



Assessing the impact of cataract surgeons trained in eastern Africa for VISION 2020

Final Report

The training of cataract surgeons in eastern Africa was initiated in the 1980s as a response to the need for additional staff to handle the backlog of cataract surgery throughout the region. Formal training programmes were initiated in Malawi, Tanzania, and Kenya; Uganda trained some cataract surgeons on an individual basis. Over this period of time it is estimated that over 100 cataract surgeons have been trained in ECCE + IOL implantation and deployed in Malawi, Tanzania, Kenya, Zambia, Ethiopia and Uganda.

There has been no information on the impact of this cadre on reducing blindness in the region, on the factors that predict productivity following training, or any cost benefit analysis of their activities (cost of training and placement contrasted with the financial and social benefit of restoring vision)? An evaluation of the cataract surgeons was undertaken because we felt this could assist in advocating for training and appropriate placement as well as in identifying the strategies needed for improving service delivery by cataract surgeons.

Objectives

The objectives of the assessment were as follows:

1. Determine the output of cataract surgeons since their graduation (year by year) and (where possible) calculate their contribution to provincial/district and national CSR figures.
2. Determine the factors associated with high output versus low output of surgeons
3. Identify approaches that will strengthen the output, supervision & support, training, and placement of surgeons.

Collaboration

This was a collaborative project with the individual training programmes, the respective Ministries of Health, NGO partners, and the KCCO. In Tanzania an

evaluation team, comprised of a representative from the MoH, NGOs, two surgeons, and KCCO, helped to guide the process.

Methodology

Training programmes in Malawi, Tanzania, Kenya and Uganda were requested to provide a list of all graduates of their training programmes with contact information. A questionnaire (attached) was designed and pre-tested prior to implementation.

All graduates (regardless of residence and current activities) were requested to complete and return the questionnaires. Significant follow up effort was made to retrieve completed questionnaires.

In-depth interview and focus group discussions (one in Dar es Salaam in January 2006 for the Tanzania surgeons and one in Nairobi in December 2005 for the other surgeons) targeted issues raised in the questionnaire. Participants for interviews and focus groups were selected thus: Surgeons who completed the questionnaire were divided into “high volume” (>300/year) and “low volume” (<300/year) and a random sample of those working in the 4 countries was generated from each list. We sampled 14 surgeons from Tanzania, 6 each from Kenya and Uganda, 1 from Zambia, 2 from Ethiopia and 1 from Malawi. Trainers from Malawi, Kenya, Uganda, Ethiopia and Tanzania also participated in these 1-2 day sessions. Others participating in the sessions included the Ministry of Health and NGOs.

Analysis of quantitative data

Data was entered on an SPSS-10 data set and mean values were calculated. Comparisons were carried out using parametric and non-parametric tests, according to the data distribution. The primary outcome was considered to be “productivity” defined as the mean number of surgeries per year over the last 5 years. Surgeons in practice for fewer years had productivity calculated according to the number of years practicing.

Findings

Surgical numbers and individual productivity

Quantitative data was received from 88 surgeons as noted in Table 1. The overall response rate was 78.6%.

Table 1
Number of cataract surgeons trained and number of completed forms

Country	# trained (active)	# forms received
Ethiopia	6	6 (100%)
Kenya	45	29 (64.4%)
Malawi	1	1
Tanzania	34	30 (88.2%)
Uganda	11	11 (100%)
Zambia	4	3 (75%)
Other countries	11	8 (72.7%)
Total	112	88 (78.6%)

The number of surgeries reported by surgeons during the 5 year period of 2000-2004 was 77,120. (Table 2) There are no figures for the total number of cataract surgeries done by ophthalmologists for this same time period (except for Tanzania¹), rendering comparison impossible. Cataract surgeons, by and large, are resident in more rural areas of eastern Africa while ophthalmologists are primarily based in large population centres. Each surgeon contributes a different number of years to the surgical totals requiring calculation of surgeon years. Overall, cataract surgeons have been doing an average of 243 surgeries per year, ranging from 114 per year in Uganda to three times this number in Ethiopia. (Table 2)

