ORIGINAL RESEARCH

# Assessment of the impact of the new paediatric surgery unit and the COSECSA training programme at Mbarara Hospital, Uganda

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## Abstract

### Background
This study aimed to assess the impact of a new pediatric surgical unit (PSU) established upcountry in a unique way in a government hospital with a non-governmental organization as the main stakeholder. The unit is run by one pediatric surgeon trained through COSECSA. It is the second PSU in the country. This PSU brought pediatric surgical services and training closer to the Mbarara community.

### Methods
The study was conducted at Mbarara regional referral hospital (MRRH). It was a cross-sectional mixed design study. For the qualitative arm, Key Informant interviews were done with the main stakeholders who established the PSU. Impact on training was assessed using a questionnaire to former postgraduate trainees (Alumni). Quantitative arm assessed number of surgeries by a historical audit of hospital operating room registers comparing volume of surgeries before and after the establishment of the unit.

### Results
Six main stakeholders were interviewed and confirmed that collaborations between the Government and private partners are feasible and sustainable. The number of pediatric surgeries nearly tripled after the establishment of the pediatric surgical department. Patients no longer had to travel to the capital city to access services. A total 2,732 pediatric surgical operations were performed within the 8 years of our evaluation. Of these, 736 (26·9%) was performed four years before the unit was established and 1,996 (73·1%) were performed after PSU establishment.

Overall, alumni that rotated in Mbarara had higher ratings than those in Mulago PSU on all aspects of the rotation, that is teaching, theatre hand-on-experience, mentorship, and skills attained (p=0.0028).

### Conclusions
The pediatric surgical unit has contributed significantly to patient care and postgraduate medical education in Mbarara. This kind of model is sustainable and can be replicated.

**Keywords:** impact, training, paediatric surgery unit, outcomes, COSECSA, Uganda

## Introduction

There is growing evidence that childhood surgical conditions, especially injuries, are common in developing countries and that poor care results in significant numbers of deaths and cases of disability. Unfortunately, surgical care is not considered an essential component of most child health programs(1).

The urgent need for surgical care in the world's poorest regions is widely unrecognized. In 2010, an estimated 16·9 million lives (32·9% of all deaths worldwide) were lost from conditions needing surgical care(2). This figure well surpassed the number of deaths from HIV/AIDS (1·46 million), tuberculosis (1·20 million), and malaria (1·17 million) combined(3). For long-term impact and capacity building, investment in training local providers, funding for clinical training, and equipment procurement must be prioritized over short-term delivery of clinical care by visiting surgeons(4).

Progress in improving Uganda's surgical system has been slow(5), and the public hospital system does not meet Lancet commission on global surgery (LCoGS) targets for surgical access, workforce, or surgical volume(6). Substantial deficits in access to surgical care, human resources, service delivery, infrastructure, equipment, and supplies limit the provision of essential and life-saving surgical care(7,8).

In addition to provider shortages, the surgical workforce is maldistributed with more than 90% of physician providers concentrated in Kampala, despite the country's population being predominantly rural, creating tremendous challenges in accessing surgical care in many parts of the country(5).

Mbarara Regional Referral Hospital(MRRH) is the main referral hospital in Southwestern Uganda serving 10 districts that include; Mbarara, Bushenyi, Isingiro, Sheema, Ibanda, Kiruhura, Buhweju, Rubirizi, Mitooma and Ntungamo. MRRH pediatric surgical unit(PSU) serves as the nearest referral centre since it is still the only pediatric surgical unit outside the capital city.

The Western region has a population of approximately 8 million people with children less than 18 constituting about 60 percent (NIRA, Uganda). Before this unit was set up all patients with complex pediatric surgical conditions had to travel to the capital city to access pediatric surgical services.

The pediatric surgery unit at Mbarara Regional Referral Hospital was established in 2014 through a tripartite partnership with the hospital, local university and a Non-Governmental organization(BethanhKids). COSECSA provided a platform for training and certifying a pediatric surgeon locally. The recruitment of a pediatric surgeon was a major landmark in the process.

BethanyKids is a Christian non-governmental organization which was founded in 2001 at AIC (Africa Inland Church) Kijabe hospital in Kenya. It has since expanded to other countries. It has mission of transforming lives of African children with surgical conditions and disabilities through pediatric surgery, rehabilitation, public education, spiritual ministry and training health professionals. The pediatric surgeon at MRRH met the director of BethanyKids during his training at Kijabe Hospital, his conversation with him about the huge unmet need for pediatric surgical services in Uganda prompted the beginning of this collaboration.

