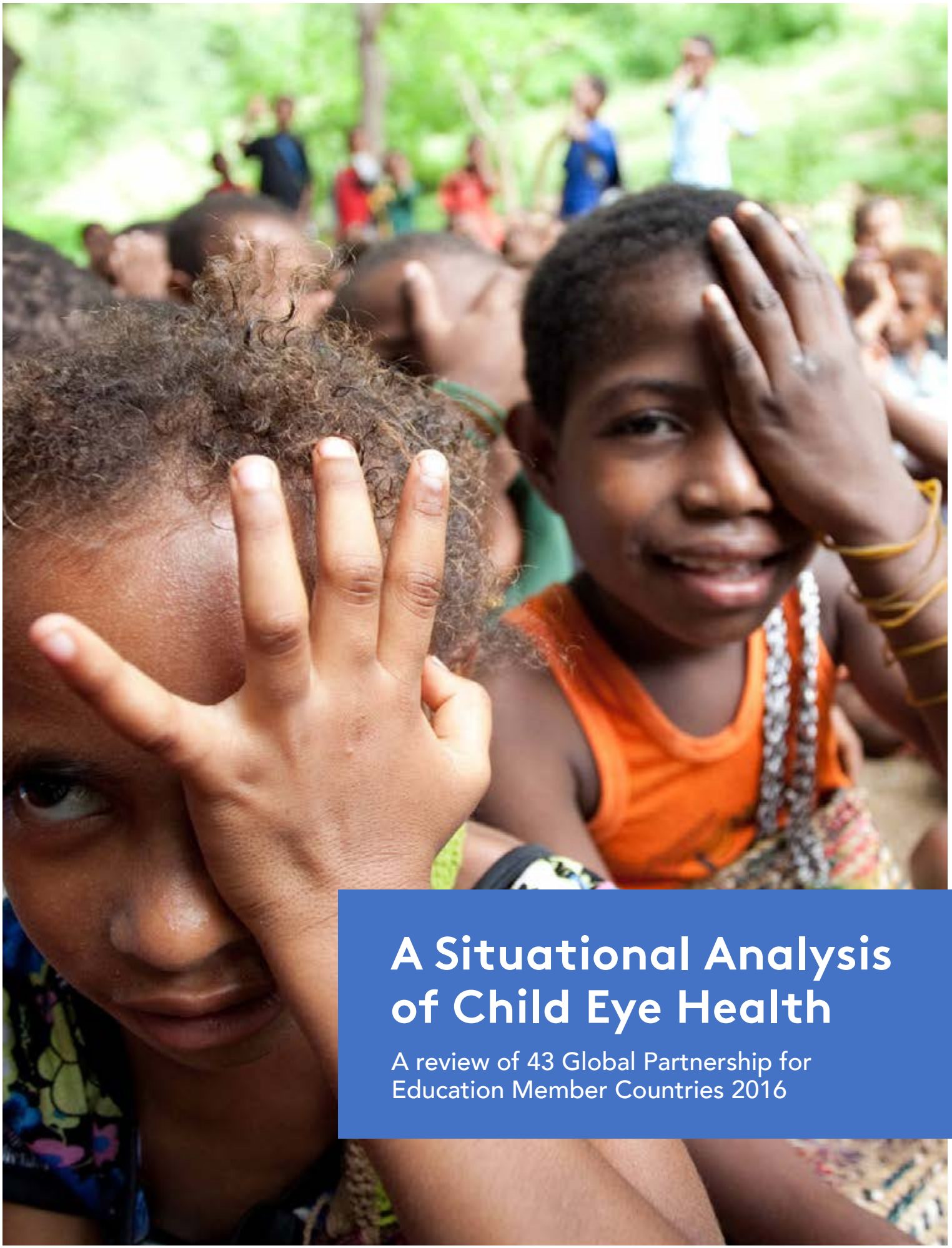

A Situational Analysis of Child Eye Health

A review of 43 Global Partnership for Education Member Countries 2016

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Photos courtesy of Brien Holden Vision Institute, Optometry Giving Sight and Essilor Vision for Life.

