



Access to Eye Care Services for Children within the Education Sector

A Systematic Review in Low- and Middle-Income Countries

2018



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Glossary of terms

- **Amblyopia** – sometimes referred to as a lazy eye, is decreased vision in one or two eyes (with optical correction and in the absence of eye or visual pathway disease) due to abnormal vision development during childhood.
- **Astigmatism** – a non-spherical curvature of the eye or lens shape, which results in distorted images, as light rays are prevented from meeting at a common focus. This can be corrected with cylindrical lenses in spectacles or contact lenses.
- **Blindness** – this is not always a complete lack of vision (or no-light perception) but is defined by the International Classification of Diseases¹ as visual acuity (VA) worse than 3/60. This means that an object that can be seen by a normal sighted person at 60 meters cannot be seen by the blind person when it is three meters away from them.
- **Hyperopia** – also referred to as long-sightedness or far-sightedness is a condition where there is difficulty focusing on objects at close range and hence near objects may appear blurred, or in children, it can cause eyestrain, headaches and/or an aversion to near work. This is the result of images being focused behind the retina instead of on the retina.
- **Low vision** – is significantly reduced vision after standard treatments and refractive corrections that still has potential in planning and/or executing a task for which vision is essential. What is “significant” and what has “potential” is dependent on social, cultural and individual factors, which means that the vision state qualifying as low vision also depends on these factors. In general, it is considered to equate to visual acuity between 6/18 and 1/60, and/or a visual field of 20 degrees or less.²
- **Myopia** – also referred to as shortsightedness or near-sightedness is a condition where objects at close range appear clear and those in the distance appear blurred. This is the result of images being focused in front of the retina instead of on the retina.
- **Pink eye** – a colloquial term, generally used by lay people to mean conjunctivitis.
- **Red eye** – a common term used in reference to any condition that causes an eye to look red/pink (i.e. including conjunctivitis, keratitis, uveitis, glaucoma, etc.).
- **Presbyopia** – an age-related eye condition that creates refractive error and usually results in poor near vision due to the reduction in elasticity of the crystalline lens and capsule in the eye.
- **Refractive errors** – a group of eye conditions including myopia, hyperopia and astigmatism. Blurred and/or distorted vision results from an unfocussed image falling on the retina. Refractive errors are measured in diopters. They are the most common cause of vision impairment in children and adults and can be corrected by spectacles or contact lenses.
- **Strabismus** – also referred to as a squint or eye turn, is a condition where one eye is deviated from normal orientation. Strabismus can be constant (present all the time) or intermittent (present sometimes), and unilateral (the same eye always deviates) or alternating (either eye may deviate).
- **Trachoma** – is a leading cause of infectious and preventable blindness in the world. It is caused by a bacterium called Chlamydia trachomatis. Infection is transmitted through contact with eye and nose discharge of infected people, particularly young children. It can also be spread by flies that have been in contact with infected people. Water shortage, inadequate sanitation and crowded households are environmental risk factors. Repeated infection causes scarring

of the eyelid, which leads to eyelashes turning inwards and scratching the surface of the eye (cornea). This can lead to pain and irreversible blindness due to scarring of the cornea.

- **Uncorrected refractive error (URE)**

- when refractive error is not optically corrected (i.e. with spectacles or contact lenses). This typically results in impaired vision except where children who are mildly long-sighted experience eyestrain instead of vision impairment.

- **Vision impairment** – is visual acuity worse than 6/12 (20/40) in the better eye with best correction. This can be classified as mild, moderate, severe or blindness depending on the level of VA. The International Classification of Diseases-10 defines mild visual impairment as VA worse than 6/12 but equal to or better than 6/18, moderate as VA worse than 6/18 but equal to or better than 6/60, severe as VA worse than 6/60 but equal to or better than 3/60 and blindness as worse than 3/60 to no light perception. Vision impairment can be caused by disease, congenital abnormality or by not being able to access spectacles for refractive error correction (e.g. hyperopia, myopia).

- **Visual acuity (VA)** – relates to clarity of vision and measured by a person's ability to discern shapes (e.g. letters) on a test chart at a given distance. Normal VA is considered to be 20/20 (test distance measured in feet) or 6/6 (test distance measured in meters). A person with a VA of 6/12 means that an object/letter needs to be 6 meters away for the person to discern it where as a normal sighted person could see it/discern it at 12 meters away.

List of abbreviations

ADC	Area Development Committee
ECP	Eye Care Professionals
EHP	Essential Health Package
EPS	Colombian health insurers which deliver health services [Empresas Prestadoras de Servicios de Salud de Planes]
FGD	Focus Group Discussions
GNI	Gross National Income
GPE	Global Partnership for Education
HSA	Health Surveillance Assistants
HDI	Human Development Index
LMIC	Low and Middle Income Countries
MoE	Ministry of Education
MOH	Ministry of Health
NGO	Non-Government Organization
PAHO	Pan American Health Organization
RARE	Rapid Assessment of Refractive Errors
URE	Uncorrected Refractive Error
VA	Visual Acuity
WHO	World Health Organization

Executive summary

School health interventions are a unique opportunity to provide comprehensive eye health services to millions of children throughout the world, but eye health is typically omitted from school health interventions, particularly in low- and middle-income countries (LMICs). A greater understanding of the factors that shape accessibility are critical in planning health and education services which enable eye care for children. **This study systematically reviews the global evidence on the facilitators and barriers for children accessing eye health services** within the education sector **in LMICs**, in order to provide global recommendations for more accessible services.

Relevance to individuals, public health, education, and economic and human development:

- **Vision impairment and blindness impacts 19 million children globally**, of which 12 million are vision impaired because they do not have an adequate pair of spectacles. In addition, 90% of children and adults with vision impairment live in developing countries, suggesting there are greater barriers to access in these settings.
- **Vision impairment in children has been associated with poorer levels of educational attainment across a range of settings.** Data from the Sustainable Development Goals shows educational attainment has a direct impact on individual and national economic growth, and individual health outcomes.

This systematic review is the first to synthesize the evidence on children's access to eye health services within the education sector, in LMICs globally.

Previous studies investigating factors influencing children's access to eye care services have explored willingness to pay, willingness to wear spectacles (compliance), knowledge and perceptions, and access to eye

care resources. This review considers access through a conceptual framework that examines resource availability (supply), against resource utilization (demand) over four broad domains of accessibility (acceptability, availability of health services, financial accessibility and geographical accessibility).

Through an extensive search, 21,713 citations were identified and 133 studies met the eligibility criteria of investigating children's access to eye care services within schools. The eligible studies were from 38 countries, and six World Bank regions.

Case studies conducted in Colombia, Malawi and Pakistan allowed triangulation of the findings from the systematic review and provide deeper exploration of some of the barriers faced in providing eye health services in school settings, from both the user and providers perspectives. For instance, limited cooperation between the Ministries of Health and Education was identified as a supply barrier in Colombia, whereas a lack of funding and resources were identified in Malawi and a lack of government engagement was identified in Pakistan. From the users' (children and their parents/guardians) perspective, there was a distinct resistance to teachers conducting eye checks in Colombia, cultural misconceptions in Malawi, and a lack of awareness of eye health in Pakistan.

Key facilitators to children's access to eye health services within schools from users' perspectives: Cultural activities and the community can be a source of pragmatic and emotional support for children with vision impairment and blindness, and positive parental/guardian attitudes can increase participation in school eye checks and spectacle wear.

Key barriers to children's access to eye health services within schools from users' perspectives: Misconceptions around the causes and significance of eye disease and vision

impairment are a major barrier to children's ability to access appropriate care. Limited availability of eye care professionals prevents parents seeking eye care for their children.

Out-of-pocket costs such as transport, spectacles, examination fees, and other constraints such as transport availability, access to health insurance, access to childcare, potential lost wages and the time required to visit eye care facilities or optical stores are also barriers to access.

Key facilitators to children's access to eye health services within schools from a supply (services) perspective: Health education interventions can successfully shift eye health misconceptions, raise awareness, prevent eye problems and encourage children to seek comprehensive care outside of school. Program costs can be reduced through strategic spectacle prescription guidelines and training protocols.

Using teachers, nurses, certified medical assistants and key informants to conduct vision screening can reduce human resource burdens, with accurate identification of children with eye problems, provided appropriate tests are provided and appropriate criteria are in place. Mobile eye clinics or outreach services allow more children to have comprehensive eye examinations at lower cost.

Key barriers to children's access to eye health services within schools from a supply (services) perspective:

Lack of planning or "squeezing" eye health interventions into the regular curriculum leads to poor support from teachers, and inappropriate training of those providing eye checks can lead to inaccurate spectacles for children. Increased distance between schools and health services negatively influences services' abilities to conduct school eye checks and facilitate referrals.



Recommendations:

Increase positive perceptions and awareness of eye health services, treatments, and spectacles among parents/guardians, children and the wider community through health promotion.

Increase the availability of school eye checks, ideally in conjunction with existing school health programs, utilizing teachers when appropriate.

Increase availability of low vision devices (such as magnifiers) and mobility training for children with vision impairment.

Ensure the provision of eye care services within schools are cost effective, including balancing the supply and demand of low cost spectacles.

Garner multidisciplinary support and cooperation from relevant government ministries to **prioritize the inclusion of eye health in relevant policies** (notably school health policy).

Where NGOs are providing school eye health interventions, ensure a **communications and collaboration plan** is in place with government ministries with the aim to work towards sustainable funding of programs.



Introduction

1. Background

Currently it is estimated that there are 19 million children with vision impairment and blindness.³ Many of the conditions causing vision impairment have treatments available, and disparities have arisen, as more than 90% of the global burden of vision impairment and blindness (inclusive of adults and children) is in low-income countries.⁴ This suggests that there are fewer services, or increased barriers to children accessing services in lower income countries, compared to higher income countries.⁵ A greater understanding of the factors which shape accessibility are critical in planning health and education services that enable appropriate eye care for children.

2. The impact of vision impairment and blindness on education outcomes

Educational outcomes for children are the result of a complex array of individual, familial, societal and cultural determinants. Vision impairment in children has been associated with poorer levels of educational attainment across a range of settings.^{6–11} While it is plausible that the relationship between vision and education is merely an association, or that poor education causes poor vision, logic (classrooms have high visual demands so performance is likely to be affected in children who can't absorb visual information)¹² and evidence (simulating vision problems worsens academic performance, and correcting real vision problems improves academic performance)^{13–18} both suggest that it is more likely that vision impairment interferes with educational attainment. Recent randomized controlled studies have demonstrated that provision of free spectacles to Chinese children with uncorrected refractive errors (specifically myopia) resulted in improvements in mathematics scores, and were less likely to fail exams, despite imperfect spectacle compliance.^{7,19} Less rigorous studies elsewhere

have also identified that uncorrected refractive errors are associated with slower reading speeds,²⁰ and that hyperopia can be associated with lower literacy scores²¹ and lower academic achievement.²²

The potential role of vision in education outcomes suggests that equitable access to appropriate eye care services for children is fundamental to achieving good quality, inclusive education, which in turn is a key component of achieving Sustainable Development Goal 4 (quality education) and Goal 10 (reduced inequalities).^{23,24} Even further, it can be argued that through aiding quality, inclusive education, equitable access to appropriate eye care services for children contributes to Sustainable Development Goal 1 (no poverty) and Goal 8 (decent work and economic growth).²⁵

3. Common eye conditions in children

Many conditions can cause vision impairment or blindness in school-aged children, however most are preventable or treatable. An estimated 12 million (63%) children are vision impaired as a result of uncorrected refractive error.²⁶ The remaining vision impairment among children globally is reportedly due to cataract, vitamin-A deficiency, trauma, retinopathy of prematurity, and other less common conditions,²⁷ however disaggregated prevalence rates for these conditions are unavailable.

Myopia (also known as shortsightedness) is the most common form of refractive error. The prevalence of myopia is predicted to increase significantly over the next 30 years (Figure 1) as a result of social and environmental determinants associated with increased urbanization, access to technology, and time spent indoors.²⁸ Eye health services, which currently fail to reach 12 million children who are vision impaired due to uncorrected refractive error, will be further challenged by

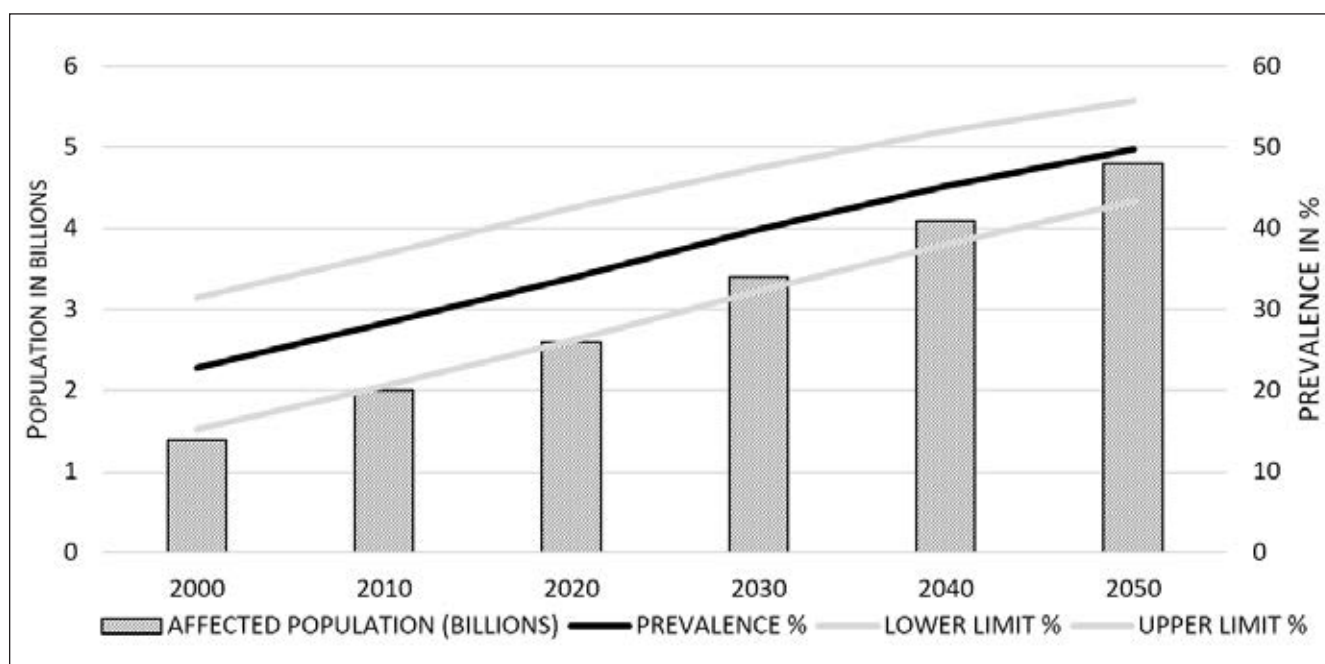


Figure 1: Projected prevalence of myopia, 2010 to 2050 (Holden et al, 2016)

the expected increase in myopia prevalence. Without significant new resources and/or new models of care, the prevalence of vision impairment in children is expected to increase similarly.

Despite myopia being relatively simple to correct with spectacles or contact lenses, progression to high levels of myopia has been associated with an increased risk of permanent blinding conditions such as retinal detachment, glaucoma and myopic degeneration.²⁹ Myopia can begin any time but is often observed to rapidly progress during childhood and adolescence due to rapid growth of the eye.³⁰ The current therapies to slow down the progression of myopia include bifocal spectacles, specialty contact lenses, atropine eye drops or environmental and behavioral modifications.^{31–35} Though these approaches are relatively new, success is often associated with early detection and timely intervention.

Amblyopia, sometimes referred to as a “lazy eye”, is a condition where a child is unable to see well with one or both eyes due to abnormal development between the eye and the brain during childhood. The main causes of amblyopia are uncorrected refractive error (particularly if unequal between eyes),

an eye turn (strabismus) or a combination of both. Amblyopia is generally treatable with early detection and intervention, but treatment becomes increasingly difficult and less successful with age.³⁶ The interventions can include optical correction, eye patching, eye drops, binocular vision training or surgery depending on the primary cause.³⁷ If timely treatment does not occur, permanent monocular vision impairment can result.

Cataracts are opacities in the ocular lens causing vision impairment. Although very common in older adults, cataract can also be congenital (present at birth) or develop during early years of childhood. If undetected and/or left untreated, there are significant development effects on the visual system.³⁸ Even when detected and treated successfully via surgery, ongoing care is usually required. This may include ophthalmic care of complications and/or comorbidities, refractive care (commonly contact lenses due to very high refractive error, depending on the type of surgery that is performed), amblyopia treatment, strabismus management, and low vision rehabilitation.

Vitamin A deficiency is almost exclusively seen in children in developing countries, and

is closely linked to both malnourishment and higher prevalence rates of infectious diseases.³⁹ Such nutritional deficit can lead to night blindness, and/or an extreme form of dry eye that can progress to corneal ulceration, corneal melt, eye perforation and total, irreversible blindness. Treatment includes providing vitamin-A rich foods or supplements, however recovery of vision is dependent on the duration of deficiency.⁴⁰

Trachoma is an infectious eye disease that can lead to in-turned eyelids (entropion), and can consequently cause eyelashes to rub on the cornea (trichiasis). The anatomical changes and abrasions caused during blinking can result in corneal scarring and blindness.⁴¹ The infection is commonly seen in children, however, permanent blindness generally occurs in adulthood after chronic re-infections throughout childhood.⁴² This can easily spread across a community where access to clean water, sanitation systems, and hygiene education is poor.

Albinism is a genetic condition generally diagnosed at birth that results in abnormal melanin pigment production that can affect the skin, hair, and eyes.⁴³ There are various forms of albinism, and most have similar ocular signs such as poor visual acuity, possible strabismus, possible nystagmus ("shaking of the eyes"), poorly formed iris/pupil, and refractive error.⁴⁴ Albinism with eye involvement usually does not worsen with age, but may require children to have spectacles, magnification aids, and sun protection.

Blindness or vision impairment in children may also be due to congenital diseases or eye diseases occurring during infancy such as retinopathy of prematurity, pediatric glaucoma or eye malformations. As many of these conditions are detected at birth, these eye conditions are not the focus of this review, with the exception of albinism. However, on rare occasions, these conditions might be detected at school. Despite vision impairment being common in these conditions, children should still have access to mainstream education, and inclusive education programs. While few of these conditions are hereditary or unavoidable, many suggest early detection and monitoring

are key to managing and preventing permanent vision impairment or blindness in children.⁴⁵

Other causes of ocular morbidity such as eye infections, allergies and trauma are often under-considered in planning child eye care services, but can be a cause of absenteeism in children, and in the case of infections, easily transmitted to other children. Comprehensive school eye health interventions also detect and treat these conditions.

Children with other disabilities such as, Downs Syndrome, cerebral palsy and autism spectrum disorder, have a higher prevalence of ocular or vision problems including refractive error, strabismus and amblyopia.^{46–48} Eye examinations for children with special needs should follow the same principles of any child, however adaptation is often required and dependent on the child's developmental level. This therefore necessitates different care guidelines and well-established referral pathways.⁴⁹

Accommodation (focusing ability) and vergence (eye coordination) are essential to performing near tasks efficiently and sustainably.⁵⁰

Children with accommodative and or vergence problems do not cause vision impairment, however, difficulties in sustaining comfortable near vision can affect learning.⁵¹ This can be managed with spectacles or vision therapy by eye care professionals.⁵²

4. Eye health services for children

Children's eye health services are typically accessed through either the health or the education system. While it is common for eye health services to be accessed within health settings – i.e. through community health centers, eye clinics and hospitals; they may also be accessed through school health interventions, where teachers or other personnel can conduct basic screenings, and visiting health practitioners provide primary eye care services on site. While these two systems of care have common goals and some shared personnel, the difference in structural processes reveals factors that influence

children's access to health care.⁵³ The common scenarios for comprehensive school eye health interventions are shown in Figure 2.

School interventions are a unique opportunity to screen vision and/or provide comprehensive eye health services to potentially more than 700 million children throughout the world.⁵⁴ Comprehensive school eye health programs are a highly cost-effective approach for detecting and treating uncorrected refractive errors (URE),⁵⁵ can impact other endemic issues faced by children such as vitamin A deficiency or trachoma,⁵⁵ and are potentially more cost-effective than other primary eye care models of delivery.⁵⁶

School eye health services need to interface directly with the broader health system – the preferred approach for delivery is 'alignment between education and health systems to ensure that quality eye health services are available and accessible to all children'.⁵⁴ While a simple eye check conducted by a teacher, a community health worker, school nurse, optometrist or other eye care practitioner can take place within a school setting, comprehensive eye health services will ensure that the child is referred to the nearest eye clinic if needed, or a trained eye care practitioner visits the school. Often vision impairment can be treated with a pair of spectacles, in this instance there needs to be a mechanism for providing and dispensing appropriate and affordable spectacles to the child. However, if the child requires further treatment or examination by an ophthalmologist, there is a need for linkages with optometrists and ophthalmologists.

As children age, different eye conditions are more likely to occur—which require different approaches to screening and detection. Preschool and school entry vision screening programs should focus on identifying congenital issues, early onset disease, amblyopia, strabismus and some significant refractive errors. However, as children age, school eye health interventions will need to focus more on myopia, later onset eye disease, acquired strabismus, and previously undiagnosed amblyopia.

In reality, many children globally do not have access to school, and one third of non-school

goers are living with a disability, which includes vision impairment.⁵⁷ While the focus of this review is the school setting, there is a need to strengthen and extend community-based rehabilitation and education services globally, to ensure that children and their families have access to and benefit from education.⁵⁸

Globally, there is a lack of consistency in cadres within the eye care sector, as well as some fluidity in terminology and roles. The clinical responsibilities of a specific cadre may vary considerably between countries, likewise, the presence of particular cadres is also highly variable. This report does not seek to impose any definitions onto the optometry, ophthalmology or optical sectors, nor define their roles. This report sometimes refers to eye care practitioners or eye care professionals (ECPs) as a generic term to be interpreted as the appropriate cadre in the local jurisdiction in which it is read.

5. Conceptual framework for assessing accessibility

In the context of health care, accessibility is a complex concept with varying definitions and interpretations. While there is no confirmed consensus regarding the sub-dimensions of accessibility, understanding the confounding factors between resource availability, and potential or realized utilization is widely recognized. It is suggested that 'access' is the interface between the availability (supply) and utilization (demand) of physical and human resources and can be detailed into several dimensions.^{59,60}

Peters et al. (2008)⁶¹ have developed a conceptual framework involving four key dimensions of accessibility in health care (acceptability, availability, financial accessibility and geographical accessibility), each with a supply and demand component (Figure 3). Factors related to broader systemic influences, such as policy and macro environment, and individual and household characteristics, also impact children's access to eye health services and need to be considered when exploring the different dimensions of accessibility (Figure 3).

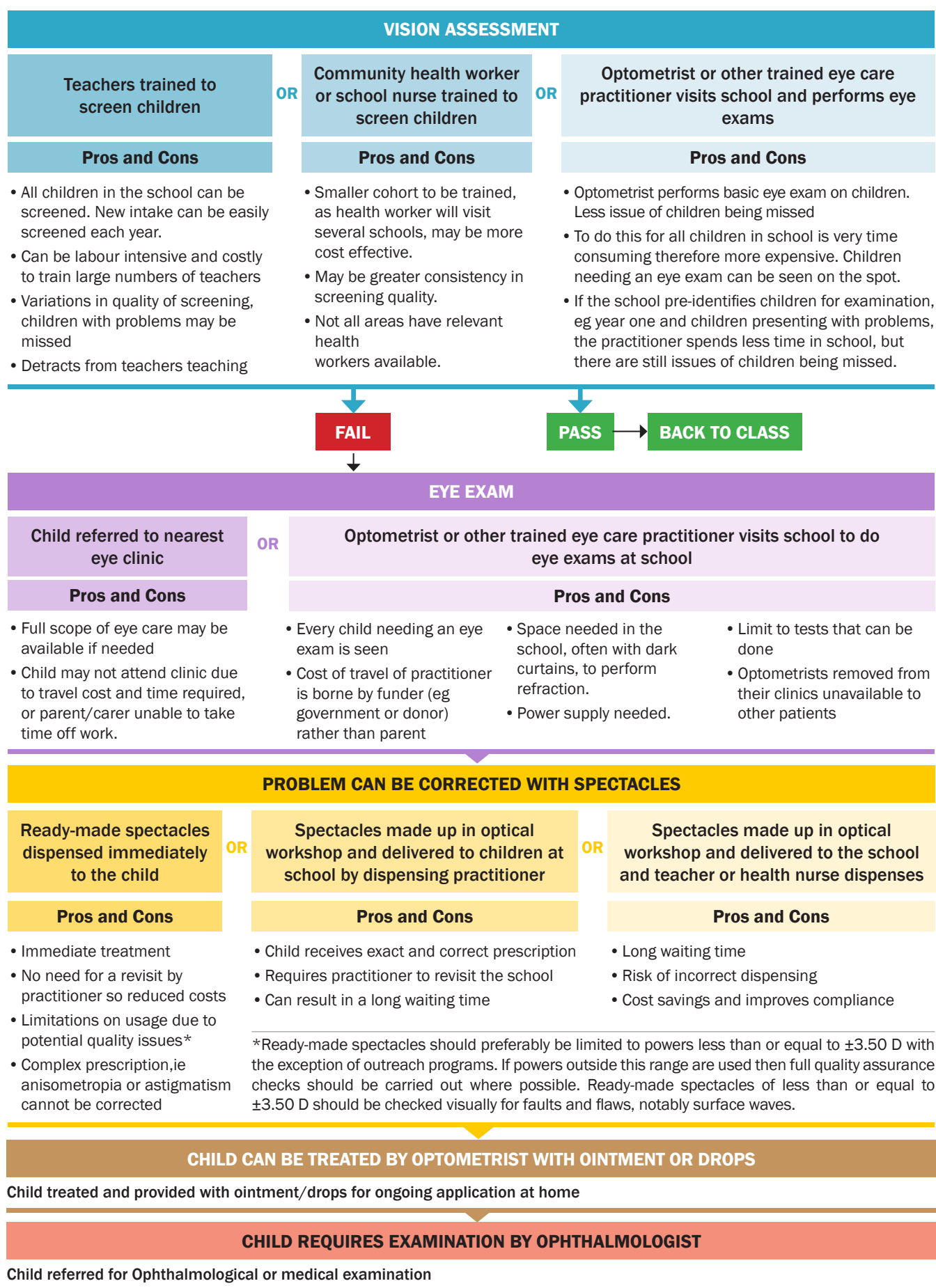


Figure 2: Common approaches to screening and service provision in school eye health programs

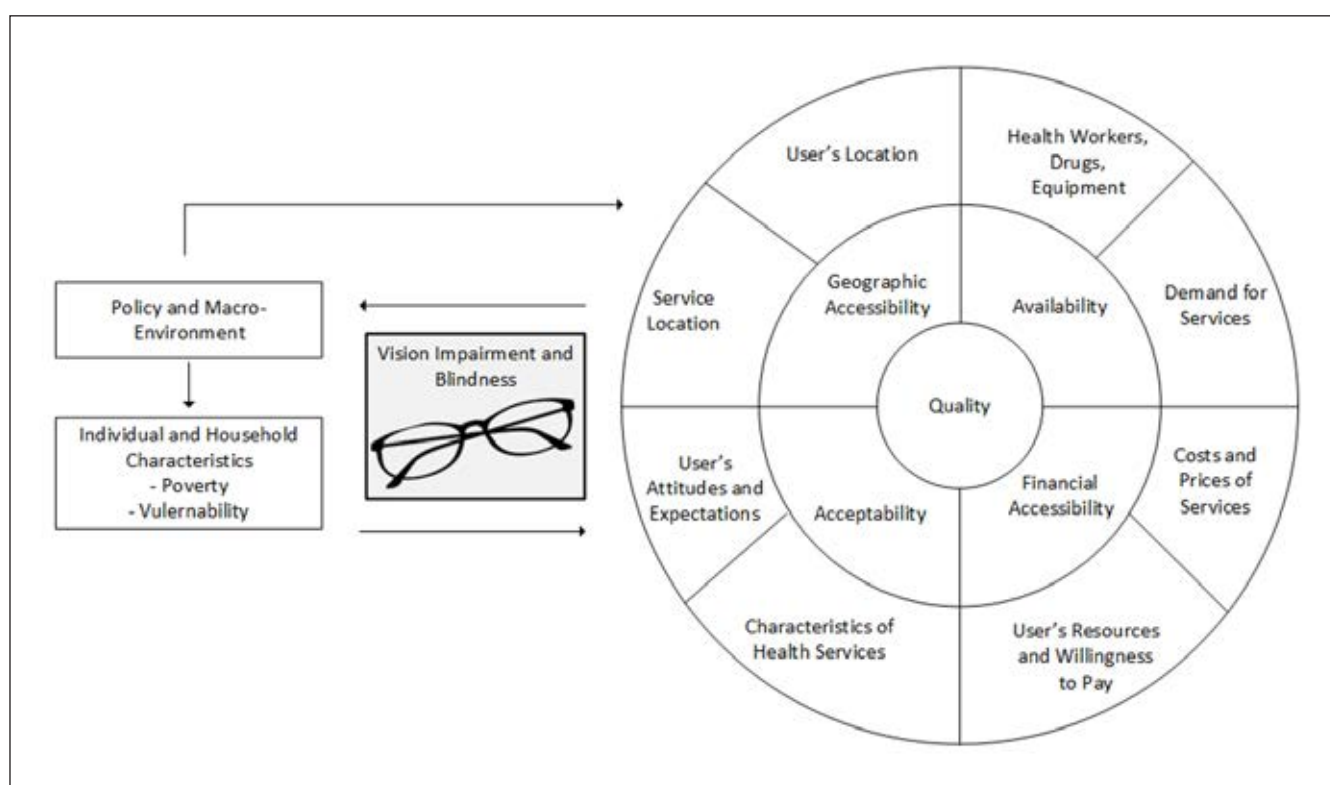


Figure 3: Conceptual framework for assessing children's access to eye health services (adapted from Peters et al. 2008)

6. Rationale

Previous studies investigating factors influencing children's access to eye care services have explored different areas including (but not exclusive to) willingness to pay, willingness to wear spectacles (compliance), knowledge and perceptions of eye health and access to eye care resources.^{62–65} Currently, there are no comprehensive reviews of these findings, or any examination of the potential commonalities or key differences that affect accessibility and eye health outcomes. A recent analysis of systematic reviews addressing universal coverage of cataract surgical services⁶⁶ revealed a dearth of literature, identifying a need for both primary research and systematic reviews to understand relationships between eye health systems and the effectiveness of eye care interventions.⁶⁷

As school eye health interventions represent an opportunity to cost-effectively and positively impact children's vision outcomes, the purpose of this study is to systematically review the available literature on children's access to

eye health services in the education sector in LMICs. We also sought to identify the barriers and facilitators to children accessing eye care, and identify factors critical to consider in the planning of eye health education services for children.



Methodology

This research used two distinct approaches: a systematic review and country case studies. The systematic review was in accordance with PRISMA guidelines⁶⁸ and aimed to locate and evaluate available literature on children's access to eye health services with a focus on education settings. Prospective qualitative research was conducted to gain further insight into the key themes emerging from the outcomes of the systematic review.

7. Global systematic review

7.1 Information sources

The following databases were searched for studies published in any language from January 2000 to May 2017: PubMed, Medline, Web of Science, CINAHL, EMBASE, ERIC and ProQuest (Arts & Humanities, Education and Social Science Databases). Table 1 shows the search terms used for each area of interest combined with the 'AND' Boolean operator. Full details of the search strategies are given in Appendix 1. The database search results were imported into a single library in EndNote (Clarivate Analytics, USA) to remove duplicate

articles. The combined library was imported in Covidence systematic review software (Veritas Health Innovation, Melbourne, Australia) for title and abstract screening.

7.2 Eligibility criteria

Studies that included schoolchildren from LMICs,⁶⁹ were eligible for inclusion. Studies of adults were also included where (i) parents or guardians participated in research regarding children's eye care, or (ii) eye care providers participated in research regarding eye care delivered to schoolchildren in an education setting. Studies that provided empirical evidence were deemed eligible, including cross-sectional epidemiological surveys, qualitative studies, economic evaluations and randomized controlled trials. Meeting abstracts, conference papers, editorial discussions and theses were excluded. Systematic reviews were excluded from the review, however the reference lists of any systematic review detected were examined to identify any potential studies missed. Due to global development, societal and technological changes, the search was limited to studies published between 2000 and 2017.

Table 1: Search terms used for systematic review

#1 Eye care services (eye care OR blindness OR ocular OR optom* OR ophthal* OR refractive error OR myop* OR visual acuit* OR vision screening* OR visual impairment OR vision impairment OR eye-care OR vision care OR visually impair* OR amblyop* OR cataract* OR spectacle* OR eyeglass* OR glasses OR vision) AND #2 Education sector (school* OR health education OR service* OR outreach OR health program* OR health service* OR health care OR school-based OR student*) AND #3 Children (child* OR boy* OR girl* OR minor* OR adolescen* OR juvenile* OR teen* OR youth* OR parent* OR guardian* OR student*) AND #4 Accessibility (access* OR utilis* OR utiliz* OR availability OR appropriat* OR acceptab* OR approach* OR adequ* OR inadequate OR equity OR inequity OR capability OR health seeking OR health care seeking OR social determinant* OR health literacy OR health beliefs OR barrier* OR facilitator* OR enabler* OR adherence OR compliance* OR afford* OR willingness OR knowledge OR perception* OR attitude* OR socioeconomic* OR participat* OR predictor* OR parental education OR key informant*)

7.3 Study selection

Two reviewers independently assessed the titles and abstracts of all articles retrieved from the literature search using the inclusion and exclusion criteria (Appendix 1). For studies where it was unclear whether the selection criteria were met, the studies were included for full-text review. The potentially relevant full-text articles were retrieved, regardless of language. Non-English language articles were translated by Brien Holden Vision Institute translators, or an English language version was requested from the first author. Two reviewers independently assessed the eligibility of the full-text articles according to the inclusion and exclusion criteria (Appendix 1). Disagreements were resolved through discussion, and adjudicated by a third reviewer.

7.4 Quality assessment

Quality of study methodology was assessed using the Mixed Methods Appraisal Tool (v-2011)⁷⁰ and when data on child eye health accessibility were available but not the study's primary outcome, additional quality appraisal on accessibility data were performed by two independent reviewers. Discrepancies were discussed and resolved with a third reviewer and findings from low-quality studies were given less weight in the analysis.

7.5 Data collection and analysis

Each study was classified by location, region, income group, study design, participant group and research quality of each, by a single reviewer.

As the literature encompassed a wide range of studies, the data presented in this report was extracted using a combination of

qualitative methods including deductive (a priori) and inductive thematic analysis using NVivo qualitative data analysis Software (QSR International Pty Ltd. Version 11, 2016). For each individual study, data were extracted by one reviewer, according to the following process:

1. Identification of themes related to 'accessibility' using 'a priori' themes: for deductive coding, using the Peters conceptual framework for accessibility⁶¹
2. Inductive analysis to identify 'new' themes: inductive analysis differs from deductive analysis in that it does not use a pre-conceived framework, allowing captured data to organically create its own framework.
3. Identification of themes that act as either a 'barrier' or 'facilitator': themes were also coded as a 'barrier' or 'facilitator' where applicable, to identify key elements that act as either a barrier or facilitator to children's access to eye health services within the education sector.
4. Mapping the results: once all the themes were identified, associations and cross-cutting issues were explored before restructuring key themes, and amalgamating sub-themes where necessary.

8. Country case studies

Three countries, Colombia, Malawi and Pakistan, were sampled for in-depth analysis. These three countries were purposively selected as they enabled the exploration and comparison of differing geographic regions, varying degrees of Gross National Income (GNI) per capita (as per World Bank data) and Human Development Index (HDI)⁷¹ (Table 2).

Table 2: Basic information on sampled countries (Colombia, Malawi, and Pakistan)

Country	Geographic Region	World Bank Income group classification (2018 fiscal year) ⁶⁹	HDI (2015 value)
Colombia	Latin America	Upper-Middle (\$3,956-\$12,235) ¹	0.727 (high human development)
Malawi	Sub-Saharan Africa	Low (\$1,005 or less)	0.476 (low human development)
Pakistan	South Asia	Lower-middle (\$1,006-\$3,995)	0.550 (medium human development)

GNI: Gross National Income; HDI: Human Development Index

¹US Dollar amounts are Gross National Income per capita

The systematic review also revealed these countries had a dearth of literature exploring child eye health, as there were only four studies set in Malawi, two in Pakistan and no published studies from Colombia.