The partnership between the PSU at the regional referral hospital and the university medical school all located and serving a predominantly rural setting is unique. The setting acts as a basis to provide lessons for other hospitals and medical schools elsewhere in Uganda and sub-Saharan Africa for establishing a PSU.

## Methods

We conducted a cross-sectional mixed design study. It involved both qualitative and quantitative arms.

The study was conducted at Mbarara Regional Referral Teaching Hospital in Mbarara district. The study population included stakeholders, former postgraduate trainees that had qualified as surgeons, historical audit of OR records.

Data collection on the processes involved in setting up Mbarara PSU, was done by in-depth interviews with all the relevant stakeholders . The objective on impact on medical education and training was achieved by interviewing surgeons who trained at MRRH before and after the establishment of the PSU, we gathered their experiences, using a self-administered online survey questionnaire designed using google forms and with a link delivered through email. .

For volumes of surgeries, we reviewed hospital records four years before and after the establishment of the unit. A data capture tool was developed including variables on type of surgery performed, surgical condition, year of surgery and demographic data of these children.

### Qualitative data management and analysis

This was performed so as to describe the process and experiences of establishing the pediatric surgical unit at Mbarara hospital. In this, we transcribed the data from records made during interviews and summarized it in a table. An electronic survey was be used for the postgraduate trainees this automatically generates generated a dataset that was downloaded for analysis in an Excel format.

### Quantitative data management and analysis

The filled data capture forms from the review of medical records were checked for completeness prior to data entry. Data was entered in a database designed in Epi-Info software version 7·2, with incorporated appropriate edit checks and data validation procedures. Independently, both datasets were imported into STATA version 13·0 for analysis. Descriptive statistics, that is, mean/median for continuous variables and proportions for categorical variables were generated.

### Ethical considerations

We obtained informed consent from the study participants. In the consent form, we mentioned that data collected will remain confidential and at no time will names of participants be revealed. Participants were identified by their study numbers or ID. We obtained approval from the Mbarara University Research Ethics Committee, the hospital administration and the Uganda National Council of Science and Technology.

## Results

### Processes involved in setting up the PSU

The feedback from six main stakeholders who were involved in the setting up of the PSU is summarized in the table 1 below. The questions were around the proposal, processes, funding, challenges and their roles in the project. The stakeholders were as listed below;

1. Director BethanyKids Africa
2. Mbarara Regional Referral Hospital (MRRH) Director
3. Dean Mbarara University Faculty Of Medicine

**Table 1.** Summary of feedback from six main stake holders who were involved in the setting up of the PSU

| Designation/ Activity | Private Partner-Bethany-Kids | Ped surgeon | Hosp Director-MRRH | Dean, Medical School-MUST | HOD –Surgery | Principal Nursing Officer |
|---|---|---|---|---|---|---|
| **Role(s)** | Director for Africa, contact person for BK, attended all meetings, participated in drafting the MoU. | PS.(Clinical head). Led the needs assessment process and participate in Drafting the MoU. | Administrative role as the HD. Participated in MoU. Attended all meetings. | Dean FOM. Faculty senior administrator. Represented the Univ. Involved with discussions. Drafted MoU. Implementation of the program/PG training. | HOD Surg. | Incharge pediatrics. Acting SPNO |
| **Proposal** | Met with PS in Kenya. Visited many sites in UG. Mbarara best choice. PS wrote proposal to BK and was approved. Hosp and Univ also approved proposal. | Came up with the proposal, approached BK. Local surgeon best to serve local population. BK wanted to support this. Proposal approved with no resistance. | All peds cases would be referred, welcomed the proposal but was worried about pay of PS. | Proposal presented to them by PS. Also met the BK team. Univ welcomed the proposal. | Several meetings held. Mostly to discuss OR and ward space. | Was glad to have a ped surgery Unit. Hated how adults and babies were being mixed up. |
| **MoU** | Several meetings. MoU btn Univ,Hosp and BK. Each had roles. | Drafted it, shared with the partners. Each partner had their contributions. | Took time. Legal opinion sought. Things were easier when BK accepted to pay PS. Hosp to provide theater, ward space and supplies. | Univ responsibility, provide acc, incorporate PS into Univ staff eventually. PS to train Univ students. | Involved in discussions. Univ given the mandate to absorb PS. | Three – party protocol, hospital has honoured its part. |
| **Logistics/ Procurement** | Availed all supplies and labour for renovation of the old theater. | No new equipment . Used available ones and renovated the old one including beds. A friend donated 2000CAD | Hosp was happy to give what was available eg old scrap beds. | Used already existing equipment and buildings. | Most assets were improvised using existing building(old theater, beds) | Used existing assets mostly, main activity was renovation and partitioning, done by BK. |
| **Human resource** | PS, Chaplain | Depended mainly on volunteer staff. Started with no dedicated nurse. | Hosp provided nurses. | Residents to participate in clinical care. | Nurses from Hosp, others private by PS arrangemen. | Hosp started by giving one nurse. Has been adding slowly , now 6. |

