

Bringing Specialist Paediatric Surgical Care to the Doorstep in Rural Ghana: A Mobile Paediatric Surgery Clinic

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Abstract

Background: The contribution of paediatric surgical conditions to the total burden of disease in low- and middle-income countries (LMICs) has recently been highlighted and it is widely agreed that solutions are needed to provide access to safe and affordable surgery for these children. **Materials and Methods:** We present a simple, cost-effective model that brings paediatric surgery to the doorstep of remote areas and uses the existing health system structure in its entirety to fulfil patients' needs. Mobile clinic teams whose members are integrated staff in affiliated mission hospitals reach out daily on a rotational basis to 10 health posts. The team receives continuous paediatric surgery education from a paediatric surgeon to diagnose and treat simple cases. **Results:** The catchment area of the Gye Nyame Mobile Clinic includes 832,984 inhabitants. From 2008 to 2019, 4362 children visited the mobile clinic with a median age of 4.41 years. Totally 4142 (95.0%) children could be treated in the health post, 150 (3.4%) children were taken to the affiliated missionary hospitals, 55 (1.3%) needed a third-level facility and 15 (0.3%) were taken to the traditional healers by the family. The common paediatric surgical diagnosis on outreach was deep soft-tissue infection/skin lesion for surgical treatment (672/23.8% children), followed by abdominal wall hernia/abdominal wall malformation (586/20.8% children) and gastrointestinal conditions (521/18.5%). **Conclusion:** This model of paediatric surgery mobile clinic includes capacity-building, task-sharing, outreach and proven 12-year sustainability. We recommend this model for paediatric surgery care in remote areas of LMIC's.

Keywords: Low- and middle - income countries, mobile paediatric-surgery clinic, LMIC, mobile clinic

INTRODUCTION

In May 2015, the World Health Assembly passed a unanimous resolution calling for 'strengthening of emergency and essential surgical care including the provision of anaesthesia as a component of universal health coverage'.^[1] This shift in the burden of disease to non-communicable diseases presents an opportunity to raise awareness and funding for surgical capacity since cancer, trauma and aspects of patient safety are increasingly becoming public health concerns and do involve significant amounts of surgical input.

While there is a global consensus on the need to strengthen surgical care in low and middle-income countries (LMIC's),^[2] little has changed in terms of access to surgery for people in remote areas. In fact, the volume of surgery has increased

globally between 2004 and 2012, and wide disparities persist between rich and poor countries.^[3]

Paediatric surgery, as a subspecialty of surgery serving the fragile, dependent and vulnerable subjects in our society, even more so in sub-Saharan Africa, only recently received attention in its existence due to organisations such as Global Initiative for Children's Surgery (GICS),^[4] Kids or^[5] and assessment in Somaliland, Northern Ghana and other LMIC's.^[6-8] Almost 2 billion children worldwide do not have access to surgery and there are more deaths in children from injuries than malaria, tuberculosis and HIV combined.^[4]

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What are the solutions and approaches to the long-existing problem of lack of care in paediatric surgery in remote areas in LMIC's? The Lancet Commission on Global Surgery^[9] in its 'Global Surgery 2030' report points out the importance of government action (e.g., National Surgery, Obstetrics and Anaesthesia Plans) and these should include children as emphasised by a group of West African paediatric surgeons in 2010^[10] and recently by GICS.^[4] A second solution approach is presented by the various charitable platforms of surgery delivered in LMIC's using a capacity-building theme rather than short-term missions.^[11,12]

We present a simple, low-cost and sustainable solution in capacity-building at primary and secondary level facilities by bringing a specialist paediatric surgical workforce to the doorstep of remote areas.

MATERIALS AND METHODS

In this descriptive study, we collected demographic data of those children aged from 1 day to 18 years that visited the Gye Nyame professional mobile clinic in Paediatric Surgery from the 1st of November 2008 to the 31st of October 2019 in the 10 health posts of the Ashanti Region of Ghana [Figure 1].

