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## Services for refractive error in Kenya: extent to which human resources and equipment are meeting VISION 2020 targets

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### ABSTRACT

**Objective:** To obtain information on Refractive Error (RE) services in Kenya in terms of human resources and equipment, their distribution and levels of provision.

**Methods:** All eye health facilities in Kenya were identified (77), through the Division of Ophthalmic Services. The following information was collected by postal questionnaire and telephone calls/visit (two purposively selected provinces) number refracting by cadre, equipment (whether functioning) and refractions performed in the last month. VISION 2020 recommendations were used to benchmark human resources (targets met/not met) and functioning equipment (exceeds/met/not met minimum).

**Results:** Seventy six out of seventy seven facilities responded (98.7%). Sixty eight (88%) were able to provide data. Study facilities were 83% government, 13% NGO/mission and 4% private. Kenya has less than 1/3 of recommended workforce for eye care. Nairobi province was best served (56.8% of target) with rural provinces having greater deficiencies (low as 3.8%). Urban facilities were better equipped than rural (22.9% vs. 9.1% units exceeded targets,  $p=0.035$ ). Fifty eight point four percent of refractions were performed at NGO/mission/private facilities although they represented only 17%. The number of refractions done per month by each refractionist varied from 12.6 (Nyanza) to 125.3 (Nairobi).

**Conclusions:** There is shortage of eye care workers at all levels of service delivery and lack of essential equipment for refractive services. Most refractions are not performed in the public sector, although more personnel in the sector have been trained on how to refract. The challenge of REs can be addressed with a public health approach. It requires integration at different service levels: diagnosing REs and other ocular conditions, clear referral pathways, health education/awareness and spectacle dispensing.

### INTRODUCTION

Recently it has been estimated that 153 million people are visually impaired from Uncorrected Refractive Errors (UREs), 8 million of whom are blind<sup>1</sup>. These estimates did not include presbyopia, which can have a significant impact on visual function and quality of life even if literacy low<sup>2,3</sup>. However, spectacle coverage is often low or very low, and this applies equally to industrialized<sup>4-6</sup> and developing countries. Current estimates indicate that 90% of people with URE live in rural areas in low-income countries<sup>7</sup>. Although several studies suggested reasons for the low coverage, most focused on patients' perspectives (e.g. lack of awareness, cost) and very few have considered providers' perspectives.

Kenya had a population of 36 million at the time of the study. The country has eight provinces and many areas are under-populated and underdeveloped. In 2006, 39.2% of the population lived below the poverty line. The Division of Ophthalmic Services (DOS) regulates and coordinates the delivery of eye care services, including REs which are provided

by the government, international Non-Government Organizations (NGO/mission) and the private sector but there is no central board for registration and regulation. Evidence suggests that distribution of services for REs is uneven, often with a mismatch between refraction and dispensing; some units refract but not sell spectacles. In urban areas an abundance of optical shops provide prescriptions based on autorefractors or provided by 'refractionists' with a spectacle workshop on the premises. There is a need for better services<sup>8</sup> and there is a demand especially in slum areas, informal settlements<sup>9</sup> and schools<sup>10,11</sup>.

The following cadres provide RE services in Kenya: ophthalmologists, Ophthalmic Clinical Officers (OCO), Cataract Surgeons (CS), Ophthalmic Nurses (ON) and refractionists. Refractionists do not have a standard job description nor training. The term 'refractionist' is ambiguous in these settings and frequently refers to someone with skills for refraction but limited or no knowledge of ocular diseases<sup>12</sup>. The National Eye Care Plan includes specific RE targets, with respect to a) number of personnel to be trained,

b) equipment and c) specific outputs. The targets are based on what is realistic rather than what is desirable.

The purpose of this study was to describe the human resources and equipment available to provide good quality RE services in Kenya, and describe their output. The data will allow the extent to which VISION 2020 targets<sup>13</sup> have been met, providing data for future policy and planning.

