



## Analysis of Eye Care Services in Yemen

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### Authors' contributions

This work was carried out in collaboration between all authors. Author SAAA participated in the conception, design of this work and the writing of the manuscript. Authors MYAS, AOAB, TKA and MAB participated in the conception, design of this work. Authors MAB and HAAA participated in the analysis of the data, writing of the manuscript. All authors read and approved the final manuscript.

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### ABSTRACT

**Purpose:** The objective of this study was to undertake an analysis of the eye care services situation in Yemen and to assess ophthalmic human resources, eye units' ownership and ophthalmic equipments.

**Methods:** Eye care providers were surveyed by a standardized questionnaire which was sent to the 184 eye units in governmental, university, military, private and charity clinics and hospitals in Yemen and covered the period between 01 January to 31 December 2012. The questionnaire determined location, human resources and eye units' ownership and ophthalmic equipments.

**Results:** The response rate to the questionnaire was 80.7%. During 2012, 184 eye units involved in providing eye care services in Yemen. 25% of eye units represent public sector, 72.3% represent private sector and 2.7% belong to non-governmental charity organizations. 682 people worked in eye care services of which 268 are ophthalmic doctors that is equivalent to 1.06 per 100,000 populations. Human resources and eye care equipments were below vision 2020 targets. There is significant unequal distribution of eye care services provision between urban and rural areas in Yemen.

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**Conclusion:** Deficiency, maldistribution and inadequate training of ophthalmic doctors in addition to poor financial resources to establish and provide eye care units with good infrastructure. All these factors are regarded as major factors that cause underperformance in the Yemeni eye health system. We recommend equal distribution of trained ophthalmic doctors and personnel with good financial support for eye care services in rural areas of Yemen.

*Keywords: Human resources; infrastructure; ophthalmologist; Yemen.*

## 1. INTRODUCTION

Yemen is one of the WHO Eastern Mediterranean Region countries, the estimated prevalence of blindness in this region is 0.97 [1, 2] and Yemen is regarded as one of the countries with high prevalence rate of blindness [3,4]. Republic of Yemen is located in the south west part of the Arab peninsula with an area of 555,000 square kilometers. Yemen population is around 25.3 Million distributed in 21 governorates in addition to the capital city of Sana'a [5]. About 68.2 percent of the Yemeni population lives in rural areas [6].

Apart from the ophthalmic situation analysis survey that was done in 2003 [7,8] there is still need to update the information describing eye health care services in Yemen. The affordability, accessibility and availability of eye health care services are affected by various changes strongly related to the socio-economic situation of Yemen.

The aim of this study which was done in 2012 is to undertake analysis of the eye care services situation and to assess ophthalmic human resources and eye units' ownerships and equipments through Yemen. The outcome of this study is going to help decision makers in the Ministry of Health and Population and other eye care providers in updating short and long term strategies for the reduction and prevention of blindness in the framework of the global initiative "Vision 2020 – the right to sight" [9].

## 2. PATIENTS AND METHODS

Eye care providers were surveyed by a standardized questionnaire adapted from the Vision 2020 form B [9] which was sent to the 184 eye units in governmental, university, military, private and charity clinics and hospitals in Yemen and covered the period between 01 January to 31 December 2012. The questionnaire determined location, human resources, and eye units' ownership and ophthalmic equipment.

Member of the data collection team visited each eye unit after a preliminary telephone call and

collected the data by face-to-face interviews with the personnel responsible for eye unit and the data were filled in the questionnaire form.

Ethical approval from Nebras Health Society was obtained.

## 3. RESULTS

The response rate to the questionnaire was 80.7%. To increase the accuracy and quality of data, the collected information were obtained from clinic and hospital administration data. In 2012, there were 184 eye units providing ophthalmic care in Yemen (Table 2). Among these, 36 (19.6%) are under the ownership of the Ministry of Health, 3 (1.6%) Universities' hospitals, 133 (72.3%) are private facilities, 7 (3.8%) army and police hospitals and 5 (2.7%) are charity hospitals.

**Table 1. Population demographic indicators and vital statistics for 2012**

Population number	25.3 million
Population Growth rate %	3
Population by age group %	
(0 – 14)	43
(15 – 64)	54
+65	3
Total Fertility Rate	6.1
Urban	4.8
Rural	6.7
Crude Death Rate / 1000 Pop.	9
Crude Birth Rate / 1000 Pop	39.7
Infant Mortality Rate /1000	68.5
Under 5years Mortality Rate /1000	78.2
Maternal Mortality Rate (per 100,000 Life Birth)	366
Life expectancy at birth (years)	
Males	61.1
Females	62.9
Both Sexes	62
Under 5 years Mortality Rate /1000	78.2

The majority (76.0%) of eye units are localized in Sana'a (city) (32.6%) and in the governorates of Aden (21.7%), Taiz (13.0%) and Hadramout (8.7%).

