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Obstacles to Surgical Services in a Rural Cameroonian District Hospital

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Abstract

Background There are significant obstacles to the delivery of surgical care in low income countries. Few studies have defined or characterized these constraints. The present study aimed to identify financial and demographic factors limiting the utilization of surgical services in rural Cameroon.

Methods A review was performed of all surgical records for patients presenting for surgery at the District Hospital of Kolofata in rural Cameroon over the 3-year study period (2004–2007). Disability-adjusted life years (DALYs) were calculated using disease- and patient-specific outcomes while accounting for postoperative morbidity. Univariate and multivariate analysis identified factors associated with failure to return for care.

Results During the study period, 1,213 patients presented for preoperative evaluation, were informed of the cost to be paid preoperatively, and had surgery scheduled. Of these, 544 patients did not return for treatment, representing 2,163 DALYs potentially lost. Multivariate analysis revealed significant factors associated with increased likelihood of not returning for care as required preoperative payment >$US 310 (OR 0.44–0.86) and a recommended procedure for cancer (OR 0.47–0.86) or cutaneous disease (OR 0.28–0.95). Factors associated with increased odds of returning were male gender (OR 1.03–1.98), preoperative payment <$US 50 (OR 2.86–16.2), and a procedure with low DALYs (OR 1.71–9.89). The average cost per DALY for all operations performed was $US 27.13.

Conclusions Although surgery addresses a significant disease burden and is reported to be a cost-effective public health intervention, utilization is limited by high costs, demographic factors, and patient perceptions of surgical diseases.

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Introduction

The World Bank requirements for a successful public health intervention are that it is implemented on a significant scale, addresses a major problem (measured by disability-adjusted life years [DALYs]), lasts more than 5 years, proves to be cost-effective (described as <$US 100 per DALY), and produces a documented effect on outcomes [1]. Despite the recognition that an estimated one-third to one-half of the world's population lacks basic surgical care, historically, surgery was not thought to meet these criteria because of perceived high costs and limited resource availability [2]. Recent studies have shown that surgical services can be delivered to a large population in a cost-effective manner, alleviating a substantial disease burden [3].

Significant obstacles to the implementation of surgical services remain and have been hypothesized to include lack of trained personnel as well as economic constraints [2, 4]. Where surgery is available, few studies have attempted to characterize factors influencing service utilization. The financial burden can be significant—initially borne at the hospital level with fixed and maintenance costs and then passed on to the patient in the form of out-of-pocket payments [5]. How costs and other factors affect the decision to receive surgical care is not well understood.

The surgical ward of the Hôpital de District de Kolofata (HODOK) in the Extreme North province of Cameroon was established to address the gap in surgical services. The primary objective of this study was to identify factors associated with utilization of surgical care. Secondary objectives were to quantify cost-effectiveness and identify variables affecting the cost-effectiveness of surgical procedures. The findings can be extrapolated to other institutions in the region and district hospitals in low income countries where services may not be utilized due to cost, environmental factors, or cultural factors.

Methods

Study site and population

HODOK is a referral hospital for six rural health centers, with a catchment population of 109,000 subsistence farmers and herders. It is approximately 13 km from neighboring Nigeria and 200 km from Chad. The hospital's surgical ward opened in November 2004 with the arrival of a Congolese general surgeon (author D.N.). The team consists of a surgeon, surgical nurse in training, trained nurse anesthetist, circulating and ward nurse, and two medical assistants. The average annual income per capita in the region is approximately $US 300. Illiteracy rates are high, and less than 25 % of adults have completed primary schooling. Six additional hospitals with surgical wards serve the larger region—four private and two public, including the Provincial Hospital of Maroua and a second district hospital in the province. A survey was performed by the author (A.I.) to determine the cost structures of these hospitals. It demonstrated that the cost per procedure for six common operations at HODOK was generally similar to that of surrounding institutions (e.g., cesarean section: $US 150 vs. $US 90–200). Ethical clearance for this study was obtained from the hospital administration, which functions as the Institutional Review Board.