Table 2
Surgeries, surgeon years, and surgeries per surgeon years among reporting surgeons

Country	# surgeries	Surgeon years	Surgeries per surgeon year
Ethiopia	10,066	29	347
Kenya	23,368	86	272
Malawi	403	3	134
Tanzania	25,819	116	223
Uganda	5,796	51	114
Zambia	1,911	6	319
Other countries	9,904	26	381
Total	77,120	317	243.3

Factors associated with productivity

Factors associated with productivity were divided into three types: demographic factors, training factors, and current work environment factors.

Demographic factors included age and sex of the surgeon. Findings, summarized in Table 3 indicate that there is some association between age and productivity with older surgeons being more productive. Further analysis revealed that younger surgeons were in practice for a much shorter period and years in practice was associated with productivity. (see Figure 1) Female surgeons generally were half as productive than male surgeons.

Table 3
Productivity by age and sex of the surgeon

Sex *	Average productivity/year (SD)
Male surgeons (n=61)	295.3 (298.4)
Female surgeons (n=14)	141.2 (163.4)

¹ Reliable data from 2002 in Tanzania showed a total of 11,176 surgeries. At that time there were 24 cataract surgeons and data indicates that they performed 4,470 surgeries that year (186 surgeries per surgeon in 2002 and 40% of the total surgeries). There were 25 registered ophthalmologists and they performed 6,706 surgeries (268 per surgeon in 2002 and 60% of the total surgeries).

Age	
Surgeons <46 years (n=38)	202.3 (223.9)
Surgeons 46+ years (n=33)	308.9 (300.3)

* Differences are statistically significant (Mann-Whitney U p value =0.03)

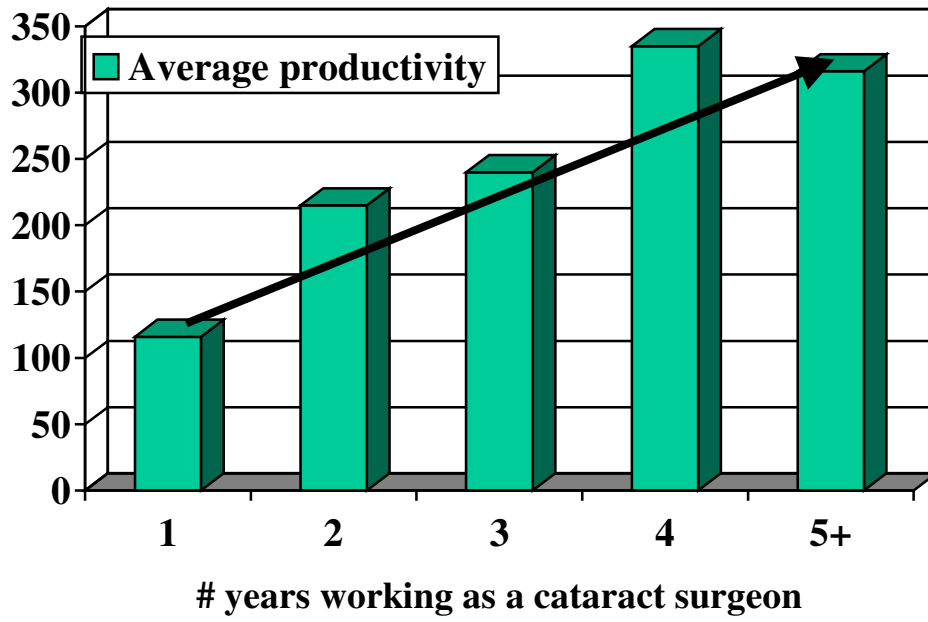
Training factors include: where trained, who supported the training, and the year trained. Those trained in Uganda (not formally) had the lowest productivity levels. This was followed by those trained at KCMC (Tanzania) and KMTC (Kenya). (Table 4) Malawi-trained surgeons (currently based in 8 countries) generally had the highest productivity. Assessment of who sponsored the training was generally not as illuminating as where the surgeons were currently based. For example, surgeons sponsored by CBM but based at MoH hospitals had lower levels of productivity compared to surgeons sponsored by CBM but based at mission or private hospitals. One of the best indicators of productivity was the number of years since completion of training; surgeons generally started out with low numbers during their first years, gradually building up to become the most productive by the 5th year. (Figure 1)

