



Enumeration of Operations Performed for Elderly Patients in Ghana: An Opportunity to Improve Global Surgery Benchmarking

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Abstract

Introduction The Lancet Commission on Global Surgery proposed 5000 operations/100,000 people annually as a benchmark for developing countries but did not define benchmarks for different age groups. We evaluated the operation rate for elderly patients (≥ 65 years) in Ghana and estimated the unmet surgical need for the elderly by comparison to a high-income country benchmark.

Methods Data on operations performed for elderly patients over a 1-year period in 2014–5 were obtained from representative samples of 48/124 small district hospitals and 12/16 larger referral hospitals and scaled-up for nationwide estimates. Operations were categorized as essential (most cost-effective, highest population impact) versus other according to The World Bank's Disease Control Priority project (DCP-3). Data from New Zealand's National Minimum Dataset were used to derive a benchmark operation rate for the elderly.

Results 16,007 operations were performed for patients ≥ 65 years. The annual operation rate was 1744/100,000 (95% UI 1440–2048), only 12% of the New Zealand benchmark of 14,103/100,000. 74% of operations for the elderly were in the essential category. The most common procedures (15%) were for urinary obstruction. 58% of operations were performed at district hospitals; 54% of these did not have fully-trained surgeons. Referral hospitals more commonly performed operations outside the essential category.

Conclusion The operation rate was well beneath the benchmark, indicating a potentially large unmet need for Ghana's elderly population. Most operations for the elderly were in the essential category and delivered at district hospitals. Future global surgery benchmarking should consider specific benchmarks for different age groups.

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Introduction

The elderly population is growing at a faster rate than the general population in almost all regions of the world [1, 2]. The number of people aged 60 years or older is projected to grow from an estimated 809 million in 2012 to over 2 billion in 2050, with most of the increase in low- and middle-income countries (LMICs) where health and social protection systems are weak [1, 2]. With increased age, the burden of non-communicable diseases (NCDs) also increases, which includes many conditions that require surgery in the course of management (e.g., hernia, bowel obstruction, cancer, injury, burn).

The Lancet Commission on Global Surgery (LCoGS) recommended an annual rate for all operations of 5000/100,000 population as a benchmark for LMICs to achieve most of the population-wide benefits of surgery [3]. The Commission did not define benchmarks for the elderly population or other age groups. Further, no nationwide assessments of surgical rates for the elderly have been performed to contextualize this metric [4, 5]. To address this gap, we aimed to estimate the annual surgical case rate for the elderly (individuals ≥ 65 years) in Ghana, characterized by type and hospital level to inform capacity building initiatives. We also sought to estimate the unmet surgical need for the elderly.

Methods

Setting

Ghana is a lower-middle-income country with a population of over 26 million [6]. Currently, the population of Ghana who are ≥ 65 years is 4.2% with an anticipated increase to 6.5% in 2050 [7]. Provision of hospital-based surgical care usually begins with district (first-level) hospitals [8, 9]. These include government-run hospitals and faith-based hospitals. They have 50–100 beds and offer some surgical services, but are often not staffed by fully-trained surgeons [10]. When necessary, patients are referred to larger regional or tertiary hospitals. Regional hospitals have

100–500 beds and are typically staffed by specialist surgical providers (e.g., general, obstetric and orthopedic surgeons). Tertiary hospitals have 500–2000 beds and offer a broader range of surgical services. At the time of data collection, Ghana had 124 district, 11 regional, and 5 tertiary hospitals.

Study design

The number and types of operations performed for the elderly in Ghana over a 1-year period from 2014 to 2015 were determined by a retrospective review of surgical logbook data at a representative sample of all hospitals. Details of power estimation, hospital sampling, and study methodology have been previously described [11]. Briefly, all regional and tertiary hospitals and 48/124 district hospitals, selected by simple random sampling, were invited to participate in the study. Private hospitals were excluded since they do not significantly contribute to the national surgical volume [12].