Description of interventions

A complete review of 1,351 available surgical records for 1,213 patients was performed from the inception of the surgical ward on 18 November 2004 through November 2007. At the time of preoperative consultation, every patient receives a cost estimate based on the planned procedure in a standardized operative price guide detailing the length of hospitalization and all anticipated perioperative supplies and medications. A copy of this estimate remains on record in the hospital. Patients are required to pay preoperatively the total anticipated *estimated cost* for all elective procedures. Emergency cases are performed without preoperative payment; payment is made in full prior to discharge, including the cost of postoperative supplies and outstanding charges. An operative log book records the name, age, gender, date, home address, postoperative diagnosis, surgical intervention, type of anesthesia, discharge condition, length of hospitalization, and biopsy results when available. Postoperatively, the *estimated cost* and financial balance are modified according to the actual supplies used, length of hospitalization, and procedures performed.

Inclusion criteria

All patients presenting to HODOK during the study period for whom surgical intervention was recommended are included in this study. Simple procedures such as laceration repair have not been included in this study because they do not require personnel trained in surgical science or an operating room. This allows a more accurate representation of surgical costs and is consistent with proposed definitions [6, 7]. Ophthalmologic procedures are excluded because of the presence of an independently functioning ophthalmology ward.

Health outcomes

The calculation of DALYs is based on the method described by McCord and Chowdhury [3]. Generally, DALYs are calculated by estimating the sum of years of life preserved and the years of life with disability averted by a specific health intervention. In this study, the calculation of DALYs was performed by summing the years of life preserved by an intervention (the product of the fatality risk from the condition, treatment efficacy, and discounted life expectancy) and the potential years lived with disability if the condition persisted without surgery. A novel technique was used to account for postoperative morbidity by subtracting postoperative disability from the total DALYs averted by surgery. Estimations of disability were derived from the World Health Organization (WHO) Global Burden of Disease, Disease Control Priorities 2, Victorian Burden of Disease Study, six classes of severity as described by McCord and Chowdhury, and available studies from the PubMed database [3, 7–12]. The DALYs for patients who did not return for surgery were based on the preoperative diagnoses and planned procedures.

Costs

When analyzing cost as a factor influencing a patient's decision to return for operative care, the *estimated cost* in the preoperative setting was used, because this price best reflects the financial decision making. The *actual cost* of

the operative intervention used in the cost per DALY analysis is the sum of the true supply cost (medical equipment and consumables) plus a weighted average of other operating, fixed, and maintenance costs based on the number of days admitted on the ward.

Fixed and recurrent costs of the surgical ward included land acquisition and construction depreciated over 30 years, surgical equipment at depreciated market values, transportation of supplies, and fuel. Operating costs, including salaries, supplies, electricity and water, were reviewed. Surgical supply costs were determined by the Cameroonian government and increased 15 % when passed on to the patient to account for transportation fees and overhead.

The *estimated cost* required preoperatively from each patient is the sum of the supplies (including suture and medication) plus hospitalization, the surgery, and an additional tax. The authors projected ward capacity at 40–50 operations per month based on the number of hospital beds as well as staff and resource availability. Deficits in the surgical ward budget (i.e., surgeon and staff salary) were partially funded by the government and bilateral donors. Costs are listed in central African francs (CFA), then converted to United States dollars ($US) based on the currency exchange rate at the middle point of the study (466 CFA = $US 1).

Data analysis

Factors associated with returning for surgical care were analyzed using logistic regression with univariate and then multivariate analysis, yielding odds ratios (OR) and associated 95 % confidence intervals (CI). All interactions were explored. Statistical analysis was performed using Epi Info v 3.4.1 (Centers for Disease Control and Prevention, Atlanta, GA) and JMP v. 9.0.3 (SAS Institute Inc., Cary, NC).

Results

Demographics

Over the 3-year study period, 1,213 patients presented for surgical care; 653 patients underwent an operation (53.8 %). There were 192 emergent procedures (15.8 %), and 1,021 patients (84.2 %) were seen in preoperative clinic on an elective basis (Table 1). Of all patients offered elective surgery, 477 returned for an operation and 544 (53.3 %) did not return; in this group, 662/1,021 (64.8 %) were male and 662/1,015 (65.3 %) were from outside Cameroon (location not available for 6 patients).