8.1 Data collection and analysis

In order to explore the different dimensions of accessibility, participants were categorized into three groups, eye health stakeholders (government/NGO), eye health providers (teachers /clinicians) and eye health users (children/parents) (Table 3). To triangulate and add texture to themes identified in the systematic review and exploring the differences between varying geographic and socioeconomic dimensions, participants were sampled purposively with the assistance of in-country personnel. Building on already existing relationships with schools, health practitioners, and stakeholders (Government and NGO), in-country personnel from the Brien Holden Vision Institute were able to gauge the interest of potential participants, in order to recruit those necessary to address the research questions. Sampling of schools were based on school type (public/private), and where possible rurality (Malawi). Children, parents, and teachers were recruited to participate in the study through administrative personnel within sampled schools. Administrative personnel were asked to choose children who had or had not been prescribed with spectacles, in order to capture a range of perspectives and experiences. Some children who participated in a focus group, also had their parents participate in a focus group, however this was not consistent. Nonetheless, child and parent focus groups were all conducted separately. Eye health stakeholders external to school settings, were identified

and purposively recruited through existing relationships with in-country personnel from the Brien Holden Vision Institute.

Participants completed either an in-depth interview or Focus Group Discussion (FGD) (Appendix 3: In-depth analysis interview & FGD guides). Eye health stakeholders and eye health providers were interviewed in order to gauge depth and clarity on the topic.

FGDs were considered the most effective method to collect data from eye health users (children/parents), due to increased participant comfortability and limited time available to collect a diverse set of perspectives. Therefore, eye health users were invited to participate in FGDs only. The majority of interviews and FGDs were conducted in the local language (Chichewa, Urdu, or Spanish). Interviews and FGDs were conducted in English if the participant/s felt comfortable. All interviews and FGDs were audio recorded, transcribed verbatim and where necessary, translated into English. The authors (AY and NS) conducted the data collection in Malawi and Colombia. In Pakistan, there were security and logistical issues, therefore an external consultancy was employed to conduct the interviews and FGDs.

Transcribed data was analyzed using NVivo qualitative data analysis Software (QSR International Pty Ltd. Version 11, 2016) and a combination of deductive coding using Peters' accessibility framework,⁶¹ and inductive coding. Inductive coding drew on grounded theory methods⁷² and thematic coding techniques whereby interviews were coded 'openly' line by line which allowed a thematic structure to emerge organically from the data. Themes were also coded as either a 'barrier' or 'facilitator' (where relevant).

Table 3: Case study participant groups

Group	Education sector participants	Health sector participants
Eye health stakeholders	Government/NGOs	Government/NGOs
Eye health providers	School screening facilitators, school administrators/educators/teachers	Ophthalmology, optometry, spectacle dispensers
Eye health users	Children, parents/guardians	

8.2 Ethical considerations

Ethical clearances were obtained from the National Health Sciences Research Committee (NHSRC) of Malawi (NHSRC#16/1650), the Comité de Ética de Investigación en Seres Humanos Universidad Antonio Nariño (Ethics Committee in Research of the University Antonio Narino, approval date 5th October 2017) and the Ethical Review Board-College of Ophthalmology and Allied Vision Sciences (ERB-COAVS) of Pakistan (COAVS/3331/16) before commencement of the study.

Informed consent was received from all participants (or from the parent/guardian in the case of a child) before an interview or FGD commenced.



Results

9. Global systematic review

9.1 Description of included studies

The defined search strategy identified 21,713 articles from multiple search engines, with two additional articles identified from the reference

lists of systematic reviews, resulting in 21,715 eligible articles. The team identified 133 studies that were eligible for inclusion in the systematic review. Figure 4 represents the review search and selection process using a PRISMA flow chart, and the distribution of article publication dates is shown in Figure 5.

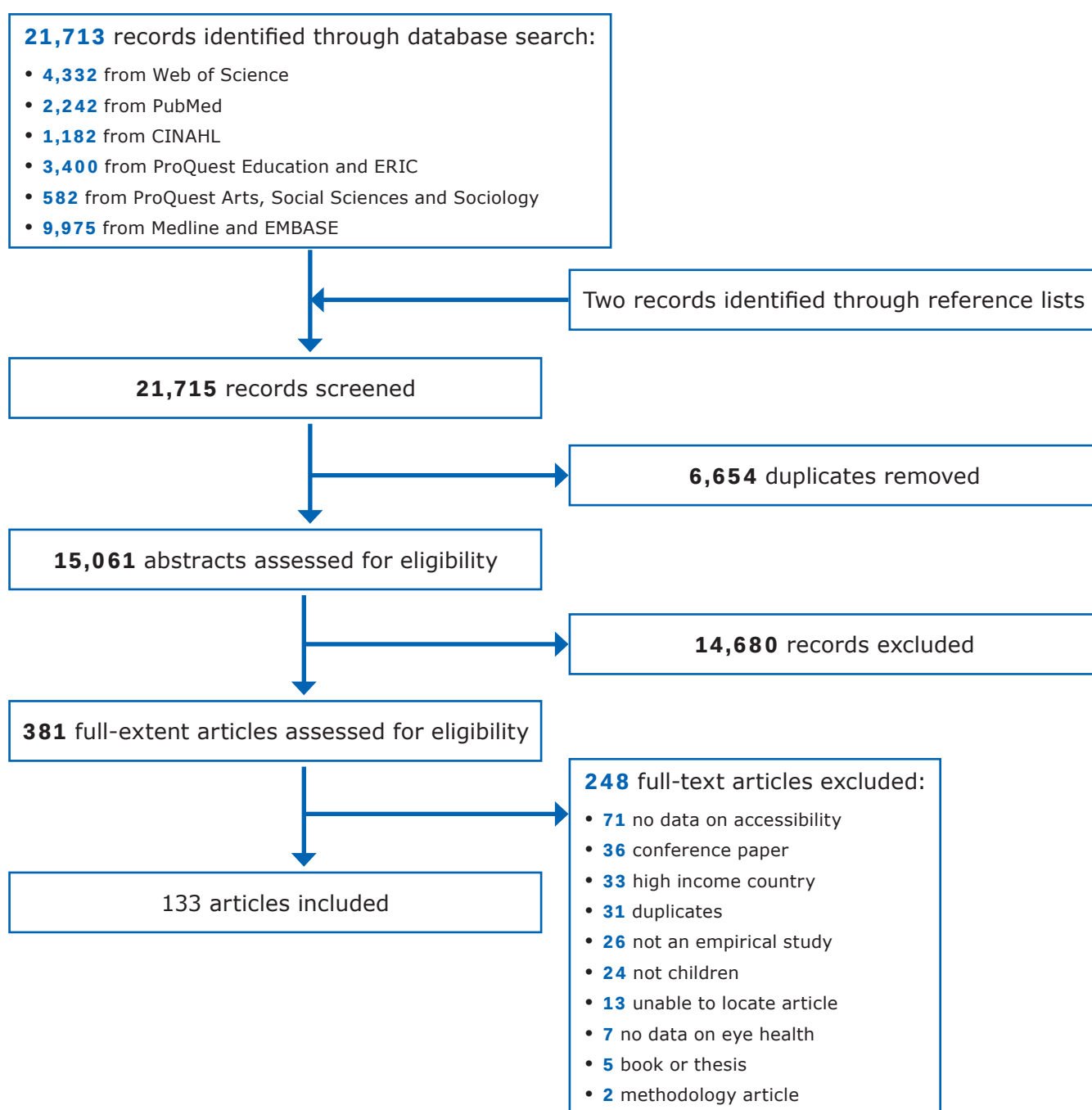


Figure 4: PRISMA flow chart showing summary of study selection, retrieval and inclusion

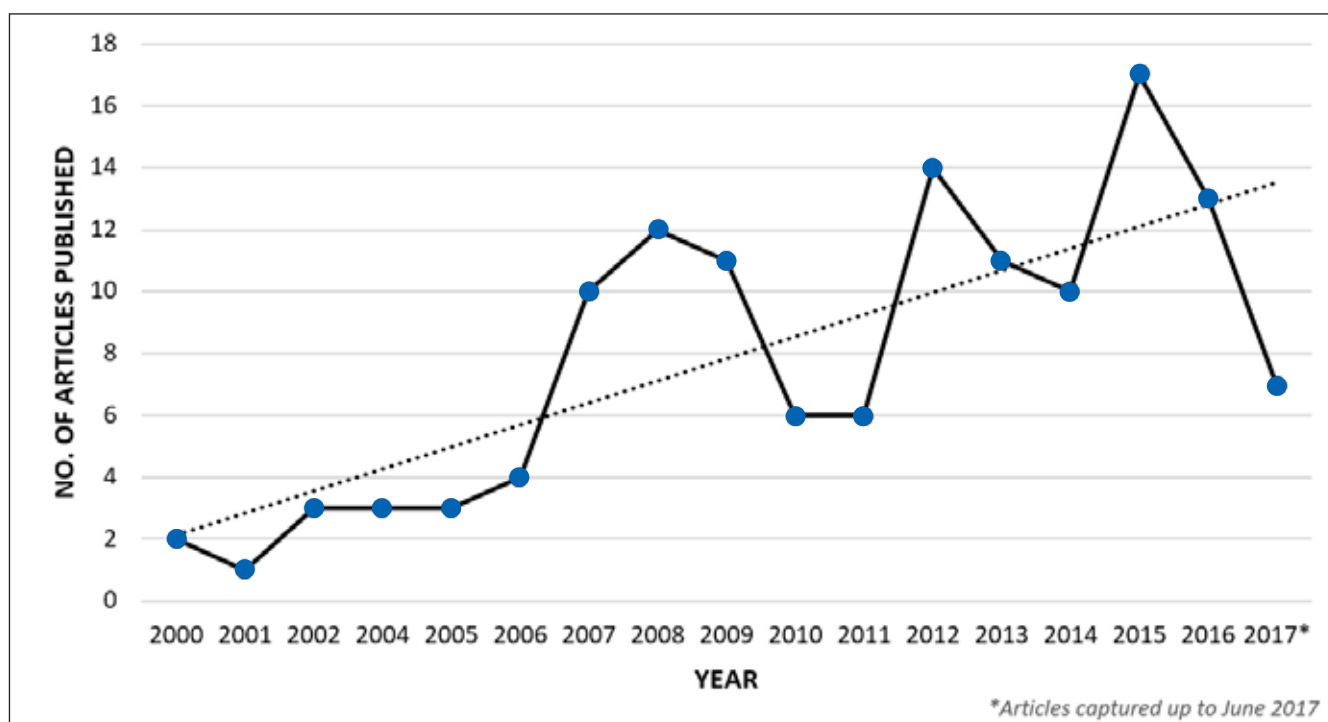


Figure 5: Numbers of selected studies published each year.

The majority of studies (44%) were conducted in 'upper-middle income' countries, with 37% from 'lower-middle income' countries and 19% from 'low-income' countries (Figure 6).

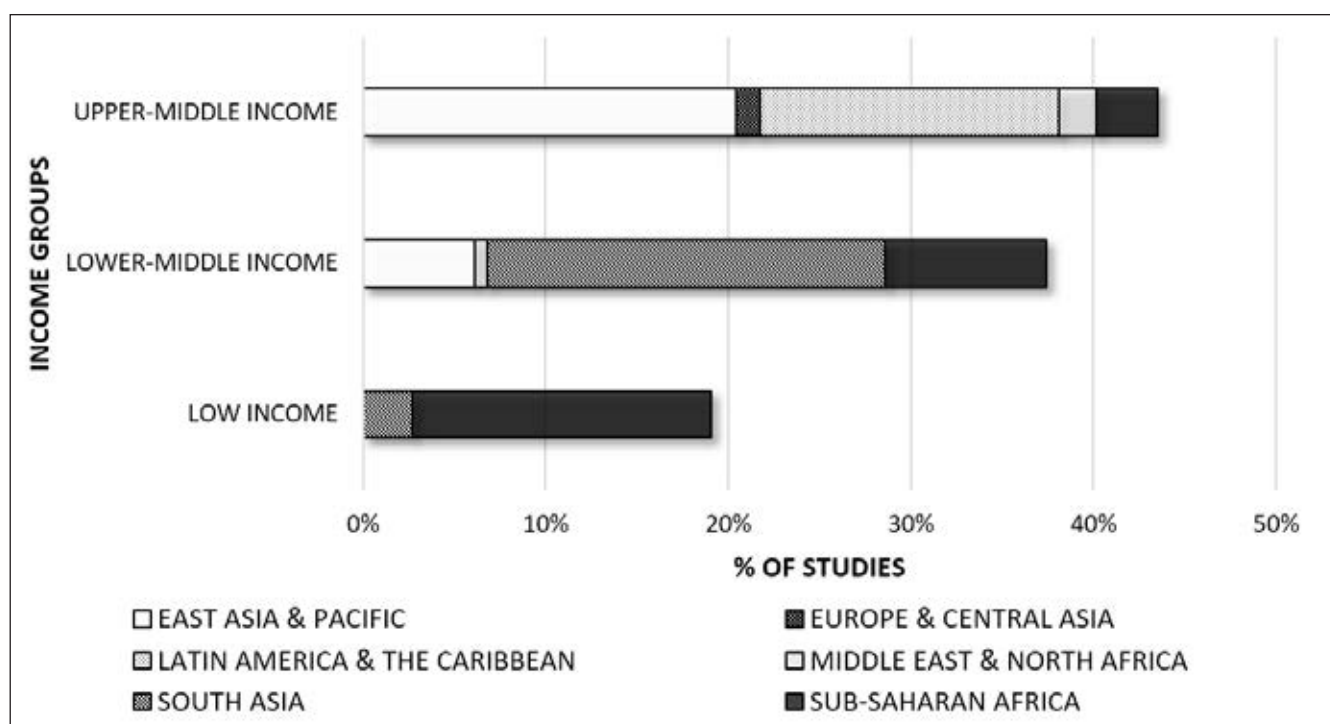


Figure 6: Number of eligible studies from each income group

Studies included in the systematic review were conducted in 38 countries (Figure 7), from six World Bank regions.

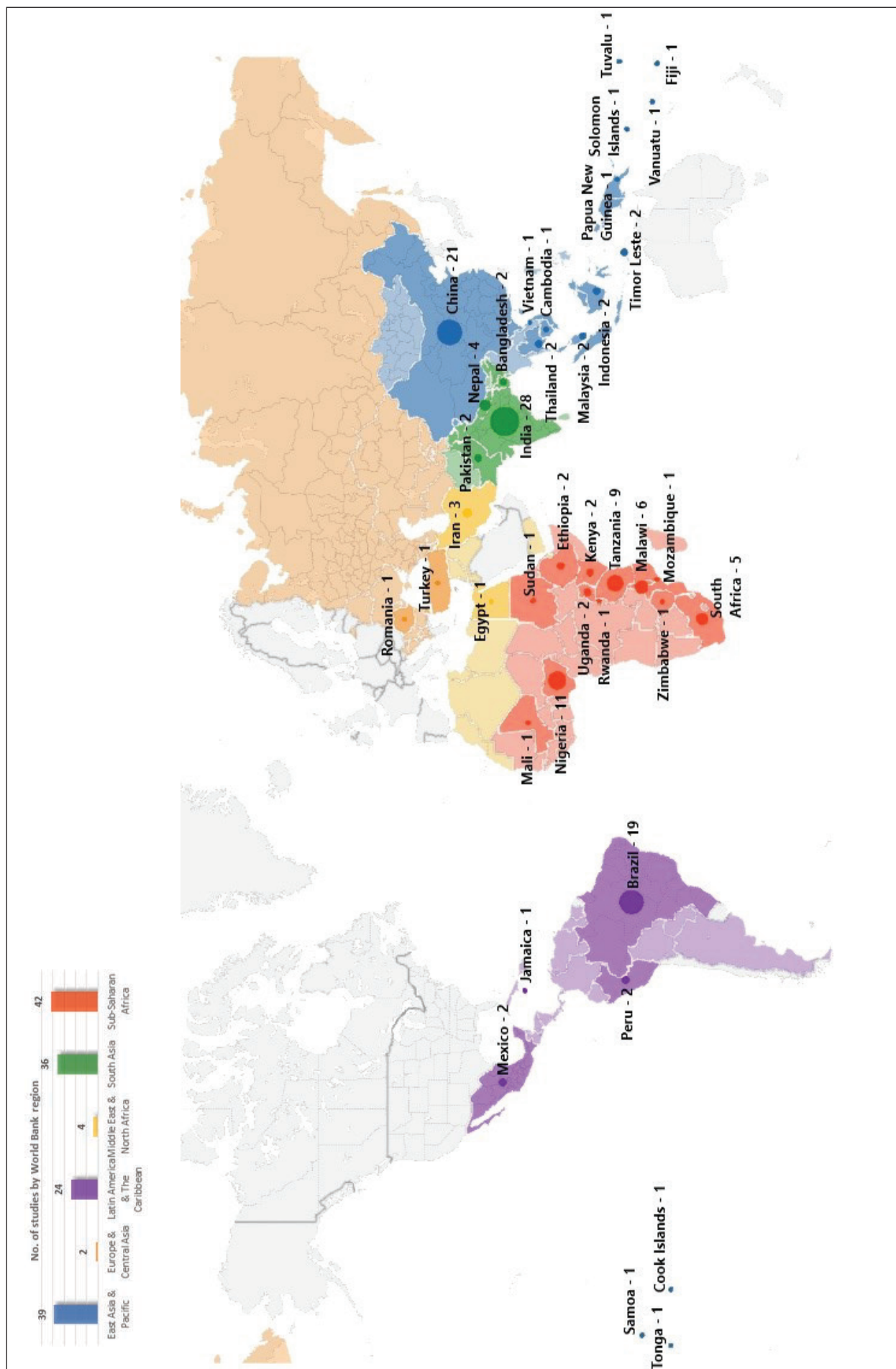


Figure 7: Number and location of selected studies by World Bank region

As can be seen in Figure 8, children from upper-middle and lower-middle income groups were the target of the majority of eligible studies, with parents/adults from lower-middle income groups the next highest study population of interest.

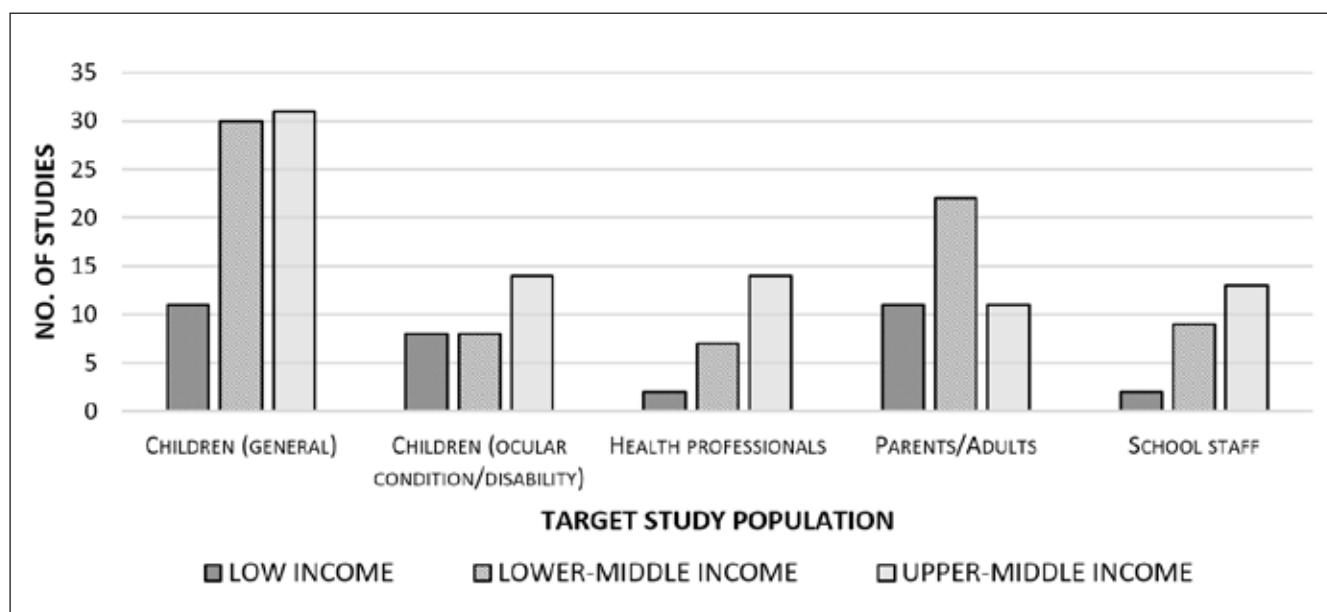


Figure 8: Target study population of eligible studies.

The eligible studies included a range of study types (Figure 9). There were only nine randomized controlled trials, and over half of all studies were cross-sectional studies (prevalence or observational studies).

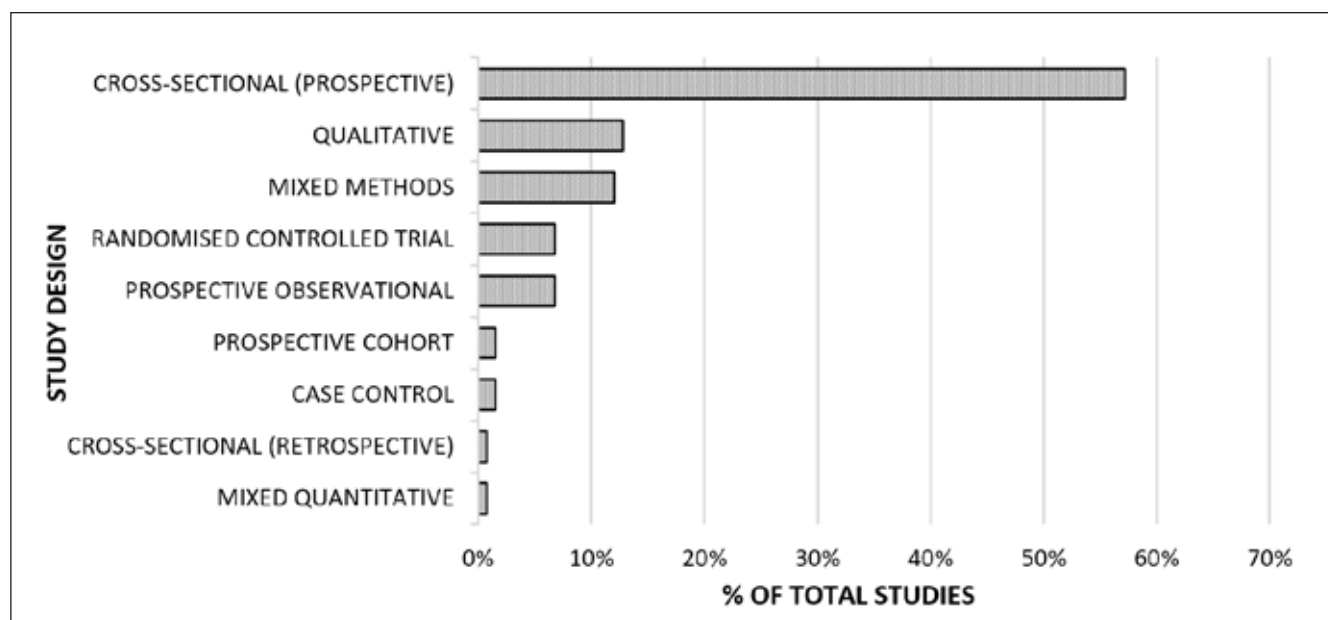


Figure 9: Study types included in systematic review

The majority of studies were assessed (as per methods outlined in 7.4) to be of medium quality in methodology and quality of accessibility data (Figure 10). Articles that were reviewed to be low or very low quality accounted for 27.8% of the included studies. For each World Bank region, a notable proportion of lower quality studies were conducted in South Asia and Latin America and the Caribbean (Figure 11).

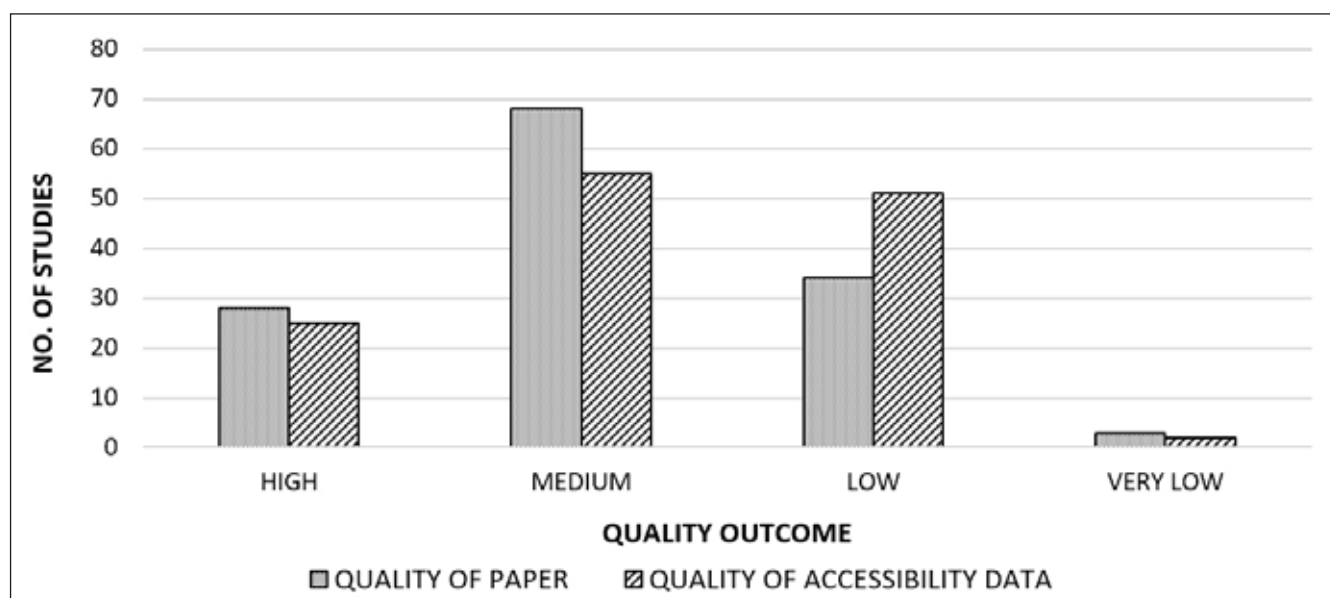


Figure 10: Quality of the studies included and the quality of accessibility data

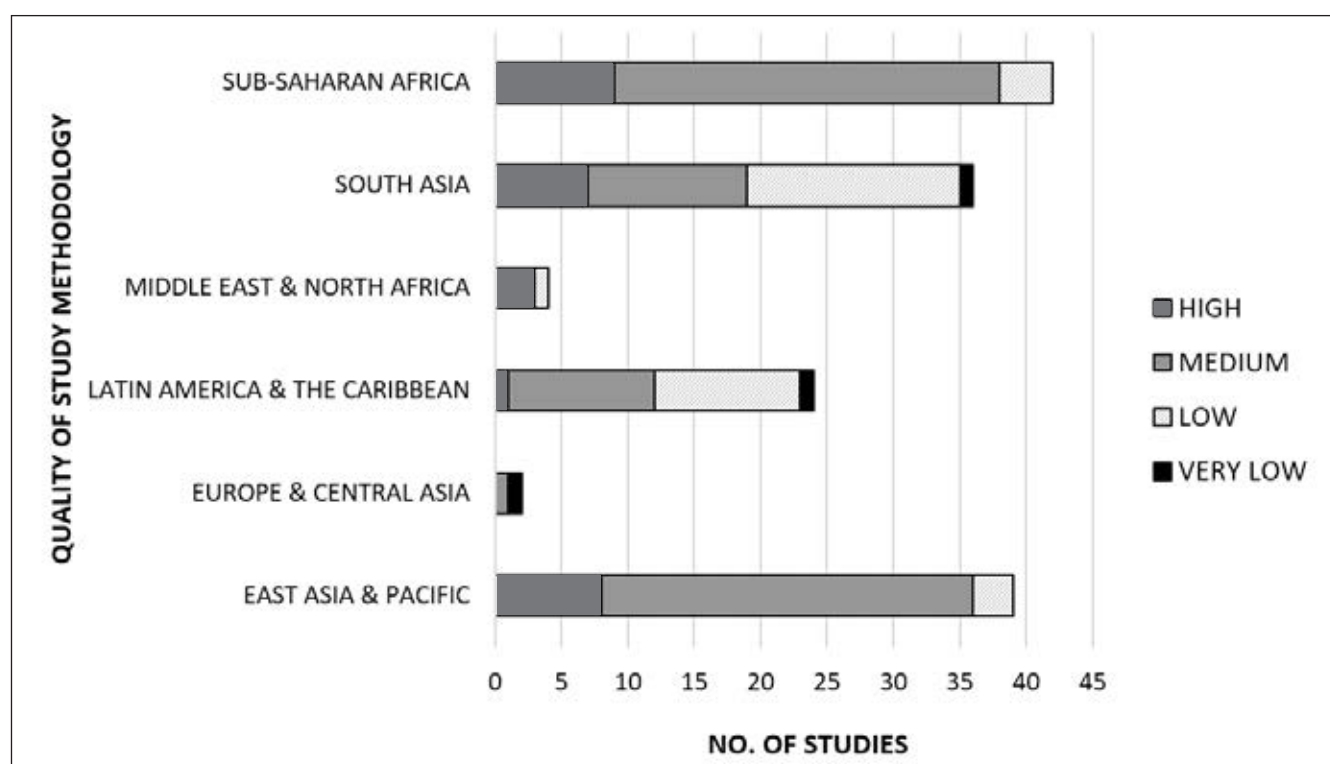


Figure 11: Quality of studies by World Bank Region

9.2 Accessibility: Policy and macro environment

While budget allocations are the enabling factor there are additional political and structural factors crucial to the success of eye health interventions within schools. First, **government support** in the form of relevant policies that include eye health, and their associated budgets, may enable or restrict the

delivery of eye care within education systems. This support should include a delineation of who has responsibility for the school health policy (Ministry of Education or Ministry of Health), and detail on how the policies are to be administered. Second, the appropriate **prioritization of child eye health** within school health policies, and third, effective **collaboration between the ministries of health and education and NGOs**.

9.2.1 Collaboration between health/ education ministries and NGOs

Studies assessing the feasibility of school eye care interventions targeting trachoma in Tanzania,⁷³ vision screening in Thailand,⁷⁴ provision of free spectacles in China,⁷⁵ and promotion of preventive knowledge in Brazil,⁷⁶ noted that success was dependent on **multidisciplinary and multisectoral support** from the Ministries of Health and Education in conjunction with local authorities, hospitals, eye care practitioners, nurses, teachers, and parents. Multidisciplinary cooperation and coordination was identified as a key barrier in the Colombian case study in this report (Section 10.1). Facilitating increased cooperation requires a clear memorandum of understanding between government ministries, in order to allocate responsibility accordingly and maintain accountability (Section 10.1.6). In low-income settings where limited resources are available to support school eye health, **NGOs often fill the service gap** which can create overlapping areas and responsibilities.⁷⁷ NGO-based studies from Timor Leste,⁷⁸ and the Western Pacific Islands (Fiji, Papua New Guinea, Solomon Islands, Vanuatu, Cook Islands, Samoa, Tonga and Tuvalu)⁷⁹ noted the importance of working in close partnership with government ministries in the implementation of eye health services and spectacle dispensing, in order to achieve shared responsibility around the monitoring and execution of programs.

9.2.2 Policy-making and prioritization of child eye health

Government prioritization of eye health can be particularly difficult in low-income settings, where resources (physical and human) are limited. Despite the important link between vision, education, and earning potential (see Section 10.2.5), **child eye health is often deprioritized** in comparison to life threatening diseases (such as HIV, malaria, tuberculosis). As reported in studies from Nepal,⁸⁰ Nigeria,⁸¹ South Sudan,⁸² India⁸³ and Ethiopia,⁸⁴ limited macroeconomic resources create barriers to the prioritization and implementation of child eye health policies and strategies. Similar findings are reported in the Malawian case

study (Section 10.2). **The inclusion of eye health in ministerial strategic plans and health budgets**, and/or the uptake of VISION 2020 national eye care plans are key political determinants for the execution of school eye health interventions.⁷⁹ While the inclusion of school eye health policies in school health and nutrition policies create a theoretical framework for school vision screening, an example from South Africa⁸⁵ noted that a lack of budget, systems and awareness within the education sector may prevent it from being materialized.

9.2.3 Water, sanitation and hygiene

Access to clean water, sanitation and knowledge of hygiene practices in school environments is key in the prevention of contagious eye diseases such as trachoma among children. In Pakistan, living conditions promoting better hygiene and fly control, including keeping livestock outside of the house, and awareness of domestic waste management should be included in school health education.⁸⁶ Limited education around face washing and environmental hygiene among school children was reported in a KAP study conducted in Vietnam.⁸⁷ Studies from India,⁸⁸ Timor Leste,⁸⁹ and Tanzania⁷³ reported that poor access to clean water and sanitation within schools made the reinforcement of good hygiene practices among children difficult, and subsequently created barriers to the prevention of contagious eye diseases. Despite having trachoma education programs in place within schools, Tanzanian teachers noted the difficulty moving from theory to practice where sanitary infrastructure was lacking.⁷³ These studies highlight the need to consider **physical infrastructure** within schools, before implementing eye health programs.

9.3 Accessibility: Individual and household characteristics

9.3.1 Household income

Several studies outlined the importance of school eye health interventions in low-income settings, as **parents with limited socioeconomic mobility** did not otherwise

have the capacity to seek eye care for their children. Parents from India reported this was related to a **fear of economic burden** associated with ocular problems,⁸³ whereas Nigerian parents voiced that their **inability to get time off work** (paid and domestic) prevented them from seeking eye care for their children.⁹⁰ According to Hornby et al. (2000), Indian children with vision impairment or blindness from lower socioeconomic families are underrepresented in schools for the blind.⁹¹ Financial accessibility is discussed further in Section 9.5.

9.3.2 Parents' education level

Parents' education was reported in several studies to have an impact on children's access to eye care services, awareness of eye health, and spectacle compliance. Ashwini et al. (2015) states that **children from educated families were more likely to attend eye care** for vernal keratoconjunctivitis (allergic conjunctivitis) in India,⁹² a finding echoed in a study conducted in Rwanda.⁹³ A Nigerian study suggested that **illiteracy prevents parents from accessing eye health information**, creating barriers around informed decision-making for their child.⁹⁴ Similar findings were reiterated in studies from Bangladesh,⁹⁵ India,⁹⁶ and Mozambique.⁹⁷ Several Chinese studies have also reported the correlation

between lower levels of parental education, and spectacle compliance^{19,98} or self-reported vision problems among children.^{62,99}

9.3.3 Gender related factors

In some countries, **gender inequity presents barriers to school attendance among girls**, which can subsequently impact access to school eye care. In Nepal, two studies reported that in the context of irregular school vision screening, inequitable school attendance among girls may impact access to eye care.^{80,100} Two separate studies from Nigeria conveyed that mothers were likely to care for their children's eye health more than fathers, however fathers were more likely to be economically empowered,^{94,101} suggesting **gender-based barriers within parental decision-making**. In Malawi, **parents prioritized the eye health of their male child**,¹⁰² a finding similar to that in Bangladesh, where parents of blind boys were more likely to seek care for their child than parents of blind girls.¹⁰³

Studies from China reported that **boys were significantly less likely to wear spectacles than girls**.^{63,104} While Gogate et al. (2013) reported a similar issue with male child spectacle wear in India. Conversely a different Indian study stated the inverse and mentioned aesthetics as an obstacle for girls.⁸³



Parents in Nigeria were concerned about the social stigma associated with wearing glasses, particularly for girls due to the glasses not being 'cosmetically appealing'.⁹⁰ Two further studies also found that **girls were apprehensive of long-term spectacle wear** because of appearance, related to perceived difficulties in getting married.^{105,106} However, a Brazilian study that assessed the adherence of students to their first pair of glasses, did not find a significant difference between genders.¹⁰⁷

Finally, the **gender** of the parent/guardian plays a role. One study suggested that mothers feature more prominently in the care of their children than fathers¹⁰⁸ and another mentioned that care might be resisted as the mother fears being blamed for her child's condition.⁸³

9.4 Acceptability of children's eye health services

A large proportion of studies (61% of eligible studies) in the review identified barriers related to acceptability, of which prominent themes are shown in Figure 12. This finding highlights

a bias towards user-end factors, and should therefore be read as the literature being weighted towards patient behavior, rather than being quantified to suggest that this is where most issues or gaps lie 'on the ground'. Instead, the findings in this section present the context which makes up the conditions of access. This bias also supports the need for more systems-focused research in eye health, including how eye health systems function and connect with general health systems, how the stakeholders interact, the quality of eye health services in schools, and the various possible paths to meeting population needs in a way that is equitable and responsive.⁶⁷

Based on the dominant focus of the literature, the information in this section covers perceptions of eye health, treatments and services available generally, not strictly pertaining to the education setting. However, because this section reveals the views of key user groups such as children and parents/guardians, as well as universally relevant factors such as culture and the role of social environments, it offers valuable context.

