building requiring that patients be transported two-blocks by ambulance to undergo surgery. In order to improve efficiency, some of the operating rooms have two operating tables so that two cases can be performed simultaneously. There is no critical-care pediatric transport team. The general pediatric surgery service has only one and a half days of operative block time per week as they share the operating rooms with all other surgical services. In the operating room, there are limited pediatric supplies (neonatal pulse oximetry, endotracheal tubes, central venous catheters, heaters, and endoscopes). There is no dedicated pediatric operating room team and limited fine instruments and sutures. Pediatric laparoscopy is currently not available. Urgent operations are performed in separate operating rooms located adjacent to the general emergency room and shared with other surgical services. Patients that require monitoring post-operatively are generally admitted to the pediatric intensive care unit (PICU). At the beginning of our partnership activities in 2010, there were two pediatric ventilators. Currently, there are an estimated five ventilators, but central venous monitoring is not yet available. The nursery (*berçario*) has an estimated census of sixty patients. It is expanding and improving but currently has limited capacity for caring for critically-ill neonates. Central venous access is not available and parenteral nutrition is limited. Neonatal ventilators were not available at the start of the partnership, but they are currently being introduced.

3.1.1 Imaging—Ultrasound, computed tomography, and magnetic resonance imaging are increasingly available, but the quality and interpretation of these studies are limited. There are no dedicated pediatric diagnostic or interventional radiologists. Currently, there is no reliable supply of contrast and no routine fluoroscopy available to perform contrast studies outside of the operating room.

3.1.2 Pathology—The hospital has a referral center for pathology, and is well-equipped to perform fine needle aspiration. However, frozen sections and special stains are not routinely available. Results for suction rectal biopsies have been unreliable. Often, congenital

megacolon is diagnosed later in life. Levelling colostomies are routinely performed to make sure that the pull through is done at a functional level.

3.1.2 Laboratory Results—While comprehensive hematology and chemistry panels can be obtained, many laboratory tests and genetic studies are not routinely available. For example, advanced hormonal and genetic work up for congenital adrenal hyperplasia and other endocrine abnormalities can not be performed. A microbiology laboratory is available for gram stain and culture/sensitivity, but not routinely utilized because of delays in reporting results.

3.1.3 Health Care Personnel—At the beginning of our partnership, there was only one Mozambican general surgeon who was actively responsible for the pediatric general surgery ward and served as Chief of the Pediatric Surgery. At that time, there were only one or two Cuban surgeons providing general pediatric surgical care to other provinces in the country. Mozambique has many such expatriate surgeons to help address the shortage of physicians in the country. A full-time Russian pediatric surgeon and visiting British surgeon had previously helped to train the native general surgeon in pediatric surgery. In addition, a North Korean junior surgeon was sent as part of an exchange to provide assistance/training for a few years around the time our partnership began. A trained pediatric surgeon from Cuba later came to provide additional coverage. There are no anesthesiologists with subspecialty training in pediatric anesthesia. Nurses also limited in number. There are only two or three nurses during the day and one nurse at night caring for 32 patients on the general pediatric surgery ward.

3.1.4 Training—Hospital Central Maputo has initiated a pediatric surgical residency program. The first trainee completed 2 years of general surgery training in Maputo (2008-2010) and 2 years of training in Spain at a children's hospital (2010-2012), before returning to Maputo for an additional year (2013) to complete her pediatric surgical residency, before joining the faculty at Hospital Central Maputo. Two additional residents are now training in pediatric surgery (2013). Mozambique surgical training programs are expanding their involvement with the College of Surgeons of East, Central, and Southern Africa (COSECSA) to help standardize and improve surgical training. The first author (VA) has recently been certified by COSECSA as the first pediatric surgery fellow in Mozambique, although there is still a shortage of fellows to provide mentorship and assistance with career development. The current general pediatric surgery curriculum incorporates rotations in pediatric surgery, general surgery, neurosurgery, orthopedics, urology, plastic surgery, maxillofacial surgery, anatomic pathology, pediatric intensive care, and nursery. The goal is to supplement this training with rotations abroad.