Factors associated with returning for surgery

Six major factors were evaluated by logistic regression to determine factors associated with returning for elective surgery (Table 2). The most significant predictor of failing to return for operative care was cost. Low cost (<$US 50) was associated with significant odds of returning for care (OR

Table 1 Demographics of patients offered elective surgery categorized by those who returned with payment and proceeded with surgery (elective surgery) and those who did not return for surgery (no elective surgery)

Factor	Elective surgery	No elective surgery
Total patients	477 (46.7 %)	544 (53.3 %)
Gender[a]		
Male	323 (31.6 %)	343 (33.7 %)
Female	153 (15 %)	199 (19.6 %)
Age		
$0 \leq 5$	38 (3.7 %)	35 (3.4 %)
$>5 \leq 21$	72 (7.1 %)	81 (7.9 %)
$>21 \leq 55$	217 (21.3 %)	274 (26.8 %)
>55	150 (14.7 %)	154 (15.1 %)
Location[b]		
Inside district	36 (3.6 %)	30 (3 %)
Outside district Inside Cameroon	145 (14.3 %)	142 (14 %)
Outside Cameroon	295 (29.1 %)	367 (36.2 %)
Diagnosis categories		
Injuries	35 (3.4 %)	47 (4.6 %)
Infectious	63 (6.2 %)	53 (5.2 %)
Abdominal/groin	54 (5.3 %)	68 (6.7 %)
Abdominal emergencies	22 (2.2 %)	24 (2.4 %)
Obstetrics	4 (0.4 %)	10 (1 %)
Gynecology	47 (4.6 %)	42 (4.1 %)
Congenital	9 (0.9 %)	13 (1.3 %)
Malignancy	93 (9.1 %)	162 (15.9 %)
Urology	124 (12.1 %)	90 (8.8 %)
Skin and soft tissue	26 (2.6 %)	35 (3.4 %)
Estimated cost ($US)		
$0 \leq 50$	69 (6.8 %)	8 (0.8 %)
$>50 \leq 200$	200 (19.6 %)	208 (20.4 %)
$>200 \leq 310$	129 (12.6 %)	175 (17.1 %)
>310	79 (7.7 %)	153 (15 %)
DALY		
$0 \leq 1$	196 (19.2 %)	125 (12.2 %)
$>1 \leq 5$	206 (20.2 %)	295 (28.9 %)
>5	75 (7.4 %)	124 (12.1 %)

DALY Disability-adjusted life years

[a] Percentages in parenthesis represent proportions of all patients who were offered elective surgical care per factor

[b] All categories might not add correctly due to a few missing values

6.35; 95 % CI 2.86–16.2; $P < 0.01$). Conversely, cost greater than $US 310 was associated with a decreased likelihood of returning for care (OR 0.61; 95 % CI 0.44–0.86; $P < 0.01$). There was an inverse relationship between cost and the probability of returning for care (Fig. 1).

Men were more likely than women to return for operative care (OR 1.43; OR 1.03–1.98) (Table 2). There was no association between age and likelihood of returning for care. However, there was a significant interaction between male gender and age >55 years; this combination markedly increased the chance of returning for care. Conversely, females >55 years of age presented 5 times less frequently and also had a lower proportion returning for care (52.9 vs. 30.6 %) than their male counterparts. Gender-related differences in the incidence of surgical disease are not known.

The types of surgical procedures most associated with reduced probability of returning for care were operations for malignancies (OR 0.64; 95 % CI 0.47–0.88; $P < 0.01$)

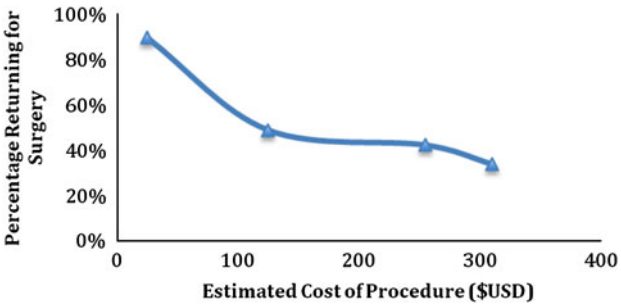

Fig. 1 Percentage of patients who returned for elective surgery per estimated cost group

Table 2 Univariate and multivariate logistic regression of factors associated with returning with payment for an indicated elective surgical procedure

