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Improving Benchmarks for Global Surgery: Nationwide Enumeration of Operations Performed in Ghana

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Abstract

Objective: To evaluate the operation rate in Ghana and characterize it by types of procedures and hospital level.

Background: The Lancet Commission on Global Surgery recommended an annual rate of 5000 operations/100,000 people as a benchmark at which low- and middle-income countries could achieve most of the population-wide benefits of surgery, but did not define procedure-type benchmarks.

Methods: Data on operations performed from June 2014 to May 2015 were obtained from representative samples of 48 of 124 district-level (first-level) hospitals, 9 of 11 regional (referral) hospitals, and 3 of 5 tertiary hospitals, and scaled-up to nationwide estimates. Operations were categorized into those deemed as essential procedures (most cost-effective, highest population impact) by the World Bank's Disease Control Priorities Project versus other.

Results: An estimated 232,776 [95% uncertainty interval (95% UI) 178,004 to 287,549] operations were performed nationally. The annual rate of operations was 869 of 100,000 (95% UI

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664 to 1073). The rate fell well short of the benchmark. 77% of the estimated annual national surgical output was in the essential procedure category. Most operations (62%) were performed at district-level hospitals. Most district-level hospitals (54%) did not have fully trained surgeons, but nonetheless performed 36% of district-level hospital operations.

Conclusion: The operation rate was short of the Lancet Commission bench mark, indicating large unmet need, although most operations were in the essential procedure category. Future global surgery benchmarking should consider both total numbers and priority levels. Most surgical care was delivered at district-level hospitals, many without fully trained surgeons. Benchmarking to improve surgical care needs to address both access deficiencies and hospital and provider level.

Keywords

enumeration; Ghana; global surgery; LMIC; surgical operation rate

Surgery is an indivisible and indispensable part of health systems, as it addresses a broad spectrum of conditions that incur large social, economic, and health burdens (eg, injury, obstructed labor, appendicitis, hernia).^{1–3} However, surgery has generally not been prioritized by the global health community or governments in low- and middle-income countries (LMICs). As a result, an estimated 312.9 million additional surgical procedures are required to address the global disease burden, most of which are needed in LMICs.^{4,5}

The World Health Assembly ratified resolution 68.15 that requests countries “collect and compile data on number, type, and indications of surgical procedures performed” to further develop benchmarks for surgical capacity and ability for the health system to meet the demands of its population.⁶ In response, The Lancet Commission on Global Surgery recommended an annual rate of 5000 operations per 100,000 population as a benchmark at which LMICs could achieve most of the population-wide benefits of surgery; however, the Commission did not define procedure-type specific benchmarks.⁷ Further, few nationwide assessments of surgical case rates from hospital data have been systematically performed and used to evaluate and contextualize this metric.^{8,9} Thus, the utility of the aforementioned surgical case rate benchmark remains in question and forthcoming case rate data difficult to interpret.

To address this gap, we aimed to estimate the surgical case rate in Ghana and to characterize it by types of procedures and hospital level. By doing so, the findings might further our understanding of this metric and refine procedure-type case rate benchmarks.

METHODS

Setting

Ghana is a lower-middle income country in West Africa with a population of over 26 million people.¹⁰ Ghana has 10 regions divided into 216 districts. The health care system has 4 levels of care: primary health centers (PHCs); and district (first-level), regional (referral), and tertiary hospitals. Most districts have several PHCs and about 60% of districts have a government or faith-based hospital that serves as a district (ie, first-level) hospital.¹¹ PHCs are an initial site of contact for some surgical patients, but they only provide basic public

health and primary care services; these facilities were not assessed in this study as it focused on hospital-based surgical care. First-level hospitals are staffed by medical officers and nurse anesthetists; these facilities usually offer at least some essential surgical services and have between 50 and 100 beds. Medical officers are physicians with various years of professional experience following 2 years of internship after graduating from medical school. Not all district hospitals have fully trained surgeons.¹² Patients requiring more complex care are transferred, as possible, to one of the regional or tertiary hospitals.¹³ In addition to medical officers and nurse anesthetists, regional hospitals are typically staffed by specialist surgical providers (eg, general, obstetric, and orthopedic surgeons) and contain between 100 and 500 beds. Tertiary hospitals typically offer a broad range of surgical services and have between 500 and 2000 beds. There are 124 district, 11 regional, and 5 tertiary hospitals.

