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RESEARCH ARTICLE

Status of Childhood Eye Care Services in the Kingdom of Saudi Arabia: Eye Care Professionals' Perspectives

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Abstract:

Background:

The World Health Organization (WHO) reported that there are approximately 19 million visually impaired children worldwide, and most of the conditions are treatable by early intervention at the primary, secondary, and tertiary levels.

Objective:

To assess the status of paediatric eye care services in the Kingdom of Saudi Arabia

Methods:

A cross-sectional study was conducted among eye care professionals (optometrists and ophthalmologists) in public sector hospitals in various regions of Saudi Arabia. Data were collected through an online self-administered paediatric eye care service questionnaire based on a validated questionnaire.

Results:

A total of 137 completed questionnaires were obtained, with a response rate of 83%. The highest percentage of trained paediatric teams at hospitals was recorded at 95% in the eastern region (p= 0.024), while the lowest percentage was 44% in the southern region. Trained paediatric nurses were available in 88% of the eastern region hospitals, followed by 56% of the central region hospitals (p= 0.001). Services such as separate paediatric optometry clinics, dedicated ophthalmology outpatient clinics, and advanced diagnostic equipment were significantly higher in number in the eastern region than in the other regions (p<0.001). The general status of human resources of eye professionals reveals that 73% of the facilities had both trained optometrists and ophthalmologists, approximately 70.8% had anaesthesiologists available, and almost 73.7% had easy access to available paediatricians.

Conclusion:

The overall quality of paediatric eye-related health care is satisfactory in most Saudi regions. However, there are some discrepancies among the regions in paediatric eye care services and facility types, which may need to be addressed by decision-makers in the Ministry of Health.

Keywords: Childhood visual impairment, Eye care services, Blindness, Optometrist, Ophthalmologists, Vision problems.

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1. INTRODUCTION

The World Health Organization (WHO) reported that there are approximately 19 million visually impaired children worldwide, including 1.4 million who are blind and 17.5 million who have low vision, and most of them reside in developing countries [1, 2]. Approximately 80% of the causes of paediatric visual impairment (VI) could be cured by timely intervention at the primary, secondary, and tertiary levels [3, 4] In response to this public health problem, the WHO has launched an initiative to eliminate the avoidable causes of childhood VI [5]. If the leading cause of childhood VI is left untreated, it could lead to permanent blindness. Half of the underlying causes of childhood blindness are avoidable through timely diagnosis and treatment [5, 6]. WHO reported that the leading causes of blindness worldwide were cataracts, 51%, glaucoma, 8%, age-related macular degeneration, 5%, childhood blindness, and corneal opacities, 4%, uncorrected refractive errors and trachoma, 3%, and diabetic retinopathy 1%, the undetermined causes responsible for 21% [1, 2, 7]. The most common causes of childhood blindness in Saudi Arabia

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were optic nerve diseases, 40%, retinal disorders, 32%, cataracts, 7.5%, and uveitis, 7.5%, and the undetermined causes responsible for 13% [8].

Childhood VI is associated with numerous factors, such as sociodemographic, cultural, and financial factors, the availability of eye care services, and awareness of the community. VI can also interfere with normal child development and educational attainment and could lead to poverty [7, 8]. Previously published studies [6, 9, 10] have reported that nearly 60% of children die within one year of becoming visually impaired due to the effect of VI on life quality. The frequency of refractive errors, strabismus, and amblyopia among children has been emphasized since the prevalence is very high. As mentioned above, most of the leading causes of childhood VI are preventable, and there should be an emphasis placed on the availability and accessibility of paediatric eye care services, in addition to public education on the importance of the early discovery of childhood eye conditions and periodic screening in schools. This could help promptly diagnose and treat the major causes of childhood VI [4, 10].