**Table 2. Eye units ownership by governorate for 2012**

Governorate	Ministry of health	University	Private	Military/Police	Charity	Total
Sana'a City	5	1	50	3	1	60
Sana'a	4	0	0	0	0	4
Aden	5	1	29	2	1	38
Taiz	5	0	18	1	0	24
Hadramout	5	0	11	0	2	16
Hodeidah	1	0	9	1	0	11
Ibb	2	0	4	0	0	6
Dhamar	1	1	2	0	0	4
Al-Beidah	0	0	2	0	0	2
Mahweet	1	0	0	0	0	1
Dhala	1	0	2	0	0	3
Abyan	1	0	0	0	0	1
Lahj	1	0	2	0	0	3
Hajja	1	0	1	0	0	2
Sada	1	0	1	0	0	2
Shabwa	1	0	2	0	0	3
Amran	1	0	1	0	0	2
Mareb	0	0	0	0	0	0
Jawf	0	0	0	0	0	0
Mahara	0	0	0	0	0	0
Raima	0	0	0	0	0	0
Total	36	3	134	7	4	184

There are no eye units in the governorates of Mareb, Al-Jawf, Al-Mahara, and Reima. There is a deficiency of eye units in the governorates of Amran, Sana'a, Shabwa, Al-Beidah, Al-Mahweet, and Hajja (Fig. 1).

Yemen has 268 ophthalmologists, of whom 246 (91.8%) are Yemeni and 22 (8.2%) are expatriates (Table 3). In addition to the practicing ophthalmologists there are 72 ophthalmic trainees sharing in providing eye care. The level of certification of the ophthalmologists ranges from diploma holders (13.1%), to MSc holders (43.3%), to PhD holders (35.1%) (Table 4).

Overall, there are 1.06 ophthalmic practitioners per 100,000 population, but they are not evenly distributed throughout the country. Sana'a (city) and the governorates of Aden, Taiz, and Hadramout have more than three quarters (79.5%) of the practicing ophthalmologists. The highest concentration of ophthalmologists is in the governorate of Aden, where there are 5.67 ophthalmologists per 100,000 population. Of 21 governorates, 11 have fewer than 0.50 ophthalmologists per 100,000 population. There are no ophthalmologists in the governorates of Mareb, Al-Jawf, Al-Mahara and Raima.

The numbers of dedicated eye beds and ophthalmic nurses are summarized in Table 5.

Overall, there are 1.81 ophthalmic beds and 1.30 ophthalmic nurses per 100,000 population. The highest concentration of ophthalmic nurses is in Sana'a (city) and the governorates of Taiz, Aden and Hadramout. A similar high concentration of ophthalmic beds is also present in Sana'a (city) and these 3 governorates.

The distribution of major ophthalmic instruments in Yemen is summarized in Table 6. There are 142 ophthalmic operating microscopes, of which 105 (74.0%) are concentrated in the governorates of Sana'a (city) (56), Taiz (25), Hadramout (12), and Aden (12). Equipment for phacoemulsification, as well as YAG and argon lasers, are present only in these 9 governorates.

#### 4. DISCUSSION

Our study has shown variations of eye care services between governorates in Yemen. There is high concentration of ophthalmic personnel and equipments in the five main governorates (Sana'a city, Aden, Taiz, Hadramout and Hodeidah) whereas the remaining 17 governorates have shortage of human resources which is accompanied by a scarcity of equipments and supplies that, once again, was most severe in remote areas of Yemen (Fig. 1).

**Table 3. Distribution of Ophthalmologists per 100000 population for 2012**

Governorate	Population	Ophthalmologist/100000 population
Sana'a City	2648063	4.50
Sana'a	1081907	0.92
Aden	794363	5.67
Taiz	2929557	0.96
Hadramout	1313225	1.60
Hodeidah	2795897	0.47
Ibb	2604358	0.35
Dhamar	1711037	0.29
Al-Beidah	685306	0.15
Mahweet	622306	0.16
Dhala	621287	0.64
Abyan	533165	0.38
Lahj	899187	0.33
Hajja	1883241	0.11
Sada	922759	0.11
Shabwa	567049	0.35
Amran	1180759	0.17
Mareb	302613	0
Jawf	576546	0
Mahara	127380	0
Raima	502027	0
Total	25302032	1.06