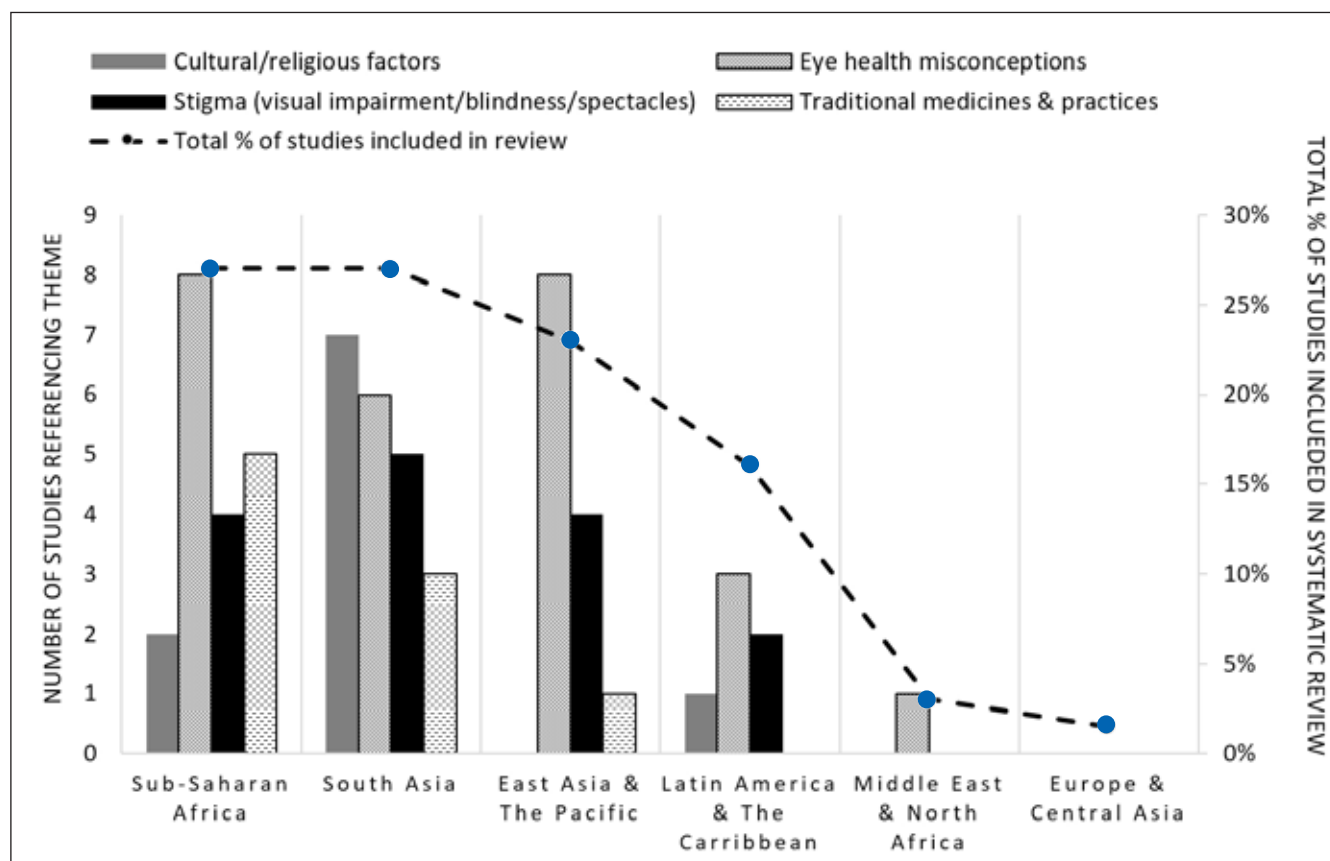


Figure 12: Number of studies referencing key barriers in the dimension of acceptability.

Figure 12 portrays an increased number of studies reporting key barriers to acceptability in the Sub-Saharan Africa, South Asia, and East Asia and the Pacific regions, which is reflective of the number of studies published in these regions overall.

The total number of studies from the Middle East and North Africa Region identified in this review (n=4) focused on prevalence data,^{109,110} and vision screening evaluation¹¹¹ and thus were limited in their reporting of themes related to acceptability.

No barriers related to acceptability were identified in studies from the Europe and Central Asia region, however one study did report facilitating themes (as opposed to barriers reflected in Figure 12) related to acceptability of patching among children with amblyopia from this region.¹¹²

9.4.1 User attitudes and expectations

9.4.1.1 Eye health misconceptions

Poor literacy, lack of awareness around eye health and misconceptions among parents were noted to impact seeking care, age of presentation and treatment choices for children.^{74,82,83,89,94,95,102,113–121} Similar findings were reported among Malawian children and parents who participated in the case study (Section 10.2). Other studies reported mistaken beliefs that eye diseases do not occur in children,⁸³ or conditions – such as strabismus – either cannot be treated,^{97,113,115} or are a sign of good luck.¹¹³

Focusing specifically on **children with albinism**, two studies highlighted a misconception on the part of healthcare workers and teaching staff, who framed blindness in children with albinism as an inevitability. Kishiki et al. (2012) reported that 44% (total n=16) of medical professionals believe that children with albinism need to be enrolled in a school for the blind,¹²² while, in a Malawian study, Lynch (2014) proposed that teachers believed that as children with albinism age, their vision will deteriorate.¹²³ In this instance, the error was passed on to

teachers from clinicians, who did not provide accurate information about children's vision in the long term.

9.4.1.2 Spectacles – understandings and misconceptions

Mistaken beliefs around spectacles include the notion that **they weaken or harm the eyes**,^{74,104,105,124,125} increase myopia,¹²⁶ or conversely that the need to wear spectacles would disappear after wear.¹⁰⁷ One Tanzanian study mentioned **concerns about safety and a distrust in Western medicine**,⁶⁴ where children were warned by family members that “spectacles shrink the eyes, causing the eyes to go deeper into the socket and make you look different”, or that they were reserved for the elderly,⁶⁴ a finding echoed in the Malawian case study (Section 10.2).

Chinese children expressed concern around the necessity of glasses when the problem is not perceived to be severe: “when you have only a little myopia, it can be treated without glasses”.¹²⁶ While Chinese parents believed **lifestyle and behavioral habits** such as watching television, not playing outdoors and vitamin deficiency were causes of refractive error.³⁵

The literature also details an **unwillingness** from parents to equip their children with glasses,^{62,64,74,98,106,119,124,125,127} a finding echoed in the Malawian case study (Section 10.2). Factors indicating **parental acceptance** of spectacles included the view that glasses were necessary for schooling,⁹⁸ keeping eyes healthy,⁸⁶ and the benefits of clear vision that they provide.¹⁰⁶ Additionally, Wang et al. (2015) write that parental spectacle wear was a predictor of the child's ownership.⁹⁹

A Brazilian study mentioned **children's disinterest** in screening and spectacles as a barrier to knowledge of this as a health issue and compliance.¹¹⁴ However, another Brazilian study contrasted children's uptake of glasses against their parents, where children held mainly negative perspectives, while parents' were in large part positive.¹⁰⁷

9.4.1.3 Awareness & perceptions of eye health and services

The single biggest barrier to eye care uptake as reported by children is a **lack of awareness** of eye disease, including risk factors and symptoms.^{82,106,127–129} Children who might benefit from treatment might be under-presented in medical services as a result of not communicating potential issues to their parents or guardians, because they are simply unaware that their experience is not healthy or normal (Table 4).

Another barrier noted in the literature is **parental failure to recognize an issue** with their child's eye health. Several reasons were noted including: a failure to seek care due to an absence of complaints from the child,^{83,113,130} the need for parents to be convinced by professionals that their child needs care,⁹⁰ (see also Colombian case study 10.1), a view that the sickness is less significant because symptoms are not easily recognized,⁶⁴ de-prioritization because vision impairment cannot lead to serious consequences like death,^{64,94,97} a lack of interest^{131,132} and a pre-occupation of other matters in daily life.¹¹¹ A Cambodian study¹³³ outlined that 43% of community members (including some parents with children aged <5 years) (n=257) reported that a child with vision impairment was not able

to attend school. A Brazilian study reported a possible link between students with vision impairment and low academic achievement, resulting in unnecessary transferal to special needs classes.¹³⁴ However, the relationship between academic achievement, vision impairment and access to spectacles is complex and determined by the knowledge, and perceptions held by parents and teachers. In China,⁹⁸ it is suggested that access to spectacles may be reduced due to a parent's low educational aspirations for their child. Whereas an Indonesian study reported that parents may assume their child's poor academic performance is not attributed to vision impairment¹³⁵ further highlighting the importance of timely and regular vision screening. A South African randomized control trial measuring the impact of visual acuity training in primary schools, stated only 20% of teachers (total n=19) attributed poor performance at school to possible vision impairment, which increased to 73% post-intervention,⁸⁵ emphasizing the need for increased awareness of the link between vision and educational attainment. While several studies reported that parents^{83,98,136} and teachers¹³⁷ were aware of the impact poor vision has on academic ability, this did not always result in treatment being obtained.¹³⁶

Table 4: Literature referencing children's lack of awareness of eye diseases

Example of lack of awareness	Country
Only some children complained of eye problems and were generally not aware that they have an issue	Western Nigeria ¹²⁹
Adolescents that were not aware of the status of their poor vision also stated that their family members did not encourage using aids	Southern India ¹⁰⁶
A third of the participants had never heard of refractive error.	Sudan ⁸²
21% of the participants believed refractive error did not cause vision impairment	Brazil ¹³²
Children with color deficiency were not aware they had a problem.	India ¹³⁸
Teachers' assumed that all children can see color	Nigeria ¹³⁷
Children with albinism did not see their eye issue-related headaches and skin sores as health problems	South Africa ¹²⁸

The opinions of parents and guardians on school eye health interventions are mixed. The **cooperation and support of parents** in school eye health interventions, was noted by two studies as a key facilitator to access.^{74,111,139} Two studies from India and Nigeria reported the parental belief that school screening is important, despite suspicion of screening validity.^{83,90} Two further studies found a **resistance** from parents to seek follow up eye care for their children. In a Brazilian study, 25% (total n=14,651) of parents felt an eye exam was unnecessary,¹⁴⁰ which was also reflective of beliefs among Iranian parents.¹¹⁰ Elsewhere, parents/guardians reported fears of treatment options and surgery.⁹⁰

A number of studies illustrated positive impacts of **eye health intervention in schools**. Hobday et al. (2015) suggested that following the introduction of eye health education via teachers, the ability of children to identify the cause of an eye problem increased from 56% to 80% (total n=237).⁸⁹ In a Vietnamese study, 90.8% of children (total n=358 aged 6-15) had sourced information about trachoma through school.⁸⁷ Positive changes regarding the knowledge of trachoma and how to avoid it as a result of health promotion messages embedded in the school curriculum were also

reported in Tanzania.⁷³ Similarly, in a Chinese study, following eye checks and behavioral interventions (such as educational seminars and eye health knowledge tests), a significant increase in awareness among children was noticed.¹⁴¹ The authors recommended the need to promote eye care knowledge in students from a young age, in combination with a relaxing and healthy visual environment.¹⁴¹

In a Pakistani study, children as well as their parents recognized the need to eat fruit and vegetables as important **sources of Vitamin A**.⁸⁶ We also observe this trend in the high percentage (79%, total n=1525) of respondents in a North Indian study, who reported acquiring knowledge in class around the role of Vitamin A in the prevention of blindness.¹⁴²

A number of studies reported a **lack of awareness of schools for the blind**. In a rural Indian study, only 15% (total n=106) of community members were aware of schools for the blind.¹⁴³ Similarly, 90% of parents (n=1600) in a Bangladeshi study believed there were no schools or support systems for blind.⁹⁵ Ormsby et al. (2012) revealed that just under half of parents (43%, total n=599) in their Cambodian study believed that a child whose vision is impaired cannot attend school.¹³³



9.4.1.4 Awareness of spectacles

Awareness of the need for children to wear spectacles and parental acceptability varied across the literature.^{98,126} In a Southeastern Turkish study, only 10% (or 2,237 children aged 6-14) did not know they needed to wear spectacles, suggesting a higher level of awareness.¹⁴⁴ While children in an Indian study believed that their parents **do not understand or ignore** their vision problems.¹⁰⁶ Parents from the same study reported that if they had known about the problem, they would have asked their children to comply with their spectacle prescription. One Chinese study hypothesized that based on the levels of literacy in the communities it investigated, poor spectacle compliance might be due to the parents' low academic aspirations for their child.⁹² Ready-made spectacles were reported as equally acceptable among children as custom made spectacles in China^{125,145} and India.¹⁴⁶

Aside from parents' involvement in spectacle compliance, another Chinese paper mentions media role models as influencers on children's choice to wear glasses – however, this was limited to prompting their design preference for thick, dark frames.¹⁴⁷

9.4.1.5 Impact of stigma

Social stigma is a notable barrier to children's ability to access eye care. Given that stigma is manifested by social perception, unsurprisingly it presents in situations where the child's appearance and/or behavior is altered – in relation to blindness, albinism and spectacle wear. Kalua et al. (2012) wrote that parents may not acknowledge they have a disabled child on account of shame, while Ebeigbe (2016) suggested that the stigma of burdening others as a result of blindness, in addition to blindness getting in the way of learning at school, made parents regard blindness as "the worst form of handicap".^{90,102}

In relation to children with albinism, a study by Gaigher et al. (2002) found their acceptance by community was hindered because they require a different level of light to other children in the classroom.¹²⁸ Solutions called upon social networks, including parents/guardians, teachers and medical professionals,

to help children explore new and positive ways to overcoming rejection and discrimination.¹²⁸

This is supported by a study from Malawi, which advocated the value of teacher training and the integration of albinism into various aspects of the school curriculum, in order to shift societal attitudes.¹²³ Cultural participation can offer positive social integration through **art and entertainment** – Barbieri et al. (2016) mentioned theatre and music as a way of increasing independence, acceptance and respect.¹⁴⁸

9.4.1.6 Spectacles – social stigma

Stigma emerged as a notable barrier in relation to spectacle acceptability. The findings of an Indian study offer compelling evidence of the severity of this, stating "more than a third (37%, total n=1018 aged 8-16) of children wearing glasses reported that they had been subjected to verbal and some even to physical abuse",⁹⁶ a finding that is echoed among Malawian and Colombian children who participated in the case studies (Section 10.1 and 10.2). There is clear social pressure against spectacles, observed across the perspectives of children and parents in varying contexts. Four papers note children's fear of being **teased or discriminated**.^{64,89,105,106,107} One example of the type of sentiment underpinning this stigma is a fear of being perceived as old.¹⁰⁶ A Brazilian study found that beyond the age of five years, children found it difficult to accept glasses out of fear of being teased, or because they found the design uncomfortable.¹⁰⁷ Practitioners in an Indian study noted that parents too hesitated having their children's eyes tested because they had issues with glasses for cosmetic reasons, perceiving them as carrying a "stigma".¹¹⁹

9.4.1.7 Traditional medicines and methods

The use of traditional medicines and methods to treat eye disease emerged in the articles identified as an impediment to medical care. Different methods included kohl and rose water as a way of maintaining healthy eyes,⁸⁶ onion, urine and breast milk to treat red eye (conjunctivitis),¹²¹ and roots, applied locally to the eye or ingested in a tea, as an intervention for impairments like refractive error, among others.⁶⁴

The **influence of social networks** and a **distrust in Western medicine** appear to be the major facilitators of traditional medicine use. In the Nigerian context, parents had used one form of traditional medicine or another before seeking medical assistance,⁹⁰ and endorsed such use due to their ease of accessibility, relative affordability, as well as their past successes with traditional care and misconceptions about medical approaches.⁹⁴ Similar findings were reported by Malawian children and parents in the case study of this report (Section 10.2).

Two articles outline the **implications** of traditional methods. A study from West Bengal, India asserted that traditional methods need to be 'seriously avoided', as they do more harm than good.¹⁴³ Similarly, Bodunde et al. (2016) warned against additional conditions that may arise as a result of this type of intervention, citing the adverse effects of delayed presentation to the medical system and how these might lead to blindness and vision loss.¹²¹

9.4.1.8 Spectacles – alternatives to use

Seeking an alternative to spectacle wear, respondents in two studies pursued general health solutions such as exercise, rest, limiting the amount of time spent on near-work, posture, lighting and diet.^{119,126} In rural China, these inclinations from parents were upheld by teachers.¹²⁶ Similarly to a Nigerian study on eye-seeking behavior of parents,⁹⁰ a Tanzanian study on spectacle use casts the **role of the family and neighbors** as influencers, reporting that students said they were advised to use **traditional medicines instead of spectacles** to improve their sight.⁶⁴ They refer to longstanding traditions as testimony to efficacy: "They say to buy the medicine from the Maasai. Have you ever seen Maasai wearing spectacles? They are not wearing (spectacles) because they are using their own traditional medicine. Go there and you will not need spectacles". This viewpoint responds to the study participants' concerns over spectacle safety and a lack of trust in Western medicine.⁶⁴ The view that spectacles are harmful to the eyes is also seen in a Tanzanian study,¹⁴⁹ and the Malawian case study of this report (Section 10.2).

The results of another study also suggested an appetite to **alternative methods**. In an Indian study, Senthilkumar et al. (2013) wrote that parents enquired about healthy food habits, eye exercises or yoga, as possible methods to spectacle correction.¹¹⁹

9.4.1.9 Cultural or religious factors

The literature reflects the impact of cultural beliefs as an obstacle to access to eye health. While some of the impacts of this have already been mentioned in relation to the misconceptions around eye health and traditional methods of treatment, other cultural or religious factors are explored here.

This review uncovered: cultural norms as an important factor in the **use of health services**,¹³⁶ and longstanding cultural practices as a **source of eye health information for teachers**.¹⁵⁰ Balasubramaniam et al. (2013) wrote that, in India, elderly relatives were likely to make the decisions around their family's health.⁸³ A finding similar to that in Nigeria where collective family decision making can determine whether a child will be taken to the health service.⁹⁰ While this has many advantages, it can also hinder parents in making decisions in relation to their children's eye health. As such, in contexts where the wider family holds an influential role, intervention design that fails to account for relatives other than parents or guardians may fail to attain desired reach or change in behavior.

In Mozambique, Thompson et al. (2015) described the belief that vision impairment in old age is viewed as the destiny of God and therefore untreatable.⁹⁷ Although this was not specifically referring to children's beliefs, it is indicative of how culture may impact decision making around children's eye care. The authors suggested that this kind of thinking is difficult to change and requires the patient, the community and the service provider to reframe beliefs. Conversely, Barbieri et al. (2016) advocated spirituality and religiosity as important facets of support for children and adolescents who are vision impaired, as religious organizations can provide spaces to socialize.¹⁴⁸



Hornby et al. (2000) suggested that **health education** and genetic counselling might be an option to preventing congenital eye diseases as it has been shown to be effective, non-invasive and relatively inexpensive for preventing genetic disease related to consanguineous marriages.⁹¹ However, the authors also caution with a reference to the opinion of a WHO expert group, which concluded that an attempt to discourage consanguineous marriage on genetic grounds might carry unintended consequences.

9.4.1.10 Community involvement

The place of community as a potential barrier or facilitator is multifaceted, in that it can act as a **potential block** or tool for patients to accessing eye healthcare.¹⁴⁸ Communities can serve as a **form of support** for patients and their families,¹⁰⁸ and as a sphere in which beliefs can be shifted to encourage better health.^{79,89,105,131} Community was largely seen as a facilitator for health,^{79,89,105,131} while critique was directed towards **healthcare providers' lack of engagement** with it.¹⁴⁸

Our review of the literature found that a child's broader community can provide a key role in: educating the broader population about

eye care,¹²¹ aiding in the development or monitoring of eye care interventions,^{79,105,131} enabling the collaboration between families and health services, reaching children who are not attending school,⁸⁹ and providing a source of emotional and instrumental strength for children living with vision impairment or blindness.^{108,148} An example of the importance and role of the community is found in a Malawian study, which states that those caring for children with vision impairment receive support from family, friends and neighbors.¹⁰⁸

Only one argument in the literature cast the involvement of community in the process of seeking treatment as negative. Barbieri et al. (2016) wrote that in some instances, professional-family relationship ties were permeated by prejudice.¹⁴⁸

9.4.2 Characteristics of eye health services within schools

9.4.2.1 Support and collaboration

A variety of eye health interventions are described in the included studies, and are provided by either teachers or external health personnel (Table 5). An overarching factor for

the success of any eye health intervention in schools is obtaining **support from principals, staff and parents**,^{85,89,111,151} which was also confirmed in the Colombian and Malawian case studies of this report (Sections 10.1 and 10.2). Poor communication between school staff and parents can affect children's spectacle wear compliance and can lead to poor motivation in implementing interventions effectively.^{106,152}

All interventions, large or small, require **preparation**. This includes sensitization and awareness generating activities, coordination with the school and scheduling sufficient time to either have no or minimal effect on the regular school curriculum,^{139,152,153} a concern of which was raised by educators in the Colombian case study (Section 10.1). A vision-screening program in Peru was successfully scaled-up from a small pilot program in one district, to 24 districts, due to the **partnerships** between non-profit organizations, local eye hospitals, regional education authorities, municipal institutions, universities and educational institutions, international organizations supporting the inclusion of people with disabilities and other stakeholders.¹⁵⁴ This approach in Peru has been considered more sustainable as no partner is entirely responsible for the whole program and therefore risk of program failure is lessened should a stakeholder discontinue participation.¹⁵⁴ Evaluation of a pilot vision screening program in Thailand reached similar conclusions – a multidisciplinary community of “policy-makers, local authorities, local hospitals, ophthalmologists, nurses, teachers, and parents” – was required for government-approved national program success.⁷⁴ An Iranian evaluation of a kindergarten intervention shows that cooperation between teachers who provided initial screening, the parents, who brought their children in for follow-ups with specialists, and the opticians and ophthalmologists who carried out further checks and treatment, was essential to the program's success.¹¹¹

Alternative to a standalone program, vision screening programs might also benefit from **combining with other physical examinations** including nutrition, hearing or

vaccinations. This has shown to be possible for schools in India, Brazil and China where either internal health nurses or community health workers attend the schools to provide the services (Table 5).^{62,76,77,155}

9.4.2.2 Effectiveness of teachers providing eye care in schools

The purpose of this systematic review was not to assess teachers' abilities to correctly conduct eye checks or detect children with vision impairment. However, a number of studies reported sensitivity/specificity values for screening programs, ranging between 46.2% sensitivity in India,¹⁵⁶ and 93.5% in China.¹⁵⁷ Similarly, specificity ranged between 91.2% in China,¹⁵⁷ and 97.1% in India.¹⁵⁸ The sensitivity (the proportion of children correctly identified as having reduced vision) and specificity (the proportion of children correctly identified as not having reduced vision) is important from a number of perspectives. Firstly, to ensure that children with reduced vision are **correctly identified and not overlooked**, and secondly, so **children with good vision are not incorrectly referred** for further assessments. The first is more dangerous, but the latter increases optometrist or ophthalmologist workload and reduces the cost-effectiveness of the intervention. The latter also creates anxiety and places an additional burden on the children and their caretakers,¹⁵⁶ and can decrease confidence in eye health programs and reduce the uptake of services.

The literature reported specific scenarios where **teacher eye examinations were not effective**. Screening very young children accurately can be very difficult due to issues with testability and varying levels of literacy, although appropriate use of the Lea chart (a chart with pictures) will improve the accuracy of assessing visual acuity in pre-literate children.⁷⁴

Table 5: Types of eye health programs identified in the systematic review literature

Location	Current or pilot program	Standalone or combined health program	Vision screening	Eye health education	Trachoma screening	Provided by
Rural China ¹⁵⁹	Current	Standalone	Yes	No	No	Visiting township (local community) health clinic staff
Guangzhou, China ⁶²	Current	Combined	Yes	No	No	Community health workers
Brazil ^{76,160}	Current	Combined	Yes	Sometimes	No	Community health workers
Abottabad, Pakistan ⁸⁶	Current	Information unavailable	No	Yes	No	Teachers
Delhi, India ⁷⁷	Current	Combined	Yes	Yes	No	Community health workers
Varamin, Iran ¹⁶¹	Current	Standalone	Yes	No	No	Community health workers
Apurimac, Peru ¹⁵²	Pilot that has scaled up	Standalone	Yes	No	No	Trained teachers
Thailand ⁷⁴	Pilot that has scaled up	Standalone	Yes	No	No	Trained teachers
Tamil Nadu, India ¹⁵³	Pilot	Standalone	Yes	No	No	Visiting University Optometry School
Oyo, Nigeria ¹³⁹	Pilot	Standalone	No	Yes	No	Training teachers and students
Aileu, Timor-Leste ⁸⁹	Pilot	Standalone	No	Yes	No	Trained teachers delivering lessons to students
Haryana, India ¹²⁷	Pilot	Standalone	Yes	No	No	Self-administered in schools
Guangzhou, China ¹⁶²	Pilot	Standalone	Yes	No	No	Self-administered at home
Manyoni, Tanzania ⁷³	Pilot	Standalone	No	Yes	Yes	Trained teachers for eye health education and clinical research team for trachoma screening

Additionally, a significant loss of specificity occurs when children are already wearing spectacles, or are known to be habitual spectacle wearers;¹⁵⁷ and there can be significant 'over-referrals' with new interventions, as teachers lack confidence and take advantage of the rare opportunity to have their students examined thoroughly by an eye health professional.¹³¹ Additionally, the case study in Colombia revealed community resistance to teachers extending beyond their teaching role (Section 10.1).

In addition to conducting screenings, **teachers can be involved in scheduling referrals, organizing the logistics for children to see eye care professionals and communicating the outcomes to the school-based community.**¹³¹ Furthermore, having **all teachers involved** and trained to screen their own class was more effective in coverage and cost than using only selected teachers for vision screening.¹⁶³ Teachers in Pakistan have reported their willingness to manage minor eye problems such as foreign body removal. However, they acknowledge their own limitations, realizing referrals to optometrists/ophthalmologists are needed for more serious matters.⁸⁶

9.4.2.3 Benefits of using teachers as providers of school eye care

When establishing a school eye health intervention, there are inherent **benefits in using teachers to conduct initial screening**, as compared to using visiting eye health professionals, especially in terms of **cost-effectiveness** in low-income settings.¹⁶³ A cross-sectional study of 17 schools in four provinces in Thailand reported that many teachers felt 'proud' to be able to help their students, and that parents like having their children examined by the teachers, as they are 'trustworthy'.⁷⁴ **Supportive** perceptions among teachers, including the usefulness of vision screening were also found in China.¹⁵⁷ A cross-sectional study of 20 schools in Delhi, India reported that teachers play a beneficial role in motivating parents and children to seek follow-up care, that they can increase spectacle compliance through monitoring,

and impact negative perceptions of spectacle use.¹⁵⁸ In addition, teachers have 'a positive influence on the educational process and may help in the different phases of the project, from locomotion and transportation of the poor population to direct forms of help, such as creating appropriate working conditions for the local ophthalmologists'.¹³¹ These findings were echoed in the Malawian case study in this report (Section 10.2), where both principals and teachers from three different schools voiced support for training in school eye care.

9.4.2.4 Factors preventing or facilitating teachers in providing eye health interventions

Teachers reported a range of issues, varying interest, and levels of confidence in providing eye care within their classrooms. The primary issues identified by teachers about the actual implementation and screening at schools were **limited time**,^{89,152} **a lack of confidence** due to either limited training,^{118,156} or a lack of experience.⁷⁴ Evidence from an Indian study shows when teachers were asked to identify the stakeholders who share responsibility for children's eye health, 95% (total n=99) selected 'parents', while only 45% selected 'teachers' as responsible.¹⁵⁰ Interestingly, a lack of interest from parents was identified by teachers as a barrier by a study conducted in 27 Brazilian states, along with difficulties scheduling visits and providing transportation and delays in receiving spectacles.¹³¹ In a Brazilian study that focused specifically on children with **vision impairment**, almost 96% of teachers (total n=230) believed that this condition prevented children from learning, but only 21% knew how to look after them and almost 44% did not know how to refer them to specialized care.¹⁶⁴ A Malaysian study highlighted the importance of equipping teachers with technical knowledge when working with children with vision impairment.¹⁶⁴

Training is essential for teachers to provide eye checks in schools. Some key elements of a **successful training program** were: the provision of good resources and support from the training body,⁸⁹ an annual training workshop and/or vision program,^{74,157} and

involving the local ophthalmologists in the training to increase motivation.¹⁶³ Teachers in Nigeria have recommended longer training periods to help make these interventions more sustainable.¹³⁹ **Teachers' motivation and confidence** in participating in school screening interventions is also an important determinant. Regular visits by a program officer reviewing the lessons could improve teacher motivation.⁸⁹ The systematic review identified that previous personal experience of eye problems,⁸⁹ and involvement in prior successful interventions, were key aspects of keeping teachers motivated.^{85,150} In addition, the satisfaction obtained from being able to help their students' vision, played a role in teachers' motivation and confidence.¹⁵⁸ While additional payment did not emerge as an important issue, this tactic may encourage teachers' willingness to participate.^{74,111}

Support from parents and principals was identified as a key facilitator in the success of an intervention. For instance, school principals are able to adjust teaching schedules to allow teachers sufficient time to conduct the screening activities.⁸⁹ Similarly, 'buy in' from the parent/guardians is critical.^{74,89} In a study from Timor-Leste, Hobday et al. (2015) further identified that parent-teacher groups may facilitate ongoing collaboration and sharing between schools and communities.⁸⁹

Other factors identified as facilitators of broader intervention success were: adding eye health to the school curriculum,⁸⁹ using successful pilot programs to support wide-spread implementation¹⁵⁰ and coordinating school eye health interventions with other community activities – particularly when the eye health program is focused on trachoma control.⁷³



9.4.2.5 Eye health education

The provision of **eye health education** for students can be provided by teachers or external health professionals,^{73,77,160} while also having the potential to filter valuable information to the wider community.¹³⁹ If teachers are involved, they are likely to benefit from having resources available on how to **recognize children with reduced vision** and better manage vision problems. For example, the Department of Education in South Africa created *The Integrated School Health Policy of 2012* detailing such information.¹⁶⁵ And yet, in a study published in 2015, the authors

noted that few teachers were aware of the policy.⁸⁵ This highlights the importance of **communicating policy-based information to potential stakeholders** and beneficiaries so that they may materialize it accordingly, as well as allocating a budget to train teachers in recognizing children's vision problems. Some of the consequences of poor eye health education include: low referral uptake by Indian schoolchildren who failed vision screenings and poor knowledge or perceptions of red/pink eye (eyes that appear red or pink) among senior secondary students in Nigeria.^{121,166} Barriers and facilitators impacting children's access to eye health care is summarized in Table 6.

Table 6: Summary of barriers and facilitators that impact the acceptability of children's eye health care

Facilitators		Barriers	
Supply side	Demand side	Supply side	Demand side
Health education and communication have emerged as possible and sometimes successful methods of shifting beliefs. Education programs in schools have achieved positive results in raising awareness of nutrition, and the causes and prevention of eye problems. Community spaces and institutions can play a role in health education, aiding the development of programming and enabling collaboration between families, communities and health services. For children with albinism, the involvement of medical professionals and teachers, and inclusion in the school curriculum improved acceptability. Eye health programs were more successful when they involved multidisciplinary organizations and had full support from teachers and principals. Acceptance of ready-made spectacles were similar to that of custom spectacles among children, suggesting that supplying the former may be an acceptable and cost effective facilitator.	Involving patients with vision impairment and the community in cultural activities can enhance social acceptance and provide emotional support for those vision impaired. Parents could be facilitators for treatment uptake. When spectacle wear is accepted by parents/guardians, children tend to have higher spectacle compliance. Parental concern around poor academic performance as a result of eye problems could act as a motivator to seek care. Education programs in schools have encouraged children to seek medical care outside of school.	Traditional medicine is often easily accessible, relatively affordable, supported by social convention and perceived positively due to past successes. Healthcare workers and teaching staff can frame blindness as an inevitability to all children with albinism. Teachers have reported lacking confidence or experience providing eye care.	Lack of awareness and children failing to perceive their vision symptoms. Eye health and spectacle wear misconceptions, often intertwined with cultural beliefs, reduced spectacle compliance and the likelihood of patients seeking services. Social stigma and distrust in Western medicine have led to a reduction in accessing appropriate eye care services. Parents who fear that they might be blamed for child's eye issues delayed children's presentation and treatment. Safety concerns with spectacle wear have led to parents seeking alternative interventions. Gender plays a role, with mothers either carrying more responsibility or feeling encumbered in seeking care treatment.



9.5 Financial accessibility

9.5.1 Financial factors influencing the supply and demand of services

There is a great deal of evidence in the literature about various ways to reduce the costs of school eye health interventions. However, **a comprehensive evaluation of the most cost-effective approaches** incorporating the costs of preventable vision impairment and blindness in children over the life course is needed. Our review identified numerous factors that influence the cost of eye health interventions in schools (Table 7). These factors could be considered by future programs as opportunities to reduce the cost of services. Four studies identified that **ready-made spectacles maybe acceptable for many children.**^{79,145,167,168} While ready-made spectacles will not suit all children, and inappropriate dispensing might result in reduced compliance, they are likely to be a cost-effective resource in many school eye health programs. However Morjaria et al. (2017) note that larger inventories (frame sizes, colors and shapes, and lens powers) improve acceptability but also increase cost.¹⁶⁷

However there was no evidence in the identified articles that compared the cost of larger inventories of ready-made spectacles, with custom-made spectacles.

By only prescribing spectacles to children with more moderate and severe refractive error, a

Mexican study¹⁶⁹ demonstrated that compliance rates increase, with a corresponding decrease in costs to the program for supplies and labor (through 24.3% reduction in spectacle costs), a finding echoed in two Chinese studies,^{63,168} and one Thai study.⁷⁴ A Brazilian study demonstrated that return visits by the screening team significantly increased costs, without significantly improving the overall coverage of the program.¹¹⁶ Interestingly, this study also determined that the need for spectacles in the children (aged 7-10) who were initially absent (32.0%, n=2069) was significantly greater than the need for children who were present at the initial visit (23.8%, n=713). The study concluded that the initially absent children should be recalled in future interventions, and emphasized the importance of ensuring that there is a large attendance at the first visit.

Aside from the cost of services, additional financial factors that influence user demand and access to eye care services identified from the literature included: access to **health insurance** to cover the cost of spectacles and examination fees;⁸² indirect costs related to the **user's distance from services**⁶⁴ or cost of transport;¹⁴⁸ loss of daily wages;^{82,83} and lack of childcare and/or lack of parent or guardian to accompany the child to additional appointments.¹¹⁶ Similar barriers were identified in the Malawian case study of this report (Section 10.2).

Table 7: Factors that decrease school eye health intervention costs

Financial Factors	Country
Source instrumentation from local tertiary institutions	India ¹⁵³
Limit false-positives through appropriate design	Indonesia ¹³⁵
Carefully consider refractive error criteria (prescribe spectacles only for moderate and severe refractive error)	Mexico ^{74,169}
Use ready-made spectacles when appropriate, reduces optician dispensing time and clinician visits	India, China ^{132,145,167}
Return visits teams to screen students who were initially absent increases costs significantly, without significantly improving coverage (although absent students appear more likely to have vision problems, so some mechanism for capture should be utilized)	Brazil ¹¹⁶
Motorbikes can be an effective and low-cost way to conduct school screening activities in rural and remote areas	Timor ⁷⁸
Use cost-effective personnel for screening (i.e. teachers, school health counsellors/nurses), followed by referrals or visiting eye care professionals for children failing the screening	India ^{151,158}
High quality services are cost-effective in the broader context in the long term	Mozambique ⁹⁷
A funding model that shares cost between parents and government	Iran ¹¹¹

9.5.2 Financial factors influencing access to spectacles

We identified many studies within the review that investigated barriers to spectacle purchase, primarily from the perspectives of parents or guardians. While each cohort varied, and the participants were asked varying questions in relation to barriers to spectacle purchase, we were able to identify seven studies, which were similar enough to compare (Li et al., 2008 reported two separate cohorts). Figure 13 shows **cost is a barrier** for children obtaining spectacles in many settings.

