

Major and Minor Surgery Output at District Level in Kenya: Review and Issues in Need of Further Research

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SUMMARY

Major and minor surgery is a service of great importance both for the people in need and for health workers and managers trying to develop a comprehensive primary health care service. While in highly industrialised countries some 5000 - 9000 major operations are performed per 100,000 people per year, the rates in East Africa in the early 1990s were in the range of 70-500. In our study all surgical operations performed at hospitals and clinics in Meru district during 12 months in 1990-1991 were listed on record forms including age, sex and home address of patients, and type of operation. Totally 3,415 major operations were recorded, corresponding to 263/100,000 people (88 for males and 434 for females), and the most common major operations were caesarean section, tubal ligation, explorative laparotomy, eye/lens removal and hernia repair. Assuming that the basic need in eastern Africa is about 1,000 major operations/100,000/year, it appears that only 7-50% of this basic need was available in this rural area. The epidemiological basis for such estimates is however rather weak and the information systems are unsatisfactory. More accurate data are required both on descriptive epidemiology and on surgical service output as a basis for planning. Comparisons are difficult due to poorly standardised epidemiology and output indicators. We examine, from a health planning perspective, four possible methods of quantifying the major surgery output: (a) the annual number of major operations per 100 hospital beds; (b) the number per 1000 inpatient admissions; (c) the number per 10,000 new out-patient consultations; and (d) the annual number per 100,000 catchment area population. The mean number per 100 beds was 310 with a range from 452 to 140; the mean number per 1000 admissions was 74 ranging from 88 to 31, the number per 10,000 new outpatient visits was 96 ranging from 188 to 55, and the mean number per 100,000 catchment area population was 263 for the entire district with a range from 383 to 119 among the five hospitals. We conclude that options (1) and (2) are useful and implementable, (3) is less useful but implementable, and option (4) is potentially very useful but not easily implementable until a catchment area population definition is agreed. Minor surgery is even less well investigated, and there are hardly any studies at all from low-income countries. Our data from Meru demonstrate that the one-year output in a population of 1.3 million people was 26,858 (2,066/100,000 people/year) of which about 82% were done at the hospitals in the area. The smaller clinics did on average only 1.8-6.4 minor operations per month. The basic need for minor surgery in these areas has not been estimated, so the unmet need must be considered unknown. Further research is recommended in the following areas: epidemiological estimates of surgical service need in eastern Africa, critical review of the health information systems with regard to surgery, quality of major and minor surgery services especially in rural areas, and reasons for low surgical output at small clinics; possible remedies.

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Introduction

Health care planning and management in eastern African are currently undergoing decentralization to district and to health facility level. The background is health systems expansion, improved management training of health personnel, resource constraints, and an increasing dependency on locally generated resources. Efficiency needs to be improved, and this calls for close monitoring of resource use and of the related service output including comparisons between service providers. Entirely new information systems would be costly and probably complex to manage.

Published data on surgical output in developing countries are more often institution-based than population-based [1-4], and most reports describe the surgical operation pattern in general terms without specifying the figures [5-7]. Many studies are restricted to one or a few surgical procedures. Shija [8] studied hernia repair and hydrocelectomy in Tanzania, Nordberg [9] compared output with estimated need of Ceasarean section, hernia repair and strangulated hernia operation in East Africa, and Makuria [10] analyzed peptic ulcer surgery in Ethiopia. Loeffler [11] reviewed major and minor surgery in rural Kenya and in Zambia, emphasizing problems related to trauma management and critically examining Western medical technology applied in African surgery. A one-year study of the surgical outputs of eight Zambian hospitals was conducted by NGO hospitals at district, provincial and central levels, often as emergency referred to hospital from smaller institutions like health centres, dispensaries, NGO clinics and private practitioners.

This paper is based on a study of the output of surgery in Meru district, Kenya. One of its aims was to examine different methods of quantitative description of surgical production so as to facilitate comparisons between institutions and areas

and between different periods at any given single institution. A few issues in need of further research are identified.

Methods

Meru district, with a surface area of 9922 square kilometers and a 1990 population of approximately 1,3 million, is located on the eastern slopes of Mount Kenya. Its people are relatively affluent and well-educated but there are large differences between the high altitude tea and coffee growing areas where the population density is high and the dry and much less fertile lowland areas where altitudes are less than 700 meters above sea level.