Study Design

The number and types of procedures performed in operating theaters from June 2014 to May 2015 were determined by a retrospective review and analysis of surgical logbook data at a representative sample of all hospitals during June to November 2015.

Forty-eight district hospitals, all regional hospitals, and all tertiary hospitals were approached to participate in the study. District hospitals were selected by simple random sampling; given 124 district-level hospitals, 0.8% of operations at district hospitals being done per hospital (an anticipated 760 operations per year), $z = 1.96$ and a precision of 2.6%, 48 hospitals were estimated for sampling.^{8,14} All first-level hospitals approached agreed to participate. Nine of 11 referral hospitals and 3 of 5 tertiary hospitals participated. Private hospitals were excluded, as they account for only 9% of all hospital beds and were not anticipated to contribute significantly to the national surgical volume.¹⁵

Data Collection

All operations from operation theater and procedure area logbooks at each of the sampled hospitals were transcribed into Excel (Microsoft Corp., Redmond, WA). Our de facto definition of an “operation” was a procedure performed in an operating theater regardless of anesthesia type or type of provider performing the procedure. The information extracted included date of procedure, age and sex of patient, condition for which the procedure was performed, procedure(s) performed, type of anesthesia provided, and vital status at end of the case (ie, dead or alive). No identifying information was recorded.

Data Analysis

Data were described with numbers and percentages and per hospital-level stratum (ie, district-level, regional, and tertiary). Next, operations were categorized into those deemed “essential procedures” (ie, most cost-effective, highest population impact) by the World Bank’s Disease Control Priorities Project (DCP-3) versus “other” (ie, less cost-effective, lower population impact).¹⁶

National estimates for each operation performed at district-level, regional, and tertiary hospitals were calculated after applying appropriate probability weights. For operations performed at district-level hospitals, we applied a district-level probability weight (w_d),

calculated by dividing the total number of district-level hospitals ($N = 124$) by the number of district-level hospitals randomly sampled for data collection ($n = 48$). Operations performed at the regional level were scaled up by a regional-level weight, $w_r = 1.22$, to account for 2 of the 11 regional hospitals for which data were not collected: 1 regional-level hospital that declined participation and 1 quasi-government hospital that operates at the level of a regional hospital. Operations performed at the tertiary level were scaled up by a tertiary-level weight (w_t), calculated by dividing the total number of beds of all 4 tertiary hospitals and 1 quasi-government hospital that operates at the tertiary level (4400) by the number of beds of the 3 tertiary hospitals from which data were collected (2000).

Given the weights applied as above:

$$\begin{aligned} &\text{Annual national estimate for each operation, } (i) \\ &(\text{district level operation number} \times \omega_d) + (\text{regional level operation number} \times \omega_r) \\ &+ (\text{regional level operation number} \times \omega_r) + \left(\text{tertiary level operation number} \times \omega_t \right) \end{aligned}$$

Thus, the total 1-year national estimate for all operations performed in Ghana was calculated as:

$$\sum_{i=1}^{i=n} \text{Annual national estimate for each operation}(i)$$

Bootstrap standard errors were calculated to produce 95% uncertainty intervals (UIs) of the total 1-year national estimate of all surgical procedures; this was divided by the 2014 total national population to estimate the annual surgical case rate. Data were analyzed with Stata v14 (StataCorp., College Station, TX).

Ethics

Approval for the study was granted by the ethical committee of the Kwame Nkrumah University of Science and Technology and deemed as exempt by the University of Washington IRB. All data were anonymously recorded.

RESULTS

National Estimates

All of the 48 district hospitals, 9 of 11 regional hospitals, and 3 of 5 tertiary hospitals participated in the study. At sampled hospitals, 103,505 operations were performed over the 1-year period. This translates to an estimated 232,776 (95% UI 178,004 to 287,549) operations performed over the 1-year period nationally; thus, the annual national rate of operations was 869 per 100,000 population (95% UI 664 to 1073 operations).