The number of parents reporting cost barriers ranged from 8.4% in China, up to 53% in Mozambique. Studies using qualitative methods described the impact of spectacle costs on families, which had in some cases prevented the parent from obtaining spectacles for their child.^{64,90}

Of the studies that conducted a formal assessment on parents' willingness to pay (n=5), **five clear factors** emerged that were associated with a **higher willingness to pay** for spectacles, these included: previous/current ownership of spectacles,¹⁰⁴ regular wear of

spectacles,¹²⁴ recognized need for spectacles, or an understanding that vision improves with spectacle wear,^{74,104} parents completion of high school education,¹⁰⁴ and good experiences with 'budget frames'.¹⁷³

In some areas of rural China, reluctance to purchase and wear spectacles was related to poor understanding of the benefits of spectacles, fears about potential harm, rather than cost, as large cohorts of participants were willing to pay for children's spectacles.^{124,125}

Children's spectacles are sometimes provided free of cost, particularly in low-income settings where parents/guardians would not have otherwise been able to afford them. However some studies outlined **barriers related to parental acceptability of free spectacles**,^{64,96,98,149} with one study noting that the free spectacles distributed were not appreciated because of their poor quality.¹⁰⁶ The relationship between cost and 'value' was further explored in a study in Mozambique, which concluded that "affordability depends as much on the cost of preserving sight as it does on the degree the patients prizes his or her sight, and the ability for it to be paid for".⁹⁷

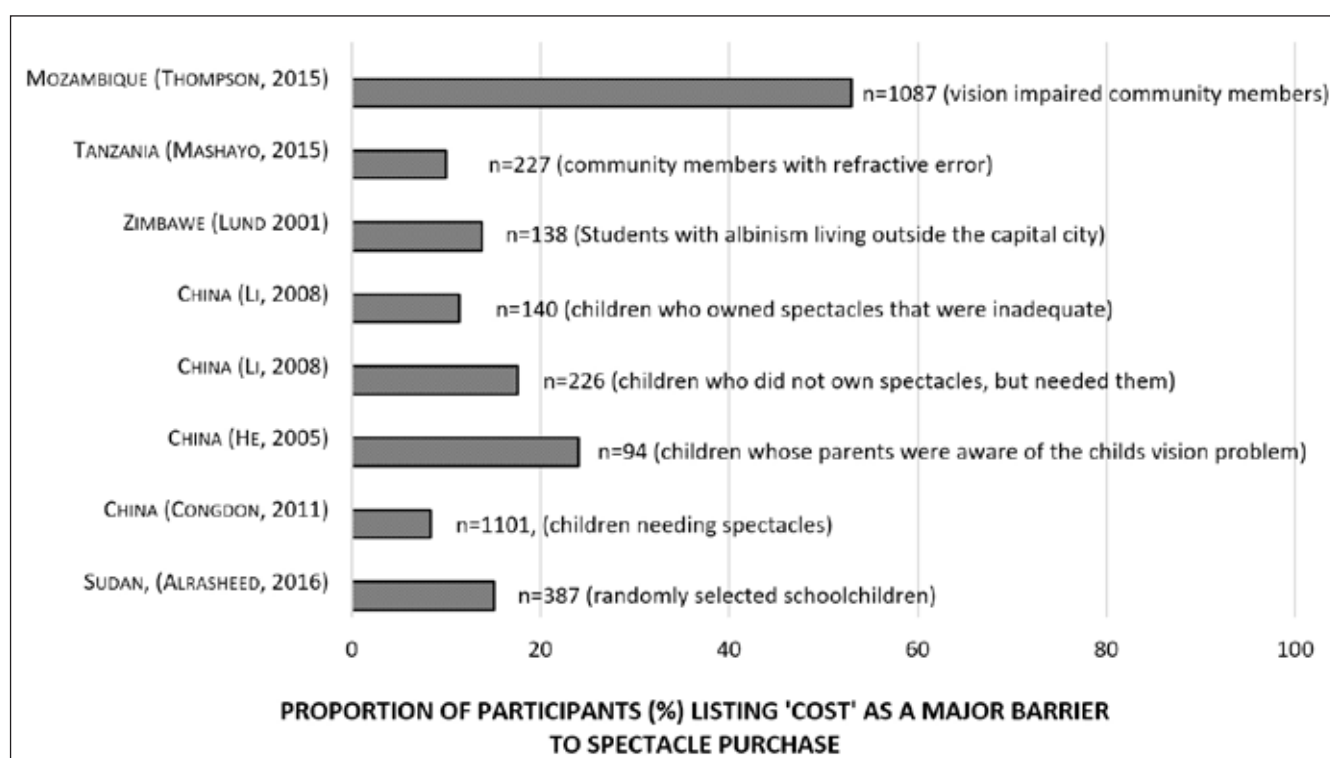


Figure 13: Cost as a barrier to spectacle purchase (spectacle costs varied between studies)
 Included studies: Thompson 2014,¹⁷⁰ Mashayo 2015,¹⁷¹ Lund 2001,¹⁷² Li 2008,¹²⁴ He 2005,⁶² Congdon 2011,¹²⁵ Alrasheed 2016.⁸²

A summary of the facilitators and barriers to financial support for children’s eye care is shown in Table 8.

Table 8: Summary of facilitators and barriers to financial accessibility for children’s eye care

Facilitators		Barriers	
Supply side	Demand side	Supply side	Demand side
Carefully chosen criteria where spectacles (ready-made or custom) are only prescribed when appropriate (e.g. for moderate and severe refractive error) reduced program costs.	Previous good experiences and regular wear of spectacles resulted in a higher willingness to pay for children's spectacles.	Return visits by the screening team increased program costs significantly, without increasing coverage.	Users’ financial access was impacted by out-of-pocket costs such as examination fees and spectacle purchase (which could be moderated by access to health insurance).
Adequate vision screening training can limit false-positives and therefore reduce program costs.			Cost of transport, childcare and potential lost wages were also barriers to accessing child eye care (when referral outside the education system was required).
Cost-effective personnel and non-traditional transport methods (e.g. motorbikes) can reduce program delivery costs.			

9.6 Geographic accessibility

9.6.1 User's location

References related to geographic accessibility of eye care services or spectacle wear were noted in 30 of the 133 articles included in the review. **Increased distance from eye health practitioners or service providers** is commonly reported as a barrier to accessing eye care services,^{97,140,148} particularly in remote settings.^{78,154} In Mozambique, 15% (n=160) of study participants noted distance to services as an issue,⁹⁷ while in Brazil, families reported feelings of neglect from health services due to distance from the doctor.¹⁴⁸ In Brazil, service limitations, including access to schools in remote areas were also noted as a geographic barrier.⁷⁶

Geographic barriers to services are often closely related to **transportation**. Studies in Timor-Leste, Brazil and Mozambique all report transport costs as a potential barrier to access.^{78,97,116} In particular, participants in Mozambique who have a household income of < \$2 USD per day were more likely to report distance to a service as a barrier. Additionally, logistics related to organizing appropriate transport and managing time to travel with children to obtain spectacles or eye care were reported as issues by parents/guardians and teachers.^{78,82,83,131,148} Similar barriers were noted in the Malawian case study (Section 10.2), which found that government funded school health programs were not being delivered in rural areas.

9.6.2 Location of services

Three studies in Mozambique, Bangladesh and Indonesia reported that most eye care services are in the main cities or urban areas, implying that **those in rural areas find it more challenging** to access services compared to those situated in urban areas.^{95,97,174} Indeed, there may be higher prevalence of non-refractive vision impairment in rural areas compared to urban areas due to geographic distance between service and patient.¹⁷⁴ This is noted in rural Malawi where families have not received assistance in understanding how to care for their child or children with vision impairment.¹⁰⁸ In a study of countries from

the Western Pacific region (Fiji, Papua New Guinea, Solomon Islands, Vanuatu, Cook Islands, Samoa, Tonga and Tuvalu), eye health workers acknowledge that improvement in services are required particularly among rural communities.⁷⁹ Conversely, in Maharashtra, India, service coverage did not appear to be different across the state, although was reported to be “uniformly poor in both urban and rural areas”.¹⁷⁵

Mobile or outreach school services can improve accessibility of eye health services for children, particularly in rural areas. These services are often financially supported by NGOs, charities or the Council for the Blind.^{78,172} In Timor-Leste, the introduction of outreach services resulted a three-fold increase in vision screenings provided for rural people in Covalima district compared to the previous year. The positive outcomes also resulted in support from the MoH for program expansion.⁵⁹ Organization and budget including travel needs to be considered carefully prior to executing, however, as a Brazilian study noted, some children referred to the mobile eye clinic from failed school vision screenings still had to walk five hours to see eye health personnel.^{152,154,158} Such findings highlight the importance of a systems-based approach to school eye health interventions, with a focus on strong referral pathways and linkages between education and health systems.⁶⁷

Schools for children with vision impairment play an important role in communities. However, challenges still exist for children with vision impairment to attend special needs schools. For example, in West Bengal India, there were rural areas where no special needs schools were available within a 50km radius.¹⁴³ Furthermore, some schools can have strict criteria or preferences for student enrollment. In Indonesia, state-supported schools for the blind preferentially enrolled children with more severe vision loss, however, this excluded those with multiple disabilities and those who are highly reliant on their parents.¹⁷⁴

A summary of the facilitators and barriers of accessibility from a geographic perspective is shown in Table 9.

Table 9: Summary of facilitators and barriers of geographic accessibility

Facilitators		Barriers	
Supply side	Demand side	Supply side	Demand side
Mobile eye clinics or outreach services generally enabled more children to be examined.	Having a bus station within the town or village marginally improved spectacle wear compliance.	Increased distance between schools and health services affected services' abilities to conduct school screenings.	Distance, transport availability, and the time required to visit optometrists, ophthalmologists or optical stores were factors hindering children and their accompanying parents to seeking eye care. Patients located in rural areas are faced with more challenges in accessing eye care often located in urban areas.

9.6.2.1 Geographic accessibility of spectacles

Differences in spectacle wear compliance have been noted based on schoolchildren's locations. Older urban children in Mexico were less likely to wear spectacles compared to those in rural areas, due to concerns about appearance and being teased.¹⁶⁹ In India, children from larger rural towns were less likely to wear spectacles to children in smaller villages.¹²⁷

Although attitudes to spectacle wear in schoolchildren from **urban areas might be a greater influence on compliance, acquiring or repairing** spectacles were the main challenges for rural children. A study in rural China reported parents "find it too inconvenient to take their children to buy glasses", and in Mexico, parents reported difficulties in repairing spectacles or obtaining a replacement pair where there were no refractive services.^{96,126} In rural China a marginal improvement in children's spectacle compliance was found where a bus station within the village was available.¹⁹ Alternatively, a study in India recommended dispensing ready-made spectacles to children on site as a solution to logistic and transport issues.¹⁶⁷

9.7 Availability of eye health services in schools

9.7.1 Demand for services from the eye health sector

Children's eye health services are often recommended in studies that have identified a significant proportion of children with vision abnormalities. Studies from various regions including countries such as Brazil, India, Tanzania, South Africa and Thailand have strongly recommended eye care in schools when vision impairment or ocular conditions requiring management were found to have a prevalence of 5.8% or more.^{74,110,116,129,134,176–178} However, in another study conducted in Tanzania, the authors have questioned the cost and time benefits of a school vision screening intervention, when children with poor visual acuity was only observed in 2.9%.¹⁴⁹ The differences found in both studies conducted in Tanzania might be associated with the populations examined and the sample size. One study sampled almost 7,000 children in Dar es Salaam (the largest city), while the other sampled only 400 children in Kibaha District and found congenital abnormalities were the main reason of vision impairment.^{149,178}



When implementing a school eye health interventions, all children should participate. Studies of first-grade children in Brazil and Iran noted a prevalence of 14.1% (n=860) with low visual acuity and 33.3% (n=271) with some form of refractive error respectively; suggesting children should have a comprehensive eye examination at school entry with follow-ups.^{110,134} Another Brazilian study also endorsed comprehensive eye examinations shortly before or after starting school.¹⁰⁷ While an Iranian study also stressed the importance of early detection, suggesting that vision screening in kindergarten, followed by timely intervention by experts, can help reduce amblyopia in children.¹¹¹

Guidelines for school eye health programs written by a group of international eye care NGOs,⁵⁴ and supported by studies from Brazil, Nepal and Nigeria,^{100,129,134} recommended screening every one to two years.

Additional benefits of school-entry intervention are the chance to identify those who might be better placed in an integrated or special needs school, and providing early education to parents on referrals to optometrists or ophthalmologists and the importance of attendance.^{116,176}

For children in integrated or blind schools, **comprehensive eye examinations at school enrollment** have been recommended for two reasons. First, to provide vision impaired children with glasses or low vision devices to enable functional vision and improve learning.¹⁰⁰ Second, to identify those who

genuinely benefit from attending schools for the blind, or special needs school. Studies in Malawi and Nepal investigated optical services and needs in integrated and schools for the blind, both found a small proportion of children with 'normal' vision – i.e. children who could attend mainstream schools.^{100,179,180} Similarly to regular school, after school entry eye examinations, children should be reviewed annually, as it has been noted vision impaired children were often not utilizing prescribed visual devices after a year.¹⁰⁰ One Brazilian study recommended assessments by an eye care practitioner, working within a multidisciplinary team and in cooperation with patients and their families, for children with vision impairment and/or multiple disabilities.¹⁸¹ And another Brazilian study, which assessed the relationship between spectacle prescription and other ocular conditions, also endorsed the need for an eye care professional to detect and treat these conditions in schoolchildren.¹⁸²

9.7.2 Demand for services from parents/ guardians

Five studies highlighted that parents as a group that can act as a **facilitator for behavior change**, and in so doing increase demand for services.^{105,119,121,152,183} Other studies reported on a **willingness** by parents to seek care. In these settings parents/guardians indicated they would seek care for refractive error;⁸² seek in-hospital services to manage eye disease;⁹⁴ or by successfully completing home vision screening procedures.¹⁶² However, these outcomes must be taken with caution due

to potential respondent bias – e.g. parents refusing research participation might have alternative opinions. Two studies also linked concerns about vision problems to **academic performance**, which is an important driver of acceptance and demand.^{83,136}

However, reduced demand for services will likely result when there is **dissatisfaction with the health system**. The public setting was particularly identified in two studies as **not meeting expectations**.^{82,90} We found instances where parents/guardians reported **frustration** due to a lack of resolution or conflicting information,¹⁴⁸ **gave up** due to the services not assisting when their child had multiple health needs,¹⁰⁸ were **concerned about medication**,¹¹⁰ **distrusted screening results**,¹⁴⁰ were given **inappropriate advice**¹⁰³ or **lacked trust** in the providers qualifications.⁹⁰

9.7.3 Availability of human resources

Few included studies have comprehensively described what eye care services and resources were available to children. In rural China (Jiangsu, Sichuan, Shaanxi, Jilin and Hebei provinces), 34% of schools (n=252 schools) had an eye care program, while only 20% of township health centers (n=50 township health centers) have optometric services.¹⁵⁹ In Sudan, parents suggested that eye specialists should be evenly distributed appropriately across the country.⁸² In 2000 in India, more than 60% of the schools (n=204 schools) provided referrals to external clinics, while the remainder either did not have a referral system (12.8%) or there were no school eye health services at all (27.2%).^{77,184}

In the Pacific Islands, the ratio of refractionists to population vary widely, so **outreach services** are recommended.⁷⁹ However, problems arising from **inadequate training** and/or planning are amplified in outreach services. A study from rural China, reported inadequate training among refractionists had led to the over-use of, and over-reliance on automated refraction machines, resulting in inaccurate prescription of spectacles for children.¹⁸⁵ One Brazilian study suggested that checks for eye diseases should be performed by an appropriate eye care

professional.¹⁸² But, as the availability of eye care professionals (ophthalmologists, optometrists, refractionists) might be limited in school settings, there have been investigations of **alternatives for providing basic eye care** for children including **teachers, nurses, certified medical assistants and key informants**.^{74,79,86,152,159,164,182} The involvement of teachers has been detailed in Section 9.4.2. However, further details regarding nurses, medical assistants and key informants are detailed here.

The Brazilian Family Health Strategy found that **nurses** are capable of providing different forms of eye health promotion including “research and guidance during the consultation of nursing”, education in schools to students and teachers, and visual acuity screenings.¹⁶⁰ At the Tshilidzini Special School, South Africa, resources include an onsite school health nurse. Although available and capable of providing basic eye care, students need to actively seek care.¹²⁸ **Certified medical assistants** in Nepal have also been trained in vision screening as an alternative to eye health professionals in detecting ocular abnormalities in children.⁸⁰

Key informants are trusted community members used to identify people with further eye care needs. They are usually chosen by leaders within the village, town or community. Studies have shown that key informants are capable of correctly referring at least 80% of children requiring further eye examinations.^{102,186}

9.7.4 Availability of equipment

Visual acuity charts such as the **standard Snellen (letter), HOTV and a modified early treatment of diabetic retinopathy survey (ETDRS) chart** with tumbling “E” have been shown to be useful tools for trained teachers to effectively detect vision abnormalities in children.^{80,85} While not reported in any of the studies included as part of the systematic review, there are versions of Tumbling E charts specifically redesigned for screening purposes,¹⁸⁷ and Lea symbols have been shown to have better testability in preschool children and agree with other charts in school-age children.¹⁸⁸

Smartphone-based visual acuity tests such as “Peek Acuity” have also shown promise recently for community-based screening.¹⁸⁹

An Indian study introduced a different screening approach to only detect vision impairment, where students were instructed to conduct a **self-administered vision examination (SAVE)**. The SAVE approach involved placing vision charts on school premises for students to screen themselves over an 8 week period. This method resulted in high sensitivity, specificity and positive and negative predictive values. However, this is likely to only be successful with older children (at least 6th grade).¹²⁷

In Malawi, the authors identified that advanced ocular conditions were difficult to determine without the necessary instruments available.¹⁷⁹ Whenever equipment-based limitations exist, appropriate referral pathways should be implemented.

A Malaysian study that looked at the **use of low vision devices, such as typoscopes and additional reading lights, in a special education school** showed that only 55% of respondents who used them did so in their daily tasks. This is because children with vision impairment in this study needed more than

one gadget for their condition, did not know how to use the device, or found its appearance unappealing.¹⁹⁰

9.7.4.1 Availability of spectacles

Evidence regarding provision of spectacles is limited. As seen within the literature, a variety of eye care programs exist, utilizing different personnel, with or without spectacle provision. Moreover, publications describing spectacle provision to schoolchildren are often research studies, such compliance assessments or as part of providing duty of care within prevalence of vision impairment studies.⁹⁶ In rural China, only 4% of eye care services in townships were capable of making and providing spectacles.¹⁵⁹ While in Brazil, one of the main issues faced by teachers providing school eye care was delivering children spectacles within a timely manner. Providing spectacles to children on the spot is possible though with two options – ready-made spectacles, or round “Harry Potter”-like spectacles. Completely round spectacles allow even astigmatic prescriptions to be fitted on the spot, however round spectacles and/or a lack of an alternative frame choice can impact compliance among children.¹⁶⁹

Table 10: Summary of facilitators and barriers in availability of children’s eye care

Facilitators		Barriers	
Supply side	Demand side	Supply side	Demand side
Training teachers, nurses, certified medical assistants and key informants in vision screenings can alleviate some of demand for eye care practitioners. Self-administered vision screenings, either paper-or smartphone-based, placed in schools could reduce vision screening human resource needs		Inadequate or inappropriate training of eye care providers leads to inaccurate spectacles for children Lack of planning or “squeezing” eye health interventions into the regular curriculum led to poor support from teachers	Unpredictable availability of appropriate eye care practitioners and untimely services prevented parents seeking eye care for their children.



10. Country case studies

Field studies were conducted to determine the key barriers and facilitators around the accessibility of child eye health within schools in Colombia, Malawi and Pakistan, according to the methodology described in Section 8 (see also Table 2). Field study countries were sampled based on differing World Bank income group classifications, as well as geographic regions and presence of in-country personnel to assist with data collection. There were 17 interviews and 4 FGDs in Colombia, 10 interviews and 6 FGDs in Malawi and 9 interviews and 3 FGDs in Pakistan. A description of the participants is presented in Table 11.

Table 11: Participants from Colombia, Malawi and Pakistan

	Colombia	Malawi	Pakistan	Total
Eye health stakeholders	Government (4) NGO (3)	Government (3) NGO (2)	Government (3) NGO (1)	16 (14%)
Eye health providers	Optometrists (1) Educators (7) School nurse (1)	Optometrist (2) Educators (3)	Ophthalmologist (1) Optometrists (3) Educators (8)	26 (23%)
Eye health users	Children (15) Parents (7)	Children (25) Parents (9)	Children (8) Parents (9)	73 (63%)
Total participants	38	44	33	115



10.1 Colombia

10.1.1 Background

The results of the fieldwork described in this case study provide a well-defined outline of the issues obstructing children's access to eye health care in Colombia. It is important to note that the opinions reflected in this sample are those of urban people living in Bogotá and that individuals in rural parts of the country are likely to have different experiences. Drastic socioeconomic disparity between the six 'strata', an official system in Colombia used to distinguish social classes based on characteristics such as housing, employment and access to resources such as health and education, needs to be acknowledged as having an impact on the respondents' perspectives. While efforts were made to triangulate the data across wealthy and economically marginalized people, capturing the opinions of those from the lower strata, or people with less economic resources, was logistically more difficult. This is also the case for people of Indigenous or African descent; while we know these groups are adversely disadvantaged in terms of detection of ocular disease and access to treatment, this case study was unable to gather an adequate research sample, and we suggest research in this area due to a dearth of Colombian literature.

Aside from children, all respondents openly shared their views. Unfortunately, children

in all three focus groups were reserved and appeared to shape their answers around what they perceived as 'correct' despite adequate probing in the local language (Spanish). For this reason, it is difficult to assess 'true' patient experience based on this data.

10.1.2 Health system in Colombia

According to the WHO Country Cooperation Strategy (2015), the Colombian health system covers 95% of the population. Universal health insurance is funded by the government and managed by a number of private health insurers (Empresas Prestadoras de Servicios de Salud de Planes or EPS). EPSs manage public resources to deliver services to the population, in which eye health is included. The type of cover offered is either contributory or subsidized, depending on the individual's social stratum, employment status and financial resources.

"We have full coverage for detection, treatment and rehabilitation of all ocular diseases, at the moment there are no exclusions. For instance, the system would cover the full treatment of an eye problem, for anyone in the population. [...] We have categorized the coverage depending on if you are part of the contributory regime or the subsidized regime. For example, the lenses are fully covered for both regimes, but the frames are subsidized according to 10% of the minimum wage for the current year (which is approx. 737,000 Pesos per month)." (Ministry of Health Representative)

A representative from Volver, an NGO that provides vision screening, eye examinations and spectacles to vulnerable populations, added that while all treatments are covered, there are limitations to the delivery of contact lenses and low vision devices. However, inequity persists, particularly in remote areas and among Indigenous populations and people of African descent. A total of 2.1 million people in Colombia (0.4% of population) have no access to health services.¹⁹¹ A Rapid Assessment of Refractive Errors (RARE) study conducted in Bogotá 2016 in adults aged 15 years and over identified the rate of uncorrected refractive error as 21%,¹⁹² while a representative from Volver believed this is likely to be an underestimate. However, there is currently no national data available.

The representative from the Ministry of Health (MoH) stated that in 2013 a 10-year National Public Health Plan (*Plan Nacional de Salud Publica*) was created. Several aims of this plan seek to increase the coverage of prevention activities in eye, dental and auditory care by 20%. This also includes a motion to identify refractive errors in children between two and eight years and enable a referral pathway to the health system, treating 100% of the children identified (*Plan decenal de Salud Colombia 2015, Ministerio de Salud*). Furthermore, in 2015, two key pieces of health sector legislation were enacted, including the Statutory Health Act (Act 1751) which addresses basic welfare law, and the National Development Plan (Act 1753), which emphasizes equity, access, quality, timeliness, trust, legitimacy and sustainability of the system (WHO Country Cooperation Strategy, 2015). The MoH states that since 2015, it has been working to create

comprehensive service pathways and evidence-based interventions, to detect, treat, and rehabilitate vision conditions, however there is no explicit school health policy.

10.1.3 Vision screening school-aged children

According to a 2000 ministerial resolution, it is mandatory for children in Colombia to undergo vision screening in health centers at ages four, 11 and 16 (which was noted by the MoH to change in 2018 to include all ages). While subsidized vision screening is provided through EPSs, accessing it is the sole responsibility of the parent. At present, routine vision screening in schools is not provided nor is there a budget to support it. A 2012 piece of legislation requires all children to present a certificate verifying good eye health in order to be admitted at the beginning of the school year. Yet, this is not enforced, particularly in the public school setting where schools are unable to refuse children access to education. The MoH is rolling out a strategy with the Secretary of Education (a branch of the Ministry of Education) called *Veo bien, aprendo bien* (I see well, I learn well). The scheme is voluntary, and the MoH representative interviewed believes it needs more regulation as not all schools embrace it. The scheme has three approaches for identifying children with vision problems:

1. Nurses check visual acuity in schools
2. Optometry students check visual acuity in schools (in some regions only)
3. Teachers check visual acuity in schools.

Once the children with vision impairment are identified, they follow the pathway identified in Figure 14.

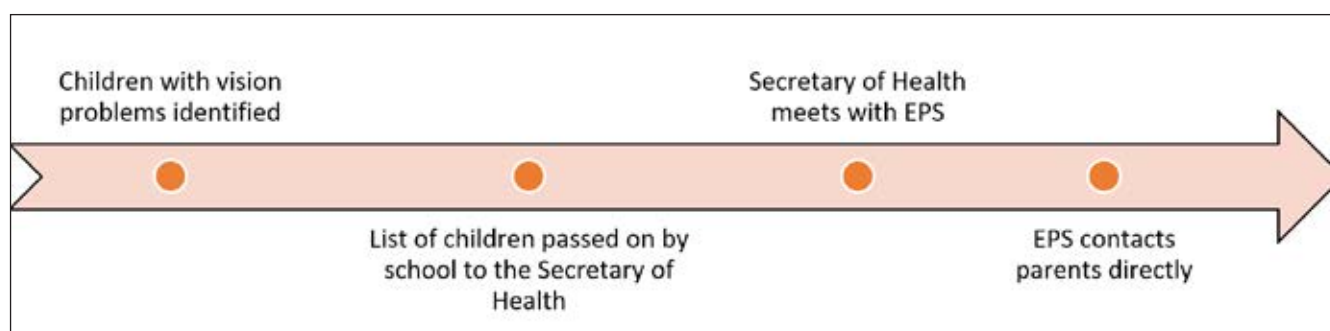


Figure 14: Screening pathway for Colombian school-aged children under current Ministry of Health scheme

The success of the referral pathway outlined is uncertain, as it was not mentioned by any of the representatives of the three schools in this study. Within this pathway, the obligation to drive children to eye exams lies with private health insurers (EPS). According to the MoH, EPS use promotion strategies to meet this requirement. The final responsibility, to ensure treatment occurs, is in the hands of the parents.

The teacher's responsibilities was perceived by respondents, to be identifying identify vision problems in class and adjusting teaching approaches to accommodate those who have trouble seeing (for example, by seating a child closer to the blackboard).

Teachers are not generally trained to assess visual acuity, although some teachers, especially those employed in 'inclusive education' schools trained to work with children with physical and intellectual disabilities, including vision impairment, do receive training.

Teachers working in private schools disclosed that they kept log books of each child's health, which are then used to communicate any issues to parents.

In theory, the health system in Colombia is well-placed to adequately detect problems and service all members of the population. And yet, vision problems commonly remain undetected and untreated, and it is likely that the complex referral system creates many opportunities for children to 'drop-out' of the referral pathway.

10.1.4 Accessibility of child eye care within Colombian schools

Using the methodology outlined in Section 8, participant interviews and FGDs were analyzed using the Peters et al. (2008) accessibility framework. Figure 15 shows the different areas of accessibility, and where key barriers were identified within each. Colombia is classified as an upper-middle-income economy, hence the availability of services and resources is not as commonly cited an issue as user acceptability of these.

10.1.5 Socioeconomic factors

All adult interviewees were asked whether they think spectacles are affordable in Colombia. Despite theoretically comprehensive health coverage, of the people who answered the question directly, the majority (67%) answered negatively.

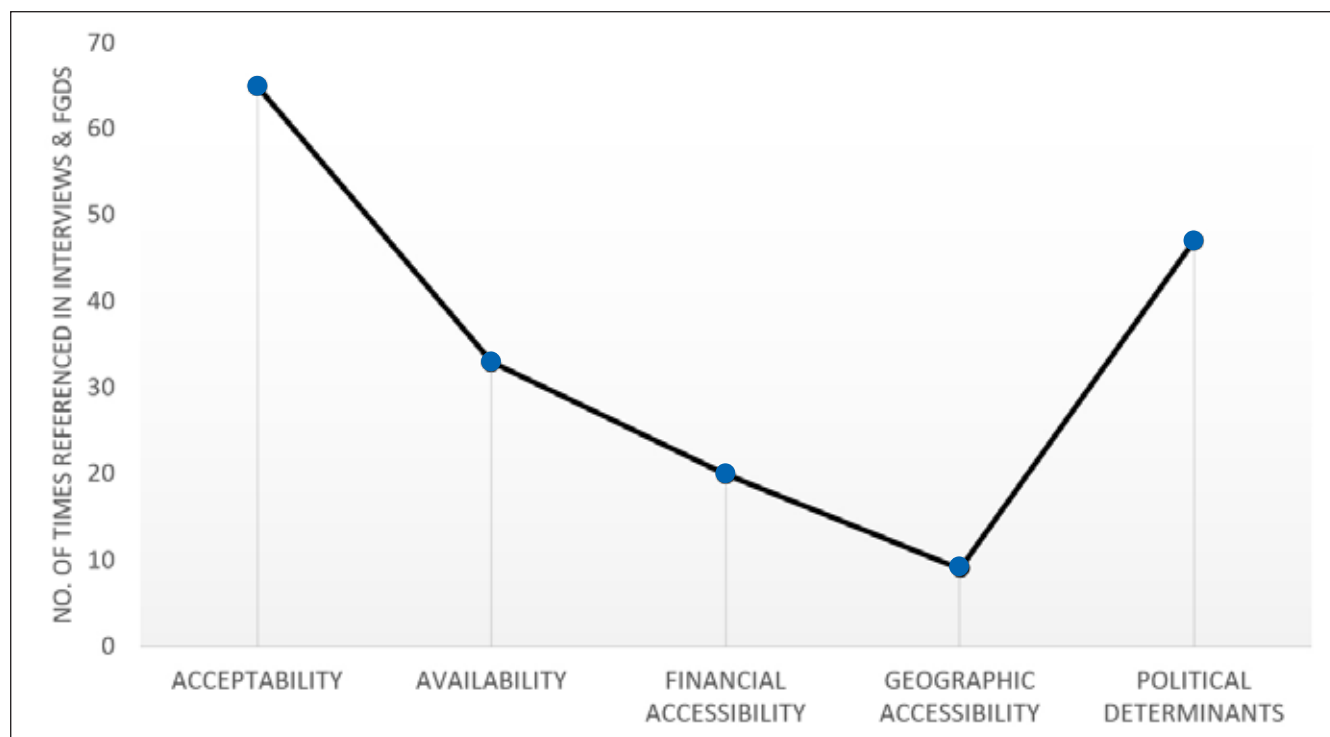


Figure 15: Barriers to child eye health within Colombian schools identified by participants and disaggregated using Peters et al. (2008) framework.

In Bogotá, treatment centers can be far away from peoples' homes and transportation is not always available, with traffic and time away from work contributing to this. The issue of geographic accessibility, was identified by government and NGO stakeholders, as pronounced in rural areas. Respondents from the Pan American Health Organization (PAHO) and Volver suggested that even if or when services are delivered to remote locations, they are not readily taken up. The respondents point towards **a lack of awareness of eye health among rural people with limited education around prevention and early detection of vision problems.** Cutting across all groups of respondents was the notion that **eye health is not priority.** For individuals in lower strata, resources are limited, and vision doesn't rank among other basic needs, such as food, education or more pressing health issues.

10.1.6 Political/systemic factors

The most significant disruption to eye care access within education systems is perceived to cascade from the pinnacle of the policy system. A lack of support or prioritization of eye health at the executive or presidential level, was a common theme. Varying participants (n=8), including school staff, NGO representatives, a parent/guardian and an optometrist, who were asked whether they thought eye health was a priority for the government replied 'no'.

"No. I think that if they don't prioritize other important things such as appendicitis, how are they [the government] going to prioritize visual health that is not a life threatening situation, unless you are complaining about an extreme ocular pain." (School Nurse, Private School)

The reasons for this are speculative. A quality management coordinator at a private school suggests that the presidential term does not provide adequate incentive to elected representatives to instill long-term solutions:

"Policies in Colombia have a problem. The president in Colombia is just in power for four years and the next person changes the policies. And the next one again. There is no continuity...stop and change. Health in Colombia is not good enough for people."

In general, eye health is not considered and it needs money." (Quality Management Coordinator, Private School)

"I think the responsibility of this should be given to the Ministry of Education. That's what I think. Because I have participated many times, many times, sitting at a table and everyone says yes yes yes, and then nothing happens. Nothing happens! Because you almost have to negotiate with every school teacher, not even with the principal, every school teacher." (PAHO Representative)

Between the education and health ministries, responsibility for childhood eye health and school vision screening was difficult to place. These respondents describe an institutional culture in which ministry workers are reticent to be involved in projects outside of the confines of their policy jurisdictions. This **stalls collaboration between the two ministries.**

"The Ministry of Health and the Ministry of Education, they are castles, the Ministry of Education don't want to the Ministry of Health people coming in to do things." (PAHO Representative)

A representative from the MoH outlined that the policies and budgets surrounding school health was a disputed topic that stemmed from issues around the perceived responsibilities of the health and education ministries.

"The education sector has more resources assigned from the national budget than the health sector, almost 50% more resources. For instance the education sector [might say] 'why should we do something extra outside of my field' and then health sector would say 'hey, if you have more money than us why don't you give us a hand'. I think the education sector is a little bit more closed minded and a bit rigid in their decisions. We haven't been able to establish the relationships between the ministries which could also mean there is no political will between them, so existing cooperation has been achieved through informal relationships. Unfortunately in order for this to improve the collaboration must come from the very top of each ministry." (Ministry of Health Representative)

Representatives from the Ministry of Education (MoE) confirmed issues around collaboration between the two ministries at the policy level, and how this had affected the efficiency of school eye health screening interventions in the past.

"I would think it is more related to how the ministries are structured. Because each ministry has their roles clearly defined and they stick to it...The rupture between the sectors became noticeable, for instance education would do their part, teachers would do the screening and make a list that was then handed over to the health sector, and then the health sector did not follow through." (Ministry of Education Representative)

While previous interventions targeting eye health in schools, and training teachers in early detection of vision impairment had been implemented in the 1990s, public funding was discontinued. Representatives from the Ministry of Education confirmed that working through the National Institute for the Blind or *Instituto Nacional para Ciegos* (a department governed by the Ministry of Education), their priorities in terms of school eye health interventions were largely focused on early childhood development, low vision, and inclusive education, rather than mass screening for refractive error.

In addition to a lack of top-level support, the research identified a number of instrumental flaws which prevent people from accessing health services. The most pressing need is in the area of **human resources**. Both public and private schools **lack adequate health care professionals** for budgetary reasons. Only one of the two private schools interviewed employs a nurse, who was trained in visual acuity at university but did not feel confident in providing this service and had not considered visual health as her responsibility.

"What I say is "zapatero a tus zapatos" (stick to what you know). I'm a nurse not an optometrist, so if I wanted to do an eye exam I don't have the proper knowledge, you know? Maybe I could refer the children that I think might have an eye problem."

[...] But if we are going to do that we would need an optometrist, but I don't think an optometrist is really necessary here, unless there were too many children with eye problems. And as I said, we do the follow ups but maybe if an optometrist could come and do a 6-month campaign we could follow up from what they did." (School Nurse, Private School)

A number of parents indicated that, especially in the subsidized system, waiting times are extensive. The MoH admits that an ophthalmologist appointment can take "up to one month in the cities, but in rural areas it could be up to six months."

10.1.7 Sociocultural factors

The possibility of training teachers to take visual acuity uncovered divisive opinions, revealing a pronounced concern from respondents around adequate qualifications. The phrase "zapatero a tus zapatos" appeared multiple times, meaning "stick to what you know". This idiom reveals a **cultural belief** that professionals should practice within their qualifications.

The representative from Volver advised that while teacher training is theoretically a great idea, the optometrists' association would need to be brought on board and that the training provided would need to meet a high quality standard. Similarly, even though the MoH considered the idea a cost-effective activity, the education sector rejected it.