Table 4
Productivity by training sponsorship and training site

Sponsorship	Average productivity per year (SD*)
MoH (20)	267.8 (338.1)
CBM (26)	331.8 (286.7)
SSI (17)	220.7 (203.2)
Other NGO (8)	221.1 (319.7)
Self (4)	121.2 (192.9)
Where trained	
KMTC (Kenya) 27	246.2 (318.9)
KCMC (Tanzania) 21	303.3 (271.8)
Lilongwe 16	277.0 (235.4)
Uganda (various places) 7	101.7 (66.5)
Others (4)	456.3 (449.9)

* There was considerable variation among people whose training was sponsored by the MoH and by other NGOs.

Figure 1
Productivity by years working as a surgeon



The current work environment of cataract surgeons included such factors as type of hospital, number of support staff, frequency of supervision, number of cataract surgical sets, presence of an operating microscope, IOLs and other consumables and whether there were community programmes in place to bring in patients for surgery.

Variability in productivity was associated with the number of supportive eye staff; surgeons with 3 or more support staff were over twice as productive as surgeons with 0-2 support staff. Mission hospitals and private hospitals were the most productive, with figures 2-3 times higher than MoH facilities. Supervision did not seem to predict productivity, however the type and quality of supervision was not measured. Having 2 or more cataract surgical sets was associated with a three-fold increase in productivity compared to having less than two cataract sets. Furthermore, having a functioning operating microscope was also associated with higher productivity. Interestingly, surgeons that relied upon a combination of purchases and donations for consumables generally had the best productivity. Finally surgeons who had programmes that brought patients to the hospital had productivity at twice the level of surgeons without such programmes. There was no difference between having no community programme and having a community programme that did not involve transporting patients to the hospital for surgery. (Table 5)

Table 5
Productivity by environmental factors

Type of hospital	Average productivity per year (SD)
MoH regional/tertiary hospital	206.6 (245.4)
MoH district hospital	194.4 (244.4)
Mission hospital	368.2 (324.4)
Private hospital	418.6 (326.3)
Number of support staff (nurses) *	
0-1 (21)	204.8 (281.9)
2 (17)	251.3 (284.9)
3+ (19)	451.1 (324.1)

* Differences are statistically significant ($p=0.02$, Kruskal Wallis Test)

Frequency of supervision by an ophthalmologist	Average productivity per year (SD)
No visit in last year (n=11)	258.2 (310.7)
One or more visit in last year (n=46)	267.4 (297.1)
Working under ophthalmologist (n=12)	301.8 (276.3)
Number of cataract surgical sets *	
Not complete (n=12)	123.7 (261.4)
1 complete set (n=26)	171.8 (191.6)
2 or more complete sets (n=32)	415.5 (309.6)

* Differences are statistically significant ($p<0.001$, Kruskal Wallis Test)

Operating microscope *	Average productivity per year (SD)
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None (n=9)	99.5 (113.3)
Not working well (n=7)	168.2 (187.2)
Functioning (n=56)	315.7 (304.0)
IOLs and other consumables *	
Rely on donations (n=34)	241.0 (275.3)
Rely on purchases (n=25)	281.6 (293.9)
Rely on combination of purchases and donations (n=8)	429.9 (351.1)

* Differences are statistically significant ($p=0.016$, Kruskal Wallis Test)

Community programmes *	Average productivity per year (SD)
None (n=32)	225.6 (275.8)
Yes, but do not bring patients to hospital (n=25)	220.3 (269.9)
Yes, includes bringing patients to hospital (n=14)	475.4 (280.6)