Very few studies have been conducted in Saudi Arabia to estimate the prevalence of childhood visual impairment. El-Sheikh and Tabbara [11] revealed that the rate of childhood blindness in Saudi Arabia among males was 2.4 per 1000 and that among females was 2.0 per 1000. A study conducted to assess eye care services at secondary and tertiary governmental institutions in Saudi Arabia showed that there were 147 optometrists and 407 ophthalmologists [11]. The optometrist-to-population ratio was 1:34,100 in the northern region and 1:146,700 in the western region, which is less than the optometrist-to-population ratio required per the guidelines of the WHO [12, 13]. Moreover, the ophthalmologist-to-population ratio in the northern region was 1:12,900, and that in the western region was 1:80,300. It was planned that by 2020, the country would need 4,400 allied eye care personnel, including optometrists, ophthalmic photographers, and ophthalmic assistants. In addition, equipment for diagnosis and treatment was unavailable in institutions, such as fundus cameras, lasers, and ultrasound machines [14, 15]. Many studies [1 - 18] and WHO have agreed that more than half of the underlying causes of childhood visual impairment could be avoided by timely diagnosis and management. Thus, to eliminate the burden of childhood VI and its preventable causes, it is essential to assess the status of paediatric eye care in the Kingdom of Saudi Arabia. However, there is a lack of published studies that discuss the status of paediatric eye care services in Saudi Arabia.

2. MATERIALS AND METHODS

2.1. Study Design and Data Collection

A cross-sectional study was conducted in public and private hospitals among eye care professionals (optometrists and ophthalmologists) in different regions (central, western, eastern, northern, and southern regions) of Saudi Arabia. The study sample included randomly selected eye care providers working in public and private hospitals who provided eye care services.

Data were collected through an online self-administered pediatric eye care service questionnaire based on a validated questionnaire by Murthy *et al*. [5]. The questionnaires were administered in English.

2.2. Inclusion and Exclusion Criteria

The study included governmental and private hospitals providing eye care services in Saudi Arabia. Hospitals or centres with no eye care services were excluded.

2.3. Study Sample

The sample size of eye care professionals was estimated by using the following formula: $N = \frac{Z^2 \times (P) \times (1-P)}{E^2}$, where Z= 1.96 at the 95% confidence level, P = the outcome of the response assumed to be 50% of the eye care professionals focusing on childhood eye care services, and C = the maximum acceptable sampling error = 8%, or 0.08 in decimal notation: $\frac{(1.96)^2 \times (0.5) \times (1-0.5)}{([0.08])^2}$ = 150 eye care professionals. In addition to a 10% nonparticipation rate (15), the final sample size of this study was calculated to be 165 eye care professionals.

2.4. Data Analysis

The data from the questionnaires were entered into an Excel sheet and then analysed by using SPSS version 24. Descriptive analysis was conducted to calculate the means with frequencies and proportions for the categorical variables. Finally, the responses were compared concerning the regions and type of facilities, and a p-value ≤ 0.05 was considered significant for all inferential analyses.

2.5. Ethics Approval and Consent to Participate

Ethical permission for the study was obtained from the Qassim University Health Research Ethics Committee under approval number (21-04-16), and the survey was performed according to the Declaration of Helsinki guidelines. Informed consent was obtained from all participants, and the purpose of the study was explained to them. The collected data were saved confidentially, and no individual information was obtained. The eye care providers participated freely; they could withdraw from the study at any time without giving a reason.

3. RESULTS

3.1. Characteristics of the Hospital

A total of 137 eye care professionals responded to the survey with a response rate of 83%, including 92% optometrists and 8% ophthalmologists from different regions of Saudi Arabia. Regarding their hospital regions, 45.3% belonged to the central region, 14.6% to the western region, 11.7% to the eastern region, 15.3% to the northern region and 13.1% to the southern region. Regarding the type of hospital, 75.2% of the participants were from public hospitals, and 24.8% were from private hospitals. The participants were also divided according to their facility type, which included 64.2% of participants in secondary care hospitals and 35.8% in tertiary care hospitals. Furthermore, approximately 52.6% of the hospitals were teaching hospitals, and 47.4% were non-teaching hospitals, whereas 84.7% provided special paediatric eye care services, as shown in Table **1**.

Table 1. Characteristics of the Hospitals.