This was echoed by the teachers who were interviewed. The mothers interviewed at one of the private schools unequivocally **rejected the prospect of eye exams performed by teachers**; which was echoed by the parent/guardian interviewed in the public school setting.

When asked if they would be comfortable if a teacher tested their children's visual acuity, mothers from a private school focus group replied:

*P4: Absolutely not
(All): It needs to be done by a professional (zapatero a tus zapatos)*

P4: A professional spends 5 years of their life getting educated...the health service provision at the school is very basic, as far as the school nurse goes. I don't even allow my child to receive medication, unless it's herbal tea, if there is the need. (Parents/guardians, Private School)

The private school mothers were concerned about non-health professionals administering medications or handling equipment around their children, and the need to obtain legal consent was also stressed.

"I have experienced, as a lawyer working in companies, regarding the issue of occupational safety, there are a lot of requirements and legal processes to be done in order to begin any of those campaigns." (Mother, Private School)

"The parents need to give permission." (Mother, Private School)

Similar issues of trust emerged with **suspicion of commercial agendas**. One private school teacher said that

"Within the private system, the qualifications of healthcare professionals cannot be trusted." (Teacher, Private School)

It was proposed that parents can be dubious of commercial providers' motives, as in the past, healthcare campaigns came with a 'catch' where the schools or parents were forced to buy something, or the service was never delivered at all.

"It's really the parents, they are very careful and defensive of these kinds of campaigns sometimes, because they have been deceived in the past by people that go to the school and offer free eye exams or glasses and don't deliver or charge after the service." (Volver NGO Representative)

On the other hand, there's the perception that the **public system is slow or ineffective** was expressed by the PAHO representative and public school teachers.

"We all know that the system is very bad in the public schools – for example, there is not even a nurse here to provide any health services in this school."

So, an eye health program is going to be considered even less so." (Public School Teacher)

10.1.8 Recommendations: Colombia

At present neither the Ministry of Health nor the Ministry of Education has claimed responsibility for the policies and budgets required to support school eye health. Any initiatives seeking to implement school eye health services in the Colombian context should carefully consider this structural barrier.

In order to be successfully adapted, it would require **buy-in from key stakeholders from the outset** and a detailed, dated implementation plan with clear responsibilities. Ideally, funding would be shared between the two ministries, falling under a **common higher-level strategy** (called *Veo bien, aprendo bien* or *I see well, I learn well*, when it has further progressed). Given the volatile political climate, longevity may be difficult to attain – so to mitigate, the program should outline measurable, short-term goals and a future rollout plan which can be implemented directly, or modified within the bounds of the higher-level strategy if ministerial leadership changes.

Secondly, given that eye health does not rank highly in health issue importance in Colombia, a comprehensive **awareness and health promotion campaign** should be put in place. Even though parents are key decision makers, given the commonplace socioeconomic and logistical constraints, the campaign should target parents/guardians, as well as children, teachers and school administrators (principals). It is important to obtain investment from the different groups using touch points most relevant to them – for example, for teachers, this could mean, stressing their role as actors who are well-placed to identify symptoms of vision problems as they have daily contact with children in the classroom.

The holistic link between **good eye health and school performance** should be emphasized both in the strategy document and in the health promotion campaign. Further, the referral pathway and the cost of spectacles should be clearly outlined, to remove any misconceptions about the health system.

Because the **referral pathway** outlined in Figure 14 contains multiple stakeholders, it would be advisable to undertake a review to understand whether referrals are happening at every step of the process. While it is likely that removing a step in order to simplify the referral process may pose challenging as this would involve a major overhaul, smaller tactics could be employed. This could involve, for example, developing relationships and maintaining ongoing communication with the different EPS, to ensure follow ups are occurring.

Given the cultural view around healthcare professionals' qualifications, a program in which **trained optometrists** made regular visits to schools would be preferred over a teacher training program.

The key facilitators and barriers of children's access to school eye health interventions in Colombia is shown in Table 12.

Table 12: Key issues that impact children's access to school eye health interventions in Colombia

Facilitators		Barriers	
Supply side	Demand side	Supply side	Demand side
Government subsidized coverage of eye health. Mandatory school vision screening at ages 4, 11, and 16. Eye health promotion campaigns within schools.	Use of EPS to obtain subsidized eye health care and spectacles.	Eye health not prioritized by the government. Narrow focus on low vision and inclusive education. Lack of cooperation between the ministries of health and education. Lack of human resources (especially in public system).	Poor awareness of eye health among people with limited education. A cultural belief that professionals should practice within their qualifications (teacher training in vision screening/ basic eye health not accepted). Suspicion of commercial agendas. Perception of the public system is slow or ineffective.

EPS: Health Provider Companies [Empresas Prestadoras de Servicios de Salud de Planes]



10.2 Malawi

10.2.1 Background

Three schools participated in the study, an urban and rural public school and an urban private school. The data described in this case study was collected in and around Lilongwe, the capital city of Malawi, and therefore does not adequately represent the issues faced in the remote areas located in the northern and southern regions. Nonetheless, this case study provides a contextual overview of the political/systemic, socioeconomic and sociocultural factors impacting accessibility to child eye health within education systems in Malawi.

10.2.2 Health system in Malawi

The Malawian health system works on a primary health care model, in which there are community health centers located in each region. Health Surveillance Assistants (HSAs), and where resources are available, nurses, are responsible for screening and referring at the community level. Universal health care is provided via the Essential Health Package (EHP) which was introduced in 2004, and allows Malawians to access a number of government health services free of charge. The EHP was updated in 2011 to include non-communicable diseases (NCDs) where 70% of health facilities were able to provide coverage, with a target of

90% by 2016.¹⁹³ The EHP now covers free eye exams, treatment for eye infections, trachoma and surgery. However, medication purchased outside the hospital, and spectacles, are not covered by the EHP and considered an out-of-pocket expense. Trachoma is endemic in Malawi and its elimination is referred to in the EHP. Eye infections, conjunctivitis and cataract are also mentioned in the strategic narrative of the government's National Health Plan, however refractive error and child eye health are not mentioned. Limited refractive services are currently provided through a partnership of public health facilities, Christian Health Association of Malawi (CHAM), hospitals and private optical workshops.

10.2.3 Vision screening school-aged children

There are close to 6000 primary schools in Malawi, where children undertake eight years of education (Standard 1 – Standard 8). Uncorrected refractive error is the leading cause of vision impairment in Malawian school-aged children,¹⁹⁴ with other issues including trachoma and bacterial conjunctivitis. While there are no known studies quantifying vision impairment from uncorrected refractive errors in children in Malawi, the Brien Holden Vision Institute internal modelling based on global evidence suggests a significant burden exists.

The modelling suggests that while the prevalence of significant refractive error is likely to be low, spectacle coverage (delivery of spectacles to those who need them) is very low. For example, the prevalence of myopia that would cause vision impairment if uncorrected occurs in approximately 2% of Malawian children at school entry, rising to approximately 5% by 18 years of age. However, 72% of urban and 89% of rural Malawian children with significant refractive error are vision impaired simply because they do not have spectacles.

School vision screening in Malawi is severely limited leaving many vision problems undetected. The school health policy is managed by the MoE in collaboration with the MoH. While school health is in theory covered under the EHP, in practice it is largely carried out in conjunction with Non-Government Organizations (NGOs).

10.2.4 Accessibility of child eye care within Malawian schools

Using the methodology outlined in Section 8, participant interviews and FGDs were analyzed using the Peters et al. (2008) accessibility framework. Figure 16 shows the different areas

of accessibility, and where key barriers were identified within each.

Due to the participants of the study being located in an urban and semi-rural setting (not more than 50km from Lilongwe Central Hospital), geographic accessibility was not as central to discussion. However, government and NGO stakeholders who were responsible for managing or providing eye care services in rural areas beyond the Lilongwe District, outlined barriers to users around the **lack of eye care services in rural areas** and the **indirect costs of traveling** to eye care services located in more densely populated areas. Issues related to geographic accessibility were compounded in the context of poverty and limited user resources.

10.2.5 Political/systemic factors

Access to free eye care within Malawian hospitals is a major facilitator to child eye health. Currently, school health programs are managed by the MoE and carried out by the MoH in collaboration with NGO personnel. Positively, there are structures in place that support collaboration between the MoE, MoH, and the Ministry of Agriculture (nutrition) on issues related to school health.

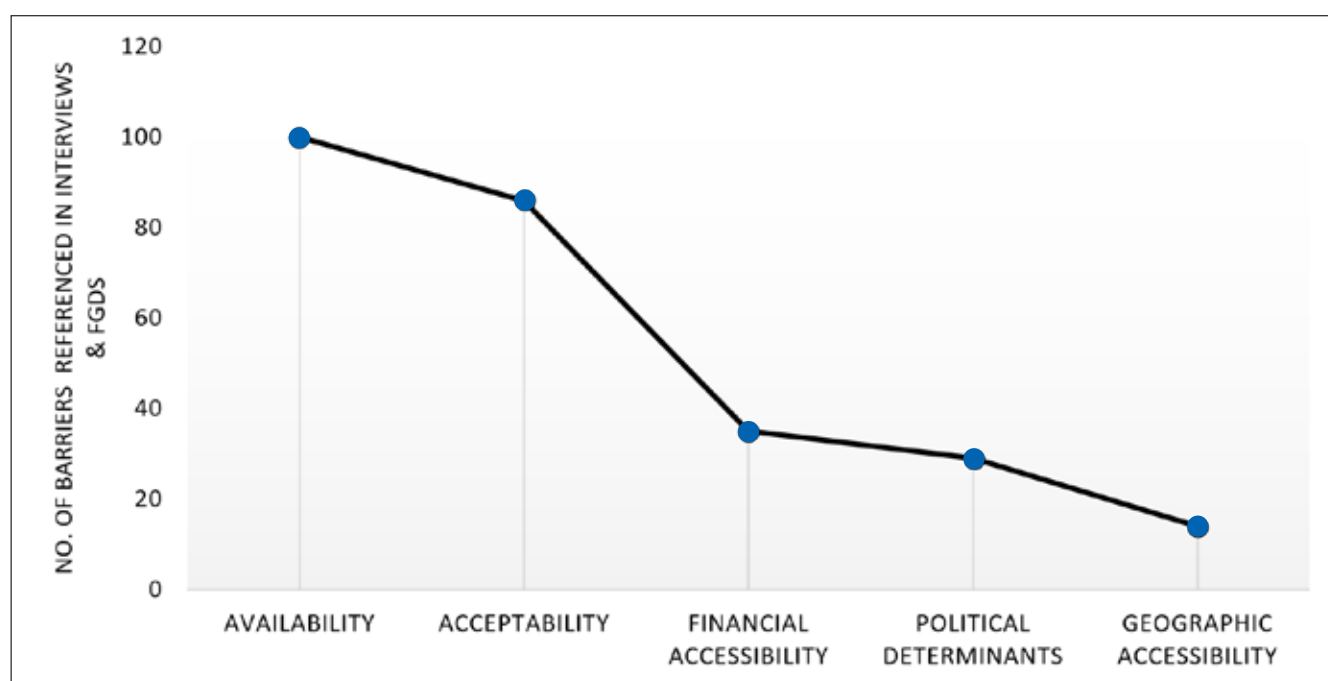


Figure 16: Barriers to child eye health within Malawian schools identified by participants and disaggregated using Peters et al. (2008) framework.

“Last year (2015) we developed the [school health] policy so we reviewed the strategies again. So because of that strategy a forum was already established where the school health coordinator from MoE and school health coordinator from MoH they are already working together. We also have a technical working group, we work together, so the collaboration between with MoH and MoE and Ministry of Agriculture it’s already there.” (Ministry of Health Representative)

Due to a **lack of public funding and resources** and limited government **prioritization of eye care**, vision screening in schools is severely limited and tends to **focus on special needs** (blind and vision impaired) children. Despite a positive collaboration between the government ministries, funding for school health programs are almost entirely **reliant on NGO resources**, with little to no funding from the Malawian government. The most recent example of school based vision screening and spectacle provision in Malawi, was conducted as part of a spectacle compliance study by the Brien Holden Vision Institute in 2016. Figure 17 portrays the current school screening and referral pathway under the Malawian School Health Policy. As there are currently little to no linkages between schools and health services, parents/families must take sole responsibility for accessing eye care services for children who fail school screenings, including spectacle purchase and/or other necessary treatments.

“We have close to 6000 primary schools. So each primary school is supposed to be visited twice per semester. But unfortunately it doesn’t happen like that, because there

are so many challenges that make it hard. Mostly, because of transport challenges, schools that are closer to the health facilities are visited maybe once a year. Those that are very far are never visited at all. It means learners in those schools are disadvantaged.” (Ministry of Education Representative)

“Eye care is not provided in schools on a routine basis unfortunately. It is supposed to be done on a routine basis but because of financial constraints that are there. We were going to different schools screening children with eye problems, referring those that need to be referred, and giving drugs to those who need them. But that project was funded by Sightsavers. Unfortunately it reached a point where Sightsavers couldn’t fund it anymore, and it wasn’t sustainable.” (Ministry of Health Representative)

“In the past [school health] was a holistic program under the Ministry of Education. But of late, I’ve seen that is not happening, because if NGOs like Sightsavers and other NGOs that work in that area, the government doesn’t. So there isn’t much that is covered under the school health program under the education system.” (Programs Manager, Sightsavers International)

“In practice HSAs are not doing the Snellen chart this is because of a lack of resources. Because if you’re relying on government funding, usually they say we don’t have fuel, you cannot go, and mostly they are doing the curative work at the hospital. They are not going into communities because of a lack of resources.” (Ministry of Health Representative)

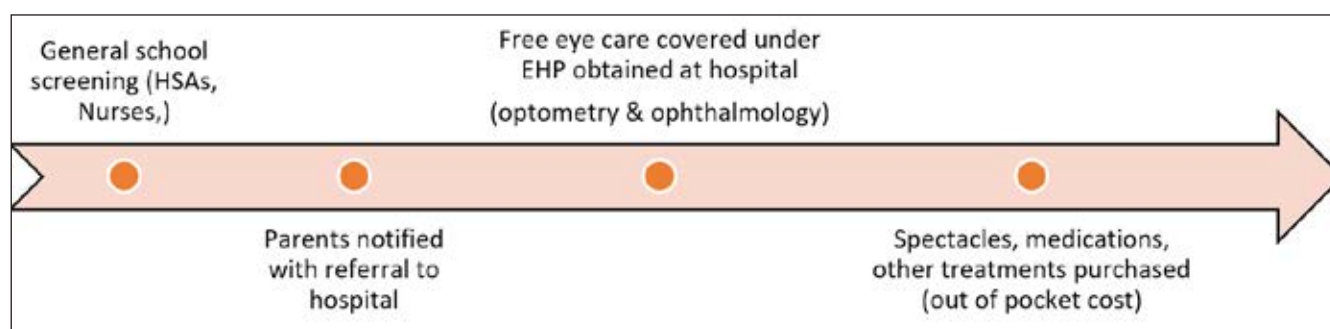


Figure 17: General school screening & referral pathway as per the School Health Policy – currently this is not occurring in rural areas.

Furthermore, **limited human resources** and **training in visual acuity** among community health personnel (HSAs and Nurses) present barriers to the availability of vision screening in schools. Limited resources had constricted the ability of HSAs to conduct community-based work, which was particularly detrimental to Malawians in rural areas who were not within close proximity of the health service or did not have the mobility to physically access it.

"We are thankful to the organizations that come to assist us here, and they should continue the good work they started. But our request stands that we need a health unit around this area so those issues could be sorted out." (Parent, Rural Public School)

Key eye care NGOs working in country include the Brien Holden Vision Institute, Lions Aid Norway, Malawi Union of the Blind, Orbis International, and Sightsavers International. Past NGO projects have delivered eye care within schools using the model outlined in Figure 18. However due to the irregularity of donor-based funding or grants this model of vision screening is neither regular nor sustainable. It was also identified that past community-based vision screening initiatives (some of which involved mass drug administration to treat eye diseases) implemented by NGOs, were undertaken during school hours resulting in children missing out on these vital eye care services.

"We do the [vision] screening from maybe 8am-10am or 12pm and we are done. What about the schoolchildren? They come back and we have already done the screening and left. So we need to involve the health sector personnel to do the screening in

schools." (Programs Manager, Sightsavers International)

Due to numerous NGOs providing different health services, linkages between NGOs, schools and health services are fragmented, which creates barriers around coordination between schools and health services.

"I'm not seeing much for linking programs. Like the eye screening to link with another health program. For example the WASH programming and the eye, that kind of thing like a package. Because for us, our interventions are in the form of a package - school health and nutrition." (Ministry of Education Representative)

"Maybe the schools we've visited they have an idea of very bad [eye health] cases. But otherwise they [the children] would just come to the hospital. But there isn't a link between the school and us." (Optometrist, Lilongwe Central Hospital)

Eye care practitioners who had been involved in school vision screening programs voiced that access to equipment, transportation and a space within the school to conduct screening, would be a key facilitator to providing eye care programs in school.

"The first thing is that the equipment needs to be there that is needed to conduct a school screening program that would be the best thing. The other thing is transportation. So equipment to be there, transport to be there, and funding. And we also need to have an office, because we need to be documenting everything so the school can follow up using a good system." (Optometrist, Lilongwe Central Hospital)

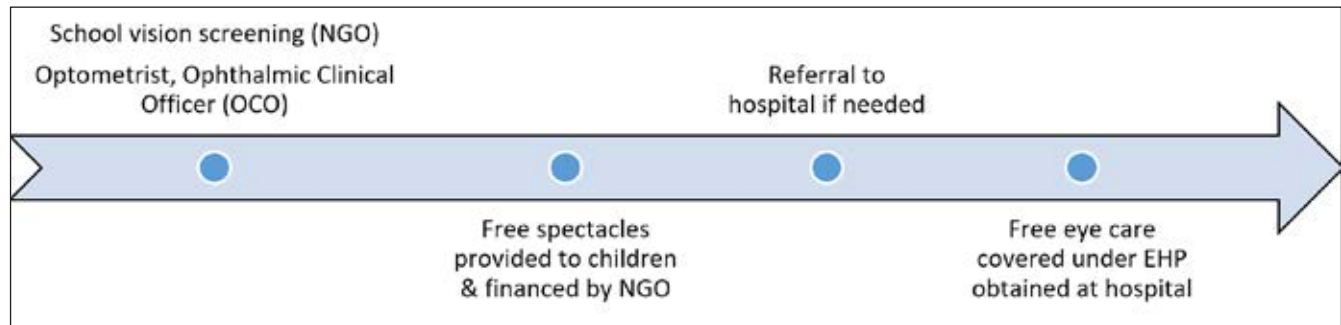


Figure 18: School vision screening as per previous NGO initiatives.

While teachers are trained to recognize basic ailments, at the time of data collection (2017) there were no programs in place (NGO or Government) to train teachers in vision screening. In conclusion, it was found that the **absence of an adequate system and referral pathway** to manage eye care in schools is a major barrier to child eye health in Malawi.

10.2.6 Socioeconomic factors

Malawi is one of the poorest countries in the world with 50.7% of the population living below the poverty line and 25% percent living in extreme poverty. Pressing issues such as food insecurity, which are exacerbated by floods and drought, means most Malawians have little to no disposable income.¹⁹⁵

While free eye care is available under the EHP, **access to ocular medication** (such as eye drops, or antibiotics) is limited within hospitals.

"Usually when patients go to the district hospitals, there are no drugs and they are told to buy. Even for the cheapest drugs, they will prescribe for them and say in the hospital we don't have this drug so you have to buy yourself. Some can pay 1,500MWK (\$2 USD), others 2,500MWK (\$3.50 USD). But those for example who have had cataract surgery, and they require post-operative drugs, they are very expensive, because it costs 6,000MWK (\$8.30 USD) for just a small pot (of drops)." (Programs Manager, Sightsavers International)

Participants were asked to give a numerical amount which they thought Malawian parents in the lowest income bracket would be willing to pay for their children's spectacles (Table 13). The approximate **cost of spectacles** in Malawi ranges from 15,000 MWK to 130,000 MWK (\$20-\$179 USD), which according to participants was not within an affordable range. Free or subsidized spectacles are not available under the EHP, which severely limits parents' ability to purchase them should their children require them. Even in the case where a child is screened for vision impairment in school, without access to affordable spectacles the benefits of school vision screening is limited.

P2: Eye care is expensive. (group agrees)

P3: For example when I enquired it was 10,000 MWK for glasses.

P1: We cannot afford it, it is too expensive. In some other cases 20,000 MWK and up to 30,000 MWK. (Parents, Rural Public School)

"They think that I don't have a problem, but I think that I have a problem. Like my mum has eye problems but she doesn't wear glasses because she thinks that they're expensive. Some other glasses can reach up to 40,000 MWK. Yeah and it's like your parents think that's a lot of money, I can buy something important for my house than going to buy something which can break easily. So, that's how they feel." (Student, Urban Private School)

"My parents said if you need glasses its ok if they [NGO] are providing them, because they couldn't afford to buy them for me." (Student, Urban Public School Student)

Table 13: Estimated willingness to pay for spectacles according to study participants in MWK and USD (conversion as at January 2018).

Participant	Amount (Malawian Kwacha)	Amount (US Dollars)
Stakeholders	500MK – 5000 MWK	\$0.60 - \$6.90 USD
Educators	500MK – 5000 MWK	\$0.60 - \$6.90 USD
Parents	1000MK – 3500 MWK	\$1.40 - \$4.80 USD

The socioeconomic barriers identified are exacerbated in rural contexts where parents' **distance from eye care services** and a **lack of available transport** limited their ability to access eye care services for their children, highlighting the importance of school or community based vision screening.

"The other serious issue is transport. Like me, I have three children with eye problems, for me and the three children to get to the hospital it costs a lot. If we could have transport that would make it very easy for us to go to the hospital." (Parent, Rural Public School)

While eye examinations in schools could minimize the indirect costs (such as transport) of accessing hospital-based eye care services, the direct cost of eye care treatment (medication or spectacles) needs to be reviewed, as it is currently unaffordable. In the context of poverty and limited incomes, parents deprioritize unaffordable eye care in light of more pressing expenses such as food, housing, and school fees.

10.2.7 Sociocultural factors

Various barriers to the acceptability of eye care services and spectacles were identified within participant perspectives. Most barriers revolved around the **stigma associated with spectacle wear**, which had in some cases prevented children from wearing their spectacles. Negative perceptions and distrust around eye care practitioners was also identified.

"Most of the time my child takes her glasses off and puts them in her bag because she cannot stand the mockery from her peers. Sometimes she is so disturbed by it that she cannot concentrate at school, they are calling her names like 'granny'." (Parent, Rural Public School)

P2: They say they look like "mazenera" (window panes) on our faces (laughs).

P3: Some say four eyes.

P4: Yes some say we are covering our eyes with curtains.

(Students, Urban Public School)

Associated stigma was complex, ranging from a purely aesthetic foundation, to negative

perceptions of wealth that were tied to **religious or cultural beliefs**. As glasses are expensive in Malawi there is a perception that they are only reserved for the wealthy, thus children who wear them are perceived by their peers as 'show offs', leaving them vulnerable to curses inflicted by jealous relatives or community members.

Cultural and economic factors alike meant that in some cases, when children complained of vision problems, their **parents did not believe they were in need of spectacles or eye care**. Disbelief related to vision problems in children among adults (parents and teachers) had caused some children to hide their vision problem from parents and teachers.

"My friends said that 'You don't really need glasses. You just want to look like a fancy princess'. They just say stop doing this, I have stopped believing in myself, I have stopped believing in God. We need to help them understand. Like mostly people who are from the villages, they just say 'Stop this, you can see properly'." (Student, Urban Private School)

"Some of our friends don't understand that we put glasses because we have a problem. They think that it's just an accessory for fun or to show off." (Student, Urban Public School)

"People believe in curses on rich people because some of the people are jealous just because the person is rich. They use like witchdoctors. So if you are wearing glasses people think you look rich." (Student, Urban Private School)

These beliefs also extended to those providing eye care, as practitioners were also perceived as wealthy, and hence satanic.

"Some people say that the people that do eye examinations are satanic. There is a prophet who is around here (in Malawi) who is pretty rich and that he got money through Satanism." (Student, Rural Public School)

Misconceptions around vision impairment and spectacle wear were identified across all participant groups, the most prominent being the **belief that spectacles make your vision worse**, which was grounded in a **lack of community education and awareness around eye care**.

"They have a belief that you shouldn't wear glasses at a young age because they will make your eyes worse." (Urban Public School Student, FGD)

P1: People in the village where we live say sometimes the glasses can cause problems.

P11: Yes, people say that my condition will get worse so I have to stop wearing them [glasses]. (Rural Public School Students, FGD)

The **use of traditional medicines** in place of spectacles or biomedical treatments was rooted in cultural and economic reasons.

While it was perceived that traditional medicines were not always effective in treating visual problems, they were cheap and readily available, which is why parents opted to use them, particularly in rural areas where geographic accessibility to health services was poor.

"Traditional belief is so strong that it effects the parents' decision to take their child to the hospital. They would rather take their child to this local traditional healer instead of the hospital.

And the healer would put some local traditional medicines, solutions or drugs or something in their eyes and makes the condition worse." (Ministry of Education Representative)

"It happens that some parents have problems, the health facilities are far, it is not about negligence. So due to that some parents are compelled to use traditional medicines. They consider the distance, it could be very far from the health facility so they resort to traditional medicine. So the problem comes from distance, and accessibility of the facilities.

As such the problem keeps on getting worse."

(Parent, Urban Private School)

"They were saying I'll look awkward wearing glasses. So there was a book telling medicine, or herbal medicines about fruits which can help you in eyesight. So that's when I started using those herbal medicines and then I stopped wearing glasses." (Student, Urban Private School)

"They wouldn't allow me to wear glasses, but use the herbal medicine." (Student, Urban Private School)

Stakeholders, educators and some parents voiced that if school vision screening programs are to be successful, they should be paired with community-based education and health promotion targeted at increasing awareness around eye care and spectacles.

"We still have a lot of illiteracy in most of the communities. So they might not understand most health interventions, they might think 'it's about making our children not able to bear children later in life', misconceptions, or maybe 'they want to reduce the population, so they want to vaccinate our children with something that is going to make them sterile'. So there is a need for more civic education and advocacy to make sure we come together and educate the masses on the importance on different health interventions." (Ministry of Education Representative)

"I think usually the community is suspicious to the health interventions in schools. So what is needed is before they start the program they need to go to the community about that health intervention. You need to explain to them then you let them see that it is important. So what is important, in order to iron out all the rumors that are there about health interventions, is to have a campaign or sensitization meetings with the local communities. So they should understand when children go to school they will be screened if they have a problem they will be referred to the next level." (Ministry of Health Representative)

"To sensitize the community or parents of these children is very good because it is 50/50. Some of the parents are caring for the eyes of their children on their own but some of them not. More information to the parents, to give that knowledge on how to take care of the eyes that is very important." (Parent, Rural Public School)

Positively government stakeholders, educators and parents were largely supportive of the idea to training teachers in vision screening. Which, as outlined in this report, has been an efficient approach to providing school vision screening in low-income settings with limited human resources. While interviewed eye care practitioners were slightly apprehensive to the idea of teachers conducting vision screening, they were supportive as long as it was limited to screening, and the appropriate training and referral systems were in place.

"That is a welcome idea, it is good plan because if you have teachers who have got that experience or that knowledge, it means that the learners will be assisted in time and it will be regular assistance." (Principal, Urban Public School)

"I think it can be so important because it can also ease some work that the professionals have so that this work can also be done by the teachers who are also keeping the learners. It will be easier because teachers will say, "OK this one has this problem" and he will know how to help rather than waiting for those other organizations to come at their own time while the need is this time. So, I think giving training to teachers or some of the people who can do it, close to the community that is good." (Teacher, Urban Private School)

"It is good to train us because we have a lot of children [here] but we haven't got any knowledge of the eye and eye sight is very important to everybody whether at school, at work, at home – everywhere." (Principal, Rural Public School)

10.2.8 Recommendations: Malawi

Regular vision screening in Malawian schools could provide the opportunity to detect vision problems in children early and prevent learning difficulties associated with uncorrected vision impairments. However, due to severely limited government resources, initiatives must in the first instance be led and funded by NGOs. In order to achieve sustainability, NGOs must **work collaboratively with the school health technical working group** (which includes representatives from the Ministries of Health, Education and Agriculture), to advocate for partial government funding.

Due to eye care being a deprioritized area of health in Malawi, if school vision screening is to work towards sustainability it needs to be **low cost**, and have **long term partial NGO funding**. While partial reliance on NGOs is not a sustainable solution to financing, such an approach may create an environment whereby eventual government funding can be facilitated over time.

A solution to provide **low cost spectacles** for children is desperately needed in Malawi. Considering the minimum daily wage of the lowest paid government worker is \$0.73 USD,¹⁹⁶ and 50.7% of the population live below the poverty line,¹⁹⁵ the average price of spectacles (\$20 USD) is currently unaffordable to the majority of the population. It is recommended that any school vision screening program consider distributing low-cost spectacles, to ensure children obtain treatment as well as care.

A possible approach to school vision screening would be to **train teachers in visual acuity and basic screening** of common eye diseases, an idea that was widely supported by stakeholders, educators, and parents. Similar NGO programs training teachers in malaria control/drug administration in Zomba have been largely successful, yet lack sustainability. Should teachers be trained in vision screening, appropriate **support, equipment and clear referral pathways** from schools to health services must be in place.

In any case, potential school vision screening programs (whether conducted by teachers or health practitioners) need to firstly be discussed with and supported by parents and community members to **build trust and awareness around the importance of eye care and spectacle wear**, particularly in the context of sociocultural factors discussed in this case study. This can be aided by the fact that Malawi has an increasing number of optometrists in the public sector who can provide the appropriate referral points for further management. The holistic link between **good eye health and school performance** should be emphasized in community health awareness initiatives.

Physical and systemic infrastructure to support eye care coordination, and referral between schools (teachers) and community health services (HSAs/nurses) is currently non-existent and would need to be considered in any program initiatives. Existing systems within the education sector, such as school health and nutrition logbooks that are used by teachers to record student health information, may be used as a starting point to refer students to community health centers for further screening. **Transportation** to attend referrals to district health centers in rural areas should be considered.

The key facilitators and barriers of children's access to school eye health interventions in Malawi is shown in Table 14.

Table 14: Key issues that impact children's access to school eye health interventions in Malawi

Facilitators		Barriers	
Supply side	Demand side	Supply side	Demand side
Free eye care, provided under the EHP (Malawi's universal health care package). Structural mechanisms in place that support collaboration between ministries of health and education. General school screening (including basic vision screening) conducted in limited capacity within urban centres.	Cultural acceptance of vision screening conducted by teachers.	Lack of public funding and resources (including human resources). Reliance on NGO sector for school eye health interventions. Lack of referral pathways/coordination between schools and health services. No school screening occurring in rural areas. High cost of spectacles and ocular medication.	Responsibility to access eye care solely with parent. Severely limited user resources. Indirect costs of accessing hospital eye care, including transport. Cultural/religious factors inhibiting trust, and awareness of eye care services, and spectacle wear. Parents' disbelief in child's vision problems.



10.3 Pakistan

10.3.1 Introduction

The data described in this case study were collected in the cities of Islamabad, Mirpur and Lahore, so do not necessarily reflect the experiences of patients, NGO workers, educators or healthcare professionals in other provinces. The views of policymakers were also not incorporated. Nonetheless, this case study provides a contextual overview of the socioeconomic, structural and sociocultural factors impacting accessibility to child eye health within education systems in Pakistan. Different stakeholders from the education and healthcare sectors, as well as users, namely teachers and children, shared their perspectives.

10.3.2 Government approach to eye health

There is currently no school health policy or school vision screening program that covers the whole country. The 2009 National Health Policy does not mention school health at all. According to the World Health Organization's (WHO) report for Pakistan, health investment is low – 0.5–0.8% of GDP is spent on health (86.8% out-of-pocket expenses).^{197,198} Progress has been made in blindness prevention though:

the prevalence of blindness was found to be 0.9% in the second National Survey on Blindness and Vision Impairment, undertaken in adults over 30 years in 2002-2004, half the rate noted in the first survey 15 years earlier.¹⁹⁹ Service delivery interventions stem from the National Program for Prevention and Control of Blindness, and their 5-year national eye care policies. Provincial eye care committees subsequently develop their own 5-year plans. These documents are submitted to the Ministry of Finance for resource allocation. Finally, the provincial committees receive budget and roll out their services, although it is unclear what provincial budget allocations are. Some of the provinces, such as Punjab, are very active in service, while others are less so, depending on leadership, issues around political instability and human resources. As such, government policy and the nature of service delivery of eye health care in Pakistan varies greatly between different provinces.

10.3.3 Service delivery

Service delivery functions across three levels – tertiary (namely, teaching hospitals), secondary (district and sub-district headquarter hospitals) and primary (basic health units and rural health centers).

The primary care level is resourced by around 100,000 workers²⁰⁰ who work primarily in rural and urban slum areas, focus on mother/child health and have received training in child eye health by organizations like the WHO. And yet, much of the service delivery occurs at the tertiary level, with less than 30% of the population using primary care facilities.²⁰¹

The reasons for this under-utilization include a lack of health care professionals, high rates of absenteeism, poor quality of services and inconvenient facility locations. Although the secondary and tertiary levels of care are well-established and robust, the tertiary sector is weighed down by basic care delivery that should have been addressed at the primary level.

In addition to the MoE, the Ministry of Special Education and Social Welfare provides schooling to children with disabilities including children with vision impairment. Within this system, children with vision impairment receive meals, transportation, uniforms, a stipend and other resources at no cost (vision aids are not a typical inclusion). In some instances, children with low vision who can be educated in the mainstream system are enrolled in special education in order to access these resources.

10.3.4 Referral pathways for school-aged children

In 2005, National Commission for Human Development (NCHD) launched its School Health Program in 16 districts. It was funded by the Bill and Melinda Gates Foundation and closed in 2010.

The program covered 2.17 million students and included eye health screening in schools. In 2006-2007, ^{43,543} children were found to have poor vision and were provided with spectacles. This program was replicated in 12 districts in 2007, 2008, 2009 and 2010, reaching 2.5 million more children.²⁰²

There are currently three methods by which children nationwide can access eye health care:

- Children are identified by teachers trained in child eye health and vision screening

- In the province of Punjab, children are screened by a school health and nutrition supervisor, who has a similar role to a school nurse (NB: Punjab, the largest province of Pakistan, has initiated a Public Health Sector Reform Project in partnership with UNICEF and other development partners in 2009 and the school health and nutrition supervisor are recruited under this project. There are currently no such projects in other provinces)
- Children are screened via a program delivered by international NGOs, in partnership with all three tiers of government. For example, the Brien Holden Vision Institute trains teachers to conduct screenings and upgrades eye health facilities at the district level. Children access spectacles in schools via NGOs.

If a vision problem is identified, parents are notified, and it is the parent's responsibility to seek care from the nearest basic health facility. The availability and quality of equipment across the facilities, and patients' ease of access to the facility itself, differs from province to province. For instance, primary care centers in Punjab, the wealthiest province in the country containing 55% of the population, have better quality equipment. However, distance and transportation for those living in Balochistan province is a significant issue; outside of having an awareness of their child's vision problems, parents are not likely to travel on public transport for many hours to reach treatment facilities.

10.3.5 Accessibility of child eye health within Pakistani schools

Using the methodology outlined in Section 8, participant interviews and FGDs were analyzed using the Peters et al. (2008) accessibility framework. Figure 19 shows the different areas of accessibility, and where key barriers were identified within each. Similarly to the Colombian and Malawian case studies, the sample was **not reflective of all geographic contexts** and therefore, Figure 19 should not be read as representative of the experiences of those located in provinces located further from urban centers.