The mobile clinic consists of a team of four professionals, namely a paediatric surgeon, nurse, ward assistant, pharmacist, and in addition, a trained paediatric surgical medical assistant. The team reaches out daily with basic medications and paediatric surgical care sets to one of the ten health posts. These sets include sterilised surgical instruments for small surgical procedures (like incision and drainage of an abscess), wound dressing material and disinfecting agents. The mobile clinic vehicle is a simple 4 × 4 jeep that is the only hope to pass the muddy ways in the rainy season.

The health posts are either central villages without medical staff, small health huts with a midwife or primary health centres with a medical assistant and a nurse. The health posts are deliberately chosen to be <2, 5 h away from the affiliated missionary hospitals to return to the hospital on the same day.

The team reaches out on a rotation basis to the health posts to have a regular follow-up. The outreach team diagnoses and treats the children ideally in the health centre, in villages in the yard of the chief's house or under mango trees with shadow. The rotation period varies from 2 to 4 weeks, depending on the local need and/or the presence of a primary health worker (nurse/midwife/medical assistant). Small procedures such as incision and drainage of abscess, wound treatment, burn bandages and all operations under local anaesthesia are performed during outreach and major cases are taken to the mission hospitals and treated in the operating theatre.

In the operating theatre of the mission hospitals, the elective paediatric operations are performed once a week and emergency operation can be performed 24/7 as house officers and young surgeons/gynaecologists are taught five procedures in paediatric surgery (hernia operation, emergency laparotomy, bowel resection with anastomosis, simple enterotomy, appendectomy). Those cover approximately 80% of all surgeries in children. All children above 5 years are managed independently by the general surgeon unless complexity demands otherwise or those under 5 years of age. All health posts, the mission hospitals and the team members are connected directly to a paediatric surgeon for children's surgical consultations and a coordinator that connects on demand to every specialist in the sub region.

Follow-up post-operatively is done by the mobile clinic team that feedback to the surgeon. The team coordinator constantly

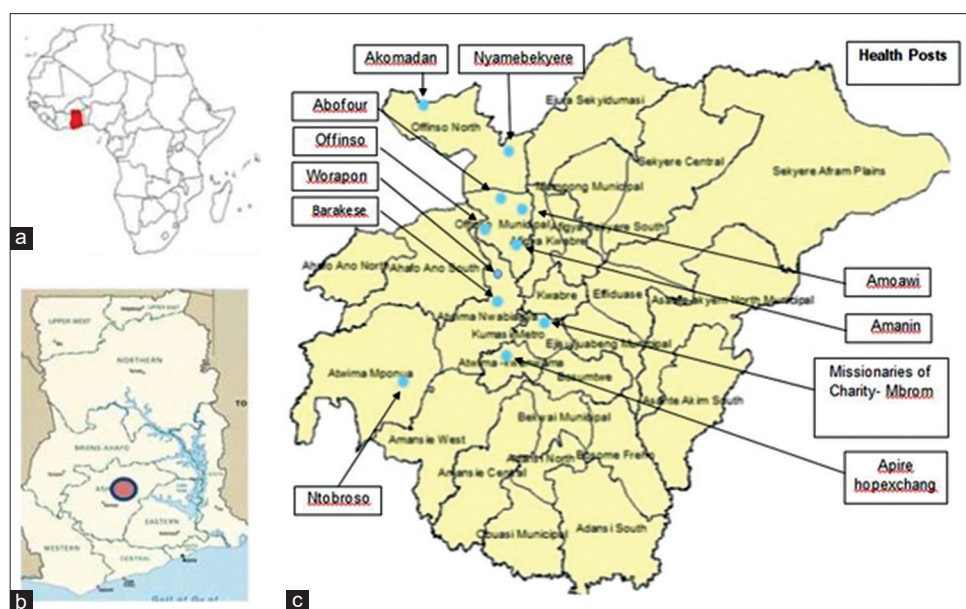


Figure 1: Map showing activity of the Gye Nyame Clinic. (a) Map of Africa showing Ghana. (b) Map of Ghana marking the Ashanti region. (c) Map of the Ashanti region marking the 10 health posts

collects contacts of paediatric surgical and non-surgical colleagues, including services of Non-governmental Organisations (NGO's) and governmental facilities in the region (other specialists and diagnostic and operative services). Diagnostics are referred to the closest facility.

