Original Article

A situational analysis of clinical refraction services in the capital city of the Maldives

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ABSTRACT

Background: Uncorrected refractive error is a leading cause of visual impairment globally. This study aimed to determine the current state of clinical refraction services and barriers to service provision in the capital city of the Maldives.

Methods: This cross-sectional, descriptive-analytical study used a purposive sampling technique. The list of facilities providing refraction services in the city of Malé was compiled through a desk review and finalized after verification by personnel from the Ministry of Health. The availability of human resources and infrastructure was measured using a pre-coded questionnaire that also listed barriers to service provision, followed by on-site observations and subsequent data analysis.

Results: Three clinical ophthalmology departments within hospitals, two ophthalmology hospitals, and nine primary eye care centers were selected for this study. The private sector (n = 12, 85.7%) was the primary provider of refractive error services. All facilities possessed the essential equipment required for refraction. Only optometrists and ophthalmologists conducted refraction. Contact lens assessment and low vision services were not available at any facility. The number of refractions conducted in Malé annually was 145,392. Human resources and management-related factors were the major barriers to the provision of clinical refraction services (n = 21, 44.7%).

Conclusions: Accessibility to refractive error management and low vision services is needed in Malé to meet current population needs. Existing resources, including humans and equipment, require augmentation regarding service provision and enhancement. Knowledge of these barriers could lead to the upscaling of refraction services in Malé, Maldives by health policy makers.

KEY WORDS

clinical refraction services, refractive error services, barriers, Malé, Maldives, refractive error, ophthalmologist, optometrist, policy maker

INTRODUCTION

The number of people worldwide with visual impairment is estimated at 2.2 billion, with 123.7 million cases of vision impairment or blindness resulting from an uncorrected refractive error [1]. Refractive error is simple to measure and easily detected, and intervention is cost-effective [2, 3]. Despite this, uncorrected refractive errors and cataracts are now the leading causes of visual impairment globally [1]. Visual impairment leads to

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various consequences during an individual's lifetime. Inadequate access to eye care, rehabilitation, and other vision-related services increases the life burden and magnifies the disability that occurs at every stage of life [4, 5]. Therefore, timely access to high-quality vision rehabilitation is paramount. However, the provision and utilization of refractive error services in a society depends on certain factors, including physical availability, affordability, and acceptability of those services [1].

The Maldives has a population of 533,941 and is an archipelagic nation consisting of approximately 1,192 islands, grouped in a double chain of twenty atolls, spread roughly over 115,300 square kilometers (including the sea). Its geographical distribution makes it one of the most disparate and isolated countries; of all the islands, only 187 are inhabited [6]. Malé is the capital city of the Maldives and accounts for more than one-third of the national population. Eliminating causes of avoidable blindness and full coverage of eye care services are priorities of the national vision care plan in the Maldives [7]. However, accurate information on the various available clinical refraction services in Malé is lacking. Such information is critical for accurate planning and justification of intervention strategies; therefore, subsequent evaluation of the impact of such interventions becomes challenging.

The availability of clinical refraction services, including infrastructure, human resources, methods of provision of services, and cost and price of services, is just as necessary as knowledge of the magnitude of refractive error. Therefore, this study aimed to analyze the current clinical refraction services available and to determine the barriers to providing eye care services in Malé, the capital city of the Maldives.

METHODS

A purposive sampling method was used in this descriptive, cross-sectional study. Therefore, all public and private health facilities registered under the Ministry of Health (MOH) of the Maldives and providing clinical refraction services in Malé were included. These included all eye hospitals, primary eye care centers, and eye departments of multispecialty hospitals. Refraction facilities unwilling to participate in the study were excluded. The study was conducted between November 15, 2019, and January 15, 2020.

Ethical approval was obtained from the National Health Research Committee (NHRC) of the MOH, the Maldives, and the Secretariat for Research and Ethics, Universiti Kebangsaan Malaysia (reference number: UKM PPI/JEP-2019-240). Approval was sought and received from the administrative units of all health facilities participating in this study. All participants provided written informed consent.

We categorized the facilities into three strata [8]: primary eye care centers, secondary/tertiary eye care centers, and eye departments of multispecialty hospitals. Based on service provider type, general hospitals were multispecialty hospitals with eye departments in which refractions and eye health services, including emergency care, were provided; ophthalmology hospitals were tertiary eye care centers in which eye health services, including surgical care, were provided; ophthalmology clinics were secondary eye care centers; and optical outlets were primary eye care centers in which only refraction services were provided.

