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ORIGINAL SCIENTIFIC REPORT

A Retrospective One-Year Estimation of the Volume and Nature of Surgical and Anaesthetic Services Delivered to the Populations of the Fako Division of the South-West Region of Cameroon: An Urgent Call for Action

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Abstract

Background Surgery-related conditions account for the majority of admissions in primary referral hospitals in Sub-Saharan Africa. The role of surgery in the reduction of global disease burden is well recognized, but there is a great qualitative and quantitative disparity in the delivery of surgical and anaesthetic services between countries. This study aims at estimating the nature and volume of surgery delivered in an entire administrative division of Cameroon.

Methods In this retrospective survey conducted during the year 2013, we used a standard tool to analyse the infrastructure and human resources involved in the delivery of surgical and anaesthetic services in the Fako division in the south-west region of Cameroon. We also estimated the nature and volume of surgical services as a rate per catchment population.

Results Public, private and mission hospital contributed equally to the delivery of surgical services in the Fako. For every 100,000 people, there were <5 operative rooms. A total of 2460 surgical interventions were performed by 2.2 surgeons, 1.1 gynaecologists and 0.3 anaesthetists. These surgical interventions consisted mostly of minor and emergency procedures. Neurosurgery, paediatric, thoracic and endocrine surgery were almost non-existent.

Conclusions The volume of surgery delivered in the Fako is far below the minimum rates required to meet up with the most basic requirements of the populations. It is likely that most of these surgical needs are left unattended. A community-based assessment of unmet surgical needs is necessary to accurately estimate the magnitude of the problem and guide surgical capacity improvements.

Introduction

The global burden of conditions potentially correctable by surgery is currently estimated to be 28–32 % [1–3]. Although the role of surgical services delivery in the reduction of disease burden has been established [4, 5], approximately 5 billion human beings currently still have no access to timely surgical care [1, 3]. There is a great qualitative and quantitative disparity in the delivery of surgical services between various countries and sometimes within the same country, and the burden of surgical conditions is known to disproportionately affect low- and middle-income countries (LMICs) [1, 6, 7]. The disparity observed is generally related to differences in availability of human resources, inadequate/inappropriate infrastructure and equipment, poor health information system and limited financial resources for health in a context of a near-absent social security system amongst other factors [8–15]. Consequently, it is suspected that the nature and volume of surgical and anaesthetic services offered in Sub-Saharan

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African countries are generally below the real needs [7, 11, 16]. According to the World Health Organization (WHO), death and disability can be greatly reduced in LMICs by timely basic surgical interventions such as caesarean sections, burn care or surgical treatment of fractures [2]. Data on the delivery of surgical services remain, however, scarce, and policies are mainly based on rough national estimates [8]. It is important to precisely estimate and analyse the specific situations and needs of individual countries. Without such estimates, it is difficult to optimize and tailor resources and interventions at the country level. In its 2015 core report, the Lancet Commission of Global Health has identified 6 surgical indicators for surgical system strengthening. These indicators include timely access to surgical services, availability of specialized workforce and surgical volume among others [3]. This study aimed at providing a comprehensive estimation of nature and volume of surgical and anaesthetic services offered to the population of an entire division of the south-west region of Cameroon. More specifically, we intended to propose a description of the characteristics of health institutions involved in the delivery of surgical services in the Fako division, analyse the strength of staff involved in delivering these services and estimate the volume of surgical and anaesthetic services offered per catchment population. The ultimate goal is to provide decision makers with information necessary for the planning of surgical care in terms of training, deployment of human resources and infrastructural development.

Methodology

Study design and setting

This retrospective survey covering the year 2013 (01st January 2013–31st December 2013) was carried out in the Fako division in the south-west region of Cameroon. This is a middle-income country located in central and western Africa with a gross domestic product per capita of 1328.64 us dollars. In 2013, the population was estimated at 22.25 million people with a life expectancy of 54.59 years (2013 World Bank estimate). The country is administratively divided into ten regions. The health centres constitute the portal of entry into the health care delivery system with the district hospitals as the primary referral level, the Regional hospitals the secondary referral and the National hospitals (national referral general hospitals, Central hospitals, University teaching hospitals) as tertiary referral level. There is no social health security system in Cameroon, and health insurance is almost non-existent. A fee-based system allows medical facilities to charge fees for services and treatment, with household financing for health care mostly done through out of pocket payment.