3.2 General Pediatric Surgery Ward Admission Diagnosis (Table 1)

For the year of 2012, 1153 patients were admitted to the pediatric general surgery ward. The most frequent discharge diagnosis was burns (n=274), which accounted for nearly one quarter of the admissions. Patients with burn diagnosis had a significantly lower median age (2.2 vs. 4 years; $p<0.0001$), longer median length of stay (4 vs. 2 days; $p<0.001$), and were less likely to originate from a province outside of Maputo (4% vs. 8%; $p<0.04$). The

following distribution of burn severity was noted for the 223 patients in whom it was recorded: 1st degree – 2 (1%); 2nd degree – 208 (93%); 3rd degree – 13 (6%). The median estimated total body surface area for the 84 patients in whom it was recorded was 9% (range 1% to 30%; interquartile range: 5%, 14%).

The infection category (n=189) was the second most frequent. The most frequent diagnoses in the infection category were abscess (n=104), cellulitis (n=35), pyomyositis (n=26), necrotizing fasciitis (n=2), and non-specified (n=22). Compared with other categories, the infection category had a lower proportion of patients originate from a province outside the local Maputo province (0.6% vs. 8%; $p<0.0001$).

Hernia/hydrocele (n=177) was the third most frequent discharge diagnosis. The majority of hernias were inguinal; umbilical and ventral hernias were also noted. Patients with hernias and hydrocele had a significantly shorter length of stay (2 vs. 3 days; $p<0.0001$) and were less likely to originate from a province outside the local Maputo province (1% vs. 8%; $p<0.002$) when compared with patients in other categories.

Trauma was the fourth most frequent discharge diagnosis (n=156) and included abdominal, extremity, and cranial trauma, as well as animal bites. Patients with a diagnosis of trauma had a significantly higher median age (7 vs. 3 years; $p<0.0001$) when compared with patients from other categories.

Colorectal disease was the fifth most frequent discharge diagnosis (n=86). The majority of patients with colorectal disorders had anorectal malformation and approximately one fourth had Hirschsprung's disease. Patients with colorectal disorders had a significantly lower median age (0.9 vs. 4 years; $p<0.0001$), longer median length of stay (12 vs. 3 days; $p<0.0001$), and were more likely to originate from a province outside of Maputo (36% vs. 5%; $p<0.0001$).

Appendicitis was the sixth most frequent discharge diagnosis (n=26). Patients with the diagnosis of appendicitis had a significantly higher median age (9 vs. 3 years; $p<0.0001$).

The urologic category (n= 39) was primarily composed of admissions for cryptorchidism (29), hypospadias (5), phimosis/paraphimosis (2), ambiguous genitalia (2), and epididymitis (1). Patients with a urologic diagnosis had a significantly higher median age (5 vs. 3 years; $p<0.003$).

Neoplasms (n=31) included tumors of the extremities, torso, and neck (25), Wilms' tumor (3), ovarian mass (1), sacrococcygeal tumor (1), and unspecified abdominal tumor (1).

The most common diagnoses in the other category (n=109) were rectal prolapse (n=16), intussusception (n=11), and rectovaginal fistula (n=7); there were less than 5 patients for categories other than those listed Patients in the other category had a significantly lower median age ($p<0.03$), longer length of stay ($p<0.02$), and were more likely to originate from a province outside of Maputo (17% vs. 6%; $p<0.001$).

3.3 Operative Case Volume for General Pediatric Surgery Service (Table 2)

A total of 625 cases were recorded in the operative logbooks for the year 2012. By location, 435 cases (70%) were performed during the elective operating room block time, and 190 cases (30%) were performed in the urgent operating rooms near the emergency room (*urgencia*). Overall, hernia repairs and colorectal procedures were the most common operations performed. The procedures most frequently performed in the urgent operating rooms were appendectomy, trauma procedures, incision and drainage or abdominal washouts, colorectal procedures, reoperations, intussusception procedures, hernia repair, and repair of congenital hernia or atresia in a neonate. With respect to age, 10% of cases were performed in patients under three months of age and 7% in patients under one month of age. The majority of patients were male (71%). The proportion of patients originating from outside the Maputo province who underwent an operation was significantly higher than the proportion admitted to the general surgery ward who were from within the Maputo province (40% vs. 7%; $p<0.001$).