Factor	Univariate OR (95 % CI)	*P* value	Multivariate OR (95 % CI)	*P* value
Gender				
Male	1.28 (0.98–1.67)	0.07	1.43 (1.03–1.98)	0.03
Female	Reference			
Age				
0 ≤ 5	1.1 (0.62–1.95)	0.7		
>5 ≤ 21	Reference			
>21 ≤ 55	0.8 (0.55–1.16)	0.2		
>55	1.02 (0.68–1.53)	0.9		
Location				
Inside district	1.33 (0.76–2.35)	0.3	1.68 (0.95–2.98)	0.07
Outside district	Reference			
Inside Cameroon				
Outside Cameroon	0.82 (0.62–1.09)	0.2		
Diagnosis categories				
Injuries	0.54 (0.32–0.9)	0.02		
Infectious	0.86 (0.55–1.36)	0.5		
Abdominal/groin	0.58 (0.37–0.9)	0.02		
Abdominal emergencies	0.67 (0.35–1.26)	0.2		
Obstetrical	0.29 (0.08–0.9)	0.03		
Gynecology	0.81 (0.49–1.34)	0.4		
Congenital	0.5 (0.2–1.21)	0.1		
Malignancy	0.42 (0.29–0.6)	<0.0001	0.64 (0.47–0.88)	<0.01
Urology	Reference			
Skin and soft tissue	0.54 (0.3–0.96)	0.03	0.52 (0.28–0.95)	0.03
Estimated cost ($US)				
0 ≤ 50	8.97 (4.45–20.66)	<0.0001	6.35 (2.86–16.22)	<0.01
>50 ≤ 200	Reference			
>200 ≤ 310	0.76 (0.57–1.03)	0.08		
>310	0.54 (0.38–0.75)	<0.001	0.61 (0.44–0.86)	<0.01
DALY				
0 ≤ 1	2.25 (1.69–2.99)	<0.0001	4 (1.71–9.89)	0.01
>1 ≤ 5	Reference			
>5	0.87 (0.62–1.21)	0.4		

and cutaneous disease (OR 0.52; 95 % CI 0.28–0.95; $P = 0.03$) (Table 2). Patients needing urologic procedures returned most frequently for elective surgery (57.9 %). The clinical benefit of surgery, measured by DALYs, was inversely related to likelihood of returning; that is, univariate and multivariate analysis showed that patients who needed procedures with 0–1 DALYs were more likely to return (OR 4; 95 % CI 1.71–9.89; $P = 0.01$). There was also an interaction between low-DALY and low-cost procedures; patients characterized by this combination demonstrated a significantly increased likelihood of undergoing an operation. As DALYs increased, so did cost: 0–1 DALYs cost \$US 157.08 ± 98.50; 1–5 DALYs cost \$US 240.99 ± 103.86; and >5 DALYs cost \$US 272.96 ± 106.65.

Surgical procedures performed

The average time between being informed of the cost of the operation at the preoperative consultation and the subsequent surgery was 13.9 days for elective cases. Most patients (77.5 %) were able to pay the deposit within one week, and 53.6 % presented in clinic with money in hand, undergoing surgery within 24 h. There was no correlation between time to payment and cost of the procedure ($P = 0.5$) or patient gender (males 12.3 ± 25 days compared with females 14.1 ± 24.4 days; $P = 0.5$). Patients living within Cameroon underwent a higher proportion of emergency operations (27.1 %) when compared with patients living outside Cameroon (8.5 %) ($P < 0.001$).

Common procedures in each price range are these: (1) <\$US 50—excision of skin/soft tissue mass, debridement of wound, circumcision; (2) \$US 50–200—hernia repair, appendectomy, mastectomy, cesarean section; (3) \$US 200–310—prostatectomy, hysterectomy, lower extremity amputation; (4) >\$US 310—laparotomy for trauma or peritonitis, obstetric fistula repairs.

Burden of disease and cost-effectiveness

Based on a variant of the WHO disease classification, the surgical Burden of Disease of patients who received care was evaluated in eight major areas (Table 3). Obstetrical procedures constituted the largest number, with 130 total cases. Cost-effectiveness analysis of the surgical ward gave a cost-effectiveness ratio of \$US 27.12/DALY. Emergency cases have a cost-effectiveness ratio of \$US 6.1/DALY.