A semi-structured questionnaire consisting of three parts, validated in a previous study [8], was administered to the participants. It was modified to fit the Maldivian community and finalized through focused group discussions. The details of this questionnaire are outlined in a previous study [8]. The third part of the questionnaire focused on the type and level of refractive services provided, the number of refractions conducted, other services related to refractive services, and perceived barriers to service provision, and administered it to the key personnel performing refractions (n = 14).

The data were analyzed using IBM SPSS Statistics for Windows (version 23.0; IBM Corp., Armonk, NY, USA). Descriptive data analysis was performed, and the calculated frequencies and percentages are presented in the text or table. Data on human resources, equipment, services, type, and output are described and presented based on provider type and public-private settings.

RESULTS

In the desk review, we found two studies on the magnitude of visual impairment and refractive error in the Maldives. The first was the nationwide Rapid Assessment of Avoidable Blindness (RAAB) study of individuals aged ≥ 50 years, which found that uncorrected refractive error accounts for 50.9% of visual impairment [9]. The second was the Maldives Action Plan Vision 2020, which included all outpatients seen at tertiary-level hospitals and revealed that 20% to 25% of cases had refractive errors. From the outpatient records of a private ophthalmologist, refractive error management constituted 38% of delivered services [7].

Of the 16 service providers found in investigating the distribution of clinical refraction services in Malé,

Table 1. Demographic profiles of 14 clinical refraction service providers included in this study

Variable	n (%)
Strata of service delivery [8]	
Primary eye care centers	4 (28.6)
Secondary/tertiary eye care centers	7 (50.0)
Eye departments of multispecialty hospitals	3 (21.4)
Type of service provider	
General hospital	3 (21.4)
Ophthalmology hospital	2 (14.3)
Ophthalmology clinic	5 (35.7)
Optical Outlet	4 (28.6)
Ownership	
Public	2 (14.3)
Private	12 (85.7)
Non-governmental organizations	0 (0.0)
Human resource for refraction	
Optometrist	17 (36.2)
Ophthalmologist	30 (63.8)

14 provided refraction services and were included in this study (Table 1). The other two facilities were optical outlets involved in the fabrication of glasses/contact lenses based on prescriptions issued by other refraction service providers. In Malé, a majority (85.7%) of the facilities delivering clinical refraction services were private providers (Table 1).

Optometrists (n = 17, 36.2%) and ophthalmologists (n = 30, 63.8%) served as the human resources for refraction services (Table 1). Most ophthalmologists (n = 23, 76.7%) and optometrists (n = 16, 94%) were foreign nationals. All local ophthalmologists were public service employees; however, they practiced outside their main jobs in private clinics. Only one optometrist was local (6%) and was a public sector employee. All optometrists performed refractions and were primarily responsible for refraction in the public and private sectors. All ophthalmologists except one performed refractions in the public sector. In the private sector, 53.3% (n = 16) of the ophthalmologists routinely performed refractions. All optical outlets employed optical technicians to fit the prescribed lenses to the customers.

Table 2 summarizes the distribution of health personnel and refraction services within these facilities. The 14 facilities had 20 refraction service setups, all with the appropriate distance required for examination and measurement of refractive errors. In addition, lighting was adjustable to suitable dark conditions. All the facilities had the necessary equipment for basic refraction (Table 2).

Table 3 shows the distribution of refraction services within the study facilities. Optical dispensing units were present in 9 (64.3%) facilities. A separate contact lens assessment setup was not available at any facility. However, soft contact lenses and soft toric contact lenses were dispensed in all facilities. None had low vision assessment or rehabilitation services.

Objective refraction based on auto-refractometer readings was performed in 5 (35.7%) facilities (Table 3). In the majority (n = 9, 64.3%) of facilities, refraction was performed based on auto-refractometers and retinoscopy findings when required. None of the optometrists or ophthalmologists engaged in dispensing prescription lenses. Nine (64.3%) facilities performed cycloplegic refractions when required. When visual acuity did not improve with the best refractive correction in place, patients were referred from primary and secondary eye care centers to tertiary centers for further investigation. After a complete assessment, if any treatment or rehabilitation unavailable in the Maldives was required, these cases were referred by the tertiary centers to suitable vision care centers abroad. Only one facility participated in the school health-screening program (Table 3); these screenings were reportedly conducted twice per year.