This report was prepared by the Brien Holden Vision Institute

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Glossary of Terms

Astigmatism – a deviation of the eye or lens shape from spherical curvature, 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.

Bitot's spots – see Xerophthalmia below

Blindness – this is not always a complete lack of vision (or no light perception) but is defined by the International Classification of Diseases[1] as visual acuity (VA) worse than 1/60. 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 one meter away from them.

Corneal ulcer – an open sore on the cornea. Causes of corneal ulcers include infection, physical and chemical trauma, corneal drying and exposure, and contact lens over wear and misuse. Corneal ulcers can result in vision loss or blindness.

Corneal xerosis – abnormal dryness of the cornea

Conjunctival xerosis – abnormal dryness of the conjunctiva

Hyperopia – also referred to as long-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 eye strain, headaches and/or an aversion to near work. This is the result of images being focused behind the retina instead of on the retina.

Inclusive education – an education system which takes into account the learning needs of all children and young people; street children, girls, children from ethnic minority groups, children from economically poor families, children from nomadic families, children with HIV/AIDS and children with disabilities. Inclusive education ensures that these children are afforded equal rights and opportunities to education. It is an approach to education which values diversity as an essential part of the teaching and learning process, and one which promotes human development. Inclusive education aims to combat the marginalization of individuals and to promote diversity.

Integrated education – an education program in which children with physical disabilities, or learning difficulties attend classes with able bodied children on either a part or full time basis with some specialized education help and services. The child must adapt to the mainstream school environment.

Low vision – severe and moderate visual impairment are grouped under the term low vision, some studies may refer to severe vision impairment (SVI) rather than Low vision. There are varying definitions of low vision in terms of the cause and visual acuity levels. For this report, statistics on low vision reported exclude those caused by uncorrected refractive error as data for uncorrected refractive error is reported separately.

Mainstream education – an education system that principally meets the needs of all the students.

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.

High myopia – myopia equal to, or worse than, –5.00 diopters (D). High myopia is associated with a significantly increased risk of potentially blinding conditions such as myopic macular degeneration, cataract, retinal detachment and glaucoma.

Ocular morbidity – any eye disease regardless of resultant vision loss

Onchocerciasis (river blindness) – an eye and skin disease caused by a parasite transmitted through the bite of a blackfly. These flies breed in fast-flowing streams and rivers, increasing the risk of blindness to people living nearby.

Primary school net attendance ratio – number of children attending primary or secondary school who are of official primary school age, expressed as a percentage of the total number of children of official primary school age. Because of the inclusion of primary-school-age children attending secondary school, this indicator can also be referred to as a primary adjusted net attendance ratio

Secondary school net attendance ratio – number of children attending secondary or tertiary school who are of official secondary school age, expressed as a percentage of the total number of children of official secondary school age. Because of the inclusion of secondary-school-age children attending tertiary school, this indicator can also be referred to as a secondary adjusted net attendance ratio.

Refractive Error – 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.

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 hence 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 eye strain instead of visual impairment.

Visual acuity (VA) – relates to clarity of vision and measured by a person's ability to discern letters on a chest 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.

Vision impairment – this can be classified as mild, moderate or severe depending on the level of VA. The international Classification of Diseases[1] defines mild visual impairment as VA better than 6/18, moderate as between 6/18 to 6/60 and severe as VA 6/60 to 3/60. Visual impairment can be caused by disease, congenital abnormality or by not being able to access spectacles for refractive error correction (e.g. long-sightedness, short-sightedness).

Xerophthalmia – the ocular manifestation of vitamin A deficiency and includes signs such as impaired night vision, severe dry eye (conjunctival or corneal xerosis), Bitot's spots (grey-white foamy triangular deposits on the conjunctiva), corneal ulcers and in severe cases, corneal opacification leading to blindness.