A map of the south-west region of Cameroon is shown in Fig. 2. Fako is one of the six divisions of the region and is located in the extreme south. Its total population was estimated at 527,525 people in 2013. The city of Buea located in the Fako is the administrative capital of the region (Fig. 1).

Data collection

This study was conducted according to principles of the Helsinki Declaration, and an ethical approval was obtained from the Institutional Review Board of the University of Buea. All administrative authorizations were obtained from the Regional Delegation of Public Health for the south-west region. We developed a data collection tool ("Annex") largely inspired by the PIPES tool used by Surgeons Overseas (SOSAS) and already validated for the assessment of delivery of surgical services in countries with similar characteristics [17, 18]. The tool was modified to meet with our objectives. This modified tool included data on the characteristics of the health facility, qualitative and quantitative estimation of human resources involved in delivery of surgical services within the facility and the nature and number of surgical and anaesthetic interventions carried out in the facility all through the year 2013.

The survey was conducted between 01st and 31st December 2014. With the collaboration of the Regional Delegation of Public Health in the south-west, we identified all health facilities in the Fako which delivered surgical and anaesthetic services during the year 2013. We then contacted the heads of these facilities by phone to schedule an appointment.

During each visit, after signing an informed consent form, the head of the institution was interviewed for data on characteristics of the institution and on information concerning human resources. We then reviewed all post-operative report documents for the number and type of surgical and anaesthetic procedures carried out during the study period. Every surgical procedure which had lasted 2 h or more and/or during which a natural cavity was explored and/or for which an hospitalization of at least 24 h was prescribed was recorded as a major procedure. All surgical procedures performed without any planning was recorded as an emergency procedure.

Data analysis and reporting

All data were entered in an MS excel (Microsoft Excel 2010, Microsoft corporation®) spread sheet and analysed using STATA 10 (STATA corps, Texas, USA). The STROBE guidelines were used in reporting this analysis [19].