* Differences are statistically significant ($p=0.001$, Kruskal Wallis Test)

The level of support to surgeons could be related to the type of facility in which they are based. Findings indicated that mission and private hospitals were more likely to have adequate support (for necessary equipment, surgical instruments, and systems to obtain consumables, nursing support, and programmes to bring patients to the hospital compared to MoH facilities. (Table 6)

Table 6
Support for surgical service delivery by type of hospital

Characteristic	Mission/ private hospital	MoH hospital	Odds Ratio (95% CI)
Nursing support			
3+	10 (47.6)	9 (25.0)	2.73 (0.76-10.04)
<3	11	27	
Cataract sets			
2+	18 (69.2)	14 (31.8)	4.82 (1.51-15.86)
<2	8	30	
Functioning microscope			
Yes	22 (81.5)	34 (75.6)	1.42 (0.38-5.50)
No	5	11	
Consumables			
Donation	12 (50)	13 (31.0)	
Purchase	8 (33.3)	25 (59.5)	
Donation+ purchase	4 (16.7)	4 (9.5)	
Supervision			
None	5 (19.2)	6 (14.0)	
One + visit	18 (69.2)	28 (65.1)	
With ophthalmologist	3 (11.5)	9 (20.9)	
Community programmes			

None or some but no programme to bring patients to hospital	17 (65.4)	39 (88.6)	4.13 (1.05-17.01)
Bring patients to hospital	9	5	

Although the number of female surgeons was small, comparing male and female surgeons revealed that female surgeons were less likely, compared to male surgeons, to have the critical components of a productive service. (Table 7)

Table 7
Environmental characteristics in settings with male & female surgeons

Characteristic	Female surgeons	Male surgeons	Odds Ratio (95% CI)
Hospital type			
MoH	13 (72.2%)	44 (63.8%)	1.48 (0.42-5.43)
Mission/private	5	25	
Nursing support			
<3	9 (81.8)	20 (38.5)	7.2 (1.24-54.1) p<0.01
3+	2	32	
Cataract sets			
<2	12 (75.0)	30 (46.9)	3.4 (0.9-14.2)
2+	4	34	
Functioning microscope			
Yes	10 (58.8)	51 (77.3)	0.42 (0.12-1.49)
No	7	15	
Consumables			
Donation	10 (76.9)	27 (44.3)	
Purchase	1 (7.7)	28 (45.9)	
Donation+ purchase	2 (15.4)	6 (9.8)	
Supervision			
None	6 (33.3)	10 (15.6)	
One + visit	7 (38.9)	43 (67.2)	
With ophthalmologist	5 (27.8)	11 (17.2)	
Community programmes			
None or does not bring to hospital	12 (85.7)	49 (80.3)	1.47 (0.25-10.94)
Bring patients to hospital	2	12	

* p<0.05

As noted in our methods section, we did not include 9 surgeons who did not perform surgeries in the last 5 years in our analyses. Findings suggest that these individuals are primarily from Tanzania, female, sponsored by other NGOs or themselves, and based at MoH facilities. (Table 8)

Table 8
 Characteristics of surgeons who have not practiced in the past 5 years

Characteristic	Number of people doing no surgeries 2000-4
Sex	
Males	6/67 (8.9%)
Females	3/17 (17.6%)
Age (mean)	46
Country	
Tanzania	6/40 (15.0%)
Kenya	3/48 (6.2%)
Years in practice (mean)	8
Sponsorship	
MoH	2/22 (9.1%)
CBM	2/28 (7.1%)
SSI	0/
Other NGO	3/11 (27.3%)
Self	2/6 (33.3%)
Hospital type	
MoH regional/district	8/65 (12.3%)
Mission/private	1/31 (3.2%)

Implications of the findings

Clearly, cataract surgeons have made a major contribution to the number of cataract surgeries carried out in eastern Africa in the past five years. Assuming the surgeons who did not report contributed some cases to the overall totals, it can be estimated that surgeons have performed over 80,000 operations in the last five years. While this number is very impressive, it has been generated from 319 surgeon years and the average productivity per surgeon is relatively low. It would be helpful to be able to estimate the cost of training and supporting a cataract surgeon (and programme) on an annual basis in order to examine cost-benefit.