The LCoGS procedure rate benchmark was established by comparing national operative volume to health outcome indicators including life expectancy and maternal mortality ratio [13]. New Zealand was selected as the standard for comparison due to its excellent health outcomes, and availability of high-quality surgical information, ensuring a high likelihood of provision of effective surgical care in an economically efficient manner [14]. Using this accepted comparator, the rate of operations performed for the elderly in New Zealand was selected as a proxy for the total surgical need of this sub-population. Considering the number of operations performed for the elderly in Ghana as the met surgical need for this sub-population, the unmet surgical need could be quantified by comparing the estimate to the respective figures from New Zealand.

Data collection

All operations logged in operating theater and procedure area registers at sampled hospitals were transcribed into Excel (Microsoft Corp., USA). An operation was defined as a procedure performed in an operating theater or procedure area regardless of anesthesia type or surgical provider. Data captured included the date of procedure, patient demographics, operation(s) performed, and anesthesia type. No identifying information was recorded. The elderly population of Ghana (i.e., people aged ≥ 65 years) was extracted from The World Bank data [6].

Surgical volume for New Zealand's elderly population was determined from the National Minimum Dataset

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(NMDS) [15]. The NMDS is a national collection of publicly funded hospital discharge information, organized and maintained by the New Zealand Ministry of Health. All surgical procedures performed for the elderly in 2015 were extracted from the larger dataset to obtain a proxy for surgical need.

Data analysis

Data were described with numbers and percentages and per hospital level [i.e., district (small) and referral (large) hospitals]. Operations were also categorized into ‘essential procedures’ (i.e., most cost-effective, highest population impact) as defined by The World Bank’s Disease Control Priorities Project 3rd Edition (DCP-3) and ‘other’ (i.e., less cost-effective, lower population impact) [16].

Utilization of hospital-level probability weights to arrive at national estimates for each operation have been previously described [11]. Briefly, district- and regional-level weights were determined as the inverse of the proportion of hospitals surveyed (48/124 and 9/11, respectively). Tertiary-level weights were determined as the inverse of the proportion of surveyed hospital bed capacity (2000/4400). Bootstrap standard errors were calculated to provide 95% uncertainty intervals (UI) for the total annual national estimate of operations for the elderly. Surgical rates were expressed as operations per 100,000 elderly population using 2014 population estimates [6]. Comparison was made between the annual surgical rate for the elderly and that for the population <65 years. The unmet surgical need for the Ghanaian elderly population was estimated by comparing the annual surgical rate to that calculated using New Zealand’s NMDS. Data were analyzed with Stata v14 (StataCorp, USA).

Ethics

The study was approved by the Committee on Human Research Publications and Ethics of Kwame Nkrumah University of Science and Technology and deemed exempt by the University of Washington Institutional Review Board.

Results

National estimates

All 48 district hospitals, 9/11 regional hospitals and 3/5 tertiary hospitals agreed to participate in the study. At sampled hospitals, 7416 operations were performed for elderly patients over the 1-year period, translating to a national estimate of 16,007 (95% UI 13,215–18,799)

operations. With a 2014 elderly Ghanaian population of 917,977, the annual national rate of operations for the elderly was 1744/100,000 (95% UI 1440–2048). The estimated rates for elderly females and males were 1278/100,000 (95% UI 1048–1508) and 2244/100,000 (95% UI 1846–2642), respectively.

National procedure-type estimates

Seventy-four percent of operations performed nationally for the elderly (11,888 operations) were of the essential procedure category (i.e., most cost-effective operations with highest population impact). Essential procedures made up 83% of operations performed for the elderly at district hospitals; for referral (regional and tertiary) hospitals, they accounted for 63%. General surgical, cataract surgery and dental operations were the majority of operations performed in this category (10,091 operations; 85%) (Table 1). The largest number of operations was for urinary obstruction, which included suprapubic or urethral catheterizations (80%), prostatectomy (10%) and repair or dilatation of urethral strictures (8%).

Operations that were outside of the essential procedure category accounted for 26% of operations performed nationally for the elderly (4119 operations). Majority of these (2879; 70%) were general surgical operations (e.g., operations for goiter and benign perianal conditions, excision biopsy for soft tissue masses, and cancer operations), head and neck operations (e.g., biopsy, foreign body removal), advanced trauma and orthopedic operations (e.g., open reduction and internal fixations for fractures, osteotomies) and urological operations (e.g., nephrectomy, cystoscopy and biopsy) (Table 1).