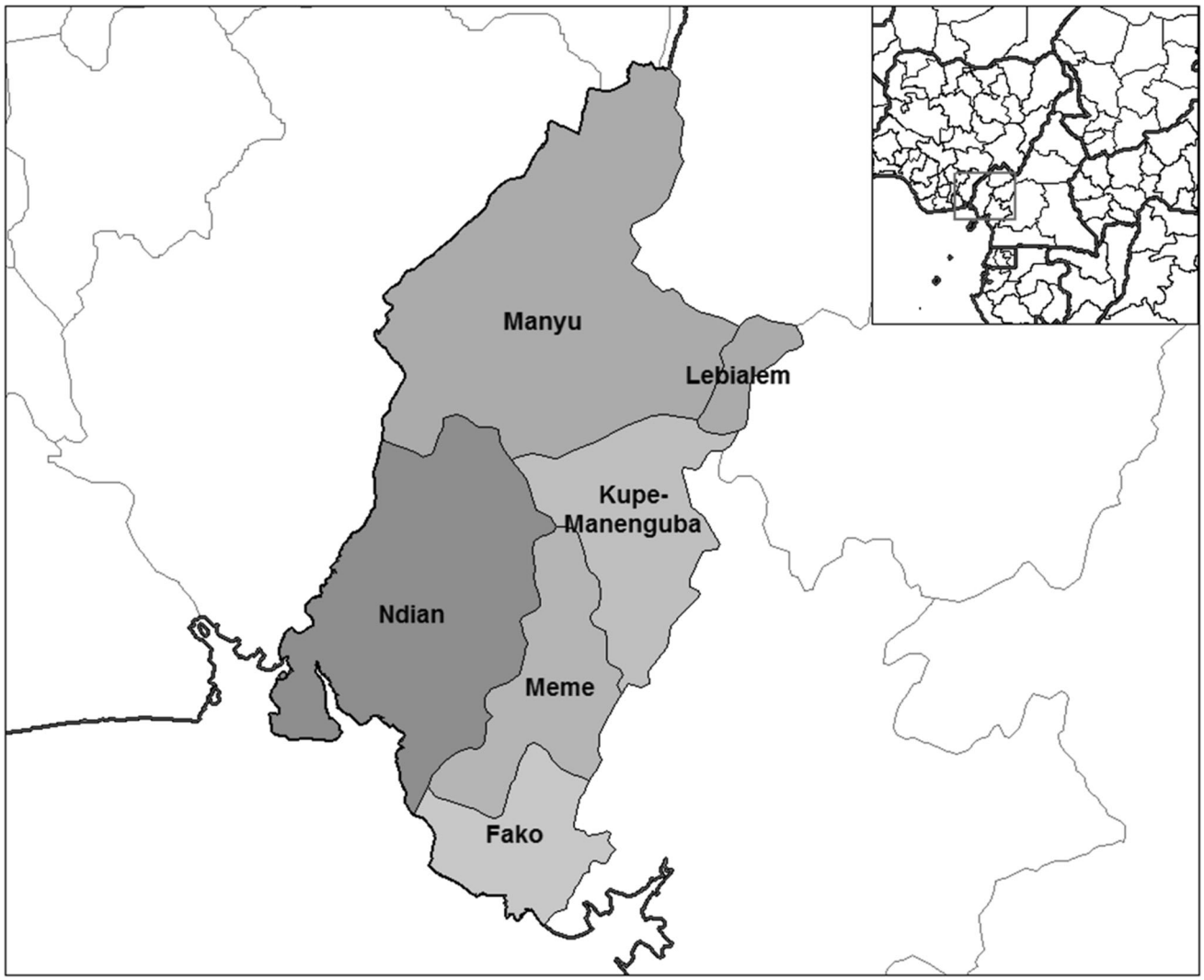

Fig. 1 Map of the south-west region of Cameroon showing the location of the Fako division

Results

Infrastructure and human resources

A total of 19 health institutions which delivered surgical and/or anaesthetic services during the year 2013 were identified. From among these, 18 responded favourably to our request and were visited. These included 7 public hospitals, 7 private clinics, 3 mission hospitals and 1 corporate hospital. Table 1 summarizes the contribution of various types of hospital facilities to the work load in terms of infrastructure and human resources. The participating hospitals summed up a total 1274 admission beds and 26 operation rooms for a total catchment population of 527,525 people. This gave a ratio of 4.93 operation rooms for 100,000 people. The total number of admissions for the study period was 38,521 (7302/100,000 catchment population per year). There were 2.27 surgeons and 0.38 anaesthetic doctors available per 100,000 people during the study period.

Table 1 Infrastructure and human resources in hospitals contributing to the management of surgical cases in the Fako Division of the south-west Cameroon

Item analysed	Public hospitals	Private clinics	Mission hospitals	Corporate hospitals	Total	Rate per 100,000 population
Characteristics of institutions						
Number of institutions	7	7	3	1	18	3.41
Number of beds	620	234	261	159	1274	241.5
Number of operation rooms	10	9	5	2	26	4.93
Number of overall admissions for 2013	20,324	5662	6313	6222	38,521	7302
Human resources (involved in surgical or anaesthetic activities)						
Number of surgeons	5	1	5	1	12	2.27
Number of gynaecologists	4	1	0	1	6	1.14
Number of GP	10	11	5	3	29	5.5
Number of anaesthetists doctors	2	0	0	0	2	0.38
Number of anaesthetists (nurses)	7	2	5	3	17	3.22

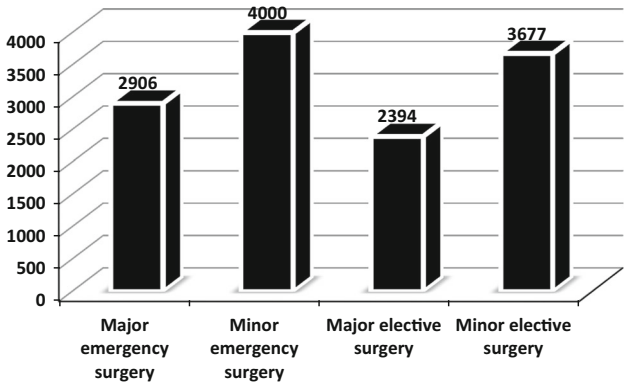

Fig. 2 Distribution of surgical operations performed in the Fako division according to the timing (emergency vs elective) and type (major vs minor)

Global surgical volume

A total of 12,977 procedures were carried out in these hospitals in 2013, giving a rate of 2460 operations/100,000 catchment population. As shown in Fig. 2, these procedures were most frequently minor procedures (59.2 %), often performed as an emergency. Figure 3 indicates the contribution of each type of institution in the total surgical workload and shows comparable contribution from public, private and mission hospitals.