National Procedure-type Estimates

Over three-quarters (77%) of operations performed nationally (179,298 operations; 95% UI 135,608 to 222,987) were in the essential procedure category (ie, operations that are the most cost-effective and have the highest population impact as outlined by The World Bank's Disease Control Priorities project). Essential procedures accounted for 64% to 83% of the annual surgical output of hospitals at any level. Obstetric and gynecological, general surgical, and trauma procedures made up the majority of operations in this category [152,432 operations; 85%] of operations in this category] (Table 1).

Twenty-three percent of the operations performed nationally (58,479 operations; 95% UI 42,395 to 64,562) were those outside of the essential procedure category operations (ie, less cost-effective, lower population impact). The majority of these operations (37,621 operations; 70%) were head and neck operations (eg, foreign body removal, excision of nasal polyps, tonsillectomy), operations for other obstetric and gynecologic conditions (eg, uterine myomectomy, diagnostic, and operative procedures for gynecologic cancers) or other general surgical operations (eg, excision biopsy for soft tissue masses, operations for goiter, operations for breast conditions including cancer). Advanced trauma and orthopedic operations performed were mostly open reduction and internal fixations for fractures (7% of all operations outside the essential procedure category) (Table 2).

Procedure-type Estimates by Hospital Level

District-level hospitals performed 143,750 operations compared with 20,247 and 68,779 operations performed by regional and tertiary hospitals, respectively. Thus, district-level hospitals performed 62% of all operations in the country. Over 80% (119,927 operations, 83%) of total annual surgical output of district-level hospitals were for operations in the essential procedure category. Faith-based hospitals in Ghana only function at the district level of the healthcare hierarchy, constituting 38% of district-level hospitals.¹⁷ They accounted for 50,597 (35%) of all operations performed at the district level and 22% of the total 1-year national estimate. Forty thousand five hundred four (34%) of the 119,927 essential surgical procedures performed by district-level hospitals were done at faith-based hospitals. Faith-based hospitals, however, were responsible for a higher proportion (10,093, 42%) of operations performed by district-level hospitals that were outside of the essential procedure group.

Most operations (62%) were performed at district-level hospitals. Most district-level hospitals (54/100) did not have fully trained surgeons. However, these district-level hospitals (without fully trained surgeons) performed 36% of all district-level hospital operations, or 22% of all operations nationally (Table 3). For the 48 district hospitals sampled, 5 had 1 surgeon, 9 had 1 obstetrician-gynecologist, and 8 had 1 of each. Even though these hospitals had one or more surgeons stationed, there may be significant periods of time (nights, weekends, periods of annual leave for the surgeon) when a fully trained surgeon is not available. Certain essential procedures, such as obstetric fistula repairs, hysterectomy for uterine rupture, or intractable postpartum hemorrhage were more commonly performed at district-level hospitals with fully trained surgeons (75% of such procedures performed at district hospitals were performed at those with a fully trained surgeon vs 25%). The same

could be said about procedures for bowel obstruction, construction of colostomy, trauma laparotomy, and skin grafting (84% vs 16%). On the contrary, operations for congenital conditions (67% vs 33%) and cataracts (51% vs 49%) were more commonly performed in district-level hospitals with no fully trained surgeons.

Regional hospitals performed only 9% of the national total annual estimate of operations. As with district-level and tertiary hospitals, they also performed operations in the essential procedure category more commonly (76%). With the exception of creation of colostomy and establishment of surgical airway, which were more commonly performed than in district-level hospitals, and release of urinary obstruction that were performed more commonly than in tertiary hospitals, they consistently performed fewer operations than district-level and tertiary hospitals for all categories of operations (Tables 1 and 2).

Over one-third (24,864 operations, 36%) of the annual surgical output of tertiary hospitals were for operations outside of the essential procedure category. These included more specialized operations such as urologic, pediatric surgical, advanced trauma and orthopedic operations, and other ophthalmologic operations, which were predominantly performed in tertiary hospitals, and made up 25% of all operations outside of the essential procedure category performed at the tertiary level (Table 2).