## MATERIALS AND METHODS

A list of all eye units, their location, and details of a contact person were provided by the Primary Eye Care Co-ordinator. Seventy seven facilities were identified. Data were collected using a standard form by post and then telephone interview (six provinces) or through site visits (two provinces) by the researcher (PM). The provinces visited were Central and Nairobi as they are densely populated and have a range of service providers.

The following data were collected:

*Human Resources:* Number of eye care personnel, number refracting, and average number of refractions per month. VISION 2020 targets were used to estimate the number of staff recommended by province and nationally, and the deficit of staff, by cadre.

*Equipment:* The equipment available was divided into two categories (based on expert recommendations),

essential (complete trial set; distance visual acuity chart; adult trial frame; working retinoscope) and desirable (near test chart; paediatric trial frame; cross cylinder). Units were divided into three levels: exceeds targets (essential and desirable equipment); targets met (essential equipment only) and targets not met (essential equipment not available).

*Barriers to refractive output:* Personnel in charge were asked what they thought limited service provision: human resources (numbers; training; motivation), infrastructure (equipment; space), spectacles (availability; cost) and community (lack of awareness; poverty).

## RESULTS

*Data collection:* Seventy six of the 77 facilities identified responded. Nine did not provide data because eye care services were no longer provided or the personnel in charge were away. The 68 units providing information were in the following sectors: government 56 (83%), NGO 3 (4%), mission 6 (9%) and private 3 (4%). For analysis, NGO, mission and private units were combined.

*Human resources:* Data were analyzed at provincial and national level using VISION 2020 targets as benchmarks. There was deficit of all cadres of eye care workers in Kenya (Table 1).

**Table 1:** Provincial and national deficits in eye care personnel against VISION 2020 targets in Kenya (2008)

Cadres	Province	Coast	Eastern	North Eastern	Nyanza	Rift Valley	Central	Nairobi	Western	Kenya
	Population	3,089,000	5,456,200	1,410,300	5,094,300	8,756,000	3,919,100	3,038,600	4,348,700	35,112,200
	Target* (1:250,000)	12	22	6	20	35	16	12	17	140
Ophthalmologist	Actual	5	4	1	3	8	8	16	4	49
	% target in place	41.7%	18.2%	16.7%	15.0%	22.9%	50.0%	133.3%	23.5%	35.0%
	Target* (1:200,000)	15	27	7	26	44	20	15	22	176
Ophthalmic Clinical Officer	Actual	7	13	2	6	14	14	10	4	70
	% target in place	46.7%	48.1%	28.6%	23.1%	31.8%	70.0%	66.7%	18.2%	39.8%
	Target* (1:100,000)	31	55	14	51	88	39	30	44	351
Ophthalmic Nurse	Actual	7	10	1	2	28	18	5	11	82
	% target in place	22.6%	18.2%	7.1%	3.9%	31.8%	46.2%	16.7%	25.0%	23.4%
	Target* (1:250,000)	12	22	6	20	35	16	12	17	140
Cataract Surgeon	Actual	7	13	0	4	19	9	2	5	59
	% target in place	58.3%	59.1%	0.0%	20.0%	54.3%	56.3%	16.7%	29.4%	42.1%
	Target* (1:250,000)	12	22	6	20	35	16	12	17	140
Refractionist	Actual	4	5	0	2	8	3	13	1	36
	% target in place	33.3%	22.7%	0.0%	10.0%	22.9%	18.8%	108.3%	5.9%	25.7%
	Target* (1:250,000)	82	148	39	137	237	107	81	117	948
All cadres	Actual	30	45	4	17	77	52	46	25	296
	% target in place	36.6%	30.4%	10.3%	12.4%	32.5%	48.6%	56.8%	21.4%	31.2%
	% deficit	63.4%	69.6%	89.7%	87.6%	67.5%	51.4%	43.2%	78.6%	68.7%

North Eastern and Nyanza Provinces were the least served, with less than 20% of the target number of eye care workers. Central and Nairobi Provinces had approximately half the target number. However, there was considerable variation by cadre. Overall in Kenya, there are only one-third the target number of ophthalmologists, approximately 40% of the target

for OCOs and CS and approximately a quarter of the target for ONs and refractionists.