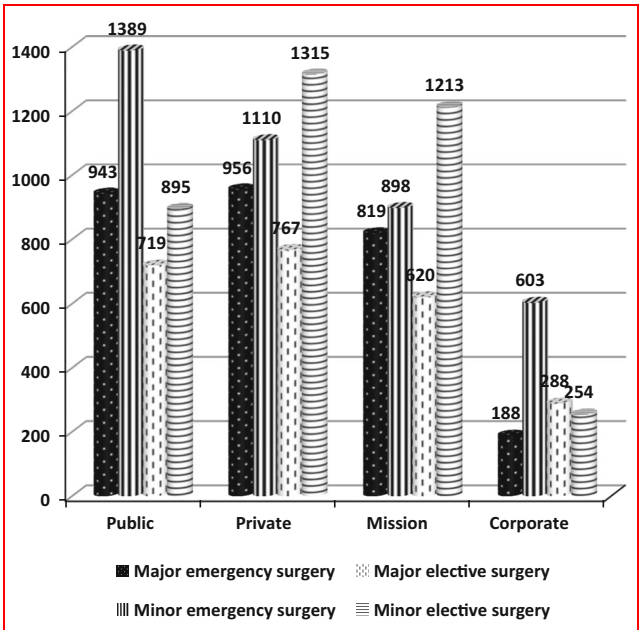

Fig. 3 Relative contribution of different types of institutions to the surgical workload in the Fako Division

The caesarean section rate as a ratio of total operations is often used as a proxy indicator for assessing surgical capacity and comparing the adequacy of surgical care between high- and low-income countries [20]. The total number of caesarean deliveries in our study was 1195. This

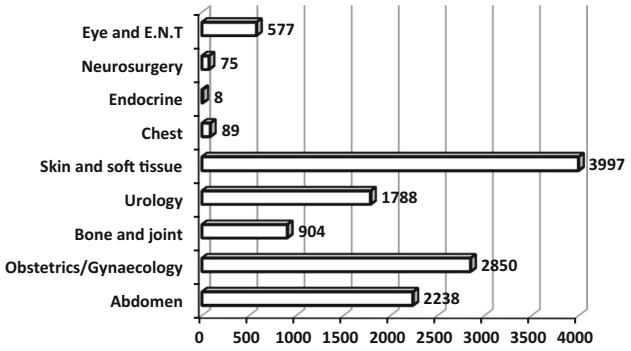

Fig. 4 Distribution of surgical operations performed in the Fako division in 2013 according to the system involved

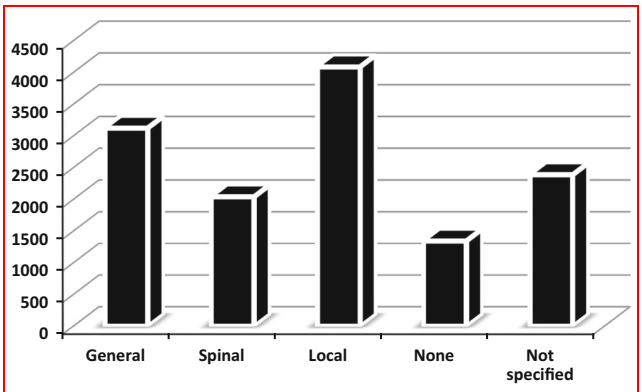

Fig. 5 Distribution of cases of surgery in Fako division according to type of anaesthesia administered

represented a rate of 226.5/100,000 catchment population and 9.2 % of the total number of operations performed.

Types of procedures performed

Figure 4 analyses the surgical interventions performed according to the system or anatomical area of the body involved. Surgery in Fako was most frequently performed on skin and soft tissue. Most procedures recorded under urology were ritual circumcisions which represented 77.5 % of all procedures recorded under this system. Neurosurgery, thoracic and endocrine surgery represented 0.6, 0.7 and 0.06 % of the total number of procedures, respectively.