DISCUSSION

The Lancet Commission on Global Surgery recommended a benchmark of 5000 operations per 100,000 population per year for LMICs in order to achieve most of the population-wide benefits of surgery. Although several LMICs have reported annual surgical rates namely from Ministry of Health reports, they did not include detail on procedure types or level of priority of procedures. Thus, we aimed to estimate the operation rate in Ghana by using nationwide data and to characterize it by types of procedures and facility level. Ghana performed 869 surgical operations per 100,000 people. This rate fell considerably short of the Lancet Commission benchmark, indicating a large unmet surgical need. However, most operations performed in Ghana were in the essential procedure category, indicating a likely higher effect on the health of the population. These data have implications for the further development of indicators for global surgery and for development of nationwide surgical capacity in Ghana and other similar countries.

The 5000 operations per 100,000 population benchmark was determined by Esquivel et al¹⁸ by correlating health system indicators (eg, life expectancy and maternal mortality) with estimated national surgical rates. This was then validated with the surgical rates of the “4C” countries (Chile, China, Costa Rica, Cuba) that are examples of LMICs that have demonstrated significant improvements in their health care systems as compared with other economically similar countries. The average case rate of the “4C” countries was 4344.¹⁸ Ghana has recently been recognized as a middle-income country. However, it performs far fewer operations than other middle-income countries such as Cuba, China, and Costa Rica. Currently, Ghana performs less than 20% of the surgery rate benchmark (ie, 5000 operations per 100,000 population annually). However, it is more than twice the rate of 400 operations per 100,000 people reported from low-income country Sierra Leone in 2014.¹⁹ Regardless,

the 5000-surgeries mark is a distant target and will remain so without concerted efforts by the government, health system planners, donors, and individual providers to improve surgical capacity and output, and the strength of the emergency, trauma, and surgical care system more broadly.

The effect of surgical volume on health of the population will vary with the nature of the surgery performed. For example, wide spread access to essential surgical procedures (eg, obstetrical and trauma care) would likely impact health more than a high rate of cosmetic surgery in urban areas with little access to any surgery in rural areas. Hence, differentiating levels of priority of procedures performed is an important next step in developing benchmarks for global surgery. The categorization of “essential procedures” by DCP-3 offers a ready-made method to accomplish this and should be considered in future development of global surgical benchmarks.

A related issue that will need further refinement is how to handle the large number of minor procedures, which might be done in operating rooms or in offices/clinics/emergency departments (and hence might or might not be recorded as “operations”), depending on the type of facility or the country. For example, this study recorded a large number of dental procedures in district-level hospitals, but fewer in better equipped regional and tertiary hospitals. Likely, many of the same dental procedures that are being done in the operating room in district hospitals are being done in clinics or offices in the bigger facilities and not being recorded as operations. Similar considerations apply to other procedures such as suturing of wounds, closed reduction of fractures, etc. Such smaller procedures are numerous and have a stronger influence on the overall rate, than less commonly performed larger procedures, such as laparotomy or open reduction. How to count such procedures in different facilities or different countries will need to be addressed, as work on global surgical benchmarks moves forward.

Another major finding of this study is the large contribution of district-level hospitals on overall surgical volume, which is likely a reflection of the decentralized healthcare system, which mandates that further surgical capacity improvements begin at the district level. Appropriately, the majority of operations performed at this level and nationally were those in the essential procedure category (ie, most cost-effective operations with the highest population impact). These procedures generally require less specialization and do not require complex surgical capacity. However, district-level hospitals also provided 45% of procedures that were outside of the essential procedure category despite the fact that most district-level hospitals did not have fully trained surgeons.^{8,14}

Although having all surgical procedures performed by fully trained surgeons would be the long-range ideal goal, for the foreseeable future, especially in underserved rural areas, nonsurgeon medical officers will continue to be the major surgical providers in much of Africa. In the current study, 22% of all operations performed nationally were performed at hospitals that did not have any fully trained surgeon present. Although data were not collected on specific providers performing surgery at other hospitals, in general in Ghana, even when there are one or more surgeons present at district-level or regional hospitals, nonsurgeon medical officers still perform many of the basic and intermediate operations.