Paediatric surgery consultations in this setting are paid for by the National Health Insurance Scheme (NHIS) in Ghana, the outreach costs are covered by the hospitals, operations and hospitalisations are largely paid for by NHIS or paid in cash. Patients without valid health insurance are advised if possible to renew their NHIS before operation to lower household costs.

Until 2007, the university hospital in Kumasi was the only referral centre for all paediatric surgery cases from Kumasi City as well as for all the Ashanti Region with 5,792,200 inhabitants.^[13] Since 2007, a substantial workload has been shifted to our mission hospital. The outreach and operation programmes are currently an inherent part of the mission hospitals and run on local expenses with local teams and leaders.

RESULTS

Health outpost activity

The catchment area of the Gye Nyame Mobile Clinic includes 832,984 inhabitants [Table 1]. The data of the 1st year at the outreach from 1st November 2007 to 31st October 2008 was lost. From the 1st of November 2008 to 31st October 2019, a total 4624 patients were seen by the mobile clinic, with documentation available for 4620 patients. Though a mobile children's surgical clinic, adult patients or children with medical conditions were not turned away. For the purposes of this study, the 258 patients over 18 years of age were excluded from the analysis. Of the total of 4362 children, 2507 (58%) had at least one paediatric surgical condition and 1855 (42%) children were found to have a paediatric medical diagnosis. There were a total of 2822 diagnoses made in paediatric surgery as some children had more than one condition. There were 1978 females and 2384 males with a median age of 4.41 years who visited the clinic. Neonates represented 156 (3.6%) of all

the patients, 386 (8.8%) were between 1 and 6 months of age, 608 (13.9%) were aged >6 months to 1 year, 1953 (44.8%) between 1 and 5 years, 788 (18.1%) aged >5–10 years and 471 (10.8%) patients >10–18 years of age [Table 2].

Of the total 4362 children, 4142 (95.0%) children could be treated in the health post, 150 (3.4%) children were taken to the affiliated missionary hospitals, 55 (1.3%) had to be taken to a third level facility for further care and 15 (0.3%) were taken to the traditional healers by the family. Repeat visits to the mobile clinic were made by 2978 (68.2%) of all paediatric patients.

The common paediatric surgical diagnosis on outreach were deep soft-tissue infection/skin lesion for surgical treatment (672 children/23.8%), followed by abdominal wall hernia/abdominal wall malformation (586 children/20.8%). Five hundred and twenty-one (521/18.5%) children presented with a suspected gastrointestinal malformation or a gastrointestinal condition with complicated bowel infection taking the lead. Genital and urological malformation were seen in 297 children (10.5%) [Table 3]. Sixty-one (2.4%) children were followed up postoperatively during the mobile clinic outreach and 17 cases of post-operative complication were diagnosed at this follow-up. Five children had a reoperation in the mission hospitals due to complications that was diagnosed at outreach. Of the children treated in the outreach, 3673 (84.1%) had NHIS and therefore had most of the treatment and medication without further payment.

Mission hospital activity

In the two mission hospitals linked to the Gye Nyame Mobile clinic, namely the St Patrick's Mission Hospital and Hopexchange Hospital, 1593 operations in 1524 children were performed under general anaesthesia in the theatre. Three hundred and ninety-six operations were emergency operations (33%). The main urgent procedures remain incarcerated inguinal hernia repair and laparotomy for gastrointestinal perforation due to typhoid fever. Elective operations made up 67% of all operations and over 70% of children operated in both missionary hospitals were male. Major operations performed in the neonatal period in the

Table 1: Catchment area of the Gye Nyame Mobile Clinic in Paediatric Surgery (Ghana Statistics 2010)