*Continued*

4. Head of Department Surgery (MUST)
5. Pediatric surgeon
6. Head nurse MRRH

## Impact on training

These were basically all the trainees that had gone through a Pediatric surgical rotation during their postgraduate training. There was only one non-responder. They participated in the online assessment of their experiences during their rotations. Of these, 12 had rotated at the PSU of MRRH, while 4 had rotated in Mulago.

**Table 1.** Continued

| Designation/ Activity | Private Partner-Bethany-Kids | Ped surgeon | Hosp Director-MRRH | Dean, Medical School-MUST | HOD – Surgery | Principal Nursing Officer |
|---|---|---|---|---|---|---|
| **Supplies** | No. | Friends, Partners like Bethanykids, Archie Foundation, Hosp | Hosp/ NMS,normal stockouts. | Hosp. | Hosp and donations. | NMS (general osp requisition) |
| **Cost** | USD 50,000/year | Shared in kind by the 3 partners. | Provided in kind. | No monetary contributions made. | - | Doesn't know the details. |
| **Challenges** | MoU not respected, Univ hadn't absorbed the PS by the time of this study. No OR specific for Peds. | Skeptism to partner with a Govt facility, Ped surgical services may not be sustainable | NMS no budget for specific Ped supplies. Shortage of HR. Govt stockouts, ltd budget. | No specialized nurses. | Expert HR | HR. Shortage of funds. Overwhelming patient numbers. |
| **Impact on training** | | Undergrads, graduate stud, nursing students . Only Ped surg training in Western UG | It's a one stop training center for Ped surgery. | Great Impact. Residents no longer had to commute to Mulago. | Very big impact. University now saving millions of money that used to be spent to send residents to Mulago. Mbarara can now train quality PSs. | Nursing students from both Govt and Private institutions are rotating in this unit. |
| **Comments** | Proud that the unit is training more PSs | Through continuous other collaborations gets supplies, camps, Fellow, research. If no COSECSA, no surgeon nor Fellow. | Train more experts especially ped anaesthesia. | Surprised that Univ hasn't yet absorbed the PS. | MoH to incorporate PS post at RR hosp. Ped surgeons to form a society for advocacy. Mbarara hosp to be used as a model to show need for Pedsurg services. **Ped surgery to have a mission.** | Hosp started by giving one nurse. Has been adding slowly , now 6. Hosp needs another PS. |

BK- BethanyKids, PS- ped Surgeon, OR - operating room, Univ - University, Hosp- hospital, ltd -limited. FOM -faculty of medicine. Govt- Government. HR – human resource. SPNO – Senior Principle Nursing Officer.

## Rating of experiences during PSU rotations

***Overall rating*** - Participants were asked to rate their experiences during rotation on PSU using a scale of 0-10, where 0= poor and 10= excellent. Overall, all former postgraduate students that participated in this survey gave an excellent rating of their experiences during rotations on PSU (mean 8.25±1.39, Range [6-10]). The mean ratings were 8.3±1.50

**Table 2.** Reasons for the alumni rating of their experiences during rotation at PSU

| Reason | MRRH PSU (N=12) | Mulago PSU (N=4) |
|---|---|---|
| Good Student-consultant in-teraction | 2 | 0 |
| Established pediatric unit | 0 | 1 |
| Diverse exposure | 1 | 2 |
| Poor orientation | 1 | 0 |
| Pediatric services availabil-ity | 2 | 0 |
| Limited exposure | 4 | 1 (33.3) |

**Table 3.** Ratings of the key components of the Alumni rotation on PSU by hospital type

| Components of the rotation at PSU | MRRH PSU (n=12) | Mulago PSU (n=4) | P value |
|---|---|---|---|
| **Teaching rating** | | | |
| Mean±SD | 8.9±1.08 | 7.8±1.26 | 0.0936 |
| [Range] | [7-10] | [6-9] | |
| **Theatre hands-on experience** | | | |
| Mean±SD | 8.3±1.37 | 5.5±1.29 | 0.0028 |
| [Range] | [6-10] | [4-7] | |
| **Mentorship** | | | |
| Mean±SD | 8.9±1.37 | 7.5±0.58 | 0.0701 |
| [Range] | [6-10] | [7-8] | |
| **Skills attained** | | | |
| Mean±SD | 8.3±1.22 | 7.3±1.71 | 0.2159 |
| [Range] | [6-10] | [5-9] | |

and 8±1.15, for alumni experiences at MRRH and Mulago PSU respectively, with no significant differences, p=0.6927. See table 2.