In the district at the time there were five hospitals, ten government health centres, 29 government dispensaries, 49 mission clinics and three nursing homes. Major surgery was performed at all five hospitals and to a small extent also at two nursing homes. Each hospital reported the current number of inpatient beds, the annual number of inpatient admissions, and the number of new outpatients. The catchment area population of each hospital was approximately calculated by dividing the latest estimate of the total district population between the five hospitals in relation to the service capacity of each hospital as reflected by its total number of beds.

All five hospitals in the district recorded, on special forms developed for the purpose, all surgical operations performed during 12 months starting August 1990. The data for each operation included name, age, sex and home address of the patient, diagnosis or condition, date and type of the operation, type of anaesthesia, and whether or not the operation was considered an emergency. All hospitals also continued using their existing system of recording every major and minor operation performed in the main surgical theatre: a "surgical operations register" where largely similar information was noted.

Results

Table 1. Meru District Hospitals Performing Major Surgery

HOSPITAL	OWNER	NO. OF BEDS	NO. OF DOCTORS
Meru District Hospital	The Government	254	10
Nkubu	Catholic Diocese	270	5
Chogoria	Presbyterian Church	307	6
Maua	Methodist Mission	140	6
Tigania	Catholic Diocese	132	3
TOTAL		1103	30

Table 2: One-year Output of Major Operations in Meru District by Hospital

TYPE OF OPERATION	MERU	NKUBU	CHOGORIA	MAUA	TIGANI	OTHE R	TOTAL
Caesarean section	670	424	255	136	138	55	1678
Hernia repair	21	23	35	0	4	0	83
Laparotomy, expl	48	72	18	22	22	9	191
Op on stomach/gut	5	21	31	0	0	3	60
Tubal ligation	221	9	201	54	0	17	502
Prostatectomy	13	13	12	0	0	0	38
Amputation arm/leg	8	12	4	0	0	0	24
Hydrocoele op	7	13	4	1	1	0	26
Hysterectomy	2	39	18	2	4	2	67
Myomectomy	1	0	1	0	0	0	2
Adnexectomy	2	4	12	0	2	1	21
Mastectomy	3	0	4	0	0	0	7
Appendectomy	4	17	5	1	2	0	29
Ectopic pregn op	3	29	11	0	3	0	46
Cleft lip/palate	4	0	1	1	0	0	6
Club foot	0	51	2	0	0	0	53
Thyroidectomy	4	3	12	0	0	0	19
Fracture, open red	4	31	16	4	1	0	56
Eye/lens removal	45	0	136	0	1	0	172
Orchidectomy	3	3	2	0	2	0	10
Haemorrhoidectomy	2	1	2	2	0	0	7
Splenectomy	1	0	1	1	0	0	3
VVF repair	1	0	0	0	0	0	1
Other	87	68	154	0	5	0	314
TOTAL	1149	833	937	224	185	87	3415

The five hospitals had total bed capacities between 307 and 132 with a district total of 1103, or 85 hospital beds per 100,000 people (Table 1).

A total of 3,415 major operations were recorded and reported during the one-year study period (Table 2), corresponding to 263 per 100,000 people. By far the most common major operation was Caesarean section (1678) followed by bilateral tubal ligation (502), explorative laparotomy (191), eye/lens removal (172) and hernia repair (83).

The government district hospital performed 1149 major operations, or 34% of all major operations in the district, while the

four church/mission hospitals did 2179 operations making up 64% of the total. These proportions varied considerably between types of operation. While for instance the district hospital did 40% of all caesareans, 44% of all tubal ligations and 20% of the cataract operations in the district, it did only 14% of the appendectomies, 3% of the hysterectomies and none of the 53 club foot corrections. Of the major operations 82% were performed on females, mainly reflecting the large number of Caesareans. Most of the gastro-intestinal surgery was done on males while exploratory laparotomy was done more often on females.