Health post	District	Number of inhabitants
Abofour	Offinso Municipality	93,058
Akomadan	Offinso North	69,790
Amanin	Offinso Municipality	93,058
Amoawi	Offinso Municipality	93,058
Apire hopexchange	Atwima Kwanwoma	110,503
Barakese	Atwima Nwabiagya	180,296
Missionaries of Charity-Mbrom	Kumasi Metropolitan subdistrict Manhyia - Tafo	(2,105,382) divided by 9 subdistricts Estimated 233,931
Ntobroso	Atwima Mponua	145,406
Nyamebekyere	Offinso North	69,790
Offinso	Offinso Municipality	93,058
Worapong	Atwima Nwabiagya	180,296
Total		832,984

Table 2: Age distribution Gye Nyame Mobile Clinic 2008 till 2019

Age	Number of children (%)
Newborn (birth-1 month)	156 (3.6)
>1-6 months	386 (8.8)
>6 months-1 years	608 (13.9)
>1 years-5 years	1953 (44.8)
>5 years-10 years	788 (18.1)
>10 years-18 years	471 (10.8)
Total	4362 (100)

Table 3: Diagnosis in paediatric surgery-Gye Nyame Mobile Clinic in Paediatric Surgery

Diagnosis	Number of conditions (%)
Skin and deep soft-tissue infection	672 (23.81)
Abdominal wall hernia/abdominal wall malformation	586 (20.77)
Gastrointestinal surgical conditions	521 (18.46)
Urogenital malformations	297 (10.52)
Abdominal distension/pain	186 (6.59)
Ear, nose, throat conditions for surgical evaluation	85 (3.01)
Tumour evaluation	47 (1.67)
Ophthalmological condition for surgery	42 (1.49)
Neurosurgical disease	38 (1.35)
Trauma	33 (1.17)
Congenital orthopaedic conditions for surgery	30 (1.06)
Ano-rectal conditions	26 (0.92)
Cardiac defect for surgical evaluation	22 (0.78)
Newborn surgical condition	17 (0.60)
Congenital lung and respiratory conditions for surgical intervention	17 (0.60)
Suspected hepatobiliary malformation	11 (0.39)
Surgical haematological condition	2 (0.07)
Unclear surgical diagnosis	97 (3.43)
Minor conditions not requiring surgery	93 (3.31)
Total	2822 (100)

2822 diagnosis

2507 children

missionary hospital were two repairs of omphalocele. Without surprise, the most common performed operation was the repair of inguinal hernia.

The cost of the paediatric surgery mobile clinic for the 1st year 2007 was 54,739.24 USD. By 2017 the clinic spent 334,830.44 USD on operating costs with an average annual expense of 126,824.52 USD.

DISCUSSION

Gye Nyame Professional Mobile Clinic in paediatric surgery was established in 2007 to provide specialist medical services to 51% of the population in Ghana that live in remote areas and have extreme difficulties in reaching a referral institution due to lack of affordability or lack of infrastructure. The mobile

clinic was born out of the experience of a general practitioner from a high-income country that worked for 10 years in two different missionary hospitals in the Ashanti Region in Ghana and realised that basic medical care is present, but that the public health care system could not provide adequate, timely, affordable and close specialist health services.

The true incidence of paediatric surgical disease in the Ashanti catchment area has never been assessed and can solely be estimated at 10%–85%.^[14-17] Before 2007, children <8 years of age at the mission hospitals did not get either elective or emergency operation in case of need. These patients were immediately referred to the next tertiary hospital 2 h away by car on a rough road. According to the field experience of the clinic staff, the vast majority of children and babies with paediatric surgical conditions did not even leave the village in their lifetime to get appropriate care. The introduction of the clinic from the mission hospitals to 10 health posts has shown tertiary services to the doorstep of this population. Over the past 10 years, 4362 children received tertiary level input with 58% needing surgical care. Children with medical problems were not excluded from visiting the mobile service as to avoid providing preferential treatment to the children of this region. Adult who visited the clinic despite the paediatric nature of the clinic were also not turned away but redirected to the best local facility.