Based on the interviews, the weekly rate of refraction was the highest in ophthalmology hospitals (67.7%). The total number of refractions in 2019 in Malé was 145,392, with the private sector accounting for the highest percentage (81.9%). Based on the category of service provider, ophthalmology hospitals performed over half (55.1%) of the refractions, followed by tertiary-level hospitals (27.8%) (Table 2).

Table 2. Number of refractions, distribution of health personnel, and refraction services within the study facilities

Variable	Facility type		Type of service provider			
	Public n (%)	Private n (%)	General Hospital n (%)	Ophthalmology Hospital n (%)	Ophthalmology Clinic n (%)	Optical Outlet n (%)
Health professional performing refraction						
Ophthalmologist	7 (18.9)	30 (81.1)	10 (27.0)	9 (24.3)	11 (29.7)	0 (0.0)
Optometrist	3 (17.7)	14 (82.4)	3 (17.7)	6 (35.3)	3 (17.7)	5 (29.4)
Number of refraction set-ups *	5 (25.0)	15 (75.0)	6 (30.0)	5 (25.0)	5 (25.0)	4 (20.0)
Number of refractions						
Mean number of refractions per week in the facility	254 (57.1)	191 (42.9)	259 (22.8)	770 (67.7)	49 (4.3)	59 (5.2)
Total number of refractions logged in the records as registered in the two weeks preceding the field visit	1014 (18.1)	4578 (81.9)	1554 (27.8)	3080 (55.1)	488 (8.7)	470 (8.4)
Total number of refractions calculated for the year 2019	26,364 (18.1)	119,028 (81.9)	40,404 (27.8)	80,080 (55.1)	12,428 (8.5)	12,480 (8.6)
Equipment checklist						
Distance VA chart	9 (28.1)	23 (71.9)	11 (34.4)	9 (28.1)	8 (25.0)	4 (12.5)
Preverbal test chart	1 (12.5)	7 (87.5)	1 (12.5)	2 (25.0)	3 (37.5)	2 (25.0)
Trial frame, adult	11 (32.4)	23 (67.6)	12 (35.3)	8 (23.5)	7 (20.6)	7 (20.6)
Trial frame, paediatric	1 (8.3)	11 (91.7)	1 (8.3)	6 (50.0)	3 (25.0)	2 (16.7)
Trial set	7 (24.1)	22 (75.9)	9 (31.0)	9 (31.0)	7 (24.1)	4 (13.8)
Retinoscope	3 (21.4)	11 (78.6)	3 (21.4)	5 (35.7)	4 (28.6)	2 (14.3)
Lensometer	2 (12.5)	14 (87.5)	2 (12.5)	5 (31.2)	4 (25.0)	5 (31.2)
Cross cylinder	1 (12.5)	7 (87.5)	1 (12.5)	4 (50.0)	1 (12.5)	2 (25.0)
Occluder	9 (29.0)	22 (71.0)	13 (41.9)	8 (25.8)	6 (19.4)	4 (12.9)
Pinhole	7 (25.0)	21 (75.0)	11 (39.3)	8 (28.6)	5 (17.8)	4 (14.3)
Autorefractor	7 (31.8)	15 (68.2)	8 (36.4)	5 (22.7)	5 (22.7)	4 (18.2)
Distance fixation targets	5 (35.7)	9 (64.3)	6 (42.8)	2 (14.3)	4 (28.6)	2 (14.3)
Near fixation targets	5 (38.5)	8 (61.5)	5 (38.4)	2 (15.4)	3 (23.1)	3 (23.1)
Ophthalmoscope	3 (13.6)	19 (86.4)	8 (36.4)	8 (36.4)	4 (18.2)	2 (9.1)
Keratometer	6 (35.3)	11 (64.7)	7 (41.2)	3 (17.6)	4 (23.5)	3 (17.6)
Prism bar	1 (33.3)	2 (66.7)	1 (33.3)	1 (33.3)	1 (33.3)	0 (0.0)
Colour vision test	4 (23.5)	13 (76.5)	5 (29.4)	4 (23.5)	5 (29.4)	3 (17.)
Amsler grid	3 (42.9)	4 (57.1)	4 (57.1)	1 (14.3)	0 (0.0)	2 (28.6)
Slit-lamp	7 (31.8)	15 (68.2)	8 (36.3)	6 (27.3)	4 (18.2)	4 (18.2)
A-scan	2 (33.3)	4 (66.7)	3 (50.0)	2 (33.3)	1 (16.7)	0 (0.0)
Contact lens assessment set up	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Low vision assessment devices	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

*Refraction setup: The arrangement of refraction equipment for which one refraction can be performed at a time is known as the refraction setup.