List of Abbreviations

CH	Child health
CEH	Child eye health
GDP	Gross domestic product
GPE	Global Partnership for Education
HDI	Human development index
NHMIS	National Health Management Information System
NEMIS	National Education Management Information System
HSSP	Health Sector Strategic Plan
HSTP	Health Sector Transformation Plan
IAPB	International Agency for the Prevention of Blindness
INGO	International non-governmental organization
LAC	Latin America and the Caribbean
MDG	Millennium development goal
MOE	Ministry of Education
MOEYS	Ministry of Education, Youth and Sport
MOH	Ministry of Health
NA	Not available
NCD	Non-communicable disease
NGO	Non-governmental organization
NHSWP	National Health and Social Welfare Policy
NHP	National health plan
NTD	Neglected tropical disease
PBL	Prevention of blindness plan
PPP	Purchasing power parity
RAAB	Rapid assessment of avoidable blindness
RE	Refractive error
REWG	Refractive error working group (IAPB)
SGD	Sustainable development goal
SOWC	State of the World's Children
SSA	Sub-Saharan Africa
SVI	Severe vision impairment
UHC	Universal health coverage
UNDP	United Nations Development Program
UNICEF	United Nations International Children's Emergency Fund
URE	Uncorrected refractive error
USAID	United States Agency for International Development
V2020	Vision 2020
VA	Visual acuity
VI	Vision impairment
WHO	World Health Organization

Executive Summary

Poor vision, if left uncorrected, can have a life-long impact on a child's educational attainment and social development.

As the data from the Sustainable Development Goals shows,[1] educational attainment has a direct impact on future indicators for individual and national economic growth, individual health outcomes and, importantly, on the health and educational outcomes of children.

The correlation between good health and improved educational outcomes for children has long been recognized (although limited rigorous research studies have been done). Blindness, low vision and vision impairment can significantly impact a child's ability to learn and have ongoing consequences for their life opportunities. It is estimated that 50 percent of blindness and low vision in children can be prevented or treated.[2] Uncorrected refractive error is the leading cause of vision impairment in children and is 100 percent correctable with spectacles.[3] Early detection of child eye health issues is tremendously important.

School-based health interventions are recognized as the primary institutional pathway for reaching a majority of children on a regular basis, particularly with preventative interventions,[4] and child eye health needs to be a part of these programs. School-based health programs also need to be aligned with the broader health system to ensure children who are identified with health conditions can enjoy an appropriate continuum of quality care.

This report provides a situational analysis of child and adolescent eye health in 43 of the most marginalized countries in the world (Table 1). Children (0-18) and adolescents (15-19) represent half of the world's population[2] and should be equally considered in planning and resourcing of eye health services. For the purposes of this report we have used data from the ages of 0-19 and a subset of 5-15 where relevant.

Although further research is necessary to better understand the impact vision has on poverty and vice-versa,[3,4] 90% of the world's visually impaired live in low-income settings[5] and it has been found that poor eye health is likely to have a negative impact on mortality,[3] quality of life,[4,6,7] and functionality,[8-10] economic situation of individuals[11] and regions,[12] employment and productivity.[13,14] A 2001 study linked preventable and avoidable blindness to a countries level of socio-economic development and demonstrated a correlation between socio-economic development and an increase in child blindness due to preventable and treatable causes.[15]

Historically child eye health was only viewed in the context of blindness and low vision and, although a priority, the absolute numbers affected were quite low when measured against adults going blind from operable cataract. It was not until 2006 that refractive error was included in the Vision 2020 global action plan for universal eye health.[16] Many eye health problems that occur in children require specialized health care procedures by trained personnel. Access to these trained physicians and healthcare workers may be limited or nonexistent in the developing world, creating unique barriers for children in need.