The striking gap between demand and provider capacity makes task sharing and task shifting a reasonable and feasible solution for this setting. The Gye Nyame model has shown that a single specialist from a mobile clinic is able to cover over 832,984 inhabitants, 60% of them estimated to be children <18 years, by networking and communicating with trained professional and allied staff based at mission hospitals. This has been achieved by training general surgeons and house officers in the most common and feasible emergency procedures, giving medical assistants and nurses the tools to assess a child, treat if in their ability and/or refer personally to the right level treatment facility and/or refer directly by mobile clinic vehicle to a paediatric surgeon, regular local supervision of task sharers to ensure the maintenance of skills and competencies and regular public education sessions by the medical assistants/nurses during health posts visits to waiting patients and families.

Capacity building has recently shown feasibility and positive outcomes in resource-constrained settings.^[18] Kaseje *et al.*^[18] established a successful programme in Haiti by increasing the human resources for paediatric surgical care. In this study, capacity building at primary and secondary levels was addressed by having the mobile paediatric surgery clinic at the patient's doorstep and ultimately reducing the congestion of patients at a tertiary level facility.

The affiliation of the Gye Nyame Professional Mobile Clinic to a mission hospitals allows for teaching house officers on rotation to manage 5 paediatric surgery standard procedures, namely hernias, appendectomy, emergency laparotomy, bowel resection and anastomosis and enterostomies. This

covered around 80% of all emergencies and is therefore highly effective in reducing morbidity and mortality from late presentations. This mobile clinic model further enhanced the capacity building programme by training nurses in paediatric surgery emergencies and common malformations, training the medical assistant (although not formally permitted to operate) to diagnose orthopaedic, neurosurgical and general paediatric surgical emergencies and common diseases.

The paediatric mobile clinic model provides a comprehensive pathway for children with health needs. The outreach local team at the health posts is connected to the mobile clinic and forms an integral part of the permanent staff in the mission hospital, thus bringing emergency cases from the village for hospitalisation or specialist care. As the team is trained in paediatric surgery, the chain of transportation and communication is not interrupted until the patient's ultimate and final destination is reached. Direct patient advantages include a close connection through public health worker to the nearest health facility, regular visits of hospital-trained staff, personal interactivity with the team, fast reply to emergencies and post hospitalisation follow-up as long as needed. The mobile clinic vehicle on many occasions doubles up as an ambulance thus, children at the outreach post can access health care easily and timely to avoid delayed presentations and the morbidity attached to it. This pathway connects the health-care provider to the patient's families and to the second and third level facility professionals.

The question of funding cannot escape any programme. The Gye Nyame clinic started as an isolated outreach project in paediatric surgery that was funded by a high-income NGO, turned naturally into a self-sufficient integrated mission hospital department. As the health insurance funds earned by the outreach project are paid (even though sometimes late) by the government back to the mission hospitals, this money is invested in keeping the outreach running (e.g., fuel, car repairs, etc.). The concept of community insurance has been recommended to the community who are presently in discussion regarding the implementation of this concept.

Health-care programme are not without their challenges. As a basic prerequisite an informed and bilateral collaboration with the local stakeholders (chiefs, queen mothers, elders, clergywomen/men and traditional authorities) is indispensable. A basic lack of this collaboration can lead to fundamental misunderstandings and comprise the target work. The financial burden to the family in need of healthcare without social security or welfare system is an ongoing problem, and this cycle needs to be broken. Furthermore, the lack of awareness that surgical conditions in children are treatable and the general lack of care for the paediatric population in the remote areas lead to often advanced pathologies or comorbidities.

The need of outreach in paediatric surgery is increasingly acknowledged among professionals in LMIC's and optional models are discussed.^[19-24] The Gye Nyame Professional Mobile Clinic in paediatric surgery has expanded and shared

its knowledge to other regions in the world through GICS, namely, Nigeria, and the Pacific islands and furthermore wish to expand the outreach programme into remote neighbouring areas in Ghana with the aim to reach out to Liberia and Sierra Leone in the near future.

CONCLUSION

This study describes the development of a Paediatric Surgery Mobile Clinic in the remote areas of Ghana into a comprehensive Paediatric Surgery Public Health programme. The integration of this programme into the mission hospital justifies working close to existing structures and connecting the village patients in this catchment area to the best possible level of care. This model confirms that tertiary level services to the patient's doorstep are possible.

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Conflicts of interest

There are no conflicts of interest.

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