Table 3. Distribution of refraction services within the study facilities

Variable	Facility type		Type of service provider			
	Public n (%)	Private n (%)	General Hospital n (%)	Ophthalmology Hospital n (%)	Ophthalmology Clinic n (%)	Optical Outlet n (%)
Optical dispensing unit present						
Yes	0 (0.0)	9 (75.0)	1 (33.3)	2 (100)	3 (60.0)	3 (75.0)
No	2 (100)	3 (25.0)	2 (66.7)	0 (0.0)	2 (40.0)	1 (25.0)
Contact lens assessment unit present						
Yes	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
No	2 (100.0)	12 (100.0)	3 (100.0)	2 (100.0)	5 (100.0)	4 (100.0)
Low vision assessment and services available						
Yes	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
No	2 (100.0)	12 (100.0)	3 (100.0)	2 (100.0)	5 (100.0)	4 (100.0)
Type of objective refraction performed						
Manual refraction (Retinoscopy)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Autorefraction	0 (0.0)	5 (41.7)	1 (33.3)	0 (0.0)	2 (40.0)	2 (50.0)
Both	2 (100)	7 (58.3)	2 (66.7)	2 (100)	3 (60.0)	2 (50.0)
Cyclorefraction performed						
Yes	2 (100)	7 (58.3)	2 (66.7)	2 (100.0)	5 (100.0)	0 (0.0)
No	0 (0.0)	5 (41.7)	1 (33.3)	0 (0.0)	0 (0.0)	4 (100.0)
Patient records maintained						
Yes	2 (100)	9 (75.0)	3 (100.0)	2 (100.0)	3 (60.0)	3 (75.0)
No	0 (0.0)	3 (25.0)	0 (0.0)	0 (0.0)	2 (40.0)	1 (25.0)
Involved in school screening						
Yes	0 (0.0)	1 (8.3)	0 (0.0)	1 (50.0)	0 (0.0)	0 (0.0)
No	2 (100.0)	11 (91.7)	3 (100.0)	1 (50.0)	5 (100.0)	4 (100.0)

Table 4. Summary of the reported barriers to service provision, from the interviewed optometrists' and ophthalmologists' point of view

Theme	Sub-theme	Frequency (n)
Human resource and management	Human resource	8
	Lack of training of service providers	9
	Lack of proper administration/management	4
Infrastructure	Equipment	6
	Allocated space for refraction unit	2
Spectacles	Availability of spectacles	1
	Cost of spectacles/services	8
Community	Poverty	1
	Lack of awareness	8

n = number of responses

Concerning the cost of clinical refraction services, all Maldivians are insured under the universal health insurance scheme named Aasandha. In the public sector, refractions are free of cost to the Maldivians. Furthermore, private employees are entitled to use other available insurance schemes in which their employers enroll. Conversely, if a citizen seeks treatment at a private eye care facility, one-third of the consultation and service charges are covered under the Aasandha scheme. Therefore, such a patient would have to pay 200 Maldivian rufiyaas (MVR) (12.97 United States Dollars [US$]) out-of-pocket if seeking refraction at a private facility. However, if the glasses are crafted at that optical outlet, the refraction charges are commonly waived.

With a prescription from any hospital/eye hospital, a grant of MVR 1000 (US$ 64.85) is available for glasses purchases under the Aasandha health scheme. The option of using multiple health insurance schemes to meet the cost of prescription glasses is also available, should that person meet the eligibility criteria. Moreover, the Maldives National Defense Force (MNDF) and the Maldives Police Service provide MVR 1500 (US$ 97.28) annually to their staff and family members for prescription glasses. The average cost of a pair of prescription lenses (+1.00D/-1.00D) in Malé is MVR 692.5 (US$ 44.90).

Refraction records were maintained in 11 (78.6%) facilities, and all had records of all refractions conducted in that facility. A majority (n = 8, 72.7%) used computerized record maintenance systems. Facilities that did not maintain records included two ophthalmology clinics and one optical outlet in the private sector.