Table 3: Major Operations at Meru District Hospital

OPERATION	0-14	15-44	45+	Adults	TOTAL
Caesarean section	1	653	1	15	670
Tubal ligation	0	218	3	0	221
Laparotomy, explor.	5	27	10	6	48
Hernia repair	11	7	1	2	21
Hydrocele op	0	3	2	2	7
Op on stomach/gut	3	2	0	0	5
Prostatectomy	0	2	8	3	13
Fracture, open red	0	2	1	1	4
Appendectomy	1	2	1	0	4
Eye/lens removal	5	11	19	0	35
Orchidectomy	1	2	0	0	3
Ectopic pregnancy op	0	3	0	0	3
Mastectomy	0	2	1	0	3
Amputation arm/leg	2	1	3	3	8
Thyroidectomy	1	2	1	0	4
Spennectomy	1	0	0	0	1
Other major op	27	55	8	0	90

Table 4: Annual Number of Major Operations per 100 Beds

Type of Operation	Meru D.H.	Nkubu	Chogoria	Maua	Tigania	Meru District
Caesarean section	264	157	83	97	105	152
Bilat. Tubal Lig.	87	3	65	39	0	46
Hernia repair	8	9	11	0	3	7
Hysterectomy	1	14	6	1	3	6
Gastro-intestinal op	2	8	10	0	0	5
All	452	309	305	160	140	310

The large number of tubal ligations - to be compared with very few recorded vasectomies - also contribute to the large number of operations on women, as illustrated by the output at Meru District Hospital (Table 3). Nkubu Hospital, a Catholic facility with 24% of all Meru district hospital beds, did 24% of all major operations but a much larger proportion of the gastro-intestinal surgery (35%), the hysterectomies (58%), the club foot corrections (96%) and the appendectomies (59%), but only 1.8% of the tubal ligations. Chogoria Presbyterian Church Hospital with 28% of all beds did 28% of all major surgery and 16% of all Caesareans but as much as 63% of all thyroidectomies and 79% of all major eye operations. Maua Hospital, run by Methodists, had 13% of the beds and did 7% of all major surgery, mainly in obstetrics and gynaecology with 8% of all Caesareans and 11% of all tubal ligations in the district. Tigania hospital, run by the Catholic Diocese, had 12% of the beds and did 6% of all major operations including 138 Caesarean (9% of all), 22 laparotomies (12%), 4 hernias (5%), 4 hysterectomies (6%) and one tubal ligation but no gastro-intestinal surgery, no hysterectomies and no major amputations.

Two of the three private nursing homes in the district did a modest amount of

surgery, and their reported output during the project period included 55 Caesarians (3% of all in the district), 17 tubal ligations (3%), 9 laparotomies (5%), 3 gastro-intestinal operations (5%) and 2 hysterectomies (3%). All operations except two were performed on female patients, and no patient was below 15 years of age.

The major surgery output, related to the number of inpatient beds as an indicator of hospital size, is shown in Table 4. The same output related to the total number of inpatient admissions, the total number of outpatient visits and the number of operating staff is given for each of the studied hospitals in table 5. In table 6 the total output as well as the output of the 23 most common types of major operation is related to the estimated population in the catchment area of each hospital.

Information was obtained about 26,858 minor operations performed in the district during the year. Of these, 22,838 (85%) took place in the five hospitals. The most common operations were episiotomy, tooth extraction, wound suture, incision and drainage, and dilatation and curettage (Table 7). The average monthly number of operations performed at a health centre, a dispensary and a mission clinic was 6.4, 1.7 and 3.5, respectively.

Table 5. Major Operations Related to Admissions, OPD visits, and number of Doctors

Hospitals	No of Major Op:s per 1000 hospital admissions	No of Major op:s per 10,000 new OPD visits	No of Major operations per doctor
Meru District Hospital	88	55	115
Nkubu Hospital	72	133	167
Chogoria Hospital	97	188	155
Maua Hospital	31	182	37
Tigania Hospital	40	70	62
All Meru District	74	96	1106