Productivity varied considerably in eastern Africa with Ugandan surgeons being, on average, one-third as productive as surgeons in Ethiopia, Zambia, and other countries. This variation could not be attributed to country of origin, but, instead to other factors.

The higher productivity of male surgeons compared to female surgeons was unexpected. Further analysis revealed that male surgeons were more likely to have more support staff, 2+ cataract surgical sets, a functioning operating microscope, and a programme bringing patients to hospital for surgery. While males are slightly more likely to be based at mission hospitals and private hospitals (where this support is the best), this difference is small and cannot explain why female surgeons are less likely to have the support needed for high productivity. Further investigation is needed.

While sponsorship, by itself, did not predict productivity, it did suggest that those who come into training programmes with self-sponsorship are least likely to end up productive. This may be a consequence of poor placement and support following completion of training. Local working environments appear to be more important than sponsorship; the considerable variation in findings among those sponsored by MoH is likely due to different supportive factors, following completion of training. In particular, the most important factors associated with productivity included support staff, surgical sets, operating microscopes and community programmes that bring patients to hospital.

The more productive mission hospitals and private hospitals were 4.8 times more likely to have 2+ cataract surgical sets, 4.1 times more likely to bring patients to hospital for surgery, 2.7 times as likely to have 3 or more supportive staff, and 1.4 times more likely to have a functioning microscope.

Review of the information on the 9 people who, although trained, have not carried out any cataract surgeries in the last 5 years was done separately. We do not anticipate that these individuals can be re-trained and put back into a functioning environment. Although the numbers are small for analytic purposes, findings suggest that non-performing surgeons are more likely to be women (x2), sponsored by other NGOs or self-sponsored (x3-4), and at MoH facilities (x3).

Findings from focus group discussions and interviews in Nairobi and Dar es Salaam covered the topics arising from the data. This led to the development of the recommendations in the section below.

Limitations

The major limitation in interpreting the data is in terms of missing data. While the coverage of the survey was relatively high (78.6% overall, ranging from 64% in Kenya to 100% in Uganda and Ethiopia) it is likely that surgeons who failed to return their forms, even after multiple requests, were those least likely to be productive. While this cannot be assumed across the board, a more in-depth knowledge of the Tanzanian environment supports this assumption there.

Summary and recommendations

During the past five years (2000-2004) cataract surgeons provided over 80,000 cataract surgeries in the region. Over 100 surgeons have been trained in the region since the inception of training programmes in the mid 1980s; in a number of countries cataract surgeons are the backbone of cataract surgical service delivery for rural populations. In all countries the trained manpower is not used to the maximum.

Hospital related key factors that contributed to high productivity of cataract surgeons included:

- Two or more cataract surgical sets for each surgeon
- A well-functioning operating microscope
- Reliance upon purchasing of IOLs (rather than donation only)
- At least 3 supporting staff per surgeon to assist in the theatre, outpatient and ward

Community related factors included:

- A community programme which brings patients to hospital for surgery

After review of the findings from the assessment and following the discussion among surgeons and trainers, the Nairobi and Dar es Salaam participants made the following recommendations:

Overall recommendations

1. The target for surgical service delivery by a cataract surgeon should be at least 800 cataract operations per year (20 per week x 40 weeks per year); this target should be achieved within 4 years of completion of training. Targets should be included in district VISION 2020 plans.
2. Training facilities, the Ministry of Health, and NGOs, as partners in the programme of training and implementation, should determine the roles of each partner in supporting cataract surgeons to achieve high productivity.
3. Cataract surgeons should be acknowledged as providing a valuable service in the region. Strategies for improving recognition of cataract surgeons as a cadre within the national VISION 2020 plan need to be developed or reviewed.
4. It is recommended that the curriculum of the training programmes in eastern Africa be harmonized. A meeting of trainers from the training institutions would be necessary to achieve this.
5. Upgrade training of existing surgeons is needed; this should include some clinical skills as well as non-clinical skills (e.g., computer, internet use, basic auditing and monitoring). Annual CME sessions (possibly at the regional level) are encouraged.