Procedures were categorized based on information available in the logbook, including procedure and diagnosis. The majority of hernia operations (n=182) were performed for inguinal hernias and/or hydroceles without umbilical hernia (n=123); combined inguinal and umbilical hernias (n=19), and isolated umbilical hernias (n=39). Colorectal procedures (n=95) were performed on anorectal malformations (n=51), Hirschsprung's disease (n=40), and acquired rectovaginal fistulas (n=4). The procedures performed included colostomies (n=36), anorectoplasties (n=28), pull-through procedures (n=8), rectal biopsies (n=18), rectovaginal fistula repairs (n=2), and procedures otherwise not specified (n=3). The tumor biopsy or resection category included biopsies of cysts, lymph nodes, soft tissue masses, and vascular tumors. In addition, nephrectomies were performed for Wilms' tumor (n=4). The majority of urologic procedures performed were orchiopexies along with hypospadias repairs and circumcisions. Trauma procedures were almost exclusively performed in the urgent operating rooms. The majority of the procedures were exploratory laparotomies for blunt abdominal trauma and a few for penetrating trauma. In addition, extremity explorations, an amputation, and a fasciotomy were recorded. Incision and drainage (n=22), abdominal washout (n=2), and cholecystectomy (n=2) were also performed. Burn procedures included skin grafts (n=19) and burn debridements (n=6). Reoperative procedures were primarily for wound explorations/revisions (n=8), lysis of adhesions (n=6), enterocutaneous fistulas (n=4), stoma revisions/dilations (n=3), abdominal washouts (n=2), and unspecified (n=2). All intussusception procedures were performed in the urgent operating rooms as fluoroscopic reduction is not available. Repair of congenital hernia or atresia included five cases of intestinal atresia, two gastroschisis cases, two omphalocele cases, a congenital diaphragmatic hernia, a mesenteric cyst excision, an excision of a remnant omphalomesenteric duct, and two esophageal atresia cases. Other procedures included a Ladd's procedure, a gastrostomy, a jejunostomy, intestinal resections, muscle biopsies, oophorectomy for right ovarian torsion, and other miscellaneous procedures for unclear diagnosis.

3.4 Partnership Activities

Our ongoing needs assessment identified limited resources and a high volume of colorectal cases and burn admissions. Partnerships activities have focused on helping provide equipment, educational material (e.g. textbooks, online resources), proctoring (e.g. individual supervision and missions), training (courses and rotations abroad), and research/conference opportunities for local surgeons. These partnership activities have been done in conjunction with several funding sources and sponsors including governmental and non-governmental organizations (see acknowledgements).

3.4.1 Equipment—The equipment donated was designated primarily for surgery in neonates and infants. Several trays with fine pediatric instruments were provided. However, because of the inability to sterilize instruments between cases, the lack of a dedicated pediatric operative nursing team, and organizational challenges, these instruments are not reliably available for all procedures. Needle-point cautery tips and fine absorbable sutures were provided. In addition, a muscle stimulator was obtained to aid in the identification of the muscle sphincter complex during anorectoplasty procedures. Lone-star retractors (Cooper Surgical, Inc.; Trumbull, CT) were introduced to facilitate exposure during pull through procedures for Hirschsprung's disease. Hegar dilators were donated to aid in anal dilations during post-operative follow up. In collaboration with Mending Kids International, an electric-power dermatome was donated to assist with skin harvesting in the management of complex burns; however, because of limited capacity to sterilize equipment between cases, the dermatome can only be utilized once daily. Furthermore, there is a limited supply of dermatome blades, which require frequent replacement. In addition, the quality of the skin meshing devices is poor, and there is no means to replace the meshing plates.

Wireless internet access was established and maintained in the pediatric wing of the hospital after internet access was introduced to the hospital by the Medical Education Partnership Initiative in collaboration with the University of California – San Diego. A computer was also donated to provide a resource for sharing of digital textbooks, videos, presentations, and references.