The topic of “task sharing” for operative care has been the subject of several studies, but has not been extensively researched. However, in general, such “task sharing” has been found to be safe and effective, with complication rates similar between nonsurgeons and surgeons, for procedures such as C- section.¹⁶ It is however to be emphasized that, in circumstances where task sharing is used successfully, adequate training and monitoring have been found to be important components of such success.¹⁶

The Ghana College of Physicians and Surgeons recently inaugurated a modular family medicine training program with the aim of providing “on-the job” training to district-level medical officers through specialist mentoring (by attachments, outreach, and telemedicine).²⁰ A similar program might improve access to trained surgical providers at the district level. To ensure safety and greater productivity, the role and training of surgical care providers who are not fully trained surgeons needs to be formalized, as is being done in Sierra Leone and Malawi.^{21,22} It is important to emphasize on-site education and training of these surgical care providers, which together with provision of oversight and supervision have been found to contribute to provider retention at facilities where they are most needed.¹⁶ As might be expected, procedures that require more skill to successfully perform, such as obstetric fistula repairs, hysterectomy for uterine rupture, trauma laparotomy, and skin grafting were performed more commonly when fully trained surgeons were available. However, cataracts and congenital conditions requiring specialized surgery were more commonly performed in district-level hospitals with no fully trained surgeons available. The activities of specialized visiting teams to these hospitals might account for this observation, but data on this specific point were not gathered, but is a reasonable assumption based on the procedures performed, and may warrant separate collection in future analyses to quantify the impact.

Regional hospitals, on the contrary, appear to be underutilized, especially in regions that also had a tertiary hospital. The low case rate at these facilities occurred despite these hospitals having fully trained surgeons and greater resources than district-level hospitals. Prior work in Ghana has highlighted the insufficient resourcing of regional hospitals with regards to emergency, trauma, and surgical care.^{12,23} Given these findings, more must be done to appropriately resource at this important level of the health care system to avoid delays at the tertiary level. Further, Ghana does not have a formalized and consistently used referral mechanism for patients with specific surgical conditions that require care at regional or tertiary levels.¹³ As a result, many patients face prohibitive barriers to care that prevent them from getting the operation they need in a timely fashion.^{24–26} The utility of regional hospitals may be improved by streamlining the referral process and strengthening cooperation between these hospitals and those that function above and below them within the health care hierarchy supplemented by national regulatory direction.

The findings also provide feedback for the DCP3 categorization scheme of essential versus other procedures. The highest single number of all “other” procedures was foreign body removal from head and neck orifices. Given the importance of this procedure and low-cost in most circumstances, it would be reasonable to consider this procedure as an “essential” procedure in future development of the DCP3 essential list.

Before drawing conclusions, several limitations must first be considered. First, estimates of operations performed in private hospitals were not included. However, the vast majority of surgical care in Ghana is provided by government and faith-based hospitals. The private sector's role has been reported to be less than 10%, and is prohibitively expensive for the majority of Ghanaians.¹⁵ Therefore, by not including private hospitals, our annual national surgical operation estimates would not be expected to be off by more than 10%. On the contrary, the nearly 10% private sector contribution to the national surgical operation estimates could be an important factor in improving access overall if government mandated that such hospitals provide a proportion of their annual surgical output as "charity care." Second, the study was conducted retrospectively and was limited by the completeness of logbooks from operating theaters. No instance occurred where a logbook was missing or there was an unexplained gap in operations; however, sporadic instances of case omission cannot be excluded. Third, the above-noted issues of some minor procedures being performed in operating rooms in some facilities, but in clinics or emergency departments in others, likely led to undercounting of some procedures. Finally, 2 regional and tertiary hospitals each did not participate in the study necessitating applications of weights to estimate the national surgical output. Despite these limitations, our study provides a useful estimate of the annual surgical operation rate in Ghana, as well as the distribution of operations by type and hospital level, which can be used for benchmarking and targeted health system strengthening initiatives.