The type of anaesthesia performed was indicated for 10,592 (81.6 %) patients. As shown in Fig. 5, local anaesthesia was the most commonly performed anaesthetic procedure (38.6 %) and it appeared that 12.7 % of patients underwent surgery without any anaesthesia.

Listed in Table 2 are the ten most commonly performed operations identified in Fako division. As shown in this table, the 3 most common surgical procedures represented by wound suture, appendectomies and caesarean sections summed up to 3840 representing 29.6 % of all surgical interventions.

Table 2 Frequency of the ten most commonly performed surgical operation performed in the Fako division in 2013

Type of surgical operation	Number of times performed	Percentage of total number
Hernia repair	1235	9.5
Appendectomy	840	6.5
Incision and drainage of abscess	808	6.2
Caesarean section	1195	9.2
Debridement	906	7
Ectopic pregnancy	124	1
Dilatation and curettage	586	4.5
Resection of mass	272	2.1
Myomectomy	262	2
Wound suture	1410	10.9
Total	7638	58.9

Discussion

Surgery-related conditions account for the majority of admissions, especially in primary referral hospitals in Sub-Saharan Africa [21].

This study is the first in Cameroon to propose a comprehensive estimation of surgical and anaesthetic services delivered in an entire administrative area of the country. Concerning the infrastructure, 19 health institutions in Fako propose surgery-related services and there are <5 operation rooms available for 100,000 people. The overall volume of surgical services delivered to the populations of the Fako division is estimated at 2460 surgical interventions per 100,000 people, most of which are minor procedures. According to available estimates, the expected number of procedures expected to meet up with the surgical needs per year is above 6000 [7, 16]. The caesarean section rate is as low as 9.2 % of all procedures as compared to 5–15 % often recommended by WHO [20]. These surgical services are delivered by 2.7 surgeons, 1.1 gynaecologists and 0.3 anaesthetists per 100,000 people. The Lancet Commission currently proposes a minimum of 20–40 surgeons/100,000 population. Consequently, general practitioners and anaesthetic nurses are heavily involved in the delivery of these specialized services. In Fako, public hospitals, private clinics and mission hospitals seem to contribute equally. Some specific surgical activities such as neurosurgery, thoracic and endocrine surgery are almost non-existent and notably significant proportion of surgical interventions is probably performed without any anaesthesia.

However, this report carries a number of limitations. It is likely that some institutions which actually carry out surgical activities in an unofficial background, especially health centres and some small-size private institutions were not included in the survey, with the likelihood that the volume of surgical services might have been consequently underestimated. It is well known that the reporting of surgical and other health care related activities is generally poor in Sub-Saharan and this contributes to the underestimation mentioned above [8, 22]. Also, it is questionable how generalizable our results are as major disparities have been previously reported between countries and sometimes within the same country [6, 14, 22–24].

The global volume of surgery and anaesthesia delivered in the Fako is about one-third of what has been estimated as necessary to address the health problems which are potentially curable by timely surgical intervention [7, 16]. When compared with available data from other LMICs, especially from Sub-Saharan Africa, although the literature on global surgical delivery is extremely scarce, available reports generally indicate a low surgical output at various rates [11, 25–29]. It has been estimated that <7 % of the global volume of surgery was performed in very low health expenditure countries which account for 37 % of the world's population, while 60 % of the surgical volume took place in the high-expenditure countries which account for only 18 % of the world's population [1]. Though caesarean section is often one of the most frequently performed surgical procedures, when used as an indicator of surgical delivery, its rate is still alarmingly low in many LMICs [11, 25, 27, 29, 30]. Also, the scope of surgical procedures performed is usually narrow and limited to emergency and life-saving procedures [11, 13, 25, 29, 31]. Up to 75 % of operations are usually performed as an emergency [13, 23, 25], and major surgery hardly exceeds 40 % of the overall surgical output [11, 32]. It has been reported that many health institutions at the district level in Sub-Saharan Africa were still not able to carry out the most basic surgical procedures such as hernia repair, appendectomy or a laparotomy [5, 15, 31]. On the other hand, the volume of specific surgical services such as orthopaedic surgery, neurosurgery, thoracic surgery and paediatric surgery is persistently reported as dangerously low [11, 27, 33–35]. In Cameroon, it has recently been shown that district hospitals are not equipped to provide basic life-saving procedures to injury victims in compliance with WHO guidelines [36].