### *Specific ratings of the Key aspects of the rotation of Alumni by place of PSU*

Overall, Alumni that rotated in Mbarara, had higher ratings than those in Mulago PSU, on all aspects of the rotation that is teaching, theatre hands-on-experience, mentorship, and skills attained. Notably, in the area of theatre hands-on experience, alumni of PSU in MRRH had significantly higher ratings than those for Mulago PSU, p=0.0028. See Table 3.

***Benefits from the rotation*** - 9/10 and 3/3 Alumni students that rotated at the MRRH and Mulago respectively, reported having benefitted.

**Table 4.** Challenges faced during rotation at PSU

| Characteristic | Pediatric Surgical Rotation Unit | |
|---|---|---|
| | MRRH, (n=12) | MULAGO (n=4) |
| **Challenges during rotation** | | |
| Stock-out problems | 2 | 0 |
| Accommodation problem | 0 | 2 |
| Delays to complete | 0 | 1 |
| Specialists deficit | 2 | 0 |
| Short duration of rotation | 5 | 1 |
| Theatre space inadequate | 3 | 0 |
| Study versus Exam schedule problems | 1 | 0 |

***Considering a career in pediatric surgery*** - 9/10 and 1/3 Alumni students that rotated at the MRRH and Mulago respectively, reported that they would consider that career.

***Room for improvement*** - Some of the proposed areas of improvements mentioned by trainees at the Mbarara surgical unit included adequate human resource (mainly pediatric surgeons and nurses), more space and beds, consistent and adequate supplies, electronic record keeping.

### Trends in volume of pediatric procedures (Figure 1)

Overall number of pediatric operations between 2009 and 2017 = 2732

Period before PSU = 736 (26.9%), period after PSU = 1,996 (73.1%)

### Characteristics of Children undergoing surgery before and after the establishment of the PSU

Overall mean age was 3.9 years and male to female ratio was 2:1. Before the PSU total number of male babies were 490(66.6%), females 246(33.4%). After the PSU male babies were 1344(67.3%) and female 652(32.7%). The mean age of children operated, was significantly lower (3·7 years) after PSU as compared to before (4·5 years), p<0·001. No significant gender disparity was noted among children operated before or after PSU installation, p=0·708.

## Discussion

The success of the Mbarara Teaching hospital pediatric surgery unit cannot be denied. Its benefits to the community are clear. This also depicts the role of COSECSA in this region. So far COSECSA has certified 3 pediatric surgeons in

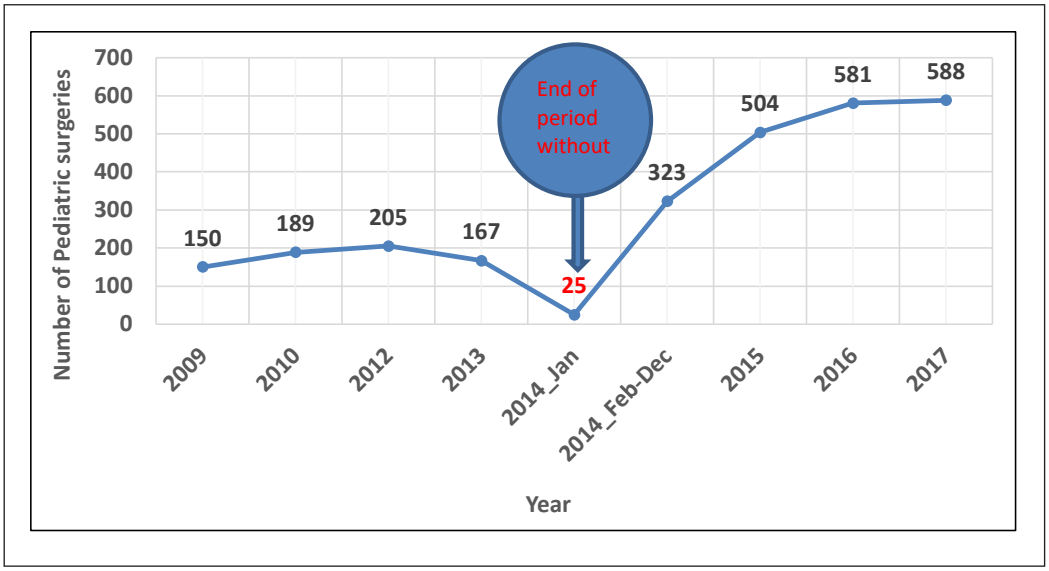


**Figure 1.** Trends in the volume of pediatric patients that have undergone surgery before and after the establishment of the pediatric surgical unit at Mbarara regional referral hospital

Uganda. Two are currently in training and will be certified in December 2019.