CONCLUSION

The operation rate in Ghana was well short of the Lancet Commission benchmark, which indicates a large unmet need for surgical care nationally. However, most operations performed were in the essential procedure category, which demonstrates the foundations for useful resource allocation. Future global surgery benchmarking should consider both total and procedure-type specific operation rate to ensure that countries are prioritizing cost-effective and high-population impact procedures. Most surgical care was delivered at district hospitals, many of which provide care without fully trained surgeons. Therefore, efforts to formalize the roles and training of this cadre might be a useful and relatively cost-effective way to improve the low surgical case rate, particularly in remote regions.²¹ Regional hospitals were grossly underutilized, which places the care burden on tertiary hospitals that are already markedly under-resourced.¹² Thus, efforts to improve the referral system to better distribute surgical care are imperative.¹³

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TABLE 1.
National Annual Estimates of Surgical Procedures Performed in Ghana 2014– 2015

	District Hospitals		Regional Hospitals		Tertiary Hospitals		All Hospitals	
	N	(%)	N	(%)	N	(%)	N	(%)
Essential surgical procedures	119,927	(83)	15,456	(76)	43,914	(64)	179,298	(77)
Obstetric, gynecologic, and family planning procedures	58,331	(41)	5313	(26)	14,256	(21)	77,900	(33)
Cesarean section	45,683	(32)	4693	(23)	11,843	(17)	62,219	(27)
Manual vacuum aspiration and D&C	9457	(6.6)	173	(0.9)	1434	(2.1)	11,065	(4.8)
laparotomy for ectopic pregnancy	2242	(1.6)	343	(1.7)	759	(1.1)	3344	(1.4)
Tubal ligation	703	(0.5)	16	(0.1)	42	(0.1)	760	(0.3)
Hysterectomy for uterine rupture or intractable PPH	230	(0.2)	26	(0.1)	42	(0.1)	297	(0.1)
Obstetric fistula repair	15	(0.01)	62	(0.3)	136	(0.2)	214	(0.1)
General surgical procedures	28,357	(20)	5464	(27)	9029	(13)	42,850	(18)
Hemiorrhaphy and hydrocelectomy	13,937	(10)	1793	(8.9)	2884	(4.2)	18,615	(8.0)
Superficial abscess drainage, wound debridement	5869	(4.1)	1025	(5.1)	1830	(2.7)	8724	(3.7)
laparotomy for peritonitis (eg, perforated viscus, appendicitis, cholecystitis)	2439	(1.7)	1172	(5.8)	2735	(4.0)	6346	(2.7)
Release of urinary obstruction	2204	(1.5)	1109	(5.5)	693	(1.0)	4006	(1.7)
Male circumcision	3575	(2.5)	41	(0.2)	51	(0.1)	3667	(1.6)
Bowel obstruction	313	(0.2)	266	(1.3)	517	(0.8)	1096	(0.5)
Colostomy	21	(0.01)	57	(0.3)	319	(0.5)	397	(0.2)
Trauma (basic, intermediate)	12,849	(8.9)	4383	(22)	14,450	(21)	31,682	(14)
Skin and soft tissue procedures	9109	(6.3)	3063	(15)	4710	(6.8)	16,882	(7.3)
Orthopedic procedures	3247	(2.3)	1130	(5.6)	8677	(13)	13,054	(5.6)
Tube thoracostomy	209	(0.1)	82	(0.4)	411	(0.6)	702	(0.3)
Trauma-related amputation	139	(0.1)	56	(0.3)	211	(0.3)	407	(0.2)
Burr hole	3	(0.0)	0	(0)	249	(0.4)	251	(0.1)
Surgical airway	5	(0.004)	11	(0.1)	101	(0.1)	117	(0.1)
Dental procedures	17,473	(12)	4	(0.02)	4200	(6.1)	21,677	(9.3)
Tooth extraction	13,025	(9.1)	2	(0.01)	2583	(3.8)	15,610	(6.7)
Drainage of abscess and treatment of caries	4448	(3.1)	1	(0.01)	1617	(2.4)	6067	(2.6)
Cataract surgery	2581	(1.8)	249	(1.2)	1166	(1.7)	3996	(1.7)