The percentage of surgical DALYs in the regional population treated was 70.5 %; at least 29.5 % (2,163 DALYs) of surgically avoidable DALYs were lost to follow-up.

Discussion

Surgical services are essential to advancing health in low income countries—the burden of disease is high and operations are cost-effective. However, more than 50 % of elective surgical patients who have access to an operating room and a trained surgeon will not return for care. This study reveals that the factors associated with failure to receive surgical care are high costs, female gender, certain disease processes, and high DALYs. Potential areas for targeted interventions include cost restructuring, addressing the access gap for women and patients with cancer, and improving patients' perceptions of surgery.

Table 3 Summary of surgical cases performed categorized by disease

Disease classification	*N* (% total)	Total DALY (% total)	Average cost (\$US)	Average DALY	CEA (\$US/DALY)[a]
Injuries	44 (6.7 %)	281 (5.4 %)	200.99	6.4	31.5
Infections	63 (9.6 %)	183 (3.5 %)	174.28	2.9	60.1
All abdominal cases	113 (17.3 %)	939 (18.1 %)	231.80	8.3	27.9
Elective abdomen/groin	54 (8.3 %)	110 (2.1 %)	163.41	2.0	80.0
Acute abdomen	59 (9.0 %)	829 (16.0 %)	294.40	14.0	20.9
Obstetrics/Gynecology	181 (27.7 %)	3305 (63.8 %)	211.88	18.3	11.6
Obstetrics	130 (19.9 %)	3137 (60.6 %)	214.26	24.1	8.8
Gynecology	51 (7.8 %)	168 (3.2 %)	205.97	3.3	62.6
Congenital anomalies	9 (1.4 %)	57 (1.1 %)	167.46	6.3	26.4
Malignancies and tumors	93 (14.2 %)	213 (4.1 %)	250.55	2.3	109.3
Urology	124 (19.9 %)	192 (3.7 %)	228.26	1.6	147.1
Cutaneous diseases	26 (4.0 %)	8 (0.2 %)	109.99	0.3	350.3
Total	653	5,178	215.00	7.9	27.1

Patients receiving multiple procedures were grouped according to the surgery which contributed greater costs and DALYs. The average cost was the actual total cost to the hospital

[a] CEA (cost-effectiveness analysis) is the cost-effectiveness measured by \$US per DALY

The cost of surgery is the most significant factor influencing a patient's decision to return for an operation. In this study, approximately 90 % of patients with low-cost procedures (<$US 50) returned for surgery, whereas only 34 % returned for procedures costing >$US 310. This relationship was preserved even when accounting for the degree of anticipated clinical benefit measured by DALY.

Out-of-pocket surgical fees at HODOK, which are similar to reports from other low income settings, cost an average of twice the annual consumption per capita [5, 13]. At HODOK, payment is required in full prior to receiving an operation, often necessitating the selling of assets, obtaining loans, and collecting funds from family members and neighbors [5, 14]. Prioritizing the health of an individual with a large upfront deposit becomes a complex family decision, juxtaposing the needs of the surgical patient against the health and stability of his or her entire family [15]. Out-of-pocket fees are a regressive method of financing health care and are known to result in health inequity, failure to utilize resources, and lower cost-effectiveness [5, 14]. The implications are evident: the personal financial burden of surgical services must be alleviated.

Female gender was also seen to be associated with a lower likelihood of returning for surgical care. Among the study population, women returned nearly 1.5 times less often than their male counterparts when accounting for cost, benefit of surgery, and diagnosis. This inequity was more pronounced among women older than 55 years of age, who were least likely to return for care, but also 5 times less likely than men of their same age group to present for evaluation. Gender-specific obstacles to utilization of resources have been observed in other low income settings and have been attributed to limited access to finances and to health illiteracy [5, 16, 17].

The present study found significant statistical differences between diagnostic classes in rates of returning for operative care. Among elective cases in the study population, the most frequent preoperative diagnosis was malignancy. This correlates with previous reports of cancer as the largest burden of elective surgical disease in low income countries [9]. However, patients with malignancies in the present study underwent surgery least frequently among all diagnostic classes, causing them to miss the greatest potential benefit (73.4 % of DALYs lost to surgical care). The perception of cancer as a terminal diagnosis often dissuades individuals from seeking care and undergoing surgery [18, 19]. Even in the presence of advanced malignancy, surgery can improve quality of life and alleviate suffering. There is a critical need to address the growing burden of cancer and to improve curative and palliative cancer care.