Characteristics of the Hospital	Frequencies (%)
Occupation:	Optometrist: 126 (92%) Ophthalmologist: 11 (8%)
Region of the hospital	Central region: 62 (45.3%) Western region: 20 (14.6%) Eastern region: 16 (11.7%) Northern region: 21 (15.3%) Southern region: 18 (13.1%)
Type of hospital	Public: 103 (75.2%) Private: 34 (24.8%)
Facility type	Secondary care: 88 (64.2%) Tertiary care: 49 (35.8%)
Teaching status	Teaching hospital: 72 (52.6%) Non-teaching hospital: 65 (47.4%)
Provide special paediatric eye care services?	Yes: 116 (84.7%) No: 21 (15.3%)

3.2. Status of Human Resources for Paediatric Optometry/Ophthalmology

Table **2** shows the status of human resources of eye care professionals, which reveals that 73% of the facilities had both trained team (optometrists and ophthalmologists). About 18.2% had only optometrists and 8.8% had only ophthalmologists, approximately 70.8% had anaesthesiologists available, almost 73.7% had easy access to available paediatricians and 50.4% had trained paediatric nurses available.

3.3. Profile of Hospitals Providing Paediatric Eye Care Services

Regarding the profile of the hospitals providing paediatric eye care services, approximately 48.2% had a separate paediatric optometric clinic, 65.7% had separate paediatric ophthalmology clinics available, 46.7% had dedicated separate paediatric optometry outpatient clinics, and 43.8% had advanced diagnostic equipment available. A total of 34.3% of the facilities reported daily visits to paediatric optometry outpatient services by patients, and 29.2% of the ophthalmology outpatient services reported daily visits by patients. A total of 21.2% of the facilities reported having more than 9 optometrists, 20.4% of the facilities reported having no optometrists who provided specialty paediatric eye care, and 51.8% of the facilities reported having optometrists who provided treatment for vision therapy and amblyopia management. Regarding the ophthalmologists, only 1.5% of the hospitals had more than 9 in their facilities, 56.2% of the hospitals did not have an ophthalmology ward, and 22.6% had no beds available for eye care patients in their hospitals, as shown in Table **3**.

Table 2. Status of human resources for paediatric optometry/ophthalmology.

Questions	Responses
Availability of a trained paediatric team at hospitals	Only trained optometrists: 18.2% Only trained ophthalmologists: 8.8% Trained team available (Both): 73%
Availability of an anaesthesiologist	Available: 70.8% Not available: 29.2%
Easy access to an available paediatrician	Available: 73.7% Not available: 26.3%
Trained paediatric nurses (with at least one month of training in paediatric ophthalmology	Available: 50.4% Not available: 49.6%

Table 3. Profile of hospitals providing paediatric eye care services.

Questions	Responses
Availability of separate paediatric optometry clinic	Available: 48.2% Not available: 51.8%
Availability of separate paediatric ophthalmology clinic	Available: 65.7% Not available: 34.3%
Dedicated separate paediatric optometry outpatient clinics	Available: 46.7% Not available: 53.3%
Dedicated separate paediatric ophthalmology outpatient clinics	Available: 56.2% Not available: 43.8%

(Table 3) contd.....