Concerning barriers to service provision, 14 optometrists/ophthalmologists were asked about barriers that could influence the output of their services. The majority of these eye health professionals were men (78.6%), and three were women (21.4%). The mean age (± standard deviation) of the interviewed professionals was 37.79 ± 9.83 years. The questionnaire presented them with various potential barriers, and they were allowed to select more than one option if appropriate. The reported barriers were later coded into four broad themes and nine subthemes (Table 4). The most frequently reported barriers were human resource- and management-related factors (n = 21, 44.7%), followed by spectacle- and community-related barriers, each accounting for 19.1% (n = 9) of the responses, and infrastructure-related barriers (n = 8, 17.0%).

DISCUSSION

This study is the first situational analysis of clinical refraction services in Malé, Maldives. The findings are discussed with respect to the following factors: human resources, equipment available, service delivery, and barriers to service provision.

We found that the available eye care services are well structured and distributed throughout Malé. The public and private sectors provide these services, with the private sector (85.7%) delivering most refraction services. We found no non-governmental organizations (NGOs) or religious/welfare missions providing eye care services. Because refraction services are centralized in the capital city, patients throughout the Maldives must travel to Malé to fulfil their eye care needs. Similarly, a study conducted in central Nepal showed a concentration of refractive services in the central region, making accessibility and affordability of services a problem for those in rural areas [8].

As outlined in the Results section, two studies in different settings estimated prevalences of 50.9% [9] and 20% to 25% [7] for visual impairment due to uncorrected refractive errors in the Maldives. With such a high prevalence of refractive errors in the Maldivian population and only 14 facilities offering refraction services, there is a considerable burden on human and infrastructure resources.

It is common in Malé for optometrists to perform refraction services. Typically, patients are first examined by an ophthalmologist and then referred to an optometrist for refraction. This situation was observed in all ophthalmology departments at tertiary-level hospitals and ophthalmology hospitals in Malé. Tertiary-level private hospitals were the only facilities in which an optometrist was not employed in refraction services. Because of the limited human resources for eye care, all local ophthalmologists also worked part-time in one or two private clinics in Malé. These are multispecialty clinics in which an ophthalmologist conducts limited outpatient services and mainly provides services for ocular diseases. Optical outlets were found to be specialized in refractions. Both cadres require licensure and registration to practice in Malé; therefore, they were both well trained and able to provide quality refraction services. This co-existence is more efficient in providing quality eye care services, as it allows the ophthalmologist to focus on managing eye diseases and other related conditions, thereby leaving the management of refractive errors to optometrists [10, 11]. Similar arrangements have been observed in most South Asian countries [11]. In other island nations, such as Papua New Guinea, refractionists and optometrists provide refraction services [12].

In this study, 47 employed staff members were capable of performing refraction. However, this might be an inaccurate representation, as eight ophthalmologists practiced as part-time eye health providers at private ophthalmology clinics outside their primary jobs, and were thus tallied more than once. Sapkota reported 20 eye care personnel for the Maldives [11]. There was no set target for the required number of ophthalmologists or optometrists to provide clinical refraction services in Malé as described in the Maldives Vision 2020 Action Plan [7]. However, according to the World Health Organization's Situational Analysis Report for Vision 2020 in the Southeast Asia Region, the Maldives has met the set ratio of one ophthalmologist per 100,000 population [13]. Thus, according to the 2006 'Global Human Resource Development Assessment for Comprehensive Eye Care', the Maldives falls within Category A, that is, ophthalmologist availability with a ratio of one per 100,000 population [14]. In addition, in the Southeast Asian region, the Maldives, Thailand, and India were the only countries that met this target [14]. Another study in 2018 reported that the Maldives had 10 ophthalmologists and 10 optometrists per 350,000 population, with a ratio of 28 per million each [11]. The results from the present study show that there are currently 17 optometrists and 22 ophthalmologists (eight ophthalmologists practiced as part-time ophthalmologists; hence, they were tallied more than once) per resident population of 67,742 based on the 2018 census [15]. This amounts to a ratio of one eye care professional performing refraction per 1736 population, which may be sufficient for the population of Malé. However, because Malé is the central hub of refraction services in the Maldives, and with various problems arising from the geographical separation of islands within the archipelago, this number may be insufficient to provide clinical refraction services for the whole nation based on the population registered in 2018 (374,775) [15].