Table 6. Major Operation Rates per 100,000 Population

Type of Operation	Meru D.H.	Nkubu	Chogoria	Maua	Tigania	TOTAL MERU DISTR.
Catchm area pop '000'	300	318	362	165	156	1,300
Caesarean section	223	133	70	82	88	129
Hernia repair	7.0	7.2	9.7	0	2.6	6.4
Laparotomy, explor.	16	23	5.0	13	14	15
Op on stomach/gut	1.7	6.6	8.6	0	0	4.6
Tubal ligation	74	2.8	56	33	0	39
Prostatectomy	4.3	4.1	3.3	0	0	2.9
Amputation arm/leg	2.7	3.8	1.1	0	0	1.8
Hydrocele op	2.3	4.1	1.1	0.6	0.6	2.0
Hysterectomy	0.7	12	5.0	1.2	2.6	5.2
Myomectomy	0.3	0	0.3	0	0	0.2
Adnexectomy	0.7	1.3	3.3	0	1.3	1.6
Mastectomy	1.0	0	1.1	0	0	0.5
Appendectomy	1.3	5.3	1.4	0.8	1.4	2.4
Ectopic pregn op	1.0	9.1	3.0	0	1.9	3.5
Cleft lip/palate	1.3	0	0.3	0.6	0	0.5
Club foot op	0	16	0.6	0	0	4.1
Thyroidectomy	1.3	0.9	3.3	0	0	1.5
Fracture, open red.	1.3	9.7	4.4	2.4	0.6	4.3
Eye/lens removal	11.7	0	37.6	0	0.6	13.2
Orchidectomy	1.0	0.9	0.6	0	1.3	0.8
Hemorrhoidectomy	0.7	0.3	0.6	1.2	0	0.5
Splenectomy	0.3	0	0.3	0.6	0	0.2
VVF repair	0.3	0	0	0	0	0.1
Other	29	21	43	0	3.2	24
TOTAL	383	262	259	136	119	263

Discussion

Although there are no well-defined definition of "major" surgery [13] this category of surgical operations seems to be interpreted similarly. Hernia repair, hydrocele operation and open reduction of fracture are considered major, for example, while cervical dilatation with curettage and closed fracture reduction are minor. Most skin grafts, tendon repairs, foreign body

removals and wound sutures are classified as minor, but they vary widely in complexity, and a small proportion may be complex enough to be counted as major. Some procedures, for instance closed reduction of fracture, do not fulfil a common criterion of surgery - cutting skin or mucous membranes or excising and removing tissue [14] - but are nevertheless often listed among minor surgical operations.

Table 7. One Year output of Minor Surgery by Type of Operation and by Type of Institution

Operation	Hospitals	Gov HC & Disp.	Mission Clinics	Nursing Homes	TOTAL	Operations per 100,000 Population
Tooth extraction	6,040	263	1104	0	7,407	570
Wound sutures	2,644	697	891	61	4,293	330
Incision & drainage	1,931	267	496	3	2,697	207
Dilatation/curettage	823	1	0	2	826	64
Evacuation of uterus	421	0	0	2	423	33
Excision	451	2	1	1	455	35
Foreign body removal	365	23	3	0	391	30
Fracture, closed red	246	0	0	0	246	19
Tendon repair	231	0	0	0	231	18
Circumcision	189	0	15	0	204	16
Biopsy	148	0	0	1	149	11
Skin graft	97	0	0	0	97	7
Cutdown	95	0	0	0	95	7
Amputation finger/toe	70	0	0	0	70	5
Urethra dilatation	67	0	0	0	67	5
Aspiration of abscess	60	0	0	0	60	5
Episiotomy	8,960	129	0	58	9,147	704
TOTAL	22,838	1,382	2,510	128	26,858	2,066

Differences between hospitals were large, and the choice of method for comparison is important. Relating the number of operations to hospital bed capacity is convenient and useful in the case of district and provincial hospitals but may be misleading for others. None of the five hospitals in Meru district had any particular surgical or non-surgical orientation which means that the method should be applicable in this case. The result, shown in Table 4, reveals major differences between hospitals for instance with regard to policy on tubal ligation. There are also large variations in the reported rates of hysterectomy and gastro-intestinal surgery, which can not be explained by classification differences. Output differences between government and NGO hospitals probably reflect policy variations, experience and interests of current operators and the privilege of NGO hospitals to be more selective as regards what cases should be managed locally and what to refer.

Other surgical rate options are based on the assumption that there is an association between, on one hand, the number of major operations performed and on the other hand the total number of inpatient admissions or the total number of new outpatients seen at the same hospital. The indicators could be the number of major operations performed per 1000 admissions, and the number of major or minor operations per 10,000 new out-patient visits at the hospital under study or in the entire district.