Questions	Responses
Availability of diagnostic equipment needed for paediatric optometry	Basic (refraction): 18.2% Essential (refraction binocular vision): 32.1% Advanced (Essential+ imaging): 43.8% No data: 5.8%
Availability of diagnostic equipment needed for paediatric ophthalmology	Available: 74.5% Not available: 25.5%
Paediatric optometry outpatient service used if a dedicated outpatient clinic was available	Daily: 34.3% 1-2 days/week: 24.8% 3-5 days/week: 19.7% No data: 21.2%
Ophthalmology outpatient service if a dedicated outpatient clinic was available	Daily: 29.2% 1-2 days/week: 34.3% 3-5 days/week: 18.2% No data: 18.2%
Number of optometrists at the hospital	0: 0. 7% ≤ 2: 29.2% 3-5: 19% 6-8: 29.9% > 9: 21.2%
Number of optometrists per hospital providing specialty paediatric eye care	0: 20.4% ≤ 2: 46.7% 3-5: 23.4% 6-8: 8% > 9: 1.5%
Paediatric eye service provided by an optometrist	Refractive correction: 10.2% Binocular vision problems: 1.5% Contact lenses: 4.4% Vision therapy and amblyopia: 51.8% Low vision: 31.4%
Number of ophthalmologists at the hospital	0: 4.4% ≤ 2: 15.3% 3-5: 29.2% 6-8: 16.8% > 9: 34.3%
Ophthalmologists per hospital providing specialty paediatric eye care	0: 14.6% ≤ 2: 51.1% 3-5: 28.5% 6-8: 4.4% > 9: 1.5%
Paediatric ophthalmology providing specialty paediatric eye care	Available: 43.8% Not available: 56.2%
Number of beds available for eye care patients in hospitals providing specialty paediatric eye care	0: 22.6% ≤ 5 beds: 21.9% 5-10 beds: 4.4% >10 beds: 9.5% Not specified: 41.6%

3.4. Outpatient and other Facilities at Hospitals Providing Childhood Eye Care Services

Regarding outpatient and other services at the hospitals providing paediatric childhood eye services, approximately 54.7% of the facilities had more than 14000 annual paediatric outpatient consultations, and 26.3% of the facilities had the majority of paediatric eye-related consultations in the outpatient clinic. Surgical equipment was not available in approximately 25.5% of the facilities; almost 70.8% of the facilities reported that they performed more than 750 paediatric surgeries annually, and 52.6% of the hospitals reported performing all paediatric surgeries.

3.5. Comparison of the Statuses of Human Resources for Paediatric Eye Care Services by Region

Tables **4** and **5** compare the statuses of human resources and the profiles of hospitals providing paediatric eye care services among different regions in Saudi Arabia. A similar type of comparison was performed between the abovementioned groups of variables and the facility type (secondary or tertiary health care). A chi-square test was performed to achieve these comparisons, with p values below 0.05 considered significant.

Table 4. Comparison of the statuses of human resources for paediatric eye care services by region.

Questions		Central	Western	Eastern	Northern	Southern	*Chi, P*
Availability of a trained paediatric team at the hospitals	Optometrist: Ophthalmologist: (Both):	16% 6% 77%	15% 0% 85%	0% 6% 94%	29% 14% 57%	33% 22% 44%	Chi: 17.6 P: .024
Availability of anaesthesiologists	Available: Not available:	68% 32%	80% 20%	94% 6%	43% 57%	83% 17%	Chi: 14.4 P: .006
Easy access to an available paediatrician	Available: Not available:	74% 26%	85% 15%	94% 6%	48% 52%	72% 28%	Chi: 12.0 P: .017
Trained paediatric nurses (with at least one month of training in paediatric ophthalmology	Available: Not available:	56% 44%	45% 55%	88% 12%	24% 76%	33% 67%	Chi: 17.9 P: .001

Table 5. Comparison of the profiles of hospitals providing paediatric eye care services by region.