Procedure-type estimates by hospital level

District hospitals were responsible for more than half (9344; 58%) of all operations performed for the elderly. Over 80% (7714 operations, 83%) of these were in the essential procedure category. These included herniorrhaphy and hydrocelectomy (1881 operations vs 483 at referral hospitals), relief of urinary obstruction (1431 operations vs. 985 at referral hospitals), cataract surgery (1374 operations vs 735 at referral hospitals), and dental operations (1550 vs. 317 at referral hospitals) (Table 1). Fifty-four percent of district hospitals were not staffed by fully-trained surgeons; nonetheless, these hospitals performed 39% of all operations for the elderly.

Referral hospitals contributed 42% of the total annual surgical output for the elderly. However, they performed the majority of operations classified outside of the essential procedure category (2489; 60%) (Table 1). Referral

Table 1 National annual estimates of surgical procedures performed for the elderly (≥ 65 years) in Ghana 2014–2015

	District (small) hospitals		Referral (large) hospitals		All hospitals	
	N	(%)	N	%	N	(%)
Essential surgical procedures	7714	(83)	4174	(63)	11,888	(74)
General surgery (basic, intermediate)	4193	(45)	1921	(29)	6113	(38)
Herniorrhaphy and hydrocelectomy	1881	(20)	483	(7.2)	2363	(15)
Superficial abscess drainage, wound debridement	754	(8.1)	211	(3.2)	965	(6.0)
Laparotomy for peritonitis (e.g., perforated viscus, appendicitis, cholecystitis)	72	(0.8)	144	(2.2)	216	(1.4)
Release of urinary obstruction	1431	(15)	985	(15)	2416	(15)
Male circumcision	21	(0.2)	9	(0.1)	30	(0.2)
Laparotomy for bowel obstruction	34	(0.4)	71	(1.1)	105	(0.7)
Colostomy	0	(0)	19	(0.3)	19	(0.1)
Cataract surgery	1374	(15)	735	(11)	2109	(13)
Dental procedures	1550	(17)	317	(4.8)	1867	(12)
Trauma (basic, intermediate)	597	(6.4)	1194	(18)	1791	(11)
Skin and soft tissue procedures	351	(3.8)	143	(2.1)	494	(3.1)
Orthopedic procedures	217	(2.3)	927	(14)	1144	(7.1)
Tube thoracostomy	23	(0.2)	29	(0.4)	52	(0.3)
Trauma laparotomy	3	(0.03)	23	(0.3)	26	(0.2)
Burr hole	0	(0)	44	(0.7)	44	(0.3)
Surgical airway	3	(0.03)	28	(0.4)	30	(0.2)
ObGyn (basic, intermediate)	0	(0)	8	(0.1)	8	(0.1)
Congenital conditions (basic, intermediate)	0	(0)	0	(0)	0	(0)
Other surgical procedures	1630	(17)	2489	(37)	4119	(26)
General surgical procedures	491	(5.3)	614	(9.2)	1104	(6.9)
Excision biopsy for soft tissue masses	220	(2.4)	109	(1.6)	329	(2.1)
Procedures for breast conditions (including cancer)	36	(0.4)	63	(0.9)	99	(0.6)
Procedures for other benign general surgical conditions ^a	222	(2.4)	333	(5.0)	556	(3.5)
Procedures for gastrointestinal and other general surgical cancers	13	(0.1)	108	(1.6)	121	(0.8)
Head/Neck procedures	256	(2.7)	752	(11)	1007	(6.3)
Foreign body removal	230	(2.5)	661	(9.9)	891	(5.6)
Procedures for other benign head/neck conditions ^b	26	(0.3)	38	(0.6)	63	(0.4)
Procedures for head/neck cancer	0	(0)	53	(0.8)	53	(0.3)
Miscellaneous minor procedures ^c	455	(4.9)	108	(1.6)	563	(3.5)
Advanced trauma and orthopedic procedures	147	(1.6)	362	(5.4)	509	(3.2)
Open reduction \pm internal fixation	59	(0.6)	239	(3.6)	299	(1.9)
Thoracotomy	0	(0)	0	(0)	0	(0)
Craniotomy	0	(0)	7	(0.1)	7	(0.04)
Tendon repairs/release of contractures	3	(0.03)	18	(0.3)	20	(0.1)
Other advanced orthopedic procedures	85	(0.9)	98	(1.5)	183	(1.1)
Ob-gyn procedures	142	(1.5)	263	(3.9)	405	(2.5)
Procedures for benign ob-gyn conditions	85	(0.9)	138	(2.1)	224	(1.4)
Procedures for gynecologic cancers	57	(0.6)	124	(1.9)	181	(1.1)
Urological procedures (including cancers)	72	(0.8)	259	(3.9)	332	(2.1)
Other ophthalmology procedures ^d	67	(0.7)	132	(2.0)	199	(1.2)
Total	9344	(100)	6663	(100)	16,007	(100)