Relating the surgical output to the catchment area population has great advantages when the size of this population can be calculated. A useful indicator is the annual number of major operations performed per 100,000 people, which means that hospital catchment area populations must be estimated or that the total surgical production in the district or province - with known populations - must be determined. Such rates exclude operations on the small numbers of people who undergo surgery

outside their home district or province. Meru district rates, based on an estimated 1990 district population of 1,3 million and shown in table 6, include rates estimated for the five hospitals in the district. Actual catchment area populations of these hospitals are unknown but have been approximated here, to aid our discussion, by simply dividing the 1990 district population proportionally to the bed capacity of each hospital.

There were interesting output differences between the hospitals. Maua and Tigania did little major surgery outside the area of obstetrics and gynaecology. Nkubu and Chogoria did considerably more electives, including gastro-intestinal surgery, and more hysterectomies and ectopics than the district hospital. In reconstructive surgery Nkubu did more club foot reconstructions than the other hospitals but no cleft lip/palates. Chogoria did a lot of eye surgery and many tubal ligations but relatively few caesareans. Some of these differences are due to annual random case-mix variation, some relate to capabilities and preferences of operating staff (reconstructive surgery) while others may reflect policy differences. Catholics' restrictive policy regarding abortions and certain family planning technologies such as tubal ligations is one example affecting rates of some surgical operations.

Most NGO hospitals are in a more fortunate resource situation than government facilities. They usually employ at least a few expatriate staff, and they tend to have highly qualified and motivated nurses. This contributes to a higher service output and usually also to higher quality services. Operating doctors at the larger mission hospitals did more surgery per doctor (167 and 155 major operations per year) than those at the district hospital (115). Shortages of surgery-related supplies such as gloves and drugs in government facilities explain part of this difference.

Most major surgery was performed by non-specialized doctors like general practitioners (GPs). Specialists often operate outside the boundaries of their speciality.

The annual number of performed major operations per doctor (surgeons plus GPs) is a useful hospital output indicator, and the Meru district figures, shown in table 5, show a major difference between, on one hand, the hospitals doing only emergency surgery (Maua and Tigania), and on the other those doing both electives and emergencies (Meru, Nkubu and Chogoria).

The findings are in harmony with those of previous studies in the sense that Meru district's annual surgical rate is similar to corresponding rates found at rural hospitals elsewhere in eastern Africa during the last decade [15]. Total annual rates of major surgery per 100,000 people at the five hospitals in Meru district varied between 119 and 383, a surprisingly narrow range considering the different sizes and characteristics of the hospitals, similar to the rate recently found at a hospital in Western Kenya [16] but much higher than rates estimated for 1983-84 in Ethiopia [17]. The 1989/90 rate of Caesarean section (average 129/100,000/year) was two to five times higher in Meru district than corresponding estimates elsewhere in eastern Africa during the 1980s but still little more than half of the estimated minimum need [13]. On the other hand, the rates of hernia repair (6.4/100,000/year) and ectopic pregnancy operation (3.5) were lower. Corresponding rates in highly industrialized countries, with generally healthier populations, are 10-100 times higher, reflecting large differences in terms of education and awareness, household resources, cultural factors and health sector capacity [15].

Surprisingly little minor surgery was done at health centres, dispensaries and mission clinics in the district. Possible explanations are unsatisfactory training, resource constraints, poor motivation and incentives, and further study of this question is recommended.

We conclude that each hospital should report its annual major surgery output in relation to its bed capacity, to its total annual number of admissions, and to its estimated catchment area population. It would be helpful to planners also to obtain the annual

output related to the number of operating doctors. Health centres, dispensaries and other small clinics should report, at least annually, their minor surgery output by type of operation per 10,000 or 100,000 in the catchment area. Each health facility without a recent catchment area population estimate should attempt, in consultation with district or central statistical and health authorities, to make such an estimate and then report its service output not only in annual absolute figures but also in the form of population-based rates. District medical officers should report annually the number of major and minor operations performed per 100,000 district population.

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Obituary: *It is with deep regret that we inform readers that Erik Nordberg, a regular contributor to this Journal, passed away before publication of this article. Editor*

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