In terms of equipment, all facilities were well suited to conduct accurate and high-quality refractions. In addition, almost all facilities had additional instruments required for refraction. However, most practitioners relied on autorefractors rather than retinoscopy findings. As the methods of clinical refraction services differ among the various providers, services must be standardized at all levels of provision to ensure the best possible quality of eye care [16]. Furthermore, optometrists and ophthalmologists could benefit from further training in manual refractions and cyclorefractions [17]. This expansion of services could reduce the need for referrals to higher centers, made predominantly from primary eye care centers. Low vision and rehabilitation services have been considered a low priority in the Maldives. Refraction services for low vision and contact lens assessment were unavailable in all the facilities, which in turn reflects a lack of trained staff and support infrastructure for these services. A situational analysis in Papua New Guinea showed that low vision services were scarce due to factors such as limited trained personnel and limited low vision devices [12]. Hence, the establishment of these complimentary eye care services requires deliberate planning for long-term benefit to the nation.

The current eye health system in Malé is already well established regarding the facilities available and services provided. Optometrists complete a four-year undergraduate program, and they are well trained in their field. We found that the optometrists in Malé did not provide low vision and rehabilitation services; they were typically employed refractionists (i.e., providing spectacles for refractive errors). This is primarily because private sector services dominate the provision of eye health care in Malé. As such, optometrists in this business-oriented sector are commonly utilized as refractionists because this forms the bulk of public demand. Similar findings have been reported in other South Asian countries such as Bangladesh and Sri Lanka, where allied ophthalmic personnel such as optometrists and ophthalmic assistants are not fully recognized or accredited to carry out eye care services independently [11, 18]. This results in the utilization of ophthalmologists for primary eye care and routine skill-based activities such as refractions, leading to reduced productivity of ophthalmologists in the region. Awareness programs must also be implemented to introduce the field of optometry to localities. Local optometry training programs could be established to encourage local recruitment into the field [19, 20]. It is essential to develop career

progression pathways and communication enhancement for optometrists and to provide incentives to serve in the Maldives archipelago, thus possibly decentralizing clinical refraction services and enhancing the quality of eye care [21, 22].

Despite a likely need for low vision and contact lens services, these services are somewhat neglected. Low vision and rehabilitation services require substantial contact between the eye care practitioner and the patient to complete the assessment, conduct appropriate training and guidance, and conduct counseling on the visual aspects of the condition. Rehabilitation services provided by optometrists, such as prescription contact lenses, optical and electronic magnification devices, contrast enhancement, visual field enhancement, eccentric viewing, and non-optical options, require additional skills and training [23]. Additional human resources and physical infrastructure are needed to provide these services in the future. Most optometrists employed in Malé are foreign nationals. Hence, social and communication barriers may become significant for low vision and rehabilitation services. In support of this, studies have shown that effective communication is necessary to ensure the quality of healthcare for people with disabilities, and formal training in communication with disabled patients would yield positive outcomes [22].

In this study, the record-keeping and reporting systems were different at each eye care facility surveyed, and most were used to record the number of patients seen rather than for client care or follow-up services. Furthermore, record maintenance was not prioritized in any of the facilities, as reported in a similar study [8]. This could be because investments in record maintenance systems may not be worthwhile for the small-scale businesses in the private sector. Without a national requirement for record maintenance and submission of regular reports to monitor the state of eye care services, this situation is unlikely to change. Therefore, a mandatory standardized record-keeping and reporting system for eye care provision in the Maldives is necessary to monitor trends in vision disorders and service delivery. This will provide baseline information for national decision-makers to determine service provision priorities and to assist future cost-benefit analyses. Das et al. [21] concluded that escalating financial allocation and periodic surveillance of disease burden are critical for the success of eye care programs across Southeast Asia [21].

Only one of the facilities studied was involved in school eye health programs or screenings. From 2014 to the present, the Ministry of Health, Ministry of Education, and the MNDF have been conducting health screenings in all public schools in Malé and in the atoll schools [24]. Screenings include basic visual acuity measurements in addition to general pediatric evaluations. Children who fail visual acuity testing are then referred to eye care centers for appropriate treatment. There is no specific engagement with the various public and private eye care facilities. These referred children are expected to seek treatment at the facility of their choice, and this choice may depend on ease of access. Therefore, while the interviewed facilities were not directly involved in the school health-screening programs, they indirectly contributed by treating those children who presented to them. The unavailability of NGOs to conduct or assist in school health-screening programs could be why the facilities in this study were not directly involved in the programs. In this study, we found that the eye care system is predominantly private sector driven; therefore, human resources and equipment are likely insufficient within these facilities to enable a nationwide comprehensive vision screening program among children. Hence, when a public system is unavailable, an NGO could provide the coordination needed to deliver such a program. Furthermore, with the government undertaking school screenings, the schools themselves may not be willing to permit eye care facilities to directly conduct such programs. Although visual function is crucial for child development and maximization of benefits from school [25], the simple provision of visual acuity screening and corrective prescriptions may not ultimately resolve all the visual function issues suffered by these children. However, there are other reported visual factors associated with learning problems and academic achievement [26]. Adding amblyopia and heterotopia screenings would allow early detection and treatment of these issues before the children achieve visual maturity [27-29].