^aIncludes goiter, hemorrhoids, rectal prolapse, diabetic foot and toe gangrene secondary to critical limb ischemia^bIncludes neck abscess, sialolithiasis, benign parotid masses, chronic sinusitis, epistaxis^cIncludes excision of ingrowing toenails, intra-articular injections for osteoarthritis, wound dressing under sedation, ear irrigation^dIncludes pterygium excisions, tarsorrhaphy, trabeculectomy and anterior chamber washouts

hospitals performed two-thirds of essential trauma surgical procedures (1194 operations, 67%) in this age group.

Comparison to population <65 years

The estimated annual total operations performed (16,007) was much less than that estimated for the population <65 years (198,578). Yet, the annual operation rate for the elderly was 1744 per 100,000 compared to 768 per 100,000 (95% UI 571–965) for the population aged <65 years (Table 2). The percentage of procedures that fell into the essential category was similar for the elderly (74%) and those under 65 years (77%). However, the patterns of surgery were somewhat different, with higher rates of surgery for hernia, relief of urinary obstruction, and cataract surgery for the elderly (Fig. 1). Predictably, there were higher rates of operations for basic/intermediate obstetric and gynecologic conditions, including cesarean sections, tubal ligations, and obstetric fistula repairs, for patients under 65 years (Fig. 2).

Comparison to high-income country benchmark

New Zealand performed 96,327 operations in 2015 for an elderly population of 683,013; yielding an estimated annual operation rate of 14,103 per 100,000. Compared to this benchmark of total surgical need for the elderly, Ghana has an annual unmet need of 12,359 operations per 100,000 elderly population indicating that only 12% of the need for surgery in the elderly was being met in Ghana. In terms of surgical rate in the younger population, New Zealand performed 201,944 operations in 2015 for an <65 year population of 3922,560, yielding a rate of 5148 per 100,000. Comparison to Ghana's rate of surgery for people <65 years of 768 per 100,000 indicates a met need for surgery of 15% for the Ghanaian population under 65 years.

Discussion

This study sought to determine the met need for surgical operations for Ghanaians aged ≥ 65 years to assess the current capacity and preparedness of the country to provide surgical care for the growing elderly population. The estimated annual surgical rate for the elderly was 1744/100,000 population, only 12% of the New Zealand benchmark, indicating a potentially large unmet need for surgery for this sub-population of Ghanaians. This large unmet need was comparable to that for the Ghanaian population <65 years, suggesting a broad deficiency of surgical care services. Majority of operations for the elderly were of the essential procedure category as defined

by The World Bank DCP-3 with district hospitals performing most of these operations.

The overwhelming burden of disease in elderly persons is from NCDs. However, 34% of people aged >60 years globally find it difficult to access healthcare when they need it [1]. This is likely particularly true for people trying to access surgical services, which have not been prioritized by many LMIC health systems. Although ischemic heart disease, stroke and chronic lung disease are the biggest killers, visual and hearing impairment, osteoarthritis, injuries, and surgical emergencies are among the main causes of disability and often related to causes of death [17, 18]. These conditions disproportionately affect older persons in LMICs [19]. As the Ghanaian elderly population continues to grow, the country's healthcare system must adapt to match the demands that its rapidly growing elderly population will place on it.