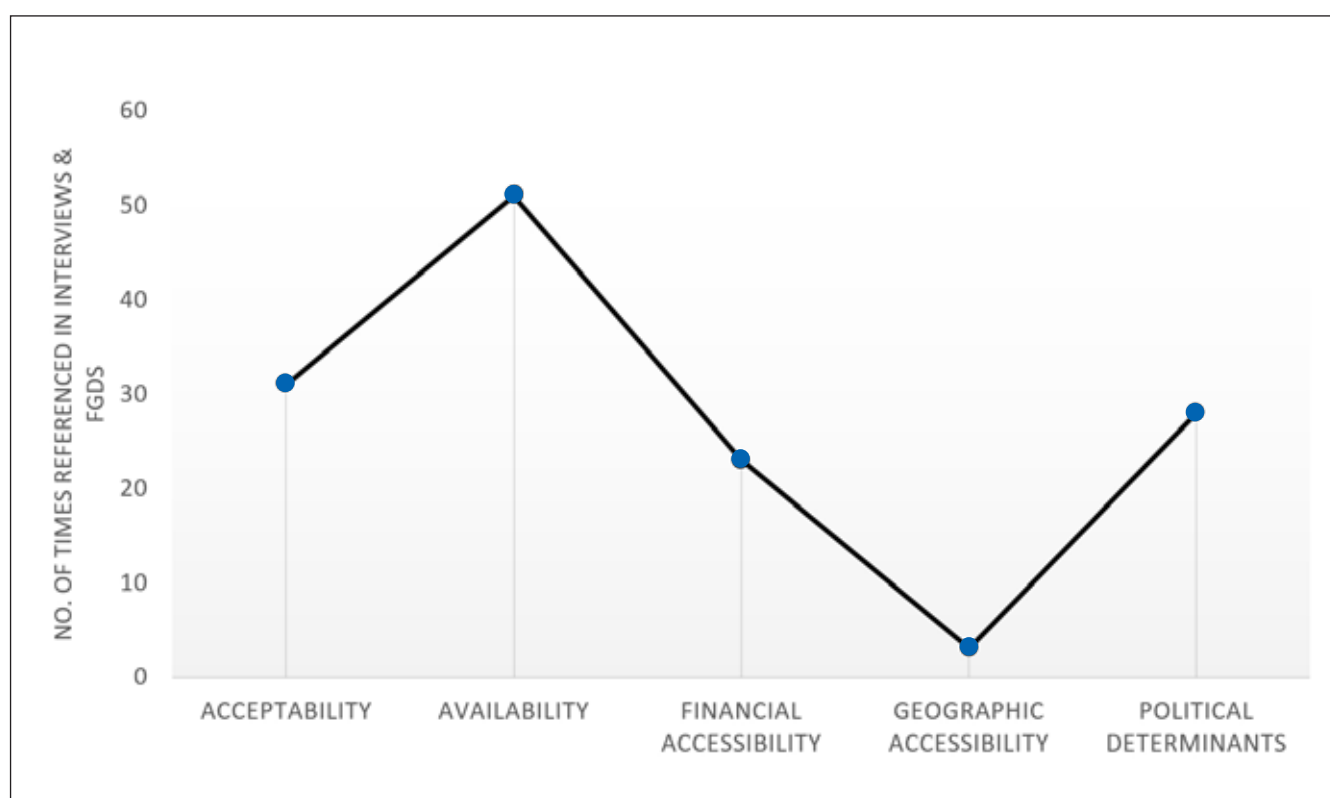


Figure 19: Barriers to child eye health within Pakistani schools identified by participants and disaggregated using Peters et al. (2008) framework.

10.3.6 Socioeconomic factors

Within the government system, which provides coverage to 30% of the population, screening, examination and treatments are free to users, as is some medication, but not spectacles.²⁰¹

In addition, there are national organizations like the Layton Rahmatulla Benevolent Trust with a network of 19 hospitals and 56 community eye health centers, which offer a quality of care that is significantly superior to the public system for free, or by donation according to financial capacity.

Despite the government offering free eye examinations in public hospitals, the respondents outlined a **number of issues** that render this approach inaccessible to people with limited financial means. These include difficulties around securing appointments, the high cost of medicines and spectacles, which the patient is required to purchase themselves, especially if they are in the private system, and a lack of availability of these medicines in hospitals.

Further, despite the apparent availability of free care, the study revealed **affordability** as the second highest concern to the perceived prioritization of eye health by the government. Fifteen participants mentioned the high cost of treatment and spectacles in various contexts. A parent/guardian focus group articulated this issue as follows:

- P2: Yes, it is expensive. Salary is mostly spent on many other necessary things.*
- P3: It is difficult to afford as my husband is a daily wager.*
- P4: It is expensive in a way that my children like the fashionable spectacle frames which is difficult for me to provide and it cost almost PKR 2000, which is expensive.*
- P5: It is expensive. All my five children have weak eyesight. Therefore, it costs too much when I provided to all.*
- P6: Fancy frames of spectacles are expensive.*
- P8: If I consult the private doctor and the optics shop, it is expensive.*
- P9: Most of the children of low-income families or poor do not wear glasses because spectacles are expensive.*

Table 15 summarizes the respondents' perception of the cost of spectacles and what they think people with limited financial means are able to afford.

10.3.7 Political/systemic factors

Despite the theoretical existence of provincially-executed eye care services, there seems to be little knowledge of any such policies among the stakeholders interviewed in this study. This suggests that the policy and eye health services formally offered by the provincial governments are poorly communicated to stakeholders or not executed in practice. The perception that the **government does not prioritize eye care** emerged in this study as the biggest barrier to children accessing care. Respondents cite a lack of effort, lack of priority, dedication, awareness and funding, on the part of the government. A school principal ranked eye health 1 out of 10 on a scale of how important they think the issue is to the government (with 0 being not at all important and 10 being most important) remarking:

"I have seen many government schools and colleges who are striving for books, teachers and infrastructure. When they do not consider education so important how to expect eye health care services to be a priority from such a government." (Principal, Private School Rawalpindi)

Interviewed eye care professionals echoed this sentiment.

"If it was priority for the government than there would not be any eye issue related to eye health care services within schools and even the teachers would also be trained up till now. It is an issue because the government does not prioritize the eye problem." (Public Health Optometrist, Rawalpindi)

"In general, the government is not interested in policy making. However, they do provide funds so as to report the budget allocated and spent on specific constituencies and districts." (Community Ophthalmologist, Lahore)

Similarly, there is the **perception that eye checks are not provided in schools** outside of NGO involvement, which was reflective of statements from eye health professionals.

"No, there is no such thing like eye health policy in schools in Pakistan." (Provincial Eye Care Coordinator, Mirpur)

"There is no school health policy in Pakistan in general and no school eye health policy specifically. In less than 1% of the schools, that I visited, has any kind of school health policy. They inspect the overall health and hygiene of a student." (Private Optometrist, Islamabad)

Table 15: Perceptions of spectacle cost and affordability for people with a low-income

Respondent	Perceived spectacle cost	What people think they can afford
Provincial coordinator, Mirpur	200-600 PKR (\$1.80 - \$5.40 USD)	50-100 PKR (\$0.45-\$0.90 USD)
Community ophthalmologist, Lahore	400 PKR (\$3.60 USD)	Not stated
District education officer, Mirpur	500 PKR (\$4.50 USD)	Not stated
Optometrist, Mirpur	500 PKR (\$4.50 USD)	Not stated
Parent/guardian	2000 PKR (\$18 USD)	Not stated
Secretary of Rotary Club, Rawalpindi	1000 PKR (\$9 USD)	500 PKR (\$4.50 USD)
Social welfare training officer, Islamabad	Not stated	200 PKR (\$1.80 USD)

It was identified by NGO and government stakeholders alike, that at the district level, some schools had attempted to incorporate school health policies into their curriculum.

"There is no formal school health policy. However, at district level, some schools with the support of District Coordination Officer (DCO) have designed informal health policy documents. These documents are designed as per the district's requirements. However, the policy is not only altered by the authorities but also sometimes get overlooked." (Community Ophthalmologist, Lahore)

"There is no specific school health policy of government; however, the general health policy of Ministry of Health covers many areas. It might be possible that school health policy, not specifically, is included, however, it might exist only on paper not on ground." (Department of Social Welfare & Training Representative)

Similarly, the respondents reported not being aware of any system or **referral pathway that links the health and education systems** together.

Variance between the **private and public education and health settings** was identified in this case study. The representative from the Department of Social Welfare and Training advised that private schools would plan and execute their own health policy, which did not happen within government schools. Adding that elite students might have access to free medical check-ups based on familial connections, via donations from government departments, private organizations and NGOs to the school.

According to an NGO representative from the Brien Holden Vision Institute, there is also a perception among respondents that public health services are low quality, especially when it comes to eye care. However, many healthcare professionals split their time between public health and private practice, so it is not clear to what extent this view is based on experience and how much it might be influenced by other factors, such as the individual's relationship to the government in other areas of life.

Asked for examples of where eye care in schools was "making progress", respondents referred to **NGO facilitated interventions**. An optometrist working in the Mirpur, Azad Jammu and Kashmir areas stated:

"No one works in school eye health program in [Brien Holden Vision Institute] program districts. Fred Hollows is working in district Muzaffarabad (capital city of Azad Jammu and Kashmir) which has been implementing the same program. Sight Savers is also working on eye health care but they are not working in schools, however they are training lady health workers." (Public Health Optometrist, Mirpur)

"Medical check-ups and other related issues are based on visits by different organizations." (Teacher, Private School, Rawalpindi)

Finally, the **availability of screening equipment** emerged as a barrier to eye care, particularly in relation to the potential for teachers to undertake screening. Hospitals may be equipped periodically, however whether workers are trained in using this equipment is unknown.

"The teachers and staff are not trained and do not have sufficient screening materials as well" (Public Health Optometrist)

"Number one, trainings should be provided on eye health care to teachers. And number two eye screening equipment should be provided." (Principal, Private School Pakistan).

10.3.8 Sociocultural factors

A spectacle compliance study among children in Thatha Sindh district, carried out by Brien Holden Vision Institute and Al Ibrahim Eye Hospital, Malir, Karachi (in press) showed that when given free spectacles, the participant compliance rate was 40%.

This points towards factors outside of availability, financial, or geographic factors. Several respondents mentioned a general **lack of awareness of eye health as a significant issue**.

“Even the children are not taken by their parents to hospital for the eye screening and the reason for it is the lack of awareness among the community.” (Ministry of Education Representative)

“Lack of awareness is the barrier. Moreover, people take eye health issues lightly because eye issues are mostly painless and, therefore, they do not concern more about it.” (Public Health Optometrist, Rawalpindi)

This lack of understanding of the significance and implications of ocular issues can **have serious consequences**. One optometrist posited:

“The teacher should know about the student vision problem for better education. If the teacher does not know about the student eyesight problem, he/she might consider him/her weak in studies (leading to his drop out from school) and the student might end up with child labour or pursue religious studies in Madrassah (religious seminary, which in some contexts, have been linked with extremism).” (Public Health Optometrist, Mirpur)

The study also uncovered some **stigma around spectacle wear**. The children’s focus group had mixed responses:

P1: I saw a girl in a street who wears glasses. However, she does not look nice and stylish when she wears glasses.
P2: My sister wears glasses and she looks good. However, I dislike wearing glasses because it does not suit me.
P5: Only one girl wears glasses and she does not look good with the spectacles.

P6: There are total 18 students in my class. Out of these, four of my classmates wear glasses. I personally like those who wear glasses.
(Children, Private School Rawalpindi)

The feedback from parents carried similar views:

P2: Usually, the students make excuses that they have forgotten to wear it.
P3: Girls think that glasses do not suit them.
P4: Children do not like to wear glasses because they feel awkward in it.
P6: Most of the children hate spectacles because their friends make fun of them.
(Parents, Public School Rawalpindi)

The issue of **gender** also impacts on access to treatment, in situations where screening or examination by a male is not seen as appropriate for women.

“In this school, most of the girls of higher classes wear hijab so they may sometimes feel hesitant to get check-up from male optometrist or trained screener.” (Teacher, Private School, Rawalpindi)

Furthermore, according to the experience of the public health optometrist speaking on the basis of prevailing patriarchal traditions in the country, in a family with limited funds but multiple children who require glasses, it is likely that only the male child or children would receive spectacles. She continues to say that different types of stigma are attached to men and women in relation to spectacle use. For women, wearing glasses could have implications on their chances of securing marriage and employment.



10.3.9 Recommendations: Pakistan

Given the positive feedback around the potential of teacher screenings, it is recommended that initiatives focus on, where possible, training teachers **in child eye health and basic screening** of common eye diseases and equipping them with the tools necessary to carry out screening. If for budgetary or other reasons this is not possible, a health promotion campaign which emphasizes the teacher's role in observing students and making parents aware of their child's vision problems would be useful.

It would be worthwhile undertaking research to understand how **government policy is implemented in practice** across different regions in order to identify whether 1) patients do not seek out existing resources because they are not accessible, or 2) patients don't know that various resources are available and hence aren't seeking treatment.

Further, an initiative which outlines instances of effective collaboration between provincial government bodies and NGOs, would be useful. In the absence of consistent government engagement on eye health issues across different provinces, continued **NGO involvement** is endorsed. This study revealed positive progress made by NGO initiatives, which provided necessary expertise and tools and were mobile enough to deliver services in more remote locations. Initiatives should also focus on securing stronger relationships with schools.

The key facilitators and barriers of children's access to school eye health interventions in Pakistan is shown in Table 16.

Table 16: Key issues that impact children's access to school eye health interventions in Pakistan

Facilitators		Barriers	
Supply side	Demand side	Supply side	Demand side
Adoption of a national school health policy. Child eye health awareness and promotion campaign.	Cultural acceptance of vision screening conducted by teachers. Moderate spectacle compliance among children (40%). NGO programs providing eye care in collaboration with government.	No school health policy. Low government prioritization of eye health. Affordability of spectacles and medication. Poor knowledge or trust in policymakers and government engagement with eye health as an issue. Inequity between public and private/ NGO systems. Limited availability of screening equipment.	Perceived affordability of examination and treatment. Indirect costs of accessing eye health care. Poor knowledge of referral pathways between the health and education systems. Stigma associated with spectacles. Gender as a barrier to perception of spectacles and a factor in selecting medical practitioner.

Discussion

To the authors' knowledge, this is the first global systematic review of children's access to eye health services within the education sector in low- and middle-income countries. The studies identified in this systematic review focused on epidemiology, willingness to pay, spectacle compliance and knowledge and perceptions. The evidence presented here has synthesized the learnings from the global evidence base to construct a collection of facilitators and barriers from the perspective of both the suppliers of services, as well as the users of these services.

The number of included studies was proportional to the number of countries in each income group — 19% of studies were from low-income countries (which represent 22% of total LMICs); 37% were from lower-middle income countries (which are 38% of total LMICs), and 44% were from upper-middle income countries (which are 40% of total LMICs).⁶⁹ In terms of evidence across World Bank Regions, research was well represented in East Asia

and the Pacific and South Asia, with multiple studies conducted in China and India. The high proportion of studies from China is likely due to its large population, yet may also be attributed to the growing health concern of high myopia, whereby half of children with vision impairment globally are situated in China,¹⁹⁴ and projected to reach the rate of 100 million by 2020.²⁰³ Europe and Central Asia, and the Middle East and North Africa regions however, were under-represented. The overall dearth of eye health literature and prevalence rates of blindness and vision impairment from these regions,²⁰⁴ suggest possible low prioritization in children's eye health. While non-English papers were reviewed, it is possible that articles from the Middle East and North Africa region published in Arabic may have been missed, as key word searches were conducted in English. Furthermore, we observed that the number of publications each year were increasing over time, indicating that our search strategy was unlikely to exclude a significant number of publications prior to the year 2000.



Children were the largest participant group in the systematic review, whereas health professionals and schools staff, particularly those from low-income countries were the least represented participant group. As identified in Section 9.2, when the literature has a higher focus on patient behavior, rather than systemic factors it should not be assumed that there is a correlation between the quantity of literature and location of the most issues or gaps. Indeed, the tendency to individualize the problem of poor health is prominent in public health research,^{205,206} despite international recognition that the social (and systemic) determinants of health shape disease causation more so than agency.^{207,208} This bias supports the need for more systems-focused research in eye health, including how eye health systems function and connect with general health systems, how the stakeholders interact and the various possible paths to meeting population needs in a way that is equitable and responsive.^{66,67} Findings from the Colombian case study also reiterate the role of government in either facilitating or preventing accessibility at the systems level.

One of the most commonly reported findings, was the need for health education

programs to reduce community eye health misconceptions, reduce stigma, reduce use of inappropriate traditional medicines, and increase understanding around the need for eye health services. Misconceptions varied by participant group and location, however a common issue across the literature was that glasses can harm or weaken children's eyes. This widespread misconception has significant implications for child eye health programs generally, as well as those that are school-based, as an unwillingness to purchase or obtain spectacles by parents and children is likely to make a significant goal of eye health programs (i.e. reduce uncorrected refractive errors) ineffective. While many school health interventions that resulted in positive knowledge changes were identified, there was only one study that demonstrated improvements in attitudes towards spectacle wear as a result of an intervention⁸⁹ — this is could be an area for future research.

Children with special needs face additional issues in accessing eye health care in schools. There were numerous misconceptions reported by teachers in regards to children with albinism, as well as rejection and discrimination in some settings.



Additionally, the literature reported limited awareness of the availability of schools for children who are blind, despite some reports of positive experiences by parents.

The costs of services and spectacles are significant barriers for children accessing eye health services. From a systems perspective, the policy and macro environment has a significant role in potentially alleviating these barriers, as most barriers were in some way connected to the cost of services, affordability or willingness to pay. If current advocacy efforts from the eye care sector to include spectacles on the WHO's Priority Assistive Products List and eliminate the import duties on low-cost spectacles are successful,²⁰⁹ this will assist in providing equitable access to spectacles for children. While health promotion interventions can certainly influence the amount 'end-users' are willing to pay for services and spectacles, we also identified numerous factors that can reduce costs of programs. Multidisciplinary support and cooperation from relevant ministries will often provide the prioritization that is required for eye health to be included in relevant policies

or school health programs. Additionally, we identified practical ways to reduce the program costs, including: sourcing instrumentation from local tertiary institutions, and limiting false-positives associated with vision screening, through appropriate intervention design, and carefully consider spectacle provision guidelines. In areas with high rates of uncorrected refractive errors, the success of an eye health program will rely on cost-effective spectacle delivery and high rates of spectacle wear. In LMIC contexts, spectacle affordability is crucial. While this is influenced by the macro/policy environment (i.e. commitment to free specs or low costs spectacles for children), user acceptability plays an essential role. We identified several factors that have been shown to be associated with a higher willingness to pay for spectacles. While some of these factors are self-perpetuating and require an initial willingness 'threshold', (for instance, previous/current ownership of spectacles and regular wear of spectacles), some of the factors are potentially modifiable through targeted health promotion activities (i.e. a recognized need for spectacles, or an understanding that vision improves with spectacle wear).



Geographic accessibility is a slightly more intractable issue, as it relies on broader infrastructure, roads, transport and amenities. The inequities that can exist as a result of geography were apparent in the Malawian case study. Although the in-depth interviews were not conducted in rural areas, there is ample evidence that accessibility to children in rural areas is practically non-existent. Additional challenges are faced in rural settings when spectacles or follow-up services are required. The literature reported that mobile services or outreach eye care are effective at improving accessibility to children particularly in rural areas, however we also noted that these services are mostly provided by NGOs, rather than the broader health service. The provision of programs by NGOs limits sustainability.

When considering the 'supply' perspective, we found that there are a number of factors that facilitate accessible services for children. When using teachers as the initial screening personnel in a school eye health program, the key aspects for success reported in the literature were a good training program, and

support from principals, staff and parents. The literature reported that there are many benefits to using teachers in this role, however the case study in Colombia revealed that in this context there was a lot of skepticism about the use of non-medical personnel in performing eye health screening. This highlights the importance of understanding the local context, before attempting to implement any health intervention.

The concept of demand for services in the context of children's eye health services, defined here as availability, links closely with acceptability, as this interfaces directly with demand for services. We identified that there is a gap in the literature relating to a demand for follow-up (i.e. specialist) services, after a school eye health intervention has taken place. While there were two studies that reported a reluctance from parents to navigate this next step, the ultimate effectiveness of a school eye health program relies on delivery of these aspects of eye care. This could be a focus of future research.



Furthermore, while availability of services is somewhat dependent on resources, planning school eye health interventions can also be constructed around the predicted prevalence of vision impairment in children. Areas with high vision impairment and schools for special needs are likely to benefit more with comprehensive eye care within schools, whereas a potentially more practical approach to areas with a moderate prevalence of vision impairment (e.g. rural areas) would be vision screening program.

It is worth stressing that the results of this review appear to be biased towards patient behavior and should not be quantified to suggest that this is where most issues or gaps lie. This point also demonstrates gaps in the literature that would benefit from further research.

Although this systematic review was rigorous and carefully executed and employed a robust conceptual framework, some limitations exist. Firstly, the peer-reviewed literature used in this review consisted of a broad range of study types that was both qualitative and quantitative in nature. However our use of the conceptual framework adapted from Peters et al.⁶¹ allowed us to consistently analyze the data on the factors related to children's access to eye health services within schools, and identify facilitators and barriers. Secondly, there are likely to be many relevant findings in program reports and evaluations published in the 'grey' literature, however it was not possible due to time, and resource constraints to also include non-peer reviewed literature.

Thirdly, in the data collection and extraction phase, we were unable to perform dual coding due to time and resource constraints. This may have resulted in some potential barriers and or facilitating factors being missed due to interpretive differences among the two researchers and creating a subsequent risk of bias. Also, our 'Education Sector' search terms were too broad, resulting in a significantly large initial batch of citations. However, the use of web-based systematic review software facilitated de-duplication and swift review by two reviewers, as well as simplifying conflict resolution. Finally, our findings that relate to the broader health system were derived from articles that had some relevance to school eye health services. As a result these findings cannot be generalized, and are not likely to be representative of child eye health services. A separate review would be necessary to examine this aspect of children's eye health services generally.

This review also has many strengths, as it was comprehensive and included articles from 38 countries, and six World Bank regions. Studies that were published in languages other than English were also included, and there were only 13 full text articles that we were unable to locate. Additionally, the use of three case studies, in Colombia, Malawi and Pakistan allowed triangulation of the systematic review results and a deeper exploration of some of the findings, across varied geographic, socioeconomic, and political backgrounds.

Recommendations

A qualitative analysis of the 133 studies included in our systematic review revealed numerous and complex factors that impact the accessibility of child eye care in education settings. We have summarized the following list of recommendations for those seeking to improve child eye health in education settings (Table 17).

Table 17: Recommendations

Policy & Macro • Multidisciplinary support and cooperation from relevant government ministries to provide the prioritization that is required for eye health to be included in relevant policies (notably school health policy). • Ensure a ministerial plan and an associated budget are in place to materialize outcomes through school health programs. • Where NGOs are providing school eye health interventions, ensure a communications and collaboration plan is in place with government ministries with the aim to work towards sustainable funding of programs. • Consider community-based approaches for delivering eye care, spectacles, low vision/adaptive devices and rehabilitation to children with special needs and out-of-school children.
Acceptability • Conduct behavior change interventions to increase positive perceptions and awareness of eye health care services and treatments (spectacles, medications) among parents/guardians, children and the wider community. This can be addressed through a multi-pronged approach to child eye health promotion that focuses on upstream (potential vision screeners such as teachers, school nurses, community health workers) and downstream education (parents/guardians, children, community), targeted at reducing misconceptions and stigma. Factors related to culture, gender, and religion must be carefully considered, with a focus on the link between good vision and child development. • Strengthen the training mechanisms for teachers to conduct basic vision screening. Either through delivery at schools, or inclusion in teacher training curricula.
Availability • Increase the availability of school vision screening programs to enhance early detection and prevention of childhood vision impairment, ideally in conjunction with existing school health interventions. In low-income settings teacher training in basic vision screening should be considered as a cost effective component of school eye health. • Ensure vision screening criteria are carefully developed for vision screeners, such as teachers, health nurses, certified medical assistants and key informants. • Where existing school eye health interventions are present, investigate the presence and/or effectiveness of referral pathways from education systems to health systems. • Increase availability of eye health information through the development and dissemination of upstream and downstream eye care resources targeted at both schools and communities. • Ongoing training and education of vision screeners to maintain effective referrals from education systems to health systems. • Increase availability of low vision devices and mobility training for children with low vision or blindness. • Ensure that vision screening tests are age and developmentally suitable, children's vision screening outcomes should not be affected literacy, if the appropriate test choice is made.

Financial Accessibility

- More evidence on the cost-effectiveness of various school eye health approaches.
- Ensure the provision of eye care services within schools are cost effective, including balancing the supply and demand of spectacles where provided. Consider the use of ready-made spectacles, where appropriate.
- Where needed, ensure access to low cost or free spectacles, particularly in low-income contexts
- Reduce the import duties on low-cost spectacles; with advocacy for spectacles to be included on the list of essential assistive products.
- Consider new and emerging technologies that will make school eye health interventions most cost-effective

Geographic Accessibility

- Advocacy of school-based eye care as a key facilitator to geographic accessibility for rural children.
- Consider geographic barriers, including indirect costs (travel, time spent), to fulfilment of school-based referrals to the health system.
- Where appropriate consider the provision of ready-made spectacles to reduce geographic barriers linked to service provider/user location.
- Multidisciplinary support and cooperation from relevant government ministries to provide the prioritization that is required for eye health to be included in relevant policies (notably school health policy).
- Ensure a ministerial plan in place to materialize outcomes through school health programs.

References

1. WHO. International Statistical Classification of Diseases and Related Health Problems 10th Revision. (2016). Available at: <http://apps.who.int/classifications/icd10/browse/2016/en>. (Accessed: 9th October 2017)
2. WHO. Priority eye diseases. Refractive errors in low vision. WHO (2014). Available at: <http://www.who.int/blindness/causes/priority/en/index4.html>. (Accessed: 29th March 2018)
3. Pascolini, D. & Mariotti, S. P. Global estimates of visual impairment: 2010. *Br. J. Ophthalmol.* 96, 614–8 (2012).
4. WHO. Universal Eye Health: A Global Action Plan 2014 - 2019 (2013). Available at: https://www.who.int/blindness/AP2014_19_English.pdf
5. WHO. Visual Impairment and Blindness, Fact Sheet No. 282. (2014). Available at: <http://www.who.int/mediacentre/factsheets/fs282/en/>.
6. Shashidhar, S., Rao, C. & Hegde, R. Factors affecting scholastic performances of adolescents. *Indian J. Pediatr.* 76, 495–499 (2009).
7. Cessie, S., He, M. & Rozelle, S. Effect of providing free glasses on children's educational outcomes in China: cluster randomized controlled trial. *BMJ* 5740, 1–12 (2014).
8. Hopkins, S., Sampson, G. P., Hendicott, P. L. & Wood, J. M. Vision problems and reduced reading outcomes in Queensland schoolchildren. *Optom. Vis. Sci.* 94, 345–352 (2017).
9. Kelly, K. R. et al. Slow reading in children with anisometropic amblyopia is associated with fixation instability and increased saccades. *J. AAPOS* 21, 447–451.e1 (2017).
10. Birch, E. E. & Kelly, K. R. Pediatric ophthalmology and childhood reading difficulties: Amblyopia and slow reading. *J. AAPOS* 21, 442–444 (2017).
11. Ponsonby, A. L. et al. Children with low literacy and poor stereoacuity: An evaluation of complex interventions in a community-based randomized trial. *Ophthalmic Epidemiol.* 16, 311–321 (2009).
12. Narayanasamy, S., Vincent, S. J., Sampson, G. P. & Wood, J. M. Visual demands in modern Australian primary school classrooms. *Clin. Exp. Optom.* 99, 233–240 (2016).
13. Narayanasamy, S., Vincent, S. J., Sampson, G. P. & Wood, J. M. Impact of Simulated Hyperopia on Academic-Related Performance in Children. *Optom. Vis. Science* 92, 227–236 (2015).
14. Narayanasamy, S., Vincent, S. J., Sampson, G. P. & Wood, J. M. Simulated astigmatism impairs academic-related performance in children. *Ophthalmic Physiol. Opt.* 35, 8–18 (2015).
15. Narayanasamy, S., Vincent, S. J., Sampson, G. P. & Wood, J. M. Simulated hyperopic anisometropia and reading, visual information processing, and reading-related eye movement performance in children. *Investig. Ophthalmol. Vis. Sci.* 55, 8015–8023 (2014).
16. Harvey, E., Miller, J., Twelker, D. & Davis, A. Reading Fluency in School-Age Children with Bilateral Astigmatism. *Optom. Vis. Science* 93, 118–125 (2016).
17. Gupta, M., Rana, S. K., Mittal, S. K. & Sinha, R. N. P. Profile of amblyopia in school going (5–15 years) children at state level referral hospital in Uttarakhand. *J. Clin. Diagnostic Res.* 10, SC09–SC11 (2016).
18. Roch-Levecq, A.-C., Brody, B. L., Thomas, R. G. & Brown, S. I. Amblyopia, Preschoolers' Cognitive Abilities and Effects of Spectacle Correction at 6-Month Follow-Up. *Arch. Ophthalmol.* 126, 252–258 (2008).
19. Hannum, E. & Zhang, Y. Poverty and Proximate Barriers to Learning: Vision Deficiencies, Vision Correction and Educational Outcomes in Rural Northwest China. *World Dev.* 40, 1921–1931 (2012).
20. Dusek, W., Pierscionek, B. K. & McClelland, J. F. A survey of visual function in an Austrian population of school-age children with reading and writing difficulties. *BMC Ophthalmol.* 10, 16 (2010).
21. Williams, W. R., Latif, A. H. A., Hannington, L. & Watkins, D. R. Hyperopia and educational attainment in a primary school cohort. *Arch. Dis. Child.* 90, 150–3 (2005).
22. Rosner, J. & Rosner, J. The relationship between moderate hyperopia and academic achievement: how much plus is enough? *J. Am. Optom. Assoc.* 68, 648–50 (1997).
23. United Nations. Sustainable development goals - United Nations. (2017). Available at: <http://www.un.org/sustainabledevelopment/sustainable-development-goals/>. (Accessed: 18th February 2018)
24. United Nations Department of Economic and Social Affairs. Sustainable Development Goals. (2015). Available at: <https://sustainabledevelopment.un.org/?menu=1300>. (Accessed: 8th January 2018)
25. UNESCO. Sustainable Development Begins with Education: How education can contribute to the proposed post-2015 goals. 2017, (2014).
26. WHO. Global data on visual impairments 2010. (2012).
27. Gogate, P., Gilbert, C. & Zin, A. Severe visual impairment and blindness in infants: causes and opportunities for control. *Middle East Afr J Ophthalmol* 18, 109–114 (2011).
28. Holden, B. A. et al. Global Prevalence of Myopia and High Myopia and Temporal Trends from 2000 through 2050. *Ophthalmology* 123, 1036–1042 (2016).
29. Saw, S.-M., Gazzard, G., Shih-Yen, E. C. & Chua, W.-H. Myopia and associated pathological complications. *Ophthalmic Physiol. Opt.* 25, 381–391 (2005).
30. Fledelius, H. C. Ophthalmic Changes From Age of 10 to 18 Years. *Acta Ophthalmol.* 60, 403–411 (1982).
31. Fulk, G. W., Cyert, L. A. & Parker, D. E. A randomized trial of the effect of single-vision vs. bifocal lenses on myopia progression in children with esophoria. *Optom. Vis. Sci.* (2000). doi:10.1097/00006324-200008000-00006
32. Gwiazda, J. E. Progressive-addition lenses versus single-vision lenses for slowing progression of myopia in children with high accommodative lag and near esophoria. *Investig. Ophthalmol. Vis. Sci.* (2011). doi:10.1167/iovs.10-6631
33. Cho, P. & Cheung, S. W. Retardation of myopia in orthokeratology (ROMIO) study: A 2-year randomized clinical trial. *Investig. Ophthalmol. Vis. Sci.* (2012). doi:10.1167/iovs.12-10565
34. Chua, W. H. et al. Atropine for the Treatment of Childhood Myopia. *Ophthalmology* (2006). doi:10.1016/j.optha.2006.05.062
35. Xiong, S. et al. Time spent in outdoor activities in relation to myopia prevention and control: a meta-analysis and systematic review. *Acta Ophthalmologica* (2017). doi:10.1111/aos.13403
36. Groenewoud, J. H. et al. Rotterdam Amblyopia Screening Effectiveness Study: Detection and Causes of Amblyopia in a Large Birth Cohort. *Investig. Ophthalmol. Vis. Sci.* 51, 3476 (2010).
37. Webber, A. L. & Wood, J. Amblyopia: prevalence, natural history, functional effects and treatment. *Clin. Exp. Optom.* 88, 365–375 (2005).
38. Lewis, T. L. & Maurer, D. Effects of early pattern deprivation on visual development. *Optometry and Vision Science* (2009). doi:10.1097/OPX.0b013e3181a7296b
39. Akhtar, S. et al. Prevalence of vitamin A deficiency in South Asia: causes, outcomes, and possible remedies. *J. Health. Popul. Nutr.* 31, 413–23 (2013).
40. Dowling, J. E. & Wald, G. Vitamin A Deficiency And Night Blindness. *Proc. Natl. Acad. Sci.* 44, (1958).
41. Bowman, R. J. C. et al. Natural history of trachomatous scarring in The Gambia: Results of a 12-year longitudinal follow-up. *Ophthalmology* (2001). doi:10.1016/S0161-6420(01)00645-5
42. Munoz, B., Aron, J., Turner, V. & West, S. Incidence estimates of late stages of trachoma among women in a hyperendemic area of central Tanzania. *Trop. Med. Int. Health* (1997). doi:10.1046/j.1365-3156.1997.d01-186.x
43. Oetting, W. S., Brilliant, M. H. & King, R. A. The clinical spectrum of albinism in humans. *Molecular Medicine Today* (1996). doi:10.1016/1357-4310(96)81798-9

44. Hertle, R. Albinism: Particular attention to the ocular motor system. *Middle East Afr. J. Ophthalmol.* (2013). doi:10.4103/0974-9233.114804
45. Gilbert, C. & Foster, A. Childhood blindness in the context of VISION 2020: the right to sight. *Bull. World Health Organ.* 79, 227–232 (2001).
46. Pueschel, S. & Gieswein, S. Ocular disorders in children with Down syndrome. *Down Syndr. Res. Pract.* (1993). doi:10.3104/reports.23
47. Black, P. Visual disorders associated with cerebral palsy. *Br. J. Ophthalmol.* 66, 46–52 (1982).
48. Black, K., McCarus, C., Collins, M. L. Z. & Jensen, A. Ocular manifestations of autism in ophthalmology. *Strabismus* (2013). doi:10.3109/09273972.2013.786733
49. Salt, A. & Sargent, J. Common visual problems in children with disability. *Archives of Disease in Childhood: Education and Practice Edition* (2014). doi:10.1136/archdischild-2013-305267
50. Sweeney, L. E., Seidel, D., Day, M. & Gray, L. S. Quantifying interactions between accommodation and vergence in a binocularly normal population. *Vision Res.* 105, 121–129 (2014).
51. Goldstand, S., Koslowe, K. C. & Parush, S. Vision, visual-information processing, and academic performance among seventh-grade schoolchildren: A more significant relationship than we thought? *Am. J. Occup. Ther.* (2005). doi:10.5014/ajot.59.4.377
52. Scheiman, M. & Wick, B. *Clinical management of binocular vision : heterophoric, accommodative, and eye movement disorders.* (Wolters Kluwer Health/Lippincott Williams & Wilkins, 2008).
53. Clayton, S., Chin, T., Blackburn, S. & Echeverria, C. Different setting, different care: integrating prevention and clinical care in school-based health centers. *Am. J. Public Health* 100, 1592–1596 (2010).
54. Gilbert, C., Minto, H., Morjaria, P. & Khan, I. *Standard Guidelines for Comprehensive School Eye Health Programs.* (Sightsavers International, London School of Hygiene and Tropical Medicine, Brien Holden Vision Institute, 2016).
55. Frick, K. D., Riva-Clement, L. & Shankar, M. B. Screening for refractive error and fitting with spectacles in rural and urban India: Cost-effectiveness. *Ophthalmic Epidemiol.* 16, 378–387 (2009).
56. Lester, B. A. Comparing the cost-effectiveness of school eye screening versus a primary eye care model to provide refractive error services for children in India. *Community eye Heal.* 20, 15 (2007).
57. UNESCO. *Inclusion of Children with Disability: the Early Childhood Imperative.* (2009).
58. WHO. *WHO global disability action plan 2014-2021. Better health for all people with disability.* (2015).
59. Levesque, J. F., Harris, M. F. & Russell, G. Patient-centred access to health care: conceptualising access at the interface of health systems and populations. *Int J Equity Heal.* 12, 18 (2013).
60. Penchansky, R. & Thomas, J. W. The concept of access: definition and relationship to consumer satisfaction. *Med. Care* (1981). doi:10.2307/3764310
61. Peters, D. H. *et al.* Poverty and access to health care in developing countries. *Ann. N. Y. Acad. Sci.* 1136, 161–171 (2008).
62. He, M., Xu, J., Yin, Q. & Ellwein, L. B. Need and challenges of refractive correction in urban Chinese school children. *Optom. Vis. Sci.* 82, 229–234 (2005).
63. Congdon, N. G. *et al.* The association between refractive cutoffs for spectacle provision and visual improvement among school-aged children in South Africa. *Br. J. Ophthalmol.* 92, 13–18 (2008).
64. Odedra, N., Wedner, S. H., Shigongo, Z. S., Nyalali, K. & Gilbert, C. Barriers to spectacle use in Tanzanian secondary school students. *Ophthalmic Epidemiol.* 15, 410–417 (2008).
65. Dudovitz, R. N., Izadpanah, N., Chung, P. J. & Slusser, W. Parent, Teacher, and Student Perspectives on How Corrective Lenses Improve Child Wellbeing and School Function. *Matern Child Heal. J* 20, 974–983 (2016).
66. Blanchet, K., Gordon, I., Gilbert, C. E., Wormald, R. & Awan, H. How to achieve universal coverage of cataract surgical services in developing countries: lessons from systematic reviews of other services. *Ophthalmic Epidemiol.* 19, 329–339 (2012).
67. Blanchet, K., Gilbert, C. & de Savigny, D. Rethinking eye health systems to achieve universal coverage: the role of research. *Br. J. Ophthalmol.* (2014). doi:10.1136/bjophthalmol-2013-303905
68. Liberati, A. *et al.* The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *PLoS Med.* 6, e1000100 (2009).
69. The World Bank. World Bank Country and Lending Groups. (2018). Available at: <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>. (Accessed: 7th May 2018)
70. Souto, R. Q. *et al.* Systematic mixed studies reviews: updating results on the reliability and efficiency of the Mixed Methods Appraisal Tool. *Int. J. Nurs. Stud.* 52, 500–1 (2015).
71. United National Development Programme. 2016 Human Development Report. (2016). Available at: <http://report.hdr.undp.org/>. (Accessed: 29th March 2018)
72. Glaser, B. G. & Strauss, A. L. *The discovery of grounded theory: Strategies for qualitative research.* (Routledge, 2017). doi:10.2307/2575405
73. Lewallen, S. *et al.* Evaluating a school-based trachoma curriculum in Tanzania. *Health Educ. Res.* 23, 1068–1073 (2008).
74. Teerawattananon, K. *et al.* Assessing the accuracy and feasibility of a refractive error screening program conducted by school teachers in pre-primary and primary schools in Thailand. *PLoS One* 9, (2014).
75. Yi, H. *et al.* Impact of Free Glasses and a Teacher Incentive on Children's Use of Eyeglasses: A Cluster-Randomized Controlled Trial. 160, 889–896.e1 (2015).
76. Alves Bezerra, T., Tavares Aleixo, A. & de Freitas Macêdo Costa, K. N. Relato de experiência da parceria saúde e educação no programa saúde na escola. *J. Nurs. UFPE / Rev. Enferm. UFPE* 10, 2262–2266 (2016).
77. Chaturvedi, S. & Aggarwal, O. P. Assessment of availability and working components of school health services in Delhi. *Indian J. Pediatr.* 67, 179–184 (2000).
78. Pereira, S. M., Blignault, I., du Toit, R. & Ramke, J. Improving access to eye health services in rural Timor-Leste. *Rural Remote Health* 12, 2095 (2012).
79. Ramke, J., du Toit, R., Palagyi, A., Williams, C. & Brian, G. Public sector refraction and spectacle dispensing in low-resource countries of the Western Pacific. *Clin. Experiment. Ophthalmol.* 36, 339–347 (2008).
80. Adhikari, S. & Shrestha, U. Validation of performance of certified medical assistants in preschool vision screening examination. *Nepal J. Ophthalmol.* 3, 128–133 (2011).
81. Aghaji, A. E., Bowman, R., Ofoegbu, V. C. & Smith, A. Dual sensory impairment in special schools in South-Eastern Nigeria. *Arch. Dis. Child.* 102, 174–177 (2017).
82. Alrasheed, S. H., Naidoo, K. S. & Clarke-Farr, P. C. Childhood eye care services in South Darfur State of Sudan: Learner and parent perspectives. *African Vis. Eye Heal. J.* 75, (2016).
83. Balasubramaniam, S. M., Kumar, D. S., Kumaran, S. E. & Ramani, K. K. Factors affecting eye care-seeking behavior of parents for their children. *Optom. Vis. Sci.* 90, 1138–1142 (2013).
84. Sewunet, S. A., Aredo, K. K. & Gedefew, M. Uncorrected refractive error and associated factors among primary school children in Debre Markos District, Northwest Ethiopia. *BMC Ophthalmol.* 14, 95 (2014).
85. Juggernath, Y. M. & Knight, S. E. Knowledge and practices of visual acuity screening by primary school educators. *African Vis. Eye Heal. J.* 74, (2015).
86. Ahmad, K. *et al.* Perceptions of eye health in schools in Pakistan. *BMC Ophthalmol.* 6, (2006).
87. Khandekar, R., Bullard, M., Thanh, T. T. K. & Binh, T. Q. Knowledge and practice related to trachoma among children in Vietnam: A cross-sectional study. *J. Health Commun.* 9, 77–83 (2004).
88. Behera, M. R., Patnaik, S. & Sahoo, N. A study of xerophthalmia and associated bio-social factors in a population of tribal residential school children of Odisha. *Indian J. Public Heal. Res. Dev.* 8, 18–23 (2017).
89. Hobday, K., Ramke, J., Du Toit, R. & Pereira, S. M. Healthy Eyes in Schools: An evaluation of a school and community-based intervention to promote eye health in rural Timor-Leste. *Health Educ. J.* 74, 392–402 (2015).