It is estimated that 50 percent of blindness and low vision in children can be prevented or treated.[17] Uncorrected refractive error is the leading cause of vision impairment in children and is 100 percent correctable with spectacles.[18]

This situational analysis found that access to access to eye care services for children in the countries included in this report is limited by lack of trained eye care personnel, availability of affordable spectacles and geographic barriers to accessing services. Table 10, demonstrates the significant gap between the minimum number of eye care personnel needed (based on World Health Organization recommendations) and actual numbers. A simple estimate from this data indicates a shortfall of at least 11,340 trained personnel across the 43 countries. This is probably an underestimate as current numbers of all cadres, and particularly mid-level cadres was often unavailable so this data is not counted in the shortfall. The table below is a topline summary of some key areas. It is critical to understand the barriers to delivering eye health to children as it is against best practice in public health to provide vision screening in schools but not be able to provide the requisite eye exams and treatment due to lack of human resources and affordable, accessible treatment options. Child eye health requires repeat, ongoing interventions. A child's eyes are growing and changing as they develop requiring regular eye exams and possibly updated spectacles. They often have different prescriptions in each eye. The American Optometric Association recommends an eye exam every year for a child when starting school and every two years after that. For children with an eye condition, the recommendation is an eye exam every year.

Therefore close alignment and collaboration between Ministries of Education, Health, Child Welfare and development and other key stakeholders, is critical if children are to receive adequate and ongoing care.

The summary below indicates some of the key challenges identified from this situational analysis.

Situational Analysis Summary of 43 Global Partnership for Education Supported Countries.

Epidemiology

- Uncorrected refractive error is the leading cause of vision impairment in children.[18]
- Myopia and high myopia rates are increasing globally[19] with onset during childhood and adolescence.
- Providing services to children and adolescents is critical, as correction to slow progression of myopia must occur while the eye is still developing.
- Of the surveyed countries, Sub-Saharan Africa has the lowest rates of uncorrected refractive error but the highest rates of child blindness and low vision.

- Vitamin A deficiency is a leading cause of child blindness and low vision by causing damage to the cornea and the retina. Two dose Vitamin A coverage data was available for 34 countries. Coverage is below the recommended 70 percent coverage[20,21] in 50 percent of the sample. This has implications for higher levels of child blindness and low vision in those countries, with flow on implications for disability and rehabilitation services and inclusive education.

Financing

- 30 of the 43 sample countries (69 percent) invest 5 percent or less of their GDP in Health, half of these invest less than 2 percent. The other 13 countries invest between 6 to 16 percent of their GDP in health.

- Spectacles for children represent a significant out of pocket expense, n Malawi for example, using and affordability measure,[22] a pair of single vision spectacles can cost the equivalent of 4.5 days worth of the daily wage of the lowest-paid government worker (figure 17).

Policy Environment

- There was not an enabling policy environment in two thirds of the sample. Only 51 percent of the sample countries had school health policies in place and the presence of a policy did not always mean a national school health intervention was occurring. Of the 22 countries with a school health policy, only 15 included eye health in the policy.

- The World Health Organization includes child blindness, low vision and uncorrected refractive error under disability. Of the 32 countries where disability policies were available, 18 (56 percent) mentioned vision impairment or blind children.

- Current Prevention of Blindness plans were only present in 22 countries (51 percent).

Human Resources and Infrastructure

- All countries have significant gaps in numbers of trained eye care personnel needed to deliver care to children including a lack of pediatric ophthalmologists.
- There is an estimated shortfall of at least 11,340 trained personnel across the 43 countries. This is probably an underestimate as current numbers of mid-level cadres were often unavailable so this was not counted in the shortfall.

School net attendance* 2013

- Primary school net attendance, from 41 countries, 6 countries had attendance rates below 50 percent.
- School attendance declined at secondary school level, data available for 39 countries and 30 countries (77 percent) had attendance rates below 50 percent.
- In the surveyed countries, eye health interventions need to consider out of school children and adolescents.