Questions		Central	Western	Eastern	Northern	Southern	*Chi, P*
Availability of a separate paediatric optometry clinic	Available: Not available:	42% 58%	65% 35%	88% 12%	19% 81%	50% 50%	Chi: 20.3 P: .000
Availability of a separate paediatric ophthalmology clinic	Available: Not available:	77% 23%	85% 15%	87% 13%	10% 90%	50% 50%	Chi: 41.8 P: .000
Dedicated separate paediatric optometry outpatient clinics	Available: Not available:	39% 61%	80% 20%	87% 13%	14% 86%	39% 61%	Chi: 30.5 P: .000
Dedicated separate paediatric ophthalmology outpatient clinics	Available: Not available:	60% 40%	75% 25%	88% 12%	10% 90%	50% 50%	Chi: 28.4 P: .000
Availability of the diagnostic equipment needed for paediatric optometry	Basic Essential Advanced No data:	10% 31% 55% 5%	5% 35% 50% 10%	6% 13% 75% 6%	43% 29% 19% 10%	44% 56% 0% 0%	Chi: 43.1 P: .000
Diagnostic equipment for paediatric ophthalmology	Available: Not available:	81% 19%	95% 5%	100% 0%	38% 62%	50% 50%	Chi: 31.4 P: .000
Frequency of paediatric optometry outpatient service	Daily: 1-2 days/week: 3-5 days/week: No data:	32% 13% 21% 34%	45% 30% 15% 10%	19% 19% 56% 6%	48% 33% 10% 10%	28% 56% 0% 17%	Chi: 39.5 P: .000
Frequency of paediatric ophthalmology outpatient service	1-2 days/week: 3-5 days/week: No data:	35% 15% 19% 31%	35% 30% 35% 0%	0% 69% 31% 0%	29% 52% 5% 14%	28% 56% 0% 17%	Chi: 44.8 P: .000
Number of optometrists at the hospital	0: ≤ 2: 3-5: 6-8: > 9:	2% 35% 24% 23% 16%	0% 20% 5% 10% 65%	0% 19% 25% 0% 56%	0% 0% 29% 29% 43%	0% 0% 78% 22% 0%	Chi: 62.5 P: .000
Number of optometrists per hospital providing specialty paediatric eye care	0: ≤ 2: 3-5: 6-8: > 9:	20.21% 44% 23% 11% 2%	10% 25% 50% 15% 0%	0% 88% 0% 6% 6%	38% 33% 29% 0% 0%	28% 61% 11% 0% 0%	Chi: 37.3 P: .002
Paediatric eye service provided by an optometrist	Refractive error Binocular vision Contact lenses: Vision therapy: Low vision:	10% 7% 5% 40% 39%	10% 5% 10% 45% 25%	6% 10% 6% 6% 61%	5% 15% 5% 60% 5%	19% 10% 10% 41% 10%	Chi: 69.9 P: .000
Number of ophthalmologists at the hospital	0: ≤ 2: 3-5: 6-8: > 9:	10% 50% 6% 19% 15%	0% 70% 0% 20% 10%	0% 13% 6% 25% 56%	0% 0% 24% 62% 14%	0% 0% 61% 39% 0%	Chi: 97.1 P: .000
Number of ophthalmologists per hospital providing specialty paediatric eye care	0: ≤ 2: 3-5: 6-8: > 9:	16% 3% 39% 32% 10%	5% 0% 15% 80% 0%	13% 0% 75% 13% 0%	24% 0% 71% 5% 0%	11% 0% 89% 0% 0%	Chi: 57.6 P: .000

(Table 5) contd.....

Questions		Central	Western	Eastern	Northern	Southern	*Chi, P*
Dedicated paediatric ophthalmology ward in the hospitals providing specialty paediatric eye care	Available:	52%	55%	81%	10%	11%	Chi: 29.5
	Not available:	48%	45%	19%	90%	89%	P: .000
Number of beds available for eye care patients in the hospitals providing specialty paediatric eye care	0:	23%	15%	6%	29%	39%	Chi: 33.2
	≤ 5 beds:	44%	50%	19%	38%	50%	P: .007
	5-10 beds:	15%	20%	6%	19%	11%	
	>10 beds:	8%	5%	69%	0%	0%	
	Not specified:	11%	10%	0%	14%	0%	

The highest percentage of trained paediatric teams at the hospitals was recorded at 95% in the eastern region (p= 0.024), while the lowest percentage was 44% in the southern region. Trained paediatric nurses were available in 88% of the eastern region hospitals, followed by 56% of the central region hospitals (p= 0.001). Services such as separate paediatric optometric clinics, separate ophthalmology clinics, dedicated ophthalmology outpatient clinics, and advanced diagnostic equipment were significantly higher in number in the eastern region than in the other regions (p<0.001). However, the northern region was the most deprived of all regions regarding the availability of the abovementioned facilities. The highest numbers of overall facilities, equipment, and workforce were available in the tertiary care hospitals compared to the secondary care hospitals.