90. Ebeigbe, J. A. Factors influencing eye-care seeking behaviour of parents for their children in Nigeria. *Clin. Exp. Optom.* (2016).
91. Hornby, S. J. *et al.* Evaluation of children in six blind schools of Andhra Pradesh. *Indian J. Ophthalmol.* 48, 195–200 (2000).
92. Ashwini, K. V, Dhatri, K. & Rajeev, K. Vernal Keratoconjunctivitis in School Children in North Bangalore: An Epidemiological and Clinical Evaluation. *J. Evol. Med. Dent. Sci.* 4, 15070–15076 (2015).
93. De Smedt, S. K. *et al.* Vernal keratoconjunctivitis in school children in Rwanda: Clinical presentation, impact on school attendance, and access to medical care. *Ophthalmology* 119, 1766–1772 (2012).
94. Ayanniyi, A. A., Olatunji, F. O., Mahmoud, A. O. & Ayanniyi, R. O. Knowledge and attitude of guardians towards eye health of primary school pupils in Ilorin, Nigeria. *Niger. Postgrad. Med. J.* 17, 1–5 (2010).
95. Muhit, M. A., Shahjahan, M., Hassan, A., Wazed, A. & Ahmed, N. Parental knowledge, attitude and practice related to blindness of children in some selected Upazilla of Bangladesh. *Mymensingh Med. J. MMJ* 20, 671 (2011).
96. Gogate, P. *et al.* Spectacle compliance amongst rural secondary school children in Pune district, India. *Indian J. Ophthalmol.* 61, 8 (2013).
97. Thompson, S. *et al.* Barriers to use of refractive services in Mozambique. *Optom. Vis. Sci.* 92, 59–69 (2015).
98. Glewwe, P., Park, A. & Zhao, M. A better vision for development: Eyeglasses and academic performance in rural primary schools in China. *J. Dev. Econ.* 122, 170 (2016).
99. Wang, X. *et al.* Population prevalence of need for spectacles and spectacle ownership among urban migrant children in Eastern China. *JAMA Ophthalmol.* 133, 1399–1406 (2015).
100. Gnyawali, S., Shrestha, J. B., Bhattarai, D. & Upadhyay, M. Optical needs of students with low vision in integrated schools of Nepal. *Optom. Vis. Sci.* 89, 1752–1756 (2012).
101. Ebeigbe, J. A., Kio, F. & Okafor, L. I. Attitude and beliefs of Nigerian undergraduates to spectacle wear. *Ghana Med. J.* 47, 70–73 (2013).
102. Kalua, K., Ng'ongola, R. T., Mbewe, F. & Gilbert, C. Using primary health care (PHC) workers and key informants for community based detection of blindness in children in Southern Malawi. *Hum Resour Heal.* 10, 37 (2012).
103. Muhit, M. A., Shah, S. P., Gilbert, C. E. & Foster, A. Causes of severe visual impairment and blindness in Bangladesh: A study of 1935 children. *Br. J. Ophthalmol.* 91, 1000–1004 (2007).
104. Congdon, N. *et al.* Prevalence and determinants of spectacle nonwear among rural Chinese secondary schoolchildren: the Xichang Pediatric Refractive Error Study report 3. *Arch. Ophthalmol.* 126, 1717 (2008).
105. Rustagi, N., Uppal, Y. & Taneja, D. K. Screening for visual impairment: Outcome among schoolchildren in a rural area of Delhi. *Indian J. Ophthalmol.* 60, 203–206 (2012).
106. Narayanan, A., Kumar, S. & Ramani, K. K. Spectacle Compliance among Adolescents: A Qualitative Study from Southern India. *Optom. Vis. Sci.* 94, 582–587 (2017).
107. Santos, M. J. *et al.* Acceptance of initial spectacle prescription for children in their first-year at primary school. *Rev. Bras. Oftalmol.* 70, 157–161 (2011).
108. Gladstone, M. *et al.* 'Maybe I will give some help.... maybe not to help the eyes but different help': an analysis of care and support of children with visual impairment in community settings in Malawi. (2017). doi:10.1111/cch.12462
109. El-Gilany, A. H., El-Fedawy, S. & Tharwat, M. Causes of blindness and needs of the blind in Mansoura, Egypt. *East. Mediterr. Heal.* 8, 6–17 (2002).
110. Jamali, P., Fotouhi, A., Hashemi, H., Younesian, M. & Jafari, A. Refractive errors and amblyopia in children entering school: Shahrood, Iran. *Optom. Vis. Sci.* 86, 364–369 (2009).
111. Khandekar, R., Parast, N. & Arabi, A. Evaluation of 'vision screening' program for three to six-year-old children in the Republic of Iran. *Indian J. Ophthalmol.* 57, 437–442 (2009).
112. Bogdanici, S. T., Roman, A. & Bogdanici, C. School Integration for Patients With Amblyopia. *Rom. J. Ophthalmol.* 59, 48–51 (2015).
113. Nirmalan, P. K. *et al.* Perceptions of eye diseases and eye care needs of children among parents in rural South India: The Kariapatti Pediatric Eye Evaluation Project (KEEP). *Indian J. Ophthalmol.* 52, 163–167 (2004).
114. Carvalho, R. de S., Temporini, E. R. & Kara-Jose, N. Assessment of visual health campaign activities at schools: teachers' perception. *Arq. Bras. Oftalmol.* 70, 239–245 (2007).
115. Geta, K. & Bejiga, A. Knowledge, attitude and practice towards strabismus in Cheha District, Central Ethiopia. *Ethiop. J. Heal. Dev.* 25, 212–215 (2011).
116. Noma, R., de Souza Carvalho, R. & Kara-Jose, N. Validity of recall absent schoolchildren to free eye health projects. *Arq. Bras. Oftalmol.* 75, 16–19 (2012).
117. Monteiro, G. B. M., Temporini, E. R. & de Carvalho, K. M. Use of optical aids by visually impaired students: Social and cultural factors. *Arq. Bras. Oftalmol.* 69, 503–507 (2006).
118. Monteiro, G. B. M., Temporini, E. R. & de Carvalho, K. M. Optical aids for low vision: Use of the internet to guide teachers of the visually impaired. *Arq. Bras. Oftalmol.* 75, 166–169 (2012).
119. Senthilkumar, D., Balasubramaniam, S. M., Kumaran, S. E. & Ramani, K. K. Parents' awareness and perception of children's eye diseases in Chennai, India. *Optom. Vis. Sci.* 90, 1462–1466 (2013).
120. Ma, X. *et al.* Safety of spectacles for children's vision: A cluster-randomized controlled trial. *Am. J. Ophthalmol.* 160, 897–904 (2015).
121. Bodunde, O. T., Sholeye, O. O., Onabolu, O. O., Otulana, T. O. & Ajibode, H. A. Perception of red eye among senior secondary students in Sagamu, Southwest Nigeria. *J. Fam. Med. Prim. care* 5, 89–93 (2016).
122. Kishiki, E., Hogeweg, M., Dieleman, M., Lewallen, S. & Courtright, P. Is the existing knowledge and skills of health workers regarding eye care in children sufficient to meet needs? *Int. Health* 4, 303–306 (2012).
123. Lynch, P., Lund, P. & Massah, B. Identifying strategies to enhance the educational inclusion of visually impaired children with albinism in Malawi. *Int. J. Educ. Dev.* 39, 226–234 (2014).
124. Li, L. *et al.* Spectacle acceptance among secondary school students in rural China: The Xichang Pediatric Refractive Error Study (X-PRES) - Report 5. *Investig. Ophthalmol. Vis. Sci.* 49, 2895–2902 (2008).
125. Congdon, N. *et al.* Randomized, controlled trial of an educational intervention to promote spectacle use in rural China: the see well to learn well study. *Ophthalmology* 118, 2343–2350 (2011).
126. Li, L. *et al.* Attitudes of students, parents, and teachers toward glasses use in rural china. *Arch. Ophthalmol.* 128, 759–765 (2010).
127. Rewri, P., Kakkar, M. & Raghav, D. Self-vision testing and intervention seeking behavior among school children: A pilot study. *Ophthalmic Epidemiol.* 20, 315–320 (2013).
128. Gaigher, R. J., Lund, P. M. & Makuya, E. A sociological study of children with albinism at a special school in the Limpopo province. *Curationis* 25, 4–11 (2002).
129. Ajaiyeoba, A. I., Isawumi, M. A., Adeoye, A. O. & Oluleye, T. S. Prevalence and causes of eye diseases amongst students in south-western Nigeria. *Ann. Afr. Med.* 5, 197–203 (2006).
130. Ezegwui, I. R. *et al.* Refractive errors in children with autism in a developing country. *Niger. J. Clin. Pract.* 17, 467–470 (2014).
131. de Souza Carvalho, R., Temporini, E. R. & Kara-Jose, N. Assessment of visual health campaign activities at schools - Teachers' perception. *Arq. Bras. Oftalmol.* 70, 239–245 (2007).
132. Salomao, S. R. *et al.* Prevalence and causes of visual impairment in low-middle income school children in Sao Paulo, Brazil. *Investig. Ophthalmol. Vis. Sci.* 49, 4308–4313 (2008).
133. Ormsby, G. M. *et al.* The Impact of Knowledge and Attitudes on Access to Eye-Care Services in Cambodia. *Asia-Pacific J. Ophthalmol.* (Philadelphia, Pa.) 1, 331–335 (2012).
134. Gianini, R. J., de Masi, E., Cleto Coelho, E., Orefice, F. R. & de Moraes, R. A. Prevalence of low visual acuity in public school's students from Brazil. *Rev. Saude Publica* 38, 201–208 (2004).
135. Boesen, M. L. & Lykke, K. Screening of vision and hearing in primary school children. *J. Fam. Med. Prim. care* 1, 114–117 (2012).
136. Datta, A., Bhardwaj, N., Patrikar, S. R. & Bhalwar, R. Study of disorders of visual acuity among adolescent school children in Pune. *Med. J. Armed Forces India* 65, 26–29 (2009).

137. Tabansi, P. N., Anochie, I. C., Nkanginieme, K. E. & Pedro-Egbe, C. N. Screening for congenital color vision deficiency in primary children in Port Harcourt City; teachers' knowledge and performance. *Niger. J. Med.* 17, 428–432 (2008).
138. Kumar, A., Kalaiselvan, G. & Karthikeyan, K. Necessity of compulsory screening of adolescents for color vision deficiency in schools. *J. Indian Med. Assoc.* 113, 62–64 (2015).
139. Ayorinde, O. O., Murthy, G. V. S. & Akinyemi, O. O. Is the Child-to-child Approach Useful in Improving Uptake of Eye Care Services in Difficult-to-reach Rural Communities? Experience From Southwest Nigeria. *Ann. Ibadan Postgrad. Med.* 14, 65–73 (2016).
140. Noma, R., Carvalho, R. S. & Kara-Jose, N. Why are there defaulters in eye health projects? *Clinics* 66, 1585–1589 (2011).
141. Li, Q. Q., Zhao, H. J., Zhu, J. F., Jiang, H. F. & Li, M. Z. Visual monitoring and intervention status of 5000 students in Baoshan District, Shanghai. *Int. J. Ophthalmol.* 11, 837–838 (2011).
142. Biswas, J. et al. A study in awareness about eye health care and eye donation among secondary level students of North Kolkata, India. *Kathmandu Univ. Med. J. (KUMJ)* 8, 317–320 (2010).
143. Baidya, K. P., Biswas, S. & Ghosh, P. A Study on Incurable Blindness in a Rural Community of West Midnapur District, West Bengal, India. *J. Evol. Med. Dent. Sci.* 5, 6339–6344 (2016).
144. Caca, I. et al. Amblyopia and refractive errors among school-aged children with low socioeconomic status in southeastern Turkey. *J. Pediatr. Ophthalmol. Strabismus* 50, 37–43 (2013).
145. Zeng, Y. et al. A Randomized, Clinical Trial Evaluating Ready-Made and Custom Spectacles Delivered Via a School-Based Screening Program in China. *Ophthalmology* 116, 1839–1845 (2009).
146. Morjaria, P., Murali, K., Evans, J. & Gilbert, C. Spectacle wearing in children randomised to ready-made or custom spectacles, and potential cost savings to programmes: Study protocol for a randomised controlled trial. *Trials* 17, no pagination (2016).
147. Zhou, Z. et al. Spectacle design preferences among Chinese primary and secondary students and their parents: A qualitative and quantitative study. *PLoS One* 9, no pagination (2014).
148. Barbieri, M. C. et al. Support network for families of children and adolescents with visual impairment: strengths and weaknesses. *Rede suporte da Fam. da criança e Adolesc. com Defic. Vis. potencialidades e fragilidades.* 21, 3213–3223 (2016).
149. Wedner, S. et al. Two strategies for correcting refractive errors in school students in Tanzania: Randomised comparison, with implications for screening programmes. *Br. J. Ophthalmol.* 92, 19–24 (2008).
150. Thummalapalli, R., Williams, J. D., Khoshnood, K., Salchow, D. J. & Forster, S. H. Effect of education sessions of a structured school eye screening programme on Indian schoolteachers' knowledge and responsibility for children's eye health. *Health Educ. J.* 72, 375–385 (2013).
151. Rajaraman, D. et al. The acceptability, feasibility and impact of a lay health counsellor delivered health promoting schools programme in India: a case study evaluation. *BMC Health Serv. Res.* 12, 127 (2012).
152. Latorre-Arteaga, S. et al. Reducing visual deficits caused by refractive errors in school and preschool children: results of a pilot school program in the Andean region of Apurimac, Peru. 7, 22656 (2014).
153. Anuradha, N. & Ramani, K. Role of optometry school in single day large scale school vision testing. *Oman J. Ophthalmol.* 8, 28–32 (2015).
154. Latorre-Arteaga, S. et al. Visual health screening by schoolteachers in remote communities of Peru: Implementation research. *Bull. World Health Organ.* 94, 652–659 (2016).
155. MacPhail, C., Venables, E., Rees, H. & Delany-Moretlwe, S. Using HPV vaccination for promotion of an adolescent package of care: opportunity and perspectives. *BMC Public Health* 13, 493 (2013).
156. Kaur, G. et al. Vision screening of school children by teachers as a community based strategy to address the challenges of childhood blindness. *J. Clin. Diagnostic Res.* 10, NC09–NC14 (2016).
157. Sharma, A. et al. Strategies to improve the accuracy of vision measurement by teachers in rural Chinese secondary schoolchildren: Xichang Pediatric Refractive Error Study (X-PRES) report no. 6. *Arch. Ophthalmol.* 126, 1434–1440 (2008).
158. Saxena, R. et al. Accuracy of visual assessment by school teachers in school eye screening program in Delhi. *Indian J. Community Med.* 40, 38–42 (2015).
159. Bai, Y. L. et al. An Investigation of Vision Problems and the Vision Care System in Rural China. *Southeast Asian J. Trop. Med. Public Health* 45, 1464–1473 (2014).
160. Fontenele, R. M., Sousa, A. I. & de Fátima Almeida Lima, E. Characterization Nurses Working for the Students Eye Health. *J. Nurs. UFPE / Rev. Enferm. UFPE* 9, 565–572 (2015).
161. Katibeh, M. et al. 'Planning eye health services in Varamin district, Iran: a cross-sectional study'. *BMC Health Serv. Res.* 15, 140 (2015).
162. Lan, W. et al. Validation and cost-effectiveness of a home-based screening system for amblyopia. *Ophthalmology* 119, 1265–1271 (2012).
163. Priya, A. et al. Vision screening by teachers in Southern Indian schools: Testing a new 'all class teacher' model. *Ophthalmic Epidemiol.* 22, 60–65 (2015).
164. Maruyama, A. T., Sampaio, P. R. S. & Rehder, J. R. L. Teachers' perception about vision illness and the inclusion of low vision students. *Rev. Bras. Oftalmol.* 68, 73–75 (2009).
165. Department of Education South Africa. *Integrated School Health Policy.* (2012).
166. Puri, S. et al. Evaluation of QOS (quality of services) by log frame analysis (LFA) and ocular morbidity in school children of Chandigarh. *Int. J. Pharm. Pharm. Sci.* 6, 55–58 (2014).
167. Morjaria, P., Evans, J., Murali, K. & Gilbert, C. Spectacle Wear Among Children in a School-Based Program for Ready-Made vs Custom-Made Spectacles in India: A Randomized Clinical Trial. *JAMA Ophthalmol.* (2017).
168. Keay, L., Zeng, Y., Munoz, B., He, M. & Friedman, D. S. Predictors of early acceptance of free spectacles provided to junior high school students in China. *Arch. Ophthalmol.* 128, 1328–1334 (2010).
169. Castanon Holguin, A. M. et al. Factors associated with spectacle-wear compliance in school-aged Mexican children. *Investig. Ophthalmol. Vis. Sci.* 47, 925–928 (2006).
170. Anstice, N. S. & Thompson, B. The measurement of visual acuity in children: An evidence-based update. *Clin. Exp. Optom.* 97, 3–11 (2014).
171. Mashayo, E. R., Chan, V. F., Ramson, P., Chinanayi, F. & Naidoo, K. S. Prevalence of refractive error, presbyopia and spectacle coverage in Kahama District, Tanzania: a rapid assessment of refractive error. *Clin. Exp. Optom.* 98, 58–64 (2015).
172. Lund, P. M. Health and education of children with albinism in Zimbabwe. *Health Educ. Res.* 16, 1–7 (2001).
173. Pillay, V., Chan, V. F., Chinanayi, F. S. & Naidoo, K. S. How Do Patients Choose Their Spectacles in the Public Sector of South Africa? *Optom. Vis. Sci.* 93, 235–242 (2016).
174. Sitorus, R. S., Sulaiman Abidin, M. & Prihartono, J. Causes and temporal trends of childhood blindness in Indonesia: Study at schools for the blind in Java. *Br. J. Ophthalmol.* 91, 1109–1113 (2007).
175. Padhye, A. S. et al. Prevalence of uncorrected refractive error and other eye problems among urban and rural school children. *Middle East Afr J Ophthalmol* 16, 69–74 (2009).
176. Ajaiyeoba, A. I., Isawumi, M. A., Adeoye, A. O. & Oluleye, T. S. Pattern of eye diseases and visual impairment among students in southwestern Nigeria. *Int. Ophthalmol.* 27, 287–292 (2007).
177. Sharma, S. et al. Socio-Demographic Correlates of Ocular Morbidity in School Children of Rural Haryana. *J. Evol. Med. Dent. Sci.* 6, 1239–1243 (2017).
178. Kingo, A. U. & Ndawi, B. T. Prevalence and causes of low vision among schoolchildren in Kibaha District, Tanzania. *Tanzan. J. Health Res.* 11, 111–115 (2009).
179. Kaphle, D., Marasini, S., Kalua, K., Reading, A. & Naidoo, K. S. Visual profile of students in integrated schools in Malawi. *Clin Exp Optom* 98, 370–374 (2015).
180. Tumwesigye, C. et al. Inappropriate enrolment of children in schools for the visually impaired in east Africa. *Ann. Trop. Paediatr.* 29, 135–139 (2009).

181. Ventura, R., Ventura, L., Brandt, C., Ferraz, D. & Ventura, B. 'Vision through the hands': Experience of a project. *Arq. Bras. Oftalmol.* 70, 823–826 (2007).
182. Gaete, M. I. L., Lira, R. P. C., Lynch de Moraes, L. F., Vasconcelos, M. S. L. & Oliveira, C. V. de. Association between the need for optical correction prescription and other ocular conditions in school children. *Assoc. entre a Necess. prescricao correcao Opt. e outras doencas Ocul. em criancas na idade Esc.* 70, 949–952 (2007).
183. Pintanel, A. C., Gomes, G. C. & Xavier, D. M. Mothers of visually impaired children: difficult and easy aspects faced in care. *Rev. Gaucha Enferm.* 34, 86–92 (2013).
184. Yingyong, P. Refractive errors survey in primary school children (6–12 year Old) in 2 provinces: Bangkok and Nakhonpathom (one year result). *J. Med. Assoc. Thai.* 93, 1205–1210 (2010).
185. Zhou, Z. *et al.* Accuracy of rural refractionists in western China. 55, 154–161 (2014).
186. Duke, R. *et al.* Using key informants to estimate prevalence of severe visual impairment and blindness in children in Cross River State, Nigeria. *J. AAPOS* 17, 381–384 (2013).
187. Bourne, R. R. A. *et al.* Evaluating a new logMAR chart designed to improve visual acuity assessment in population-based surveys. *Eye* 17, 754–758 (2003).
188. Preschool Visual Acuity Screening with HOTV and Lea Symbols: Testability and Between-Test Agreement. *Optom. Vis. Sci.* 81, 678–683 (2004).
189. Bastawrous, A. *et al.* Development and Validation of a Smartphone-Based Visual Acuity Test (Peek Acuity) for Clinical Practice and Community-Based Fieldwork. *JAMA Ophthalmol.* 133, 930 (2015).
190. Omar, R., Knight, V. F. & Mohammed, Z. Effectiveness of Low Vision Devices in a Special Education School. *Sains Malaysiana* 38, 799–804 (2009).
191. WHO. *Colombia Country Cooperation Strategy at a glance.* (2016).
192. Casas Luque, L. A Rapid Assessment of Refractive Errors (RARE) Study to Determine the Prevalence of Refractive Errors, Presbyopia and Spectacle Coverage Among Adults (15+) in Bogotá, D.C, Colombia. in *World Congress of Optometry* (2017).
193. Government of Malawi & Ministry of Health. *Malawi Health Sector Strategic Plan 2011 - 2016.* (2011).
194. Resnikoff, S., Pascolini, D., Mariotti, S. P. & Pokharel, G. P. Global magnitude of visual impairment caused by uncorrected refractive errors in 2004. *Bull World Heal. Organ* 86, 63–70 (2008).
195. International Monetary Fund. African Dept. Malawi : Economic Development Document. (2017). Available at: <http://www.imf.org/en/Publications/CR/Issues/2017/07/05/Malawi-Economic-Development-Document-45037>. (Accessed: 1st February 2018)
196. United Nations. UN Salaries-General Service and related categories. (2017). Available at: http://www.un.org/Depts/OHRM/salaries_allowances/salaries/gs.htm. (Accessed: 2nd February 2018)
197. Government of Pakistan. *Pakistan Economic Survey. Pakistan Economic Survey, 2013-14* (2017).
198. The World Bank Group. Out-of-pocket health expenditure (% of private expenditure on health). *World Health Organization Global Health Expenditure database* (2014). Available at: <https://data.worldbank.org/indicator/SH.XPD.OOPC.ZS>. (Accessed: 30th March 2018)
199. Jadoon, M. Z. *et al.* Prevalence of Blindness and Visual Impairment in Pakistan: The Pakistan National Blindness and Visual Impairment Survey. *Investig. Ophthalmology Vis. Sci.* 47, 4749 (2006).
200. WHO Global Health Workforce Alliance. *Pakistan's lady health worker programme.*
201. WHO Regional Health Systems Observatory. *Health system profile: Pakistan.* (2007).
202. National Commission for Human Development. *School Health Program.*
203. Sun, H.-P., Li, A., Xu, Y. & Pan, C.-W. Secular trends of reduced visual acuity from 1985 to 2010 and disease burden projection for 2020 and 2030 among primary and secondary school students in China. *JAMA Ophthalmol.* 133, 262–268 (2015).
204. Bourne, R. R. A. *et al.* Magnitude, temporal trends, and projections of the global prevalence of blindness and distance and near vision impairment: a systematic review and meta-analysis. *Lancet Glob. Heal.* 5, e888–e897 (2017).
205. White, K. *An Introduction to the Sociology of Health and Illness.* (SAGE, 2002).
206. Beaglehole, R. & Bonita, R. *Public health at the crossroads: achievements and prospects.* (Cambridge University Press, 2004).
207. Marmot, M., Friel, S., Bell, R., Houweling, T. A. J. & Taylor, S. Closing the gap in a generation: health equity through action on the social determinants of health. *Lancet* 372, 1661–1669 (2008).
208. WHO. Closing the gap in a generation: health equity through action on the social determinants of health: Commission on Social Determinants of Health Final Report. *World Heal. Organ.* 33 (2008).
209. EYElliance, Entrepreneurs, S. & Forum, W. E. *Eyeglasses for Global Development: Bridging the Visual Divide.* (2016).

Appendix 1: Literature search strategies

A. Search strategy

Four categories of search terms were used, to identify studies that identify factors that either facilitate or inhibit children's access to eye care services in the context of education services. The four search term categories were (A) eye care services, (B) education sector, (C) children, and (D) factors related to accessibility. Each search term category has an array of related search terms likely to be found in the title, subject or abstract of relevant studies. The following tables detail the keyword searches and applied filters within each database to yield potential articles for the systematic review.

Database: Ovid MEDLINE(R) 1946 to Present with Daily Update Embase 1974 to 2017 May 23	
Search Strategy	
1	eye care OR blindness OR ocular OR optom* OR ophthal* OR refractive error OR myop* OR visual acuit* OR vision screening* OR visual impairment OR vision impairment OR eye-care OR vision care OR visually impair* OR amblyop* OR cataract* OR spectacle* OR eyeglass* OR glasses OR vision
2	school* OR health education OR service* OR outreach OR health program* OR health service* OR health care OR school-based OR student*
3	child* OR boy* OR girl* OR minor* OR adolescen* OR juvenile* OR teen* OR youth* OR parent* OR guardian* OR student*
4	access* OR utilis* OR utiliz* OR availability OR appropriat* OR acceptab* OR approach* OR adequ* OR inadequate OR equity OR inequity OR capability OR health seeking OR health care seeking OR social determinant* OR health literacy OR health beliefs OR barrier* OR facilitator* OR enabler* OR adherence OR compliance* OR afford* OR willingness OR knowledge OR perception* OR attitude* OR socioeconomic* OR participat* OR predictor* OR parental education OR key informant*
5	1 AND 2 AND 3 AND 4 Limitations: Publication Year 2000 – Current Search field: Keyword

Database: PubMed
Search Strategy
(((((eye care OR blindness OR ocular OR optom* OR ophthal* OR refractive error OR myop* OR visual acuit* OR vision screening* OR visual impairment OR vision impairment OR eye-care OR vision care OR visually impair* OR amblyop* OR cataract* OR spectacle* OR eyeglass* OR glasses OR vision))) AND (school* OR health education OR service* OR outreach OR health program* OR health service* OR health care OR school-based OR student*)) AND (child* OR boy* OR girl* OR minor* OR adolescen* OR juvenile* OR teen* OR youth* OR parent* OR guardian* OR student*)) AND (access* OR utilis* OR utiliz* OR availability OR appropriat* OR acceptab* OR approach* OR adequ* OR inadequate OR equity OR inequity OR capability OR health seeking OR health care seeking OR social determinant* OR health literacy OR health beliefs OR barrier* OR facilitator* OR enabler* OR adherence OR compliance* OR afford* OR willingness OR knowledge OR perception* OR attitude* OR socioeconomic* OR participat* OR predictor* OR parental education OR key informant*) Filters: Publication date from 2000/01/01 to 2017/05/31; Field: Title/Abstract

Database: Proquest Arts & Humanities, Proquest Social Sciences and Proquest Sociology		
eye care OR blindness OR ocular OR optom* OR ophthal* OR refractive error OR myop* OR visual acuit* OR vision screening* OR visual impairment OR vision impairment OR eye-care OR vision care OR visually impair* OR amblyop* OR cataract* OR spectacle* OR eyeglass* OR glasses OR vision	in	Abstract - AB
AND		
school* OR health education OR service* OR outreach OR health program* OR health service* OR health care OR school-based OR student*	in	Abstract - AB
AND		
child* OR boy* OR girl* OR minor* OR adolescen* OR juvenile* OR teen* OR youth* OR parent* OR guardian* OR student*	in	Abstract - AB
AND		
access* OR utilis* OR utiliz* OR availability OR appropriat* OR acceptab* OR approach* OR adequ* OR inadequate OR equity OR inequity OR capability OR health seeking OR health care seeking OR social determinant* OR health literacy OR health beliefs OR barrier* OR facilitator* OR enabler* OR adherence OR compliance* OR afford* OR willingness OR knowledge OR perception* OR attitude* OR socioeconomic* OR participat* OR predictor* OR parental education OR key informant*	in	Abstract - AB
Limit: 2000 - Current		

Database: CINAHL
eye care OR blindness OR ocular OR optom* OR ophthal* OR refractive error OR myop* OR visual acuit* OR vision screening* OR visual impairment OR vision impairment OR eye-care OR vision care OR visually impair* OR amblyop* OR cataract* OR spectacle* OR eyeglass* OR glasses OR vision
AND
school* OR health education OR service* OR outreach OR health program* OR health service* OR health care OR school-based OR student*
AND
child* OR boy* OR girl* OR minor* OR adolescen* OR juvenile* OR teen* OR youth* OR parent* OR guardian* OR student*
AND
access* OR utilis* OR utiliz* OR availability OR appropriat* OR acceptab* OR approach* OR adequ* OR inadequate OR equity OR inequity OR capability OR health seeking OR health care seeking OR social determinant* OR health literacy OR health beliefs OR barrier* OR facilitator* OR enabler* OR adherence OR compliance* OR afford* OR willingness OR knowledge OR perception* OR attitude* OR socioeconomic* OR participat* OR predictor* OR parental education OR key informant*
Limit: 2000 – Current

The number of titles yielded from each database are provided in Table 18. From the total results for each database, titles and abstracts were reviewed in Covidence systematic review software (Veritas Health Innovation, Melbourne, Australia. Available at www.covidence.org) to identify relevant titles.

Table 18: Number of results yielded from each database

Database	Initial results
OVID Medline (R) / EMBASE	9,975
PubMed	2,242
Proquest Arts & Humanities / Proquest Social Sciences / Proquest Sociology	582
Proquest Education / ERIC	3,400
CINAHL	1,182
Web of Science	4,332

B. Inclusion and exclusion criteria: Stage 1 (initial title/ abstract screening)

When screening studies, the following inclusion and exclusion criteria were applied to the titles and abstracts of the studies to generate a list of studies for full-text review:

- Method: Studies that evaluated interventions/programs or were exploratory in nature. This encompasses studies that are quantitative, qualitative, mixed method empirical studies
- Publication type: Journal articles
- Publication date: Studies published since January 1, 2010, and after were included.
- Participants: School-aged children (includes pre-school excludes neonatal), parents/guardians, teachers, health educators
- Topic: accessibility of child eye care, child eye health, school health
- Language: all languages were included
- Location: Lower, Lower-Middle & Upper-Middle income countries as per World Bank categories

The titles and abstracts that did not provide enough information to determine if the study met this selection criteria, were included in the stage 2 review.

C. Inclusion and exclusion criteria: Stage 2 (full text review)

During Stage 2, articles included from Stage 1 had the full text reviewed. The following inclusion and exclusion criteria were applied to generate a list of studies for extraction.