*NOTE: * Primary school net attendance ratio = number of children attending primary or secondary school who are of official primary school age, expressed as a percentage of the total number of children of official primary school age. Because of the inclusion of primary-school-age children attending secondary school, this indicator can also be referred to as a primary adjusted net attendance ratio. Secondary school net attendance ratio = number of children attending secondary or tertiary school who are of official secondary school age expressed as a percentage of the total number of children of official secondary school age. Because of the inclusion of secondary-school-age children attending tertiary school, this indicator can also be referred to as a secondary adjusted net attendance ratio.*
SOURCE: UNICEF[23]

The findings of the Situational analysis indicate that child eye health services in the surveyed countries vary significantly and remain far from adequate. The data from the Situational analysis reveals that coverage in most cases is still much less than required, although there are concerted, positive efforts in affect to address this huge gap in service delivery, health workforce, financing and governance by engaging diverse stakeholders at various levels. These collaborations will redefine child eye care by setting new standards in technical aspects, capacity development and access, especially in the context of developing countries.

This report is a starting point for a conversation with relevant health, education and child welfare ministries, bilateral and multilateral donor agencies, health profession councils and other stakeholders on how to address the key issues. Extending this situational analysis to more countries would build a compelling body of evidence to support relevant advocacy at a global and national level.

To strengthen the child eye health agenda, there will be a need to engage proactively in policy, planning and implementation of public health programs. This implies that specialty support functions will need to be aligned with the WHO Health Systems Framework to contribute to the strengthening of health systems in different ways. The six building blocks of the Health Systems Framework have been used to develop the recommendations put forward at the conclusion of the document and provide the basis for:

- Strategic direction of advocacy efforts
- Thematic positioning of the existing initiatives
- Prioritizing the areas where we need to collect evidence
- Possibilities that lend themselves to innovation and learning.

Introduction

No major situational analysis into the status of child eye health (epidemiology, policy environment, service planning and delivery) has previously been conducted.

Poor vision, if left uncorrected, can have a life-long impact on a child's educational attainment and social development. As the data from the Sustainable Development Goals shows[24], educational attainment has a direct impact on future indicators for individual and national economic growth, individual health outcomes and, importantly, on the health and educational outcomes of children. No major situational analysis into the status of child eye health (epidemiology, policy environment, service planning and delivery) has previously been conducted. Furthermore, there are limited studies on the impact of poor vision on educational outcomes. The data provided in this report could be valuable in planning more effective approaches, determining the gaps in existing service provision, providing a roadmap for targeted advocacy communication plans or guiding government policy development. The data can also serve as a baseline to potentially measure change over time, either as a result of interventions or otherwise.

Brien Holden Vision Institute was commissioned by the World Bank via a Global Partnership for Education (GPE)-funded Inclusive Education Grant to provide this situational analysis of child vision and eye health and the factors that impact this in a selection of their member countries. The countries were chosen by GPE and World Bank as they are countries of interest for the GPE under the 2016-2020 Strategic Plan. Countries are located in East Asia and Pacific, South Asia, Latin America and the Caribbean and Sub-Saharan Africa (Table 1). The report provides epidemiological data on child eye health conditions and policies, practice and financing of child eye health services; factors that impact child eye health including affordability of services, health infrastructure, human resource capacity and school and government health policies, are also presented and discussed.

Data collection and methodology are outlined in detail and then data presented including; child eye health indicators, eye and visual epidemiology, and regional demographics. In order to simplify the presentation of large amounts of data, data in this report is grouped and summarized according to World Bank regions. However, it is important to recognize that this information is not truly representative of a region due to the limited number of countries sampled. Supplementary material is provided within the document – 'A Situational Analysis of Child Eye Health: Supplementary Tables: a review of 43 Global Partnership for Education Member Countries 2016', which provides data for each individual country which can be extracted and referred to as a stand-alone 'country fact sheet' if needed. Of the 43 countries, six countries were chosen for more in-depth analysis, the rationale for choosing these countries is covered in the methodology section.