Finally, an unexpected finding in this study was a higher rate of return among patients scheduled for low-benefit interventions as measured by DALYs. Low-DALY procedures are also frequently low cost. But, even when accounting for cost, low-benefit operations in this study population were performed nearly 4 times more frequently than high-DALY procedures. One hypothesis is a perception that high-DALY procedures reflect serious illness, thus portending a poor prognosis even when an intervention is offered. Alternatively, there may be an aversion to a high-benefit operation, which often carries higher risks. Finally, patients' perceptions of clinical benefit may not be accurately represented by DALYs.

To improve patient retention rates, programs must address the aforementioned obstacles, particularly the major driving factor—financial costs to the patient. In the present study, low-cost procedures had a 90 % follow-up rate, suggesting that patients in the community were willing to pay for and undergo an operation when the price was not restrictive. To overcome financial constraints, several financial models are being tested in low income countries to reduce the rate of catastrophic expenditures and improve accessibility for those with limited income. Examples include community-based health insurance schemes and a government voucher system. Studies have shown that these programs have significantly improved health care access for the poor, although there have been obstacles when applied to surgical services [14, 20]. Community-based health insurance has been constrained by lack of participation and limited local finances [5, 21]. Government vouchers may not offer a reliable revenue stream [14].

The data from this study indicate that directing funding streams toward essential surgical supplies or staff salary may alleviate the greatest costs passed on to the patient; together, they constitute more than 60 % of the total costs. Directed funding alleviates high out-of-pocket patient costs and improves resource utilization. For example, governmental and bilateral donor funding of highly active antiretroviral therapy has resulted in increased utilization of services and outcomes for HIV/AIDS [22]. This principle can be applied to essential surgical supplies or personnel.

Targeting high-risk groups and improving health education are critical steps to ensure equity of care. Restructuring costs and improving health education through outreach have improved women's access to and utilization of health and surgical services [16]. Providing free services for women and children has also been proposed as a method to increase coverage rates [17]. To improve cancer-specific outcomes, programs highlighting screening, counseling, and survivor groups must be further developed [18, 23].

Maximizing case volume is another important component of generating revenue and optimizing cost-effectiveness. If all the patients who had been seen in the preoperative clinic had returned for care, then the surgical ward at HODOK would have been able to more than

double revenues, resulting in decreased total charges per patient. Costs to individual patients increase as surgical volume decreases, which creates a cycle ending in the loss of viability of a surgical ward. Additionally, increased volume and revenue have also been correlated with improved outcomes and increased purchasing power for cost-effective technologies [16, 24].

Study limitations

Disability-adjusted life years calculations are imbued with potential limitations. Several key assumptions were made and may not be uniformly accepted, such as the discount rate, the use of a specific life expectancy table, the rating of disability, and the case inclusion criteria [25]. Two main methodological limitations were encountered during this study's analysis. First, the assessments relied on parameters of the DALY calculation that are based on the available data and also the authors' clinical judgment. Second, accurate data regarding clinical outcomes were difficult to obtain (e.g., life expectancy and morbidity after prostatectomy for prostate cancer in which the stage is not known). When possible, data and methods of the WHO Global Burden of Disease were employed.

Efforts were made to contact patients, their families, and affiliated community clinics to obtain accurate information about patients' medical status. When no information was available, it was assumed that patients did not receive an operation at a different institution.

Conclusions

Surgical services in low income countries are known to be cost-effective, but face considerable obstacles. Cost is absolutely prohibitive for many patients. To generate revenue, the reimbursement model must be restructured to include interventions such as seeking government subsidies for salaries, equipment, or bulk purchasing of supplies; altering repayment schemes; and minimizing patients lost to follow-up.

Additionally, access must be improved for high-risk groups and patients with surgical illnesses that carry a stigma. This can be done through outreach programs to the community and referring health centers, health education, and survivor groups. Implementation of these and other interventions will further augment the efficacy of surgical interventions as a critical and cost-effective public health tool.

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