- Method: Studies that evaluated interventions/programs or were exploratory in nature. This encompasses studies that are quantitative, qualitative, mixed method empirical studies
- Publication type: Journal articles
- Publication date: Studies published since January 1, 2010, and after were included.
- Participants: School-aged children (includes pre-school excludes neonatal), parents/guardians, teachers, health educators
- Topic: accessibility of child eye care, child eye health, school health
- Language: all languages were included
- Location: Lower, Lower-Middle & Upper-Middle income countries as per World Bank categories

Content: Accessibility data related to the following domains: Geographical accessibility, Availability (human/other resources), Financial accessibility, Acceptability (demand side, cultural acceptability, spectacle compliance)

Appendix 2: Eligible studies

First author	Year	Title	Country	Eye health topic	Study Design	Target Study Group	World Bank Region / Lending Group
Adhikari	2011	Validation of performance of certified medical assistants in preschool vision screening examination	Nepal	Amblyopia	Cross-sectional (prospective)	Pre-school (general)/Health professionals	South Asia/Low
Aghaji	2017	Dual sensory impairment in special	Nigeria	Dual sensory impairment	Cross-sectional (prospective)	Disability/Children (ocular condition/disability)	Sub-Saharan Africa/Lower-middle
Ahmad	2006	Perceptions of eye health in schools in Pakistan	Pakistan	General eye health	Mixed methods	Primary school (general)/School staff and children	South Asia/Lower-middle
Aina	2016	Comparison between focometer and autorefractor	Nigeria	Refractive error	Cross-sectional (prospective)	Secondary school (general)/Adults and children	Sub-Saharan Africa/Lower-middle
Ajaiyeoba	2006	Prevalence of eye diseases in students South-western Nigeria	Nigeria	General eye health	Cross-sectional (prospective)	Primary/secondary school (general)/Adults and children	Sub-Saharan Africa/Lower-middle
Ajaiyeoba	2007	Pattern of eye diseases and visual impairment	Nigeria	General eye health	Cross-sectional (prospective)	Primary/secondary school (general)/Adults and children	Sub-Saharan Africa/Lower-middle
Almeida	2005	A cost analysis of therapy for amblyopia for an outpatient at a university hospital	Brazil	Amblyopia	Prospective observational	Blind or low vision children	Latin America / The Caribbean/Upper-middle
Alrasheed	2016	Childhood eye care services in South Darfur State of Sudan: Learner and parent perspectives	Sudan	General eye health	Mixed methods	Secondary school (general)/Adults and children	Sub-Saharan Africa/Low
AlvesBezerra	2016	Relato De Experiência Da Parceria Saúde E Educação No Programa Saúde Na Escola	Brazil	Eye health programming	Qualitative	Primary school (general)/Children (general)	Latin America / The Caribbean/Upper-middle
Ambika	2013	A Study on Awareness of Primary School Teachers Regarding Refractive Errors and its Early Identification among Primary School Children	India	Refractive error	Cross-sectional (prospective)	Teachers or Principals/School staff	South Asia/Lower-middle
Anuradha	2015	Role of optometry school in single day large scale school vision testing	India	Eye health programming	Cross-sectional (prospective)	Primary/secondary school (general)/Children (general)	South Asia/Lower-middle
Ashwini	2015	Vernal Keratoconjunctivitis in School Children in North Bangalore: An Epidemiological and Clinical Evaluation	India	Keratoconjunctivitis	Cross-sectional (prospective)	Primary/secondary school (general)/Children (general)	South Asia/Lower-middle

First author	Year	Title	Country	Eye health topic	Study Design	Target Study Group	World Bank Region / Lending Group
Awasthi	2013	Vitamin A supplementation every 6 months with retinol in 1 million pre-school children in north India: DEVTA, a cluster-randomised trial	India	Vitamin A deficiency	Randomized Controlled Trial	Pre-school (general)/Children (general)	South Asia/Lower-middle
Ayanniyi	2010	Knowledge and attitude of guardians towards eye health of primary school pupils in Ilorin, Nigeria	Nigeria	General eye health	Cross-sectional (prospective)	Parents/Parents/Adults	Sub-Saharan Africa/Lower-middle
Ayorinde	2016	Is the Child-to-child Approach Useful in Improving Uptake of Eye Care Services in Difficult-to-reach Rural Communities? Experience From Southwest Nigeria	Nigeria	General eye health	Mixed methods	Primary/secondary school (general)/Children (general)	Sub-Saharan Africa/Lower-middle
Bai	2014	An Investigation of Vision Problems and the Vision Care System in Rural China	China	General eye health	Cross-sectional (retrospective)	Blind or low vision children/Adults, children and health professionals	East Asia / Pacific/Upper-middle
Baidya	2016	A Study on Incurable Blindness in a Rural Community of West Midnapur District, West Bengal, India	India	General eye health	Cross-sectional (prospective)	Adults/children/Adults and children	South Asia/Lower-middle
Balasubramaniam	2013	Factors affecting eye care-seeking behavior of parents for their children	India	General eye health	Qualitative	Parents/Adults and health professionals	South Asia/Lower-middle
Barbieri	2016	Support network for families of children and adolescents with visual impairment strengths and weaknesses	Brazil	Blindness / Low Vision	Qualitative	Blind or low vision children/Adults and children	Latin America / The Caribbean/Upper-middle
Behera	2017	A study of xerophthalmia and associated bio-social factors in a population of tribal residential school children of Odisha	India	Xerophthalmia	Cross-sectional (prospective)	Primary school (general)/Children (general)	South Asia/Lower-middle
Biswas	2010	A study in awareness about eye health care and eye donation among secondary level students of North Kolkata, India	India	Eye donation	Cross-sectional (prospective)	Secondary school (general)/Adults and children	South Asia/Lower-middle
Bodunde	2016	Perception of red eye among senior secondary students in Sagamu	Nigeria	Red Eye	Cross-sectional (prospective)	Secondary school (general)/Adults and children	Sub-Saharan Africa/Lower-middle
Boesen	2012	Screening of Vision and Hearing in Primary School Children	Indonesia	General eye health	Cross-sectional (prospective)	Primary school (general)/Children (general)	East Asia / Pacific/Lower-middle
Bogdanici	2015	School integration for patients with amblyopia	Romania	Eye health programming	Cross-sectional (prospective)	Pre-school (general)/Children (ocular condition/disability)	Europe / Central Asia/Upper-middle

First author	Year	Title	Country	Eye health topic	Study Design	Target Study Group	World Bank Region / Lending Group
Caca	2013	Amblyopia and refractive errors among school-aged children with low socioeconomic status in southeastern Turkey	Turkey	General eye health	Cross-sectional (prospective)	Primary/secondary school (general)/Children (general)	Europe / Central Asia/ Upper-middle
Castanon Holguin	2006	Factors associated with spectacle-wear compliance in school-aged Mexican children	Mexico	Spectacle Compliance	Prospective observational	Primary/secondary school (general)/Adults and children	Latin America / The Caribbean/Upper-middle
Cavalcanti Junior	2015	Teachers' knowledge about signs/symptoms which indicate low visual acuity in students	Brazil	General eye health	Cross-sectional (prospective)	Teachers or Principals/ School staff	Latin America / The Caribbean/Upper-middle
Chaturvedi	2000	Assessment of availability and working components of school health services in Delhi	India	Eye health programming	Cross-sectional (prospective)	Teachers or Principals/ School staff	South Asia/Lower-middle
Congdon	2008	The association between refractive cutoffs for spectacle provision and visual improvement among school-aged children in South Africa	South Africa	Refractive error	Prospective observational	Primary/secondary school (general)/Children (general)	Sub-Saharan Africa/Upper-middle
Congdon	2008	Prevalence and determinants of spectacle nonwear among rural Chinese secondary schoolchildren: the Xichang Pediatric Refractive Error Study report 3	China	Spectacle Compliance	Cross-sectional (prospective)	Secondary school (general)/Children (general)	East Asia / Pacific/Upper-middle
Congdon	2011	Randomized, controlled trial of an educational intervention to promote spectacle use in rural China: the see well to learn well study	China	Spectacle Compliance	Randomised Controlled Trial	Secondary school (general)/Children (general)	East Asia / Pacific/Upper-middle
Datta	2009	Study of disorders of visual acuity among adolescent school children in Pune	India	General eye health	Cross-sectional (prospective)	Parents/children/Adults and children	South Asia/Lower-middle
De Souza Carvalho	2007	Assessment of visual health campaign activities at schools - Teachers' perception	Brazil	General eye health	Cross-sectional (prospective)	Teachers or Principals/ School staff	Latin America / The Caribbean/Upper-middle
DeSmedt	2012	Vernal keratoconjunctivitis in school children in Rwanda: Clinical presentation, impact on school attendance, and access to medical care	Rwanda	Keratoconjunctivitis	Case control	Primary school (general)/Children (general)	Sub-Saharan Africa/Low
Donahue	2008	Photo Screening Around the World Lions Club International Foundation Experience	Global	Amblyopia	Cross-sectional (prospective)	Pre-school (general)/Children (general)	Multiple regions/Multiple lending groups

First author	Year	Title	Country	Eye health topic	Study Design	Target Study Group	World Bank Region / Lending Group
Duke	2013	Using key informants to estimate prevalence of severe visual impairment and blindness in children in Cross River State, Nigeria	Nigeria	General eye health	Cross-sectional (prospective)	Primary/secondary school (general)/Adults and children	Sub-Saharan Africa/Lower-middle
Durrani	2007	Nutritional and health status of school age children in Islamabad Capital Territory	Pakistan	General eye health	Cross-sectional (prospective)	Primary/secondary school (general)/Children (general)	South Asia/Lower-middle
Ebeigbe	2016	Factors influencing eye-care seeking behaviour of parents for their children in Nigeria	Nigeria	General eye health	Qualitative	Parents/Adults and health professionals	Sub-Saharan Africa/Lower-middle
El Gilany	2002	Causes of blindness and needs of the blind in Mansoura, Egypt	Egypt	Blindness / Low Vision	Cross-sectional (prospective)	Blind or low vision children/Children (ocular condition/disability)	Middle East / North Africa/Lower-middle
Esteso	2007	Correction of moderate myopia is associated with improvement in self-reported visual functioning among Mexican school-aged children	Mexico	Refractive error	Prospective observational	Primary/secondary school (general)/Children (general)	Latin America / The Caribbean/Upper-middle
Ezegwui	2014	Refractive errors in children with autism in a developing country	Nigeria	General eye health	Cross-sectional (prospective)	Disability/Children (general)	Sub-Saharan Africa/Lower-middle
Fontenele	2015	Characterization Nurses Working for the Students Eye Health	Brazil	Eye health programming	Cross-sectional (prospective)	School health nurses/Health professionals	Latin America / The Caribbean/Upper-middle
Gaete	2007	Association between the need for optical correction prescription and other ocular conditions in school children	Brazil	General eye health	Cross-sectional (prospective)	Primary school (general)	Latin America / The Caribbean/Upper-middle
Gaigher	2002	A sociological study of children with albinism at a special school in the Limpopo province	South Africa	Blindness / Low Vision	Mixed methods	Children with Albinism/Adults and children	Sub-Saharan Africa/Upper-middle
Geta	2011	Knowledge, attitude and practice towards strabismus in Cheha District, Central Ethiopia	Ethiopia	Strabismus	Cross-sectional (prospective)	Parents/Parents/Adults	Sub-Saharan Africa/Low
Gianini	2004	Prevalence of low visual acuity in public school's students from Brazil	Brazil	Refractive error	Cross-sectional (prospective)	Primary school (general)/Children (general)	Latin America / The Caribbean/Upper-middle
Gladstone	2017	'Maybe I will give some help.... maybe not to help the eyes but different help': an analysis of care and support of children with visual impairment in community settings in Malawi	Malawi	General eye health	Qualitative	Pre-school (general)/Parents/Adults	Sub-Saharan Africa/Low

First author	Year	Title	Country	Eye health topic	Study Design	Target Study Group	World Bank Region / Lending Group
Glewwe	2016	A better vision for development: Eyeglasses and academic performance in rural primary schools in China	China	Refractive error	Mixed quantitative	Primary school (general)/ Children (general)	East Asia / Pacific/Upper-middle
Gnyawali	2012	Optical needs of students with low vision in integrated schools of Nepal	Nepal	Blindness / Low Vision	Cross-sectional (prospective)	Blind or low vision children/Adults and children	South Asia/Low
Gogate	2009	Visual impairment in the hearing impaired students	India	Dual sensory impairment	Cross-sectional (prospective)	Disability/Children (ocular condition/disability)	South Asia/Lower-middle
Gogate	2013	Spectacle compliance amongst rural secondary school children in Pune district, India	India	Spectacle Compliance	Cross-sectional (prospective)	Secondary school (general)/Adults and children	South Asia/Lower-middle
Hannum	2012	Poverty and Proximate Barriers to Learning: Vision Deficiencies, Vision Correction and Educational Outcomes in Rural Northwest China	China	Refractive error	Prospective cohort	Primary school (general)/ Children (general)	East Asia / Pacific/Upper-middle
He	2005	Need and challenges of refractive correction in urban Chinese school children	China	Refractive error	Cross-sectional (prospective)	Children/Parents/ Children (general)	East Asia / Pacific/Upper-middle
Hobday	2015	Healthy Eyes in Schools: An evaluation of a school and community-based intervention to promote eye health in rural Timor-Leste	Timor-Leste	General eye health	Mixed methods	Primary school (general)/ Adults, children and school staff	East Asia / Pacific/Lower-middle
Hornby	2000	Evaluation of children in six blind schools of Andhra Pradesh	India	Blindness / Low Vision	Cross-sectional (prospective)	Blind or low vision children/Children (ocular condition/disability)	South Asia/Lower-middle
Jamali	2009	Refractive errors and amblyopia in children entering school: Shahrrood, Iran	Iran	General eye health	Cross-sectional (prospective)	Pre-school (general)/ Children (general)	Middle East / North Africa/ Upper-middle
Jayaraman	2016	The Determinants of Early Refractive Error on School-Going Chinese Children: An Empirical Study in Malaysia	Malaysia	Refractive error	Cross-sectional (prospective)	Primary school (general)/ Children (general)	East Asia / Pacific/Upper-middle
Joshi	2008	The efficacy of low vision devices for students in specialized schools for students who are blind in Kathmandu Valley, Nepal	Nepal	Blindness / Low Vision	Prospective observational	Blind or low vision children/Adults and children	South Asia/Low
Juggernath	2015	Knowledge and practices of visual acuity screening by primary school educators	South Africa	Refractive error	Randomised Controlled Trial	Teachers or Principals/ School staff	Sub-Saharan Africa/Upper-middle

First author	Year	Title	Country	Eye health topic	Study Design	Target Study Group	World Bank Region / Lending Group
Kalua	2012	Using primary health care (PHC) workers and key informants for community based detection of blindness in children in Southern Malawi	Malawi	Eye health programming	Mixed methods	Primary/secondary school (general)/Parents/Adults	Sub-Saharan Africa/Low
Kaphle	2015	Visual profile of students in integrated schools in Malawi	Malawi	Blindness / Low Vision	Cross-sectional (prospective)	Blind or low vision children/Children (ocular condition/disability)	Sub-Saharan Africa/Low
Katibeh	2015	"Planning eye health services in Varamin district, Iran: a cross-sectional "	Iran	General eye health	Cross-sectional (prospective)	Adults/Health professionals	Middle East / North Africa/ Upper-middle
Kaur	2016	Vision screening of school children by teachers as a community based strategy to address the challenges of childhood blindness	India	General eye health	Cross-sectional (prospective)	Teachers or Principals/ School staff and health professionals	South Asia/Lower-middle
Keay	2010	Predictors of Early Acceptance of Free Spectacles Provided to Junior High School Students in China	China	Refractive error	Prospective observational	Secondary school (general)/Children (ocular condition/disability)	East Asia / Pacific/Upper-middle
Khandekar	2004	Knowledge and practice related to trachoma among children in Vietnam: A cross-sectional study	Vietnam	Trachoma	Cross-sectional (prospective)	Primary/secondary school (general)/Children (general)	East Asia / Pacific/Lower-middle
Khandekar	2009	Evaluation of 'vision screening' program for three to six-year-old children in the Republic of Iran	Iran	Eye health programming	Case control	Teachers/medical professionals/School staff and health professionals	Middle East / North Africa/ Upper-middle
Kingo	2009	Prevalence and causes of low vision among schoolchildren in Kibaha District, Tanzania	Tanzania	Blindness / Low Vision	Cross-sectional (prospective)	Primary school (general)/ Children (general)	Sub-Saharan Africa/Low
Kishiki	2012	Is the existing knowledge and skills of health workers regarding eye care in children sufficient to meet needs?	Tanzania	General eye health	Mixed methods	Medical professionals/ Health professionals	Sub-Saharan Africa/Low
Kumar	2015	Necessity of compulsory screening of adolescents for color vision deficiency in schools	India	Color Vision Deficiency	Cross-sectional (prospective)	Secondary school (general)/Children (general)	South Asia/Lower-middle
Lan	2012	Validation and cost-effectiveness of a home-based screening system for amblyopia	China	Amblyopia	Cross-sectional (prospective)	Pre-school (general)/ Adults, children and health professionals	East Asia / Pacific/Upper-middle

First author	Year	Title	Country	Eye health topic	Study Design	Target Study Group	World Bank Region/ Lending Group
Latorre Arteaga	2014	Reducing visual deficits caused by refractive errors in school and preschool children: results of a pilot school program in the Andean region of Apurimac, Peru	Peru	Eye health programming	Cross-sectional (prospective)	Teachers/children/School staff and children	Latin America / The Caribbean/Upper-middle
Latorre Arteaga	2016	Visual health screening by schoolteachers in remote communities of Peru: Implementation research	Peru	General eye health	Cross-sectional (prospective)	Teachers or Principals/School staff	Latin America / The Caribbean/Upper-middle
Lewallen	2008	Evaluating a school-based trachoma curriculum in Tanzania	Tanzania	Trachoma	Mixed methods	Teachers/children/School staff and children	Sub-Saharan Africa/Low
Li	2008	Spectacle acceptance among secondary school students in rural China: The Xichang Pediatric Refractive Error Study (X-PRES)/ Report 5	China	Spectacle Compliance	Prospective cohort	Secondary school (general)/Children (general)	East Asia / Pacific/Upper-middle
Li	2010	Attitudes of students, parents, and teachers toward glasses use in rural China	China	Spectacle Compliance	Qualitative	Teachers, parents, children/Adults, children and school staff	East Asia / Pacific/Upper-middle
Li	2011	Visual monitoring and intervention status of 5000 students in Baoshan District, Shanghai	China	Refractive error	Cross-sectional (prospective)	Primary & secondary school (general)	East Asia / Pacific/Upper-middle
Li	2012	Pediatric first aid knowledge and attitudes among staff in the preschools of Shanghai, China	China	General eye health	Cross-sectional (prospective)	Teachers or Principals/School staff	East Asia / Pacific/Upper-middle
Lockheed	2005	Beneath Education Production Functions: The Case of Primary Education in Jamaica	Jamaica	Barriers to education	Qualitative	Primary/secondary school (general)/Children (general)	Latin America / The Caribbean/Upper-middle
Lund	2001	Health and education of children with albinism in Zimbabwe	Zimbabwe	Blindness / Low Vision	Mixed methods	Children with Albinism/Children (ocular condition/disability)	Sub-Saharan Africa/Low
Lynch	2014	Identifying strategies to enhance the educational inclusion of visually impaired children with albinism in Malawi	Malawi	Blindness / Low Vision	Qualitative	Teachers, parents, children/Adults, children and school staff	Sub-Saharan Africa/Low
Ma	2014	Effect of providing free glasses on children's educational outcomes in China : cluster randomized controlled trial	China	Refractive error	Randomised Controlled Trial	Primary school (general)/Children (general)	East Asia / Pacific/Upper-middle

First author	Year	Title	Country	Eye health topic	Study Design	Target Study Group	World Bank Region / Lending Group
Ma	2015	Safety of spectacles for children's vision: A cluster-randomized controlled trial	China	Spectacle Compliance	Randomised Controlled Trial	Primary school (general)/Children (general)	East Asia / Pacific/Upper-middle
MacPhail	2013	Using HPV vaccination for promotion of an adolescent package of care: opportunity and perspectives	South Africa	General eye health	Qualitative	Parents/children/Adults, children and health professionals	Sub-Saharan Africa/Upper-middle
Maruyama	2009	Teachers' perception about vision illness and the inclusion of low vision students	Brazil	Blindness & Low Vision	Cross-sectional (prospective)	Teachers or Principals	Latin America / The Caribbean/Upper-middle
Mashayo	2015	Prevalence of refractive error, presbyopia and spectacle coverage in Kahama District, Tanzania: a rapid assessment of refractive error	Tanzania	Refractive error	Cross-sectional (prospective)	Adults/children/Adults and children	Sub-Saharan Africa/Low
Monteiro	2006	Use of optical aids by visually impaired students: Social and cultural factors	Brazil	Blindness / Low Vision	Qualitative	Blind or low vision children/Children (ocular condition/disability)	Latin America / The Caribbean/Upper-middle
Monteiro	2012	Optical aids for low vision: Use of the internet to guide teachers of the visually impaired	Brazil	Blindness / Low Vision	Mixed methods	Teachers or Principals/ School staff	Latin America / The Caribbean/Upper-middle
Morjaria	2017	Spectacle Wear Among Children in a School-Based Program for Ready-Made vs Custom-Made Spectacles in India: A Randomized Clinical Trial	India	Spectacle Compliance	Randomised Controlled Trial	Secondary school (general)/Children (ocular condition/disability)	South Asia/Lower-middle
Msukwa	2009	Cataract in Children Attending Schools for the Blind and Resource Centers in Eastern Africa	Africa (regional)	Blindness / Low Vision	Cross-sectional (prospective)	Blind or low vision children/Children (ocular condition/disability)	Sub-Saharan Africa/Low
Muhit	2007	Causes of severe visual impairment and blindness in Bangladesh: A study of 1935 children	Bangladesh	Blindness / Low Vision	Cross-sectional (prospective)	Primary/secondary school (general)/ Children (general)	South Asia/Lower-middle
Muhit	2010	Parental knowledge, attitude and practice related to blindness of children in some selected Upazilla of Bangladesh	Bangladesh	General eye health	Cross-sectional (prospective)	Parents/Parents/Adults	South Asia/Lower-middle
Narayanan	2017	Spectacle Compliance among Adolescents: A Qualitative Study from Southern India	India	Spectacle Compliance	Qualitative	Parents/children/Adults and children	South Asia/Lower-middle
Nirmalan	2004	Perceptions of eye diseases and eye care needs of children among parents in rural South India: The Kariapatti Pediatric Eye Evaluation Project (KEEP)	India	General eye health	Qualitative	Parents/Parents/Adults	South Asia/Lower-middle

First author	Year	Title	Country	Eye health topic	Study Design	Target Study Group	World Bank Region / Lending Group
Noma	2011	Why are there defaulters in eye health projects?	Brazil	General eye health	Cross-sectional (prospective)	Parents/children/Children (general)	Latin America / The Caribbean/Upper-middle
Noma	2012	Validity of recall absent schoolchildren to free eye health projects	Brazil	Eye health programming	Cross-sectional (prospective)	Primary school (general)/Children (general)	Latin America / The Caribbean/Upper-middle
Odedra	2008	Barriers to spectacle use in Tanzanian secondary school students	Tanzania	Spectacle Compliance	Mixed methods	Secondary school (general)/Children (general)	Sub-Saharan Africa/Low
Omar	2009	Effectiveness of Low Vision Devices in a Special Education School	Malaysia	Blindness & Low Vision	Cross-sectional (prospective)	Blind or low vision children	East Asia / Pacific/Upper-middle
Ormsby	2012	The Impact of Knowledge and Attitudes on Access to Eye-Care Services in Cambodia	Cambodia	General eye health	Cross-sectional (prospective)	Parents/Parents/Adults	East Asia / Pacific/Lower-middle
Padhye	2009	Prevalence of uncorrected refractive error and other eye problems among urban and rural school children	India	Amblyopia	Cross-sectional (prospective)	Secondary school (general)/Children (general)	South Asia/Lower-middle
Pereira	2012	Improving access to eye health services in rural Timor-Leste	Timor-Leste	Eye health programming	Mixed methods	School health nurses/Adults and children	East Asia / Pacific/Lower-middle
Pillay	2016	How Do Patients Choose Their Spectacles in the Public Sector of South Africa?	South Africa	Spectacle Compliance	Mixed methods	Adults/children/Adults and children	Sub-Saharan Africa/Upper-middle
Pintanel	2013	Mothers of visually impaired children: difficult and easy aspects faced in care	Brazil	Blindness / Low Vision	Qualitative	Parents/Parents/Adults	Latin America / The Caribbean/Upper-middle
Priya	2015	Vision screening by teachers in Southern Indian schools: Testing a new "all class teacher" model	India	General eye health	Case control	Teachers/children/School staff	South Asia/Lower-middle
Puri	2014	Evaluation of QOS (quality of services) by log frame analysis (LFA) and ocular morbidity in school children of Chandigarh	India	General eye health	Cross-sectional (prospective)	Primary school (general)/Children (general)	South Asia/Lower-middle
Rajaraman	2012	The acceptability, feasibility and impact of a lay health counsellor delivered health promoting schools programme in India: a case study evaluation	India	General eye health	Mixed methods	School counsellors/Adults, children and school staff	South Asia/Lower-middle
Ramke	2008	Public sector refraction and spectacle dispensing in low-resource countries of the Western Pacific	Pacific (Regional)	Refractive error	Mixed methods	Medical professionals/Health professionals	East Asia / Pacific/Multiple lending groups

First author	Year	Title	Country	Eye health topic	Study Design	Target Study Group	World Bank Region / Lending Group
Rewri	2013	Self-vision testing and intervention seeking behavior among school children: A pilot study	India	Refractive error	Cross-sectional (prospective)	Secondary school (general)/Adults and children	South Asia/Lower-middle
Rustagi	2012	Screening for visual impairment: Outcome among schoolchildren in a rural area of Delhi	India	Refractive error	Mixed methods	Secondary school (general)/Adults and children	South Asia/Lower-middle
Salamao	2008	Prevalence and causes of visual impairment in low-middle school children in Sao Paulo, Brazil	Brazil	General eye health	Cross-sectional (prospective)	Primary/secondary school (general)/Children (general)	Latin America / The Caribbean/Upper-middle
Santos	2011	Acceptance of initial spectacle prescription for children in their first-year at primary school	Brazil	Refractive error	Cross-sectional (prospective)	Primary school (general)	Latin America / The Caribbean/Upper-middle
Saxena	2015	Accuracy of visual assessment by school teachers in school eye screening program in Delhi	India	General eye health	Cross-sectional (prospective)	Primary school (general)/Children (general)	South Asia/Lower-middle
Schemann	2007	Mapping xerophthalmia in Mali: results of a national survey on regional distribution and related risk factors	Mali	Xerophthalmia	Cross-sectional (prospective)	Children/Parents/Adults and children	Sub-Saharan Africa/Low
Senthilkumar	2013	Parents' awareness and perception of children's eye diseases in Chennai, India	India	General eye health	Qualitative	Parents/medical professionals/Adults and health professionals	South Asia/Lower-middle
Sewunet	2014	Uncorrected refractive error and associated factors among primary school children in Debre Markos District, Northwest Ethiopia	Ethiopia	Refractive error	Cross-sectional (prospective)	Primary/secondary school (general)/Children (general)	Sub-Saharan Africa/Low
Sharma	2008	Strategies to improve the accuracy of vision measurement by teachers in rural Chinese secondary schoolchildren: Xichang Pediatric Refractive Error Study (X-PRES) report no. 6	China	General eye health	Cross-sectional (prospective)	Teachers/medical professionals/School staff and health professionals	East Asia / Pacific/Upper-middle
Sharma	2010	A profile of low vision among the blind school students in Lumbini Zone of Nepal	Nepal	General eye health	Cross-sectional (prospective)	Primary/secondary school (general)/Adults and children	South Asia/Low
Sharma	2017	Socio-Demographic Correlates of Ocular morbidity	India	General eye health	Cross-sectional (prospective)	Primary/secondary school (general)/Children (general)	South Asia/Lower-middle

First author	Year	Title	Country	Eye health topic	Study Design	Target Study Group	World Bank Region/ Lending Group
Silva	2017	Health program in a Brazilian school	Brazil	General eye health	Qualitative	Medical professionals/ School staff and health professionals	Latin America / The Caribbean/Upper-middle
Sitorus	2007	Causes and temporal trends of childhood blindness in Indonesia: Study at schools for the blind in Java	Indonesia	Blindness / Low Vision	Cross-sectional (prospective)	Blind or low vision children/Children (ocular condition/disability)	East Asia / Pacific/Lower-middle
Tabansi	2008	Screening for congenital color vision deficiency in primary children in Port Harcourt City; teachers' knowledge and performance	Nigeria	Color Vision Deficiency	Prospective observational	Teachers or Principals/ School staff and children	Sub-Saharan Africa/Lower-middle
Teerawattananon	2014	Assessing the accuracy and feasibility of a refractive error screening program conducted by school teachers in pre-primary and primary schools in Thailand	Thailand	Refractive error	Cross-sectional (prospective)	Teachers/parents/ School staff and health professionals	East Asia / Pacific/Upper-middle
Thompson	2015	Barriers to use of refractive services Mozambique	Mozambique	Refractive error	Cross-sectional (prospective)	Adults/Adults and children	Sub-Saharan Africa/Low
Thummalapalli	2013	Effect of education sessions of a structured school eye screening programme on Indian schoolteachers' knowledge and responsibility for children's eye health	India	General eye health	Prospective observational	Teachers or Principals/ School staff	South Asia/Lower-middle
Tumwesigye	2009	Inappropriate enrolment of children in schools for the visually impaired in east Africa	Africa (regional)	Eye health programming	Cross-sectional (prospective)	Blind or low vision children/Children (ocular condition/disability)	Sub-Saharan Africa/Low
Ventura	2007	"Vision through the hands": Experience of a project	Brazil	Blindness & Low Vision	Cross-sectional (prospective)	Blind or low vision children	Latin America / The Caribbean/Upper-middle
Wang	2015	Population prevalence of need for spectacles and spectacle ownership among urban migrant children in Eastern China	China	Spectacle Compliance	Cross-sectional (prospective)	Primary school (general)/ Children (general)	East Asia / Pacific/Upper-middle
Wedner	2002	Myopia in secondary school students in Mwanza City, Tanzania: The need for a national screening programme	Tanzania	Myopia	Cross-sectional (prospective)	Secondary school (general)/ Children (general)	Sub-Saharan Africa/Low
Wedner	2008	Two strategies for correcting refractive errors in school students in Tanzania: Randomised comparison, with implications for screening	Tanzania	Spectacle Compliance	Randomised Controlled Trial	Secondary school (general)/ Children (general)	Sub-Saharan Africa/Low

First author	Year	Title	Country	Eye health topic	Study Design	Target Study Group	World Bank Region / Lending Group
Yi	2015	Impact of Free Glasses and a Teacher Incentive on Children's Use of Eyeglasses: A Cluster-Randomized Controlled Trial	China	Refractive error	Randomised Controlled Trial	Primary school (general)/ Children (ocular condition/ disability)	East Asia / Pacific/ Upper-middle
Yingyong	2010	Refractive errors survey in primary school children (6-12 year Old) in 2 provinces: Bangkok and Nakhonpathom (one year result)	Thailand	Refractive error	Cross-sectional (prospective)	Primary school (general)/ Children (general)	East Asia / Pacific/ Upper-middle
Zeng	2009	A Randomized, Clinical Trial Evaluating Ready-Made and Custom Spectacles Delivered Via a School-Based Screening Program in China	China	Refractive error	Randomised Controlled Trial	Secondary school (general)/ Adults and children	East Asia / Pacific/ Upper-middle
Zhou	2014	Spectacle design preferences among Chinese primary and secondary students and their parents: A qualitative and quantitative study	China	Spectacle Compliance	Mixed methods	Primary/secondary school (general)/Adults and children	East Asia / Pacific/ Upper-middle
Zhou	2014	Accuracy of rural refractionists in western China	China	Refractive error	Cross-sectional (prospective)	Children/medical professionals/Children (general)	East Asia / Pacific/ Upper-middle

Appendix 3: In-depth analysis interview & FGD guides

A. Eye health stakeholders (Interview)

Potential participants: Government ministers, NGO representatives working in eye health sector

1. Please state who you work for and a brief description of your role.
2. Please give a brief description of what is covered under the school health policy in Malawi.
3. Is eye health care provided in schools in Malawi? (If not please explain why)
 - a. Please describe who is involved in planning eye health care within schools
 - b. Who funds eye health care within schools in Malawi? (adequate/ongoing funding? Barriers to funding?)
 - c. Are spectacles provided through schools?
 - d. Are spectacles covered in the school health budget?
4. Are there adequate human resources to support eye health care within schools in Malawi?
5. Can you describe any barriers around providing human resources that support eye health care in schools? (Number of clinicians? Training available to those who are not clinicians such as teachers/school nurses? Are schools geographically accessible to potential screeners?)
6. Do you think it is reasonable for eye health screening to be part of a teacher's job? School nurses job?
7. Can you describe how school health (education system) works with primary health (health system) to provide child eye health services?
 - a. Are there any barriers that prevent education and health systems working together to provide child eye health services?
 - b. Are there clear referral pathways from school screening to primary or tertiary eye care services? (If yes/no please describe factors that make referral pathways clear/unclear)
8. Do you think eye care services in general are affordable for Malawians?
 - a. Which eye care services are/are not covered or subsidized by the government?
9. Does the Government consider eye health care services within schools – such as screening for refractive error and/ eye diseases such as trachoma – as a priority? (Why is it important? Is it prioritized on the overall child health agenda?)
10. Could you describe some key factors that would help enable eye screening within schools and subsequent referral to the health system?

B. Eye health providers (Interview)

Potential participants: Clinicians (optometrists/ophthalmologists), teachers, school nurses

1. Please state who you work for and a brief description of your role.
2. (If relevant) Please give a brief description of what is covered under the school health policy in Malawi.
3. Please describe some the eye health problems you have seen among the children you work with.
4. Is eye health care provided in schools in Malawi?

- a. (Teachers/school nurses) Is eye health care provided in this school?
- b. If yes, please describe the process involved in providing eye health care within this school
- c. Please describe the referral systems in place around eye health care/screening within this school? (If a child is found to have RE or an eye disease, what happens next, how do they obtain the care they need?)
5. Are there adequate human resources to support eye health care within schools in Malawi?
 - a. (Teachers/school nurses) Are there adequate human resources to support eye health care within this schools?
6. Can you describe any barriers around providing human resources that support eye health care in schools? (Number of available clinicians?)
7. Is there or has there been - training to provide those who are not clinicians such as teachers/school nurses with the skills to conduct school eye health screening?
 - a. (Teachers/school nurses) have you received training to conduct school eye health screening? If yes what was involved, who provided/funded etc.? If no, why?
8. Are schools geographically accessible to potential screeners? (optometrists, other trained screeners)
9. Do you think it is reasonable for eye health screening to be part of a teacher's job? School nurses job?
10. Do you think eye care services in general are affordable for Malawians?
 - a. Which eye care services are/are not covered or subsidized by the government?
11. Does the Government consider eye health care services within schools – such as screening for refractive error and/ eye diseases such as trachoma – as a priority? (Why is it important? Is it prioritized on the overall child health agenda?)

12. Could you describe some key factors that would help enable eye screening within schools and subsequent referral to the health system?

C. Eye health users (FGD)

Potential participants: Parents, children

Parents

1. Has your child or does your child currently have any problems with their eyes?
2. If your child voiced they had an eye problem, where would you seek care in the first instance? (Home treatment, traditional treatment, health care services)
3. Does your child receive health services at school?
 - a. Do these include eye health services?
4. If your child came home from school with a letter stating they needed to see an optometrist (eye doctor) what would you do next?
5. Are eye health services costly? Please describe any cost barriers you've faced accessing eye health services for your child.
6. Are spectacles costly?
 - a. Are you able to get free/cheap spectacles for your child? If so how?
7. Do you think eye health services should be provided within schools?
 - a. Why?
8. Why do you think eye screening is important?
9. Would you be comfortable with your child being screened for eye problems at school?
 - a. By their teacher?
 - b. By school nurse?
 - c. Is the gender of the person who provides eye care to your child a concern?
 - d. Do you have any other concerns about your child receiving eye health care at school?

10. What would help make getting eye care for your child easier?

Children

1. If you were finding it hard to see the blackboard at school what would you do?
(Who would you tell – teacher/parents/friends)
2. If you had a pain in your eye what would you do?
3. Have you ever had your eyes tested at school?
 - a. If yes how did that feel?
 - b. If no – would you be comfortable getting your eyes tested at school?
4. If the teacher or nurse said that you needed glasses how would you feel?
 - a. Would you tell your parents?
5. What do you think about glasses?
 - a. What are they for?
 - b. What kind of people wear glasses?
 - c. Is there anyone in your class that wears glasses? (What do you think about them)
 - d. What do your friends think about glasses?
 - e. What do your parents think about glasses?



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