The report has been compiled with the cooperation of the International Agency for the Prevention of Blindness (IAPB), the World Health Organization (WHO) and national ministries of health and education. National, regional and sub-regional representatives from these organizations were identified as key informants for data collection purposes in selected countries. The data was collected through questionnaires and interviews via telephone, skype and in-country visits. Data has been supplemented using the evidence available in the published literature, Brien Holden Vision Institute's existing epidemiological database, and internal, unpublished reports such as program evaluations and country planning documents.

It is hoped that this report is only the beginning and that by working with the IAPB, national ministries and Non-governmental organization (NGO) partners over the next few years, similar data can be attained for many more countries. This can provide a global baseline against which progress can be measured.

Methodology

Objective

To provide data on child eye and visual epidemiology and the policies, services and human resources that impact child eye health outcomes in 43 Global Partnership for Education (GPE) member countries (Table 1). This report identifies current gaps in data, human resources and service delivery and may support planning for child eye health, both within health systems and as part of school health. The data can also serve as a baseline to potentially measure change over time, either as a result of interventions or otherwise.

Table 1: Countries selected for review

Region	Country
East Asia & Pacific	Cambodia, Kiribati, Marshall Islands, Micronesia (Federated States of), Myanmar, Samoa, Solomon Islands,Timor-Leste, Tonga, Tuvalu, Vanuatu.
Latin America & Caribbean	Guyana, Haiti, Jamaica, Nicaragua, Trinidad and Tobago.
South Asia	Afghanistan, Bhutan, Maldives.
Sub-Saharan Africa	Benin, Burkina Faso, Burundi, Cabo Verde, Chad, Comoros, Dem. Rep Congo, Cote d'Ivoire, Eritrea, Ethiopia, The Gambia, Guinea-Bissau, Lesotho, Liberia, Madagascar, Malawi, Mali, São Tomé and Principe, Sierra Leone, Somalia, South Sudan, United Republic of Tanzania, Togo, Zimbabwe.

Approach

Global Partnership for education focal countries

Global Partnership and the World Bank designated the countries chosen for the review, as they are GPE member countries under their 2016-2020 Strategic plan. GPE focuses on lower income and lower middle-income countries, especially those with high numbers of out-of-school children and significant gender disparities. Many of the countries chosen are either in sector analysis, sector planning or section implementation/review mode during the timeframe for the study.

The study used primarily a desk-based approach, however, six focal countries (Cambodia, Haiti, Malawi, Tanzania, Tonga and Zimbabwe) were chosen for a more in depth analysis with qualitative interviews being conducted and additional quantitative data collected. These countries were chosen to represent the various regions in which the situational analysis was undertaken and to represent a diversity of developmental contexts. The results of these in-depth analysis can be found in the focal country pages of supplementary document – 'A Situational Analysis of Child Eye Health: Supplementary Tables: a review of 43 Global Partnership for Education Member Countries 2016'.

Method

Age groups

This study focuses on children and adolescents, the United Nations Convention on the Rights of the Child defines a child as "a human being below the age of 18 years unless, under the law applicable to the child, majority is attained earlier." Older adolescents are considered 15-19 years of age. The United Nations Population Division uses data sets that either conclude at the ages of 15 or 19. In this report, data is presented for either ages 0-19 or for 'school age children' typically defined as ages 5-14. The review chose to include adolescents (15-19) since some adolescents are still in school up to the ages of 18 or 19, and, critically, the leading cause of vision impairment, refractive error, increases during adolescence. An analysis that excludes both prevalence of refractive error rates and potential barriers of adolescents accessing eye care, risks having them excluded from decisions around planning and financing of services.

Literature review and data sources

A peer-reviewed literature search was conducted to obtain data related to childhood eye and visual epidemiology. Research evidence was obtained using academic datasets from PubMed literature database (National Library of Medicine) and Google Scholar. The search terms included the country name AND (blindness OR "low vision" OR "visual impairment"). The search was conducted between the 9th November 2016 and 24th December 2016.