Ophthalmic equipment and consumables

1. A list of essential equipment (suggested: operating microscope, 2+ cataract sets, slit lamp, direct and indirect ophthalmoscope) should be agreed upon by the partners. All hospitals where graduates will be placed should be provided the essential equipment at the time the cataract surgeon graduates. It is suggested, for logistic and financial reasons, that NGOs be approached to provide the essential equipment.
2. Basic equipment maintenance courses have recently been introduced in the region and most cataract surgeons in training have access to these new courses. However, cataract surgeons who have already completed their programme require a short course in basic equipment maintenance. In addition, a copy of the Aravind equipment maintenance CD should be provided for every cataract surgeon.
3. Obtaining replacements and spare parts remains a problem; equipment maintenance training programmes are encouraged to develop more responsive mechanisms to obtain replacements and spares and to disseminate this information to all cataract surgeons.
4. Upon graduation it is recommended that all cataract surgeons should be provided a starter pack of consumables for 200 surgeries. Additional consumables should be obtained through "revolving fund" mechanisms rather than relying on donations. Where applicable, patient fees should be used to establish a revolving fund. Funds collected from surgery should be accessible for purchase of consumables; local accounts may be helpful in this regard. Advocacy to government authorities will be needed and transparent accountability is essential.

5. Including eye care purchases within government funding at the district and regional level will be facilitated by inclusion of someone from the eye care sector onto the hospital management committees (HMC) and district health management committees (DHMC). All partners should lobby to have an eye care representative on the HMC and DHMC.

Supportive staff

1. It was recognized that having adequate supportive staff is necessary for improved productivity. It was recommended that cataract surgeons completing training should have, as a minimum, two staff members trained in theatre assistance and out patient services. Within one year of completion a third ophthalmic staff member will be required. Additional clinical staff will be required as the programme matures.

District planning and community programmes

1. Where not conducted, planning workshops for district VISION 2020 implementation plans are needed. Additional resources (financial, manpower) for planning may be needed.
2. Increased productivity requires a community programme that includes more than raising awareness and referral. It is recommended that, within one year of placement as a cataract surgeon, a community programme should be established for the catchment area. It was recognized that very few patients who are referred for surgery by primary eye care workers or others ever show up for surgery. Thus, community programmes, ideally, should include a system to transport patients to the hospital for surgery.
3. Surgical outreach, although a valuable programme activity, should be introduced only after a strong non-surgical outreach has been established to increase utilization of services at the base hospital.

Communication & reporting

1. All cataract surgeons should be strongly encouraged to have an email addresses and use the internet for communication. Regular communication and knowledge transfer from various training centres, NGOs, others, would be easier if carried out through email.
2. Monthly and quarterly reporting should be strengthened. Less complicated reporting forms should be adopted and feedback to the surgeon implemented.
3. Supervisory visits and regular meetings are encouraged to monitor and evaluate progress at all levels.

Partnerships

1. National and district eye care programmes have benefited from the efforts made by service clubs, however, there is a need to assist them to provide the service in a more effective and sustainable way. All activities of service clubs should be consistent with district eye care plans. Thus, in settings where eye care services include patient fees service clubs are discouraged from providing "free eye camps" as these may undermine local efforts at sustainability and increased surgical numbers.

2. Sensitization of members of service clubs regarding strategies for sustainability should be carried out at the national, regional and district level.
3. Partnership between government and NGOs need to be strengthened, at the implementation level as well as at the national planning and resourcing level. When NGOs have an exit strategy from supporting the programme there needs to be a well-developed sustainability plan to ensure continuous service delivery.

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