Distribution of eye care staff in relation to the population distribution demonstrates an excess of ophthalmologists and refractionists in urban areas, but an excess of ONs in rural areas (Table 2).

**Table 2:** Urban-rural distribution of eye care personnel indicating the total and those who conduct refractions<sup>1</sup>

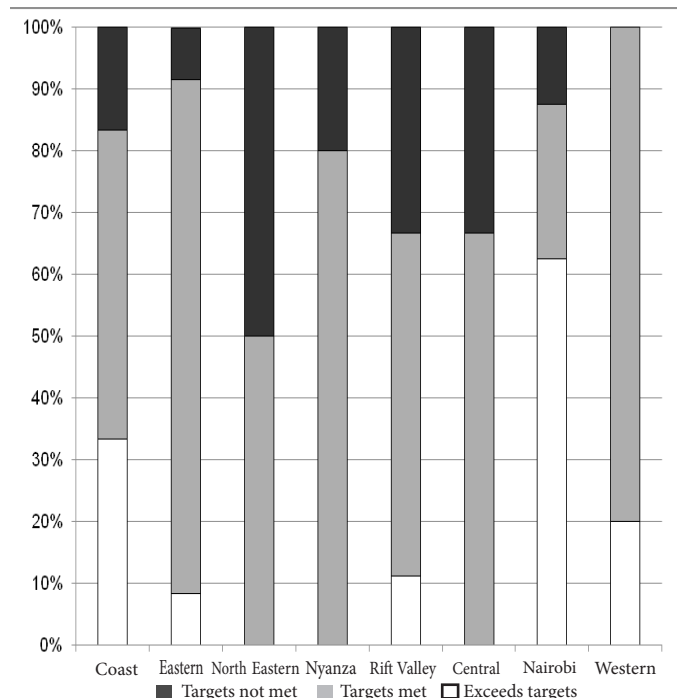
Population	Urban		Rural		% who refract	Numbers if ideally distributed	Urban		Urban excess
	23,793,000		12,257,000				Urban	Rural	
Ophthalmologists	Total = 49	42	85.7%	7	14.3%	73.5%	33	16	9
	Refract* = 36	32	88.9%	4	11.1%		24	12	8
Ophthalmic clinical officers	Total = 70	48	68.6%	22	31.4%	75.7%	47	23	1
	Refract = 53	34	64.2%	19	35.8%		36	17	-2
Ophthalmic nurses	Total = 82	42	4.9%	40	48.8%	31.7%	55	27	-13
	Refract = 26	6	23.1%	20	76.9%		17	9	-11
Cataract surgeons	Total = 59	36	61.0%	23	39.0%	76.3%	40	19	-4
	Refract = 45	26	57.8%	19	42.2%		30	15	-4
Refractionists	Total = 36	28	77.8%	8	22.2%	100.0%	24	12	4
	Refract = 36	28	77.8%	8	22.2%		24	12	4

\*personnel who were conducting refractions

*Training institutions:* Only one institution in Kenya trains ophthalmologists, (University of Nairobi). Mid-level ophthalmic workers (clinical officers and nurses) are trained at the Kenya Medical Training College (KMTC). A private university has recently initiated an optometry program but there are no plans on how graduates can be deployed in the public system. Refraction training is undertaken at an eye hospital in Central Province and Kenya Medical Training College (KMTC) provides ON and CS courses.

*Equipment for refraction:* In the North Eastern and Nyanza Provinces no facilities exceeded targets (Figure 1). The highest number of facilities where equipment was below target was in the Rift Valley Province and in the Western province, there were no facilities with inadequate facilities. There were statistically significant differences in the provision of equipment across provinces (p=0.003).