One of the possible reasons to this low output is probably the major infrastructural failure described in most African countries despite recent minor improvements [4, 37]. The number of functioning operating rooms per catchment population usually fluctuates between 0.2 and <5 per 100,000 people [13, 24, 29]. This is probably why in some countries part of the workload is left to private and mission hospitals which sometimes display a better potential than governmental structures in terms of infrastructure, human resources and management [30, 38]. In our

report, 3 mission hospitals could perform as well as 7 public hospitals in terms of volume of surgical services.

The second possible reason for this low surgical output is the total absence of a mechanism of financing the most basic surgical needs even in the context of extreme emergency. Affordability had been clearly identified as one of the major barriers to delivery of surgical services in Sub-Saharan African countries [28, 39–41].

The third possible reason is a major workforce crisis which has been reported in numerous LMICs [10, 12, 13, 15, 23, 24, 26, 42]. In a systematic review, Hoyler et al. estimated that across LMICs, general surgeon density ranged from 0.13 to 1.57 per 100,000 population, obstetrician density ranged from 0.042 to 12.5 per 100,000, and anaesthesiologist density ranged from 0 to 4.9 per 100,000 [8]. There is also a major disparity in terms of human resources between countries and sometimes within the same country, and the available trained health care providers usually work in large cities and referral hospitals [9–11, 24]. Consequently, surgical and anaesthetic services in the most remote areas tend to be delivered by unqualified staff with possible consequences on the quality of health care delivered [24, 42, 43]. This situation raises the need to discuss the possibility of officially shifting the performance of some selected surgical and anaesthetic procedures on non-medical personnel and reorganizing the training of health workers towards this objective. This must be particularly considered for anaesthesia as it is well known that anaesthetic interventions are often performed by nurses even at the regional or referral level [11, 24, 42–45]. Also, this problem could also be strategically addressed by encouraging the redeployment of available human resources towards rural areas through improvement of working conditions (technical settings, accommodation, remuneration, etc.).

Based on the above analysis, it can be accurately predicted that a large volume of the most basic surgical conditions in the Fako actually remains unattended. In a similar setting, it was recently estimated that up to 25 % of conditions potentially correctable by surgery are not taken care of and their contribution to death in households could be as high as 25 % [46, 47]. If hernia, the most frequently reported surgical condition in the world, is used as an example, it is estimated that 85 % of hernia cases in LMICs are not taken care of for various reasons [48]. It is also known that a significant fraction of these unattended surgical needs concern the musculoskeletal system, head and neck and paediatric surgery [33, 42, 49].

Conclusion

There is a major infrastructural failure in terms of number and quality of institutions delivering surgical and anaesthetic services, and the existing structures are probably underutilized. There is also a major workforce crisis, especially in the most remote areas where surgery and anaesthesia are often practiced by non-qualified health care providers. Consequently, most health conditions potentially correctable by surgery probably remain unattended.

The extent to which the overall low surgical and anaesthetic output in the Fako translate into unmet needs for services can only be estimated by a community-based assessment. In Cameroon in general, there is an acute need for systematically collected data at the national level to accurately and precisely estimate the real availability and effective utilization of infrastructure, the global volume of surgical and anaesthetic services delivered, the real workforce and the exact situation of surgery and anaesthesia health care providers. Further urgent research efforts should be directed towards obtaining these data. This would be in straight line with the Lancet Commission on Global Surgery—Global Indicator Initiative (LCoGS-GII) and the WHO global surgical workforce database. In the meantime, an improved utilization of existing infrastructure is possible by addressing some of the obstacle to the delivery of surgical and anaesthetic services. An urgent measure to achieve this goal would be the immediate implementation of a universal health insurance system. Measures to encourage the redeployment of existing qualified staff are also likely to rapidly improve the surgical output.

Acknowledgments The authors are extremely grateful to the directors and chief executive of all hospitals and health institutions who accepted to contribute to this important survey.