## Processes involved

The recruitment of a pediatric surgeon was a major landmark in the process emphasizing the importance of skilled human resource. The presence of a university and hospital provided a suitable environment to teach and transfer skills to the next generation. BethanyKids, a Christian based non-governmental organization (NGO) provided the needed support for kick-starting the process. The model of an NGO working with two public institutions is a good example of a private-public partnership that can be adapted to bridge the gap in health systems in developing countries. The process involved setting a clear agenda for each partner and a common long term goal. It also looked at sustainability by ensuring that the pediatric surgeon is absorbed into the public institution eventually. This kind of arrangement has already been shown to be successful (10).

Mbarara regional referral hospital had a surgical department where pediatric patients were being worked on by the general surgeons and admitted to the adult general ward. When the idea was put forth to the administration about private partners willing to collaborate with the hospital to establish a pediatric surgical unit, the idea was well received. The memorandum of understanding was signed. The hospital provided space (the old operating theater). It allocated nurses to work in the unit and also provided supplies. Renovations and partitioning of the ward were funded by BethanyKids. It was also responsible for the enumeration of the surgeon. Archie foundation (Kids OR) later stepped in and built a standard of the art operating room.

This is an example that can easily be adopted in our setting to improve service delivery in our health systems including all other surgical disciplines. This kind of arrangement already exists on the medical side and has proved to be a success in HIV and malaria. However, this particular one is unique because it was initiated by an indigenous surgeon who was trained and certified by a local body and then brought different partners together. In addition using available resources to start a novel project.

## Trends in procedures

We looked at surgeries over 8 years, 4 before the pediatric surgery service i.e. 2009, 2010, 2012 and 2013 (2011 was excluded due to more than 50% of missing data) and 4 years after i.e. 2014, 2015, 2016 and 2017. The volume of surgery tripled and complex operations were being performed once the pediatric surgical service was operational. A total 2,732 pediatric surgical operations were performed within the 8 years of our evaluation. Of these, 736 (26·9%) and 1,996 (73·1%) were performed before and after PSU establishment respectively. Index operations were previously all being referred to Mulago hospital for surgery mainly Pullthroughs for Hirschsprung's disease and anorectal malformations, esophageal atresias, nephrectomies for Wilms' tumor, urology procedures including hypospadias and posterior urethral valves. The most common minor operations were hernia repairs and colostomies. Major operations were Posterior Sagittal Anorectoplasies(PSARPs) for anorectal malformations (60%) and nephrectomies for Wilms tumor (35%). The impact of bringing a service nearer to the population is clear in this scenario. It has remained a big challenge to get super specialists out of the capital cities in developing countries for many obvious reasons, financial, social amenities, lack of anesthesia providers and intensive care units. However, this scenario clearly shows that some of these barriers can be overcome through partnerships with clear agendas outlined in MOUs.

## Training

This is one of the greatest successes of the service second to patient care. All postgraduate students in the Master's training(MMed) program for general surgery must have a couple of months in the unit for pediatric surgery training. Before the establishment of the pediatric surgery service, surgical residents were required to travel to Mulago teaching hospital for their pediatric rotation at a cost of about USD1333 per student. This was an extra cost that was eliminated once the pediatric surgery unit started operating locally. Again this demonstrates clearly that although it may appear expensive in relocating superspecialized services out of the City Centre, the benefits numerous including training the next generation and proximity of essential services to the community. This kind of sustainability can be afforded in low income countries.

## Limitations

### *Missing records*

Large discrepancy in resident numbers in Mulago Vs Mbarara to give a statistical significance.

The hospital does not have an electronic database; data had to be collected from hardcopy books in the records office. Some pages were found missing, the book containing pages from June 2011 to Dec 2011 could not be traced, and therefore we did not include the year 2011. Hence the four years before establishing PSU included 2009, 2010, 2012 and 2013.

# Conclusions

The PSU has had a significant impact on the clinical care of patients and training and hence has contributed to community development in Mbarara.

The successes of the PSU at Mbarara Regional Referral Hospital can be used as a foundation to replicate the same in other COSECSA regions.

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