3.4.2 Educational Material—Many of the textbooks available in the medical school and surgical libraries were out of date. Therefore, several hardcover and online textbooks and surgical atlases were donated including: Spitz' Operative Pediatric Surgery, Coran's Pediatric Surgery, Ashcraft's Pediatric Surgery, Pediatric Surgery – A Comprehensive Textbook for Africa, and textbooks in pediatric urology. In addition, visiting surgeons left copies of power point slides on a myriad of pediatric surgery topics.

3.4.3 Proctoring—Based on our analysis of the spectrum of diagnosis and operative case volume, we tried to focus our visits on the management of prevalent diseases and corresponding procedures: anorectoplasty, pull-through for Hirschsprung's disease, hypospadias repair, and burn care. Over 10 American surgeon-visits of one to two weeks duration were made to Maputo to proctor one or both of the local general pediatric surgeons over the course of two years. The visiting American surgeons assisted with complex cases and provided suggestions, taking into consideration local conditions and resources. Pre-

operative management of Hirschsprung's disease with rectal washouts was introduced, and rectal washouts are now routinely carried out by nursing staff. In the operating rooms, the routine utilization of muscle stimulators for anorectal malformations and lone-star retractors for Hirschsprung's disease were adopted.

3.4.4 Training—In order to improve knowledge and expertise in colorectal disorders (including anorectal malformations and Hirschsprung's disease), both surgeons participated in the Colorectal Courses (one in Cincinnati, 2011 and one in Cape Town, 2013). One of the surgeons participated in an Advanced Trauma and Life Support class at Loma Linda Hospital in California and a Pediatric Urology Course at Red Cross War Memorial Children's Hospital in Cape Town. Another participated in a Burn Advanced Life Support Course at the University of California, San Diego. In addition, both surgeons had the opportunity to visit the U.S. for at least one month and observe clinical practice and educational training at children's hospitals in Southern California (e.g. Mattel Children's Hospital, Children's Hospital Los Angeles, and Rady Children's Hospital – San Diego).

3.4.5 Research/Conference Opportunities—Local surgeons had the opportunity to present partnership activities and research projects at international and regional meetings including the Pan African Pediatric Surgical Association Meeting (2012) and the Pacific Coast Surgical Association (2013). The partnership has resulted in several joint projects and publications, which have been presented locally and abroad, including the evaluation of perioperative transfusion practices, and the evaluation of socioeconomic and cultural factors associated with pediatric burn injuries.[5-7]

4. Discussion

This review highlights the spectrum of disease and operative case volume of a referral center for general pediatric surgery in Sub-Saharan Africa, and it provides a context for academic partnership activities to facilitate training and improve the quality of pediatric general surgical care in limited-resource settings. The model for the partnership has been to work within the resource-constrained environment. Rather than focus on short-term missions alone, we sought to provide career development opportunities for participants through the sharing of educational resources, provision of sustainable equipment, attendance of workshops and conferences, bilateral exchanges, local proctoring/mentoring, and engagement in joint research projects. Furthermore, our pediatric surgical partnership benefits from being part of a larger pediatric partnership that enables capacity-building and quality improvement projects across the spectrum of children's health services.

The challenges faced in Mozambique are similar to those seen in other Sub-Saharan African countries, including limited facilities, a lack of human resources, and late presentation of disease due to poor healthcare outreach and low health literacy.[8] The spectrum of disease in the pediatric general surgery ward reflects findings in other similar contexts, with injuries, congenital anomalies, and surgical infections accounting for approximately 90% of pediatric surgical admissions.[9,10] Within the category of injuries, burns account for nearly one quarter of all admissions to the general pediatric surgery ward. The majority of burns on the general pediatric surgery ward are from scald injuries,[7] and the majority occur in infants and

toddlers. Surgery was rarely performed even in patients with documented deep 2nd degree and 3rd degree burns. The limited operative block time and inadequate instrumentation may account for the high rates of non-operative management. Our partnership has expanded to include surgical missions sponsored by Mending Kids International to help introduce techniques and wound care for burn management. Additionally, traumatic injuries other than burn injuries accounted for 14% of the admissions. No formal adult or pediatric trauma system exists due to resource shortage. Efforts are being made to establish a trauma registry and a pre-hospital transport system, and to improve training in the delivery of trauma care.