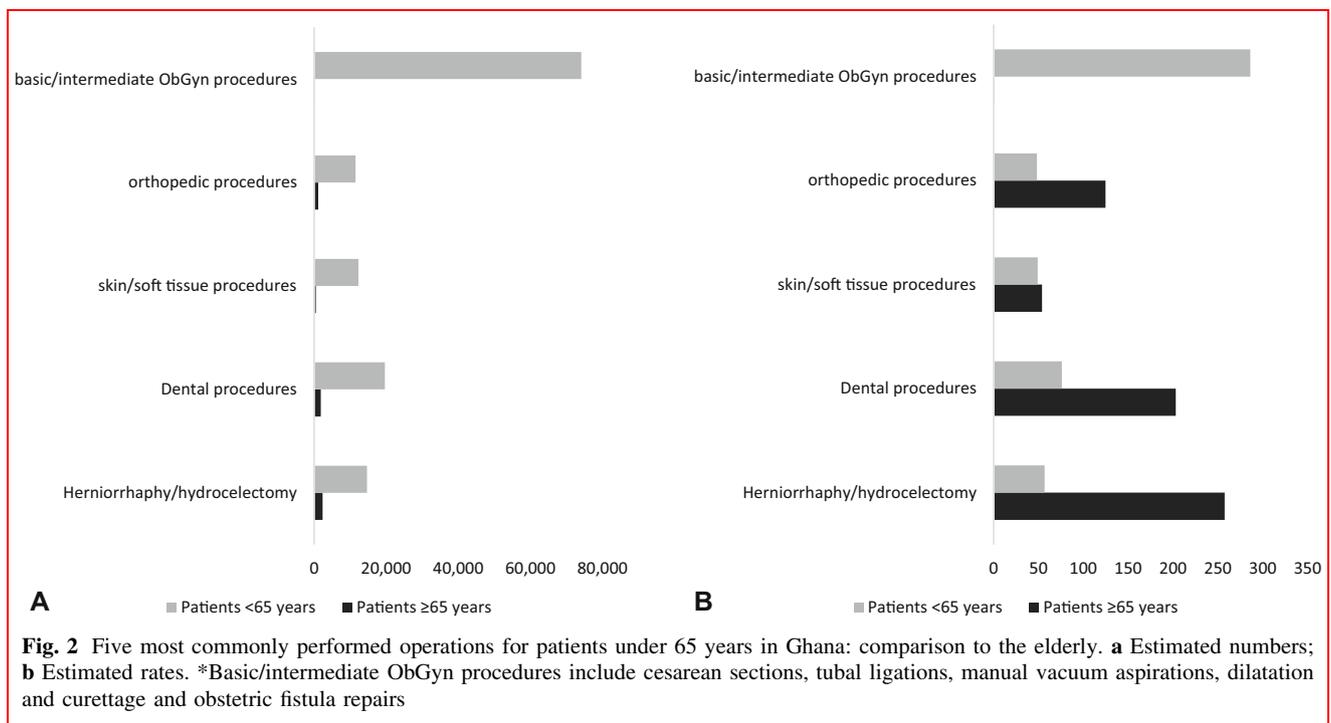
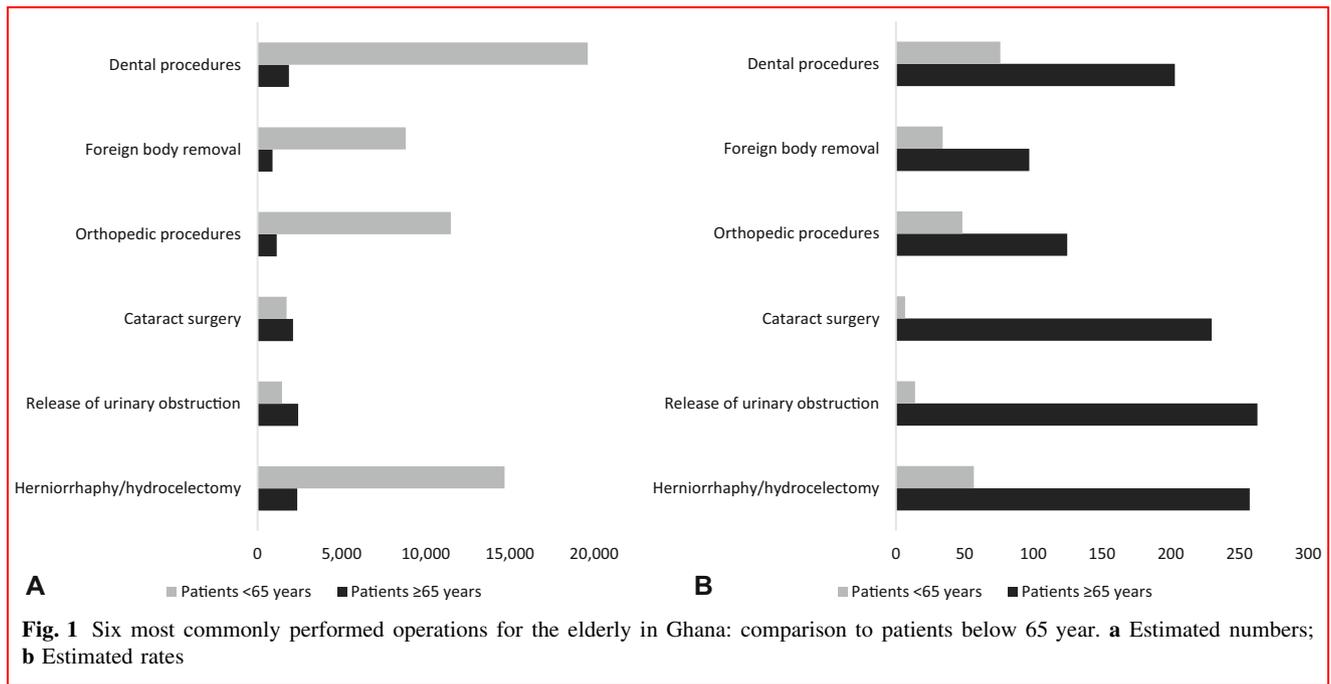
Despite growing demand for elderly care, few training programs and out-migration of healthcare professionals limit the number of healthcare workers, seriously affecting adequate healthcare delivery. Further, there is a serious lack of geriatricians, surgeons, and palliative care specialists to care for the elderly in Ghana, like most LMICs. The increase in the absolute and relative numbers of older persons makes gerontological, surgical, and palliative care education urgent needs [20]. Until specific training programs are developed, existing health and social care professionals and informal caregivers need improved information and training on the needs of elderly persons, which could be integrated into current curricula [21].