Public search engines (including Google) were used to obtain demographic and other non-epidemiological country information relating to eye health services and policies. Demographic and development data and indicators, were obtained from United Nations Population Division (UNPD) Department of Economic and Social Affairs, UNICEF, WHO/UNICEF Joint Monitoring Program (JMP) for Water Supply and Sanitation. (Appendix A: Sources for demographic and development data and indicators).

Brien Holden Vision Institute has a global epidemiological database of eye and vision disorders with prevalence data gathered from population-based studies published in scientific, peer-reviewed journals. For countries or regions where data is not available, extrapolations are made using geopolitical assumptions to provide estimates. This meta-analysis of evidence and the associated assumptions made for extrapolations have been published in the peer-reviewed literature.[25,26]

Quantitative data were analyzed using summary statistics in Microsoft Excel.

In-country data collection

Two data collection tools were developed:

1. **In-country questionnaire:** 'Situational Analysis Questionnaire: Prevalence, policies, practice and financing for child eye health' - a detailed quantitative questionnaire completed by key informants (Appendix B: 'Situational Analysis Questionnaire: Prevalence, policies, practice and financing for child eye health').
2. **In-depth interview guide:** 'Situational Analysis Interview Guide: Prevalence, policies, practice and financing for child eye health interview guide' - a qualitative interview guide for in-depth interviews with identified key stakeholders from a sub-set of six countries (Appendix C: 'Situational Analysis Interview Guide: Prevalence, policies, practice and financing for child eye health').

The two data collection tools were designed based on previous situational analyses that were conducted for similar purposes.[27] The data collection tools were reviewed by field experts, pre-tested and refined for clarity and brevity. To ensure consistency of key data by using uniform sources as much as possible, general country data such as population, gender ratios, GDP, investment in health, etc. was pre-entered in the in-country questionnaire and in-country respondents were asked to review and confirm the data. The in-country quantitative questionnaire was completed by all 43 countries, while the in-depth interview was conducted in a sub-set of six focal countries: Cambodia, Haiti, Malawi, Togo, Tanzania and Zimbabwe. Both data collections were completed in English.

The in-country quantitative questionnaire covered the following domains of country profile data: child disease control strategies (vaccinations, vitamin A supplementation, trachoma, onchocerciasis), child eye health, epidemiology of vision impairment and blindness among children, financing for child eye health, human resources for eye care with an emphasis on child eye health by using WHO recommendations for minimum coverage, infrastructure, insurance schemes, national policies, population dependence on public care, programs and plans for eye health, school eye health, school health, training programs to support child eye health, and universal health (including eye exams, corrective devices, spectacles, cataract surgery and consumables).

In order to conduct in-depth interviews with key informants, the project team sought cooperation from the International Agency for the Prevention of Blindness (IAPB) and WHO, through IAPB sub-regional representatives and relevant sub-regional WHO representatives. Letters of introduction were sent to potential key informants, advising them on the purpose of the project and requesting their support in completing the questionnaire (Appendix D: Letters of introduction). Once lead key informant/s were identified the standard survey was emailed to them for circulation to relevant stakeholders.

Key informants were national eye care coordinators, representatives from ministries of health and education, leading ophthalmologists and optometrists, representatives from councils for the blind and staff from NGOs involved in child eye health and/or school health activities in each country. Where needed, follow-up calls were made by phone or skype to clarify or complete information.

Data from the completed in-country questionnaires were entered into Microsoft Excel. Data was checked for accuracy against expected and previously published data. Missing data was obtained from reports published prior where possible. In-depth interviews were conducted in English and hand recorded or transcribed verbatim (if digitally recorded), and a high level thematic analysis was conducted in order to identify major themes. Representative quotes from individual participants are included in the individual country profiles.

Rationale for choosing the focal countries

Cambodia is a country with a relatively large and dense population. The relevant ministries are currently updating their school health policy. There has also been research undertaken recently by the World Bank on the uptake of ready-made spectacles in school children. Lastly, a number of International non-governmental organizations (INGOs) are supporting School Eye Health Programs.