The most common congenital anomalies requiring surgical repair were inguinal hernias and hydroceles followed by anorectal malformations. Because many patients with colorectal disorders, including anorectal malformation and Hirschsprung's disease, can be temporized in the district hospitals with a colostomy by general surgeons and non-physician surgeons (*tecnicos*), there is an opportunity to transfer patients for definitive repair. In response to the high incidence of colorectal disorders, many of our partnership activities have focused on providing equipment, training workshops, and on-site proctoring in the management of anorectal malformations and Hirschsprung's disease.

Despite being the major referral hospital for the country, Hospital Central Maputo had a relatively low number of index neonatal cases. This may be more a reflection of the limited capacity for neonatal transport, anesthesia, nutritional support, and intensive care.[11] These factors likely contribute to late presentation and high neonatal mortality rates.[12] Improvements are being made in the nursery to improve care, including the introduction of parenteral nutrition and neonatal ventilators and an increase in the number of neonatal providers. Our academic partnership includes activities to facilitate training in neonatal and pediatric advanced life support, as well as neonatal resuscitation and intensive care.

In addition to the improvements being made in perioperative care, we are looking to support the improvement of several other pediatric services. Efforts are being made to improve infection control practices with education of health-care providers on handwashing and utilization of recently installed alcohol dispensers throughout the hospital. There is a shortage of radiologists and technologists, and there is no dedicated pediatric radiologist. As contrast agents and fluoroscopy are not available pre-operatively, diagnostic work up for neonatal bowel obstruction is limited and fluoroscopic reduction is not performed for intussusception. Efforts are being made to improve training in interpretation of plain radiographs and sonography. Interventional services and conscious sedation are not readily available; therefore, percutaneous procedures are also unavailable. From a pathology standpoint, frozen sections are not readily available or reliable; therefore, diverting colostomy for Hirschsprung's disease is generally preferred to confirm a functional level. Oncologic therapies are limited as tunneled central venous catheters and radiation therapy are not available. Nonetheless, some cases of Wilms' tumor cases can be successfully treated. Ancillary service providers including nurses, dietitians, physical and occupational therapists, and wound-care specialists are not routinely available.

There are many limitations to this study. Discharge diagnosis and operative case volume data were derived retrospectively from handwritten logbooks that often had missing data or

entries that were illegible or difficult to interpret. The data on complications including wound infections and mortality were limited and could not be reported. Furthermore, we do not report on admissions to the pediatric intensive care unit or nursery, where some of the operative patients were managed either pre- or post-operatively. There is a goal to improve peri-operative outcomes with improved record keeping. This study and future ones will hopefully help to identify areas to initiate quality improvement projects.

The goal of our partnership has been to improve training and delivery of pediatric surgical care. It is our intent that the Hospital Central Maputo will continue to serve as a training site for providers throughout the country. It is estimated that there are just over 116 Mozambican and expatriate surgical providers working in Mozambique, of which one third are general surgeons. Complementing this limited work force are an estimated 63 non-physician surgeons (*tecnicos*). Currently, there are only 2 native pediatric general surgeons in the country; therefore, they must provide guidance for the initial management and referral of complex pediatric surgical cases. Along these lines, providers will need to be able to provide initial care in the management of congenital disorders not routinely managed by the general pediatric surgery service, including cleft lips/palates, hydrocephalus, spinal dysraphism, and other disorders that are not routinely managed by the general pediatric surgery service.

There is a great effort by the Mozambican government with the assistance of foreign aid to expand the health care workforce and infrastructure. Along these lines, new medical and nursing schools have opened and are increasing the output of health care providers. There is hope to expand the existing infrastructure to include dedicated pediatric operating room facilities that are adjacent to the children's wing, thus avoiding transport and facilitating better communication between anesthesiologists, pediatricians, surgeons, intensivists, and nurses. In the developed world, these luxuries are often taken for granted. First and foremost, however, is a goal to help develop the careers of the local providers, to keep them engaged, and to avoid brain drain. The Portuguese language has been a relative barrier to physicians leaving the country. However, many providers have sought employment from non-governmental organizations where they can earn more income and have better benefits.[13] Our hope is that by providing contextually-appropriate mentorship, career-development, and research opportunities, the partnership will keep its participants engaged and continue to improve the training and delivery of pediatric surgical care.