The majority of older people in developing countries live in rural areas consequent to rural-to-urban migration of younger adults [22]. Surgical care needs of the rural elderly population usually fall on frontline district hospitals that typically lack fully-trained surgeons [11]. Increasing the number of surgeons at district hospitals may be a worthwhile endeavor with implications for the number and types of surgical operations available for the elderly living in rural areas. Efforts by the Ghana College of Physicians and Surgeons (GCPS) to increase the number of surgeons trained in-country and posted to rural hospitals should be applauded. Since its inception till 2016, the GCPS trained 146 surgeons who were more widely distributed, especially among district hospitals, than they were before training [23]. However, more needs to be done to narrow the gap in met need for surgery among the Ghanaian elderly. The introduction of certain high-yield aspects of gerontology (e.g., prevention and care of delirium, geriatric nutrition and pharmacotherapy, appreciation of frailty and high-risk patients, patient- and family-centered goals-of-care and end-of-life communication, aging ethics) into surgical training might be considered to equip trainees with

Table 2 Comparison of national annual estimated rates of surgical procedures performed in Ghana for the elderly and patients below 65 years

	Patients ≥65 years		Patients <65 years	
	N	Rate ^a	N	Rate ^b
Essential surgical procedures	11,888	1295	153,645	594
General surgery (basic, intermediate)	6113	666	32,032	124
Herniorrhaphy and hydrocelectomy	2363	257	14,680	57
Superficial abscess drainage, wound debridement	965	105	6928	30
Laparotomy for peritonitis (e.g., perforated viscus, appendicitis, cholecystitis)	216	24	4597	19
Release of urinary obstruction	2416	263	1454	14
Male circumcision	30	3	3092	12
Bowel obstruction	105	11	943	4
Colostomy	19	2	336	1
Cataract surgery	2109	230	1728	7
Dental procedures	1867	203	19,619	76
Trauma (basic, intermediate)	1791	195	25,132	97
Skin and soft tissue procedures	494	54	12,278	49
Orthopedic procedures	1144	125	11,481	48
Tube thoracostomy	52	6	473	2
Trauma laparotomy	26	3	624	2
Burr hole	44	5	198	1
Surgical airway	30	3	78	0
Ob-gyn (basic, intermediate)	8	1	74,083	286
Congenital conditions (basic, intermediate)	0	0	1051	4
Other surgical procedures	4119	449	44,933	174
General Surgical procedures	1104	120	9095	35
Excision biopsy for soft tissue masses	329	36	3748	14
Procedures for breast conditions (including cancer)	99	11	1882	7
Procedures for other benign general surgical conditions ^c	556	61	3110	12
Procedures for gastrointestinal and other general surgical cancers	121	13	356	1
Head/Neck procedures	1007	110	10,985	42
Foreign body removal	891	97	8806	34
Procedures for other benign head/neck conditions ^d	63	7	2007	8
Procedures for head/neck cancer	53	6	172	1
Miscellaneous minor procedures ^e	563	61	4983	19
Advanced trauma and orthopedic procedures	509	55	5102	20
Open reduction ± internal fixation	299	33	3143	12
Thoracotomy	0	0	15	0
Craniotomy	7	1	210	1
Tendon repairs/release of contractures	20	2	480	2
Other advanced orthopedic procedures	183	20	1253	5
Ob-gyn procedures	405	44	11,323	44
Procedures for benign Ob-gyn conditions	224	24	9728	38
Procedures for gynecologic cancers	181	20	1595	6
Urological procedures (including cancers)	332	36	2324	9
Other ophthalmology procedures ^f	199	22	1122	4
Total	16,007	1744	198,578	768

^aRate per 100,000 patients ≥65 years^bRate per 100,000 patients <65 years^cIncludes goiter, hemorrhoids, rectal prolapse, diabetic foot and toe gangrene secondary to critical limb ischemia^dIncludes neck abscess, sialolithiasis, benign parotid masses, chronic sinusitis, epistaxis^eIncludes excision of ingrowing toenails, intra-articular injections for osteoarthritis, wound dressing under sedation, ear irrigation^fIncludes pterygium excisions, tarsorrhaphy, trabeculectomy and anterior chamber washouts



requisite knowledge and skills to provide better services and more integrated care for the elderly.

Before drawing conclusions, several limitations should be considered. First, private hospitals were not included in the study as they provide less than 10% of the national surgical volume [12]. Therefore, excluding them is not expected to alter our estimates significantly. Second, 8% of

observations in logbooks were missing age data and were excluded from the analysis. We have no reason to believe that the age distribution of missing entries is different than that seen within the complete data. Third, there are significant differences in the population demographics between New Zealand and Ghana, which likely impacts on the epidemiology of conditions requiring surgery within

the two populations especially among the elderly. However, the LCoGS utilized New Zealand data to arrive at the widely accepted and utilized annual surgery rate benchmark of 5000 operations/100,000 population. This provides good precedence and external validity for using other benchmarks derived from the New Zealand data. Nonetheless, our unmet surgical need might be over-estimated due to the fact that there might be a greater percent of very old people in New Zealand compared with Ghana. Lastly, we have noted the amount of surgery performed at district hospitals that do not have fully-trained surgeons. However, we do not have data on the quality of care at such hospitals vs. hospitals with fully-trained surgeons. Despite these limitations, these data provide a useful estimate of the annual surgical operation rate for the elderly in Ghana and allow at least a general idea of unmet need. More importantly, the study highlights current surgical care capacity for the elderly and provides data that might inform planning to better meet the surgical needs of this growing and vulnerable population.

Conclusion

The annual rate of surgical procedures for the elderly in Ghana points toward potentially large unmet surgical needs that need to be addressed. Most operations for the elderly were in the highest priority category and delivered at district hospitals, majority of which lack fully-trained surgeons. More work is required to better define geriatric surgical needs and benchmarks in LMICs and identify ways that national institutions and the global surgery community can meet the challenges of elderly population growth.

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Compliance with ethical standards

Conflicts of interest The authors declare no competing interest in any form related directly or indirectly to the subject of this article.

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