	District Hospitals		Regional Hospitals		Tertiary Hospitals		All Hospitals	
	N	(%)	N	(%)	N	(%)	N	(%)
Congenital conditions (basic, intermediate)	336	(0.2)	43	(0.2)	814	(1.2)	1193	(0.5)
Repair of ARM and HPD	238	(0.2)	0	(0)	255	(0.4)	493	(0.2)
Cleft lip and palate repair	5	(0.004)	10	(0.05)	420	(0.6)	435	(0.2)
Club foot repair	90	(0.1)	33	(0.2)	33	(0.05)	156	(0.1)
Shunt for hydrocephalus	3	(0.002)	0	(0)	106	(0.2)	108	(0.05)
Other surgical procedures	23,823	(17)	4791	(24)	24,864	(36)	53,479	(23)
Total	143,750	(100)	20,247	(100)	68,779	(100)	232,776	(100)

ARM indicates anorectal malformation; D&C, dilatation and curettage; HPD, Hirschsprung disease; PPH, postpartum hemorrhage.

TABLE 2.
National Annual Estimates of Procedures Outside of Essential Procedure Category Performed in Ghana 2014–2015

	DistrictHospitals		RegionalHospitals		TertiaryHospitals		AllHospitals	
	N	(%)	N	(%)	N	(%)	N	(%)
Head/Neck procedures	5603	(24)	301	(6.3)	8004	(32)	13,908	(26)
Foreign body removal	5169	(22)	151	(3.2)	6248	(25)	11,568	(22)
Procedures for other benign head/neck conditions	406	(1.7)	145	(3.0)	1562	(6.3)	2113	(4.0)
Procedures for head/neck cancer	28	(0.1)	5	(0.1)	194	(0.8)	227	(0.4)
ObGy procedures	5846	(25)	1137	(24)	5161	(21)	12,144	(23)
Procedures for uterine fibroids	3557	(15)	578	(12)	1239	(5.0)	5374	(10)
Procedures for other benign ObGy conditions	1491	(6.3)	307	(6.4)	3137	(13)	4935	(9.2)
Operative procedures for gynecologic cancers	465	(2.0)	160	(3.3)	321	(1.3)	946	(1.8)
Diagnostic procedures for gynecologic cancers	333	(1.4)	92	(1.9)	464	(1.9)	889	(1.7)
General surgical procedures	5138	(22)	1742	(36)	4688	(19)	11,569	(22)
Excision biopsy for soft tissue masses	2663	(11)	550	(11)	1617	(6.5)	4831	(9.0)
Other general surgical procedures	1186	(5.0)	589	(12)	1269	(5.1)	3044	(5.7)
Procedures for breast conditions (including cancer)	827	(3.5)	368	(7.7)	1008	(4.1)	2203	(4.1)
Procedures for goiter	362	(1.5)	149	(3.1)	488	(2.0)	999	(1.9)
Procedures for gastrointestinal and other general surgical cancers	101	(0.4)	85	(1.8)	306	(1.2)	492	(0.9)
Trauma and orthopedic procedures	1689	(7.1)	237	(4.9)	3771	(15)	5697	(11)
Orthopedic procedures	1687	(7.1)	234	(4.9)	3540	(14)	5461	(10)
Craniotomy for intracranial hematoma	0	(0)	1	(0.03)	220	(0.9)	221	(0.4)
Thoracotomy	3	(0.01)	1	(0.03)	11	(0.04)	15	(0.03)
Miscellaneous office procedures	4446	(19)	837	(17)	772	(3.1)	6055	(11)
Urological procedures (including for cancers)	375	(1.6)	249	(5.2)	794	(3.2)	1418	(2.7)
Pediatric surgical procedures	191	(0.8)	132	(2.8)	1021	(4.1)	1344	(2.5)
Ophthalmology procedures	535	(2.2)	156	(3.3)	653	(2.6)	1344	(2.5)
Total	23,823	(100)	4791	(100)	24,864	(100)	53,479	(100)

TABLE 3.
National Annual Estimates of Procedures Performed by Districts Hospitals With or Without Fully Trained Surgeons