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Table 1

Ward Admission Diagnosis for General Pediatric Surgery Service (Year 2012).

Discharge Diagnosis	Number (%)	Age in Years	Length of Stay	% From Outside Province
		Median (IQR)	Median (IQR)	
TOTAL	1153 (100%)	3 (1.3, 8)	3 (2,6)	7%
Burns	274 (24%)	2.2 (1.2, 5)	4 (2, 7)	4%
Infection (Abscess, Pyomyositis, Cellulitis, etc.)	189 (16%)	4 (1.3, 9)	3 (1, 6)	1%
Hernia and Hydrocele	177 (15%)	3 (1.8, 7)	2 (2, 2)	1%
Trauma	156 (14%)	7 (3, 10)	3 (1, 6)	4%
Colorectal Disease (Megacolon & Anorectal Malformation)	86 (7%)	0.9 (0.3, 4)	12 (2, 36)	36%
Urologic (Cryptorchism, Hypospadias, etc.)	39 (3%)	5 (3, 9)	2 (2, 4)	11%
Neoplasms (Benign and Malignant)	31 (3%)	4 (1.1, 7)	2 (2, 9)	13%
Appendicitis	26 (2%)	9 (7, 11)	5 (2, 7)	0%
Other	109 (9%)	3 (0.6, 7)	4 (2, 10)	17%
Unspecified	66 (6%)	2 (0,9)	2 (1,20)	13%

Table 2

Operative Case Volume for General Pediatric Surgery Service (Years 2012).

Operation Category	Number	Urgent Cases	Age - Years	% Male	% From Outside Province
	No. (% Total)	No. (% Category)	Median (IQR)		
TOTAL	625 (100%)	190 (30%)	3 (1, 8)	71%	40%
Hernia Repair (Umbilical, Inguinal, Hydrocele)	182 (29%)	11 (6%)	3 (2, 7)	82%	25%
Colorectal Procedures (Anorectal Malformation & Hirschsprung's)	95 (15%)	19 (20%)	0.7 (0.08, 3)	65%	51%
Tumor Biopsy / Resection	56 (9%)	6 (11%)	4 (1.2, 8)	54%	30%
Urologic Procedures (Orchidopexy, Circumcision, Ambiguous Sex)	39 (6%)	1 (3%)	4 (2, 8)	97%	18%
Appendectomy	36 (6%)	36 (100%)	10 (8, 12)	49%	61%
Trauma Procedure (Laparotomy, Fasciotomy, Amputation)	32 (5%)	31 (97%)	9.5 (5, 11)	69%	66%
Closure of Colostomy	30 (5%)	0 (0%)	1.0 (0.6, 3)	70%	27%
Incision & Drainage or Abdominal Washout	26 (4%)	24 (92%)	6 (3, 9.3)	77%	54%
Burn Procedure (Biopsy, Debridement, Graft)	25 (4%)	1 (4%)	4 (3, 6)	52%	48%
Reoperation (Wound Closure, Dilation, Revision)	25 (4%)	19 (76%)	1.6 (0.8, 9)	83%	68%
Intussusception Procedure (Reduction or Resection)	18 (3%)	18 (100%)	0.5 (0.3, 1.2)	65%	72%
Repair of Congenital Hernia or Atresia in Neonate	14 (2%)	11 (79%)	0.01 (0.01, 0.05)	50%	57%
Alcohol Injection Sclerosis for Rectal Prolapse	13 (2%)	0 (0%)	4 (3, 6)	85%	15%
Pyloromyotomy	4 (1%)	3 (75%)	0.1 (0.1, 1.3)	75%	50%
Other	15 (2%)	8 (53%)	1.0 (0.5, 11)	47%	47%
Unspecified	15 (2%)	2 (13%)	2.5 (0.6, 7)	79%	40%