We found that the number of refractions performed in the Maldives varied according to the time of year. Because most optical outlets and eye care centers are in Malé, the capital city, it is by default the primary clinical refraction service provider for the whole nation. As a result, each year, there is a substantial increase in the patient load during school semester breaks and academic year-end holidays, when people from the various islands in the archipelago visit Malé for their refraction and other medical needs. Aasandha covers the total cost of refraction services or consultations in the public sector and one-third of the cost of these services in the private sector. Refraction may be performed free of charge at certain optical outlets and eye care facilities. Typically, the refraction fee would be waived if the patient opted to wear glasses crafted at that outlet. Thus, the allowances provided through public health insurance schemes have significantly reduced the costs of spectacles for Maldivians in general. The cost of health care in the Maldives has been shown to be the lowest among South Asian countries [30].

Our analysis found that the barriers to eye care services were predominantly provider-related. The identified barriers included lack of human resources and training programs. This was followed by spectacle-associated factors such as affordability, and community-related factors such as a lack of awareness of refractive error and the corrective

services available. Our review of the available literature did not find a similar previously published barrier-related data analysis from other small island nations. However, a study conducted in Singapore, an urban population, reported that lack of awareness of refractive error was a significant risk factor for uncorrected refractive errors [31]. Therefore, solutions to these barriers to eye care services are crucial, from the perspective of both service providers and consumers, to help achieve the Vision 2020 target [32].

The major findings of this study, however, are limited in that the data were obtained from the capital city, although its population comprises only 40.8% of the national population. Although Malé provides most clinical refraction services for the entire nation, a nationwide study would perhaps have been more inclusive. However, because almost half the population of the Maldives is located in or near Malé, these findings could be representative of the nation as a whole. This study also failed to identify a gap between the national requirements, infrastructure, and human resources available to provide refraction services. Based on the available data, we could not determine the efficiency of optometrists/ophthalmologists in providing refraction services. This is an area for future research. Another factor that may limit our findings is that the study period coincided with the academic year-end break. Thus, the number of refractions enumerated and calculated as annual refractions may not have been representative of the Malé population, as it almost certainly included refractions for people visiting Malé from other islands in the archipelago during the academic holidays. Furthermore, the data could not be disaggregated into new, repeat, or follow-up refractions, as the available records do not allow this differentiation. Larger studies, region-wise and nationwide, to investigate refraction services in the country must be planned and conducted. These studies could explain why people choose to travel to capital cities despite the presence of many regional hospitals throughout the Maldives. Exposing barriers to service utilization in the capital city, as well as in the islands, will enhance existing services for this population. Additionally, studies exploring the quality of refraction services are recommended.

CONCLUSIONS

This mixed method study explored the current status of refraction care services in Malé to address the gap in existing knowledge of service delivery. The available services, though sufficient for the capital city, are too insufficient and sub-optimal in quality to address the emerging burden of refractive errors in the Maldivian population. Furthermore, we documented barriers to service provision from the perspective of eye care stakeholders, including optometrists and ophthalmologists. Knowledge of these barriers could lead to the upscaling of refraction services in Malé, Maldives by health policy makers. Strategies including health promotion activities, outreach services, training of local human resources, regulation and accreditation of service providers, and distribution of services outside the capital city could aid in preventing vision loss in the Maldives.

ETHICAL DECLARATIONS

Ethical approval: The study adhered to and was performed in accordance with the Declaration of Helsinki. Ethical clearance was obtained from the NHRC of the MOH, the Maldives, and the Secretariat for Research and Ethics, UKM (ethics approval reference number: UKM PPI/JEP-2019-240). Approval was sought and received from the administrative units of all health facilities participating in this study. All participants provided written informed consent.

Conflict of interests: None

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