**Figure 1:** Refraction equipment analysis by province



The two national referral hospitals both exceeded targets (Table 3) and six of the seven provincial level facilities were satisfactory. Differences by level of the facility was statistically significant ( $p < 0.001$ ).

**Table 3:** Equipment level by hospital level

Level	Exceeds target <sup>1</sup>		Targets met <sup>2</sup>		Targets not met <sup>3</sup>	
	No.	(%)	No.	(%)	No.	(%)
National (n=2)	2	100	0	-	0	-
Provincial (n=7)	1	14.3	6	85.7	0	-
District (n=44)	0	-	32	64.0	12	24.0
Sub-district (n=3)	0	-	1	20.0	2	40.0
Mission/NGO/Private (n=12)	8	61.5	3	23.1	1	7.7
Total (n=68)	11	16.2	42	61.8	15	22.1

More facilities in urban settings exceeded or met targets than rural facilities (Table 4). There is evidence for an association between the setting of the facility and availability of equipment ( $p = 0.035$ ).

Overall 22.1% facilities were below target for equipment: 61.8% had adequate equipment and only 16.2% exceeded the minimum requirement.

**Table 5:** Productivity of eye care workers who provide refraction services

Province	Coast	Eastern	North Eastern	Nyanza	Rift Valley	Central	Nairobi	Western	Kenya
Population*	3,089,000	5,456,200	1,410,300	5,094,300	8,756,000	3,919,100	3,038,600	4,348,700	35,112,200
Total eye care staff	30 (10.1%)	45 (15.2%)	4 (1.4%)	17 (5.7%)	77 (26.0%)	52 (17.6%)	46 (15.5%)	25 (8.4%)	296 (100%)
Staff who refract	17 (5.7%)	33 (11.1%)	4 (1.4%)	16 (5.4%)	62 (20.9%)	22 (7.4%)	33 (11.1%)	9 (3.0%)	196 (66.2%)
Actual refractions done (annually)	4,620	7,920	1,680	2,412	14,736	30,792	49,632	7,872	119,664
Refractions / 1,000 population / year	1.5	1.5	1.2	0.5	1.7	7.9	16.3	1.8	3.4
Refractions per eye care worker per month	22.6	20.0	35.0	12.6	19.8	116.6	125.3	72.9	50.9

\* Based on 2008 population estimates

**Table 4:** Equipment level by urban-rural setting

Setting	Exceeds target		Targets met		Targets not met	
	No.	(%)	No.	(%)	No.	(%)
Urban (n=35)	8	22.9	23	65.7	4	11.4
Rural (n=33)	3	9.1	19	57.6	11	33.3

Pearson Chi Square=8.5943,  $p = 0.035$

*Number of refractions:* Data on the average number of refractions per month was obtained for all 68 units. More than half of all refractions were performed at mission/NGO/private facilities (58.4%). District facilities had the highest number of refracting staff (91) and performed the second highest number of refractions (27.9%). Provincial hospitals had more refracting staff (39) than national hospitals (23) but did fewer refractions (national 7.4%, provincial 6.0%). There is statistically significant difference between hospital level and monthly refractions ( $p = 0.001$ ). Monthly data were extrapolated to annual data, assuming the data for the month of the visit to be representative. The number of refractions per 1,000 population per year ranged from 0.5 in Nyanza to 16.3 in Nairobi, being 3.4 for the country (Table 5).



*Barriers to the output of refractive services:* In six of the eight provinces the top two barriers were lack of equipment followed by need for further training. More than one-third of the barriers related to human resources (36.8%), a quarter to community issues (26.5%) and 21.3% to lack of infrastructure. Inability to source spectacles was uncommon (15.4%). The association between hospital level and type of barrier was statistically significant ( $p < 0.001$ ).

## DISCUSSION

In this study, cadres other than specialist refractionists performed the majority of refractions in Kenya. A reason for this could be that there is no optometry/specialist training in Kenya. Refractionists are either OCOs who have chosen to refract, ophthalmologists refracting in their public/private clinic, or ONs who refract as there are no other personnel.