**Table 4. Distribution of ophthalmologists by governorates for 2012**

Governorate	PhD holders	MSc holders	Diploma holders	Specialists total	Training in ophthalmology (GPs)	Total
Sana'a City	50	57	12	119	64	183
Sana'a	2	7	1	10	0	10
Aden	16	18	11	45	3	48
Taiz	10	15	3	28	3	31
Hadramout	10	8	3	21	1	22
Hodeidah	4	8	1	13	0	13
Ibb	5	3	1	9	2	11
Dhamar	2	2	1	5	0	5
Al-Beidah	1	0	0	1	0	1
Mahweet	0	0	1	1	0	1
Dhala	2	1	1	4	0	4
Abyan	1	1	0	2	0	2
Lahj	1	1	1	3	0	3
Hajja	1	1	0	2	0	2
Sada	1	0	0	1	0	1
Shabwa	0	2	0	2	0	2
Amran	1	0	1	2	0	2
Mareb	0	0	0	0	0	0
Jawf	0	0	0	0	0	0
Mahara	0	0	0	0	0	0
Raima	0	0	0	0	0	0
Total	107	124	37	268	73	341

The number of practicing ophthalmologists in Yemen has increased from 203 (in 2003) [7] to 268 (in 2012), this increase in number of ophthalmologists during the 10 years period is regarded as low in comparison to the need of ophthalmic personnel in Yemen. Also a number

of ophthalmologists have left Yemen since the Arab spring in 2011 [10].

The ratio of ophthalmologists per population (1.06:100,000) and this ratio varies among different governorates where it is highest in Aden

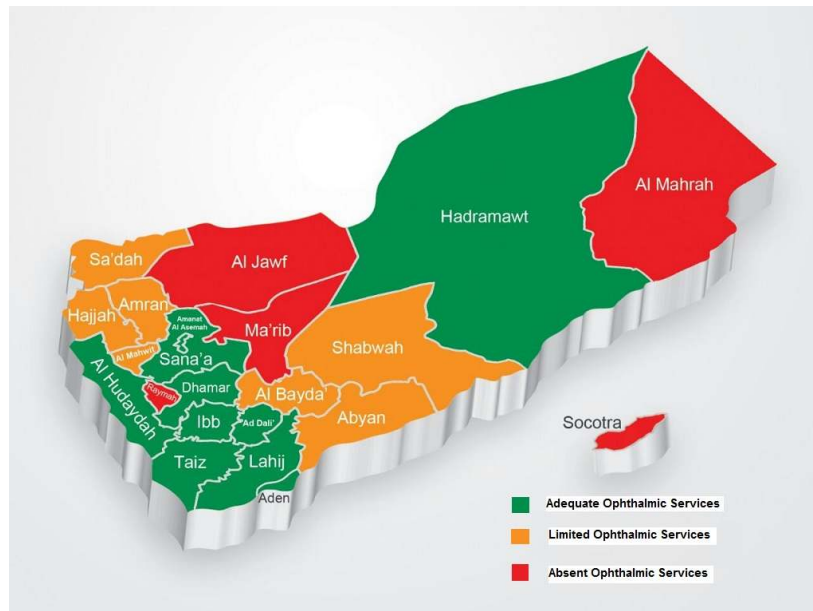
governorate (5.67:100,000) and lowest Hajja Raima). This huge variation between governorate (0.11:100,000) and unfortunately governorates is due the scarcity and unequal there are no ophthalmologists in four distribution of eye care personnel and ophthalmic governorates (Mareb, Jawf, Mahara and equipments.

**Table 5. Number of ophthalmic beds and ophthalmic nurses per 100,000 population by governorates for 2012**

Governorate	Population	Beds	Beds/100,000 pop	Ophthalmic nurses	Nurses / 100,000 pop
Sana'a City	2648063	161	6.08	152	5.74
Sana'a	1081907	0	0	1	0.09
Aden	794363	40	5.04	30	3.78
Taiz	2929557	95	3.24	55	1.88
Hadramout	1313225	57	4.34	23	1.75
Hodeidah	2795897	64	2.29	27	0.97
Ibb	2604358	7	0.27	12	0.46
Dhamar	1711037	2	0.12	9	0.53
Al-Beidah	685306	2	0.29	0	0
Mahweet	622306	0	0	0	0
Dhala	621287	12	1.93	7	1.13
Abyan	533165	2	0.38	2	0.38
Lahj	899187	12	1.34	3	0.33
Hajja	1883241	2	0.11	2	0.11
Sada	922759	1	0.12	4	0.43
Shabwa	567049	1	0.18	2	0.35
Amran	1180759	0	0	0	0
Mareb	302613	0	0	0	0
Jawf	576546	0	0	0	0
Mahara	127380	0	0	0	0
Raima	502027	0	0	0	0
Total	25302032	458	1.81	329	1.30