	Fully Trained Surgeon				All District Hospitals			
	Stationed		Not Stationed		Stationed		Not Stationed	
	N	(%)	N	(%)	N	(%)	N	(%)
Essential surgical procedures	76,114	(83)	43,813	(85)	119,927	(83)		
Ob-gyn (basic, intermediate)	35,185	(38)	23,146	(45)	58,331	(41)		
Cesarean section	27,339	(30)	18,344	(36)	45,683	(32)		
Manual vacuum aspiration and D&C	5890	(6.4)	3568	(6.9)	9457	(6.6)		
Laparotomy for ectopic pregnancy	1516	(1.6)	726	(1.4)	2242	(1.6)		
Tubal ligation	256	(0.3)	447	(0.9)	703	(0.5)		
Hysterectomy for uterine rupture or intractable PPH	168	(0.2)	62	(0.1)	230	(0.2)		
Obstetric fistula repair	15	(0.02)	0	(0)	15	(0.01)		
General surgery (basic, intermediate)	18,980	(21)	9377	(18)	28,357	(20)		
Herniorrhaphy and hydrocelectomy	8465	(9.2)	5471	(10.6)	13,937	(10)		
Superficial abscess drainage, wound debridement	4027	(4.4)	1842	(3.6)	5869	(4.1)		
Male circumcision	2829	(3.1)	747	(1.4)	3575	(2.5)		
Laparotomy for peritonitis (perforated viscus, appendicitis, cholecystitis)	1945	(2.1)	493	(1.0)	2439	(1.7)		
Release of urinary obstruction	1405	(1.5)	798	(1.5)	2204	(1.5)		
Bowel obstruction	287	(0.3)	26	(0.1)	313	(0.2)		
Colostomy	21	(0.02)	0	(0)	21	(0.01)		
Trauma (basic, intermediate)	8031	(8.7)	4818	(9.3)	12,849	(8.9)		
Skin and soft tissue procedures	5066	(5.5)	4043	(7.8)	9109	(6.3)		
Orthopedic procedures	2534	(2.8)	713	(1.4)	3247	(2.3)		
Trauma laparotomy	227	(0.2)	49	(0.1)	276	(0.2)		
Tube thoracostomy	196	(0.2)	13	(0.03)	209	(0.1)		
Escharotomy or fasciotomy	10	(0.01)	8	(0.02)	18	(0.01)		
Surgical airway	5	(0.006)	0	(0)	5	(0.004)		
Burr hole	3	(0.003)	0	(0)	3	(0.0)		
Dental procedures	12,534	(14)	4939	(9.6)	17,473	(12)		
Tooth extraction	10,517	(11.4)	2508	(4.9)	13,025	(9.1)		

	Fully Trained Surgeon				All District Hospitals			
	Stationed		Not Stationed		Stationed		Not Stationed	
	N	(%)	N	(%)	N	(%)	N	(%)
Drainage of abscess and treatment of caries	2018	(2.2)	2431	(4.7)	4448	(3.1)		
Cataract surgery	1274	(1.4)	1307	(2.5)	2581	(1.8)		
Congenital conditions (basic, intermediate)	111	(0.1)	225	(0.4)	336	(0.2)		
Repair of ARM and HPD	28	(0.03)	209	(0.4)	238	(0.2)		
Club foot repair	77	(0.1)	13	(0.03)	90	(0.1)		
Cleft lip and palate repair	5	(0.006)	0	(0)	5	(0.004)		
Shunt for hydrocephalus	0	(0)	3	(0.01)	3	(0.002)		
Other surgical procedures	16,009	(17)	7814	(15)	23,823	(17)		
Total	92,123	(100)	51,627	(100)	143,750	(100)		

Fully trained surgeon stationed at a hospital implies that either a fully trained surgeon and/or a fully trained obstetrician-gynecologist was stationed at that hospital. However, there might be periods of time (nights, weekends, periods on leave) when that surgeon would not be available and procedures would be done by the general medical officers at that hospital.

ARM indicates anorectal malformation; D&C, dilatation and curettage; HPD, Hirschsprung disease; PPH, postpartum hemorrhage.