As anticipated, more eye care personnel work in urban settings with ONs performing the majority of the refractions in rural areas. This is important as ONs can be taught how to refract, as in other African countries. The unequal distribution of eye care staff between urban and rural areas, with rural areas being relatively underserved, is a key finding in all areas of health care delivery<sup>14</sup>.

Only Nairobi province had reached VISION2020 targets<sup>15</sup> for ophthalmologists and refractionists. Increasing the number and geographic distribution of training institutions could increase the number of cadres being trained and deployed to rural areas. The WHO recently summarized the evidence of interventions which promote recruitment, training, deployment and retention of the health workforce, focussing on underserved communities; this could provide a framework for strategies to improve the health workforce for eye care, including for REs in rural areas in Africa<sup>16</sup>. A systematic approach is needed to ensure the correct personnel are trained with standardized training. Naidoo *et al* suggest that training 'dedicated personnel remains the best strategy', along with institutionalizing training programs<sup>17</sup>.

The number of refractions performed was very low overall and varied widely, being highest in urban areas. The very low level of productivity is highly unlikely to meet the need for RE services, considering that 40% of the population are likely to be presbyopic. Lack of functioning equipment was reported as a barrier but there may be little motivation to refract. Leadership can be a key factor in ensuring refraction is given greater priority, by providing space and equipment, ensuring staff have time for refraction, providing a career path and adequate remuneration.

## LIMITATIONS

One limitation of this study was that information was not obtained on the provision nor cost of spectacles. This would have been challenging, as many outlets dispense spectacles in Kenya over and above those in this study. Indeed, it is a common practice for those refracting in the government sector to refer patients to their own private optical shops for spectacles. It was not possible to assess the number of small, private/independent 'high street' optical outlets as there is no central system of registration. This is an important area to investigate, as these outlets are likely to be readily accessible.

*Key issues raised by the study:* Key areas have been identified that can be addressed to reduce visual impairment and blindness from URE in Kenya. This will have a further impact in terms of removing barriers to education and employment. Naidoo *et al.*<sup>18</sup> suggests this will "improve the quality of life of millions of disadvantaged people and ultimately contribute to attaining the United Nations' Millennium Development Goals"<sup>18</sup>.

The majority of the findings of this study in relation to the human workforce have been described in other areas of health<sup>16</sup>. Training is essential to increase the number of eye care professionals required to meet the deficit. Over the last six years a new multiple entry-exit optical technician course has been under development in Kenya but has not started. Ideally this program should be evaluated, focussing on recruitment and deployment to assess whether underserved areas are prioritized, the quality of refractions and dispensing and post training support for equipment and continuing professional development.

Not all eye facilities had personnel who could refract, particularly in rural areas. One approach is to ensure at least one member of the team is trained in refraction. This may entail task shifting, which has been successful in other sectors<sup>19</sup>. Another approach is to promote public-private partnerships so that "refractive care is an integral component of health systems and poverty alleviation."<sup>20</sup> The Durban Declaration on Refractive Error and Service Development encourages public-private co-ordination for "greater impact and outcomes"<sup>18</sup>.

A registration body for opticians/refractionists/optometrists needs to be created to recognise them in the Ministry of Health's scheme of work. An 'Optician's Bill' development for the past ten years would make it compulsory for all refractionists to register with a regulatory body. This would be an important mechanism to regulate activities of the many high street refractionists.

Providers identified lack of basic equipment as an important barrier. Facilities need to be prioritized

and ranked according to need, to ensure equipment is distributed systematically.

The majority of eye facilities in this study were in the public sector but these recommendations apply to both the public and private sector. The challenge of UREs can be addressed within a public health approach as it requires integration of different levels of services: diagnosing REs along with other ocular conditions, clearly defined pathways for referrals, health education/awareness and dispensing of spectacles.

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