4. DISCUSSION

This study aimed to determine the status of paediatric eye care services in different regions of Saudi Arabia. The availability of certain health services, workforce, and equipment is imperative to provide the necessary childhood eye care services. The findings of the current study revealed that there is a noticeable difference in the number and types of childhood eye care services available in the different regions of Saudi Arabia, as well as health care facilities such as secondary and tertiary care hospitals. A previous study conducted in Saudi Arabia reported that some rural areas in Saudi Arabia, such as the northern and Al-Jouf regions, have adequate health services in both the private and public sectors, and some urban regions, such as the Makkah and eastern regions, have an inadequate number of health facilities [18]. These findings contradict our results, as the northern region reported the least number of childhood eye care services and facilities compared to the eastern region. Therefore, health legislators in Saudi Arabia must consider the differences between the regions to improve the efficiency of childhood eye care services. Mousa and Aldehayyat recommended that some health resources be shifted among the regions to improve effectiveness [18].

Our findings also reveal that cases related to vision therapy and amblyopia were treated mostly in the northern region, followed by the western region. The western region consists of Qassim, which was reported to have a high number of cases of amblyopia among adults as well as children [19]. Regarding refractive errors among children, a prevalence of 4.5% was observed in a study conducted in Riyadh, which is part of the central region [20]. When assessing the facilities and treatment equipment related to refraction in the central region, our findings indicated that the central region had the second-highest availability among all regions with such facilities. The overall availability of facilities and equipment related to advanced optometry was satisfactory, with most facilities and equipment located in the eastern region. However, the workforce related to paediatric optometry and ophthalmology was considerably higher in the western region than in the other regions. We also compared the findings based on facility type, including secondary and tertiary health care centres. In several health systems, dedicated tertiary childhood eye care services are established on a regional basis so patients can easily access facilities and rapid care for their illnesses or injury. This also creates good coordination between the hospitals and specialized centres. With such a scheme, clinical resources and services are enhanced. Health care providers in specialized eye care centres are devoted to best practices, with few practice variations. Regionalization is also a cost-effective approach to delivering specialist public health services [21] (Table **5**).

Although a few comparisons between secondary and tertiary health care services were not statistically significant, the significant differences suggest that the overall number of facilities and readiness level of tertiary eye care centres was much improved compared to those of secondary centres. The number of patients, availability of surgical equipment, number of dedicated ophthalmology wards, and availability of advanced diagnostic equipment were all greater in tertiary centres than in secondary centres.

4.1. LIMITATIONS

A limitation of this study includes the uneven sampling from different regions, as there were disparities in the number of participants from each region. This was caused by the low response rates from the different regions (eastern, southern, northern, and western), which included a considerably small number of participants. This is a common limitation of cross-sectional studies, as it is associated with the risk of nonresponses, leading to less accurate findings. As the validity of prevalence estimation within a sample may be influenced by nonresponses, this may also relate to analyses of between-variable associations within such datasets [22]. Future research may examine whether our results are replicable with a more organized design, comparing compulsory and voluntary sampling from an identical population.

CONCLUSION

The overall quality of paediatric eye-related health care is satisfactory in most Saudi regions. However, there are some discrepancies among the regions in paediatric eye care services, such as human resources, advanced diagnostic equipment, and facility types, which may need to be addressed by decision-makers in the Ministry of Health.

LIST OF ABBREVIATIONS

WHO	=	World Health Organization
VI	=	Visual Impairment

AUTHORS' CONTRIBUTIONS

SA and MA were involved in planning the design of the study. MA drafted the manuscript. SA has done the analysis and interpretation of the results. All authors discussed the results, commented on the manuscript, and approved the final version.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical permission for the study was obtained from the Qassim University Health Research Ethics Committee under approval number (21-04-16).

HUMAN AND ANIMAL RIGHTS

No Animals were used that are the basis of the research. All the human procedures were performed according to the Declaration of Helsinki guidelines.

CONSENT FOR PUBLICATION

Informed consent was obtained from all participants, and the purpose of the study was explained to them.

STANDARDS OF REPORTING

STROBE guidelines were followed for this cross-sectional study.

AVAILABILITY OF DATA AND MATERIALS

Not applicable

FUNDING

None.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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