**Table 6. Distribution of ophthalmic diagnostic, operating and laser machines by governorate for 2012**

Governorate	Siltlamp	Operating microscope	A & B Scan	Phaco machine	Yag laser	Argon laser
Sana'a City	113	56	18	21	17	15
Sana'a	4	2	2	0	0	0
Aden	45	12	9	6	5	2
Taiz	28	25	6	5	3	2
Hadramout	12	12	8	3	1	1
Hodeidah	14	11	10	6	1	0
Ibb	5	5	2	1	1	0
Dhamar	4	3	1	1	1	0
Al-Beidah	1	1	1	0	0	0
Mahweet	1	2	0	0	0	0
Dhala	3	3	1	1	1	0
Abyan	2	1	0	0	0	0
Lahj	5	4	1	2	1	1
Hajja	1	2	0	0	0	0
Sada	1	1	2	0	1	0
Shabwa	1	1	0	0	0	0
Amran	2	2	1	0	0	0
Mareb	0	0	0	0	0	0
Jawf	0	0	0	0	0	0
Mahara	0	0	0	0	0	0
Raima	0	0	0	0	0	0
Total	242	143	62	46	32	21



**Fig. 1. Distribution of eye care services in Yemeni governorates**

There was a shortage of skilled ophthalmologists in some ophthalmic surgical techniques namely phacoemulsification and vitreoretinal surgery. In 2003 the number of phaco machines in Yemen were 12 [7] and this number increased four folds (46 phaco machines) in 2012. The increase in phacoemulsification machines in recent years in Yemen reflected as an increase in number of phacoemulsification procedures for cataract surgery from 0.8% in 2003 to 17.9% in 2012 [7, 11]. During the 12-month period, a total of 62,577 cataract surgeries were performed by 268 ophthalmology specialists. The majority of cataract surgeries (61.54%) were performed in the private sector facilities. The cataract surgical rate was 2,473 operations per million inhabitants per year. Intraocular lens implantation was performed on 98.02% of the cases [11].

Despite availability of operating ophthalmic microscopes in the majority of governorates, modern equipments (ie, YAG laser, Argon lasers and phacoemulsification machines) are only present in the five main governorates.

Based on our findings, we make the following recommendations:

1. Establish eye units in governorates where no such facilities currently exist.
2. Improve the experience and training of the ophthalmic personnel. Cataract is the leading cause of reversible blindness,

improved training in cataract extraction and intraocular lens implantation is essential. Support of ophthalmologists in training in exchange for several years of public service in underserved areas is one solution. Financial incentives for practicing in rural areas may also be effective.

3. Distribute ophthalmologists throughout the country mainly in those areas where there is no or low number of ophthalmic personnel.
4. Address the poor distribution of essential ophthalmic equipment. Lasers for the management of common retinal disorders, as well as posterior capsule opacification, are necessary in all regions where ophthalmic care is provided. Government funding of these essential items of equipment is more than offset by the savings realized by avoiding the costs associated with transferring patients to major urban areas for relatively routine procedures. Because Yemenis demand, and should have access to modern cataract surgery, phacoemulsification units should be available in all regions.
5. Evaluate and determine the main causes of blindness by collecting and reevaluating existing data on blindness and performing a new national survey on the major causes of blindness. A national database of eye disease should be established and maintained. Establish a national evidence-

based strategy for the prevention of blindness and prepare effective plans to implement this strategy. Increase financial resources for blindness prevention from governmental agencies, as well as local and international nongovernmental organizations (NGOs).

The number of cataract surgery in Yemen is still lower than the incidence of cataract in the population, this is attributed to low number of trained ophthalmic surgeons, inadequate eye units all over the governorates of Yemen and socio-economic factors mainly low education and poverty.

Our study faced a number of limitations firstly; our questionnaire could have been subject to bias due to selective under-reporting as, due to practical constraints, some of our respondents were emailed the questionnaire for self-completion while others responded face-to-face. We tried to minimize bias by contacting all facilities via telephone before emailing the questionnaire, to ensure that the same information was provided to all respondents and potential questions were answered.

## 5. CONCLUSION

The factors that are regarded as major obstacles that cause underperformance of the Yemeni eye health system include: deficiency, maldistribution and inadequate training of ophthalmic doctors in addition to poor financial resources to establish and provide eye care units with good infrastructure.

## CONSENT

It is not applicable.

## ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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