Annex

ASSESSMENT OF SURGICAL CAPACITIES OF HEALTH FACILITIES IN THE FAKO DIVISION

DATA COLLECTION TOOL.

I – Characteristics of Health institution	
Name of institution (in caps)	
Health district	1 = Buea
	2 = Limbe 3 = Tiko 4 -=Muyuka
Municipality (in caps)	
Type of setting	1 = Urban 2 = Rural
Type of institution	1 = Public 2 = Mission 3 = Private clinic 4 = Corporate 5 = other (specify)
If public institution, level (I, II, III, IV, or V)	1 = Level III (Regional) 2 = Level IV(district) 3 = Level V (below district)
Catchment population (number of people living in the health district)	
Total number of beds	
Number of beds in the surgical ward (s)	
Number of operation rooms	
Total number of admissions for the year 2013 (between 01st January and 31st December).	

Human Resources Characteristics	
Type of human resource:	**Number available:**
Surgeons (if specialized, please indicate sub-specialty)	
Obstetricians/Gynaecologists	
Anaesthetist (medical doctor)	
General practitioners (involved in operative surgery)	
Other medical officers (specify)	
Anaesthetic nurses	
Who performs surgery in your institution?	1 = Surgeon 2 = General practitioner 3 = Nurse 4 = Other (specify)
Who administers anaesthesia in your institution? (Doctor anaesthetist, General practitioner, anaesthetic nurse, non-	1 = Doctor anaesthetist 2 = General practitioner

specialized nurse, other)	3 = anaesthetist nurse 4 = Non specialized nurse 5 = Other (specify)

Surgical procedures performed in the hospital between 01st January and 31st December 2013 (please kindly include all procedures performed in the emergency departments, the main operation room and the maternity. Also mark with "E" if procedure performed as emergency). Please, use the empty spaces for surgical procedures which are not listed.

Type of procedure	**Number of times it was performed.**
Major procedures	
Laparotomy for peritonitis	
Laparotomy for intestinal obstruction	
Intestinal resection	
Rectopexy for rectal prolapse	
Gastric surgery (except for peritonitis)	
Oesophageal surgery	
Cholecystectomy	
Colectomy (all types)	
Anal surgery (fistulas, haemorrhoids, fissure-in-ano)	
Hernia repair(all types)	
Appendectomy	
Surgery for neo-natal malformations (Imperforate anus, toxic megacolon, etc.	
Major breast surgery	
Testicular surgery (Fixation of un-descended testis, torsion of cord, etc)	
Hydrocele repair	
Prostatectomy	
Myomectomy	
Hysterectomy	
Surgery for ovarian and other adnexial problems	
Tubal ligation	
Surgery for urinary lithiasis	
Surgery of male urethra	
Nephrectomy	
Vascular surgery	
Open reduction and internal fixation of limb fractures	
Arthrotomy for septic arthritis	
Debridement of open fracture	
Reduction of dislocation	
Tendon rupture repair	
Limb amputation	
Surgery for osteomyelitis and other bone infections	
Total splenectomy	
Thyroidectomy	
Caesarean section	
Laparotomy for ruptured ectopic pregnancy	

Debridement of burns	
Thoracotomy	
Explorative cervicotomy	
Plastic surgery	
Minor procedures	
Incision and drainage of suppurative lesions	
Debridement of non traumatic lesions (including burns)	
Debridement of traumatic lesions	
Excision of benign lesions of various natures	
Open biopsy (breast, lymph node, etc.)	
Wound suture	
Arthrocentesis	
Repair of sexual injury to female genitals	
Bartholin cyst repair	
Cast immobilization of a limb	
Circumcision	
Chest tube placement	
Strapping and other contentions	
Extraction of orificial foreign body (ENT)	
Uterine revision and D&C	
Removal of in-growing toe nail	
Cystostomy	
Endoscopic procedures	
Insertion of device for family planning (Norplant, IUD)	
Skin grafting	
Others procedures (use the spaces below and specify)	
Anaesthetic procedures carried out in the institution between 01st January and 31st December 2013	
Type of anaesthesia	Number of times performed
General	
Spinal	
Local	
Regional	
Others (specify)	

Thanks for your precious collaboration!!!

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