Haiti represents the Caribbean region and being a country facing key challenges of extreme poverty, natural and political calamities, it is an example of what services are available and the key constraints in delivering care.

Malawi is one of the less developed economies in Southern Africa with a severe lack of human resources and finances to roll out a comprehensive school health program. However, in 2008 Malawi introduced a school of optometry and the post of optometrist is being integrated into the public health system.
However, other than the programs directly supported by INGOs there is limited coverage of eye health services and access to spectacles.

Tanzania is a representative of the East Africa Community with a large population and a long history of delivery of school health and nutrition programs.

Also in the last five years, there has been a roll-out of a major school /child eye initiative. Tanzania is also unusual in Africa as it has a well-developed public health optometry and primary eye health systems.

Zimbabwe has undergone economic challenges in the last 17 years resulting in a decline in infrastructure and financing. Until fairly recently, international support was focused primarily on humanitarian relief and recovery. The government of Zimbabwe is developing a policy framework for school health services, and existing school health programs are occurring. Eye health is included in the policy but not yet in practice due to a lack of trained human resources in the public sector and a very high cost of spectacles.

Tonga represents the Pacific region, an area characterized by small nations with low populations spread across several islands and the infrastructure and human resource challenges that this presents. Eye health is one area affected by a lack of specialist health practitioners and supply chain challenges limit access to spectacles and other devices.

Choosing these countries for in-depth analysis provide us with a sample of challenges and successes in delivering child eye health initiatives and the types of interventions that could work in various resource settings.

Background

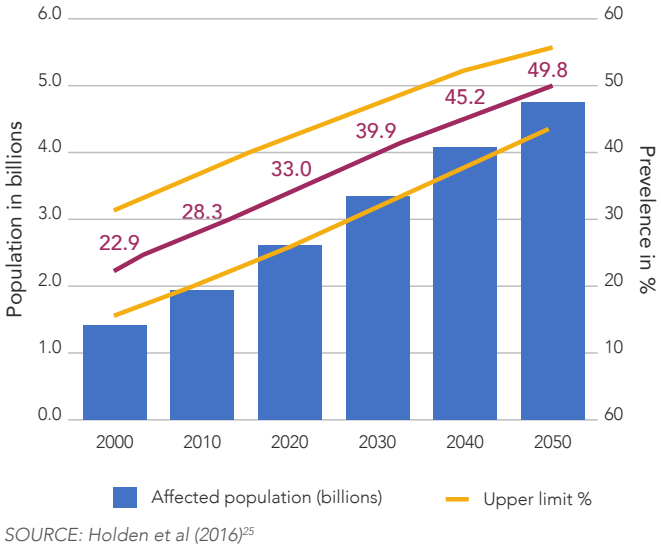
Child eye health has traditionally focused on blindness and low vision, it was not until 2006 that uncorrected refractive error as a cause of vision impairment was included in the Vision 2020 (V2020) global action plan 2006-11.[17]

It is estimated that up to 50% of childhood blindness is preventable or treatable. Preventable: corneal scarring from vitamin A deficiency, measles, ophthalmia neonatorium, harmful traditional eye treatments, retinopathy of prematurity (ROP); treatable: cataract, glaucoma unavoidable: anomalies, genetic disease, central nervous system lesions.[15] The World Health Organization (WHO) estimates that of the 19 million children with vision impairment worldwide an estimated 12 million (63%) cases are the result of uncorrected refractive error.[28] Refractive error, which includes myopia (short or near-sightedness), hyperopia (long-sightedness) and astigmatism (irregular shaped corneas leading to distorted vision at all distances), can easily be corrected with spectacles. The WHO estimates are based on a 6/12 visual acuity (VA) cut-off. However, there is an additional cohort of children who have 6/9 visual acuity who may also experience difficulties with seeing even though they fall outside the WHO cut-off. The 6/12 VA cut-off took into account challenges in providing services in resource poor settings, however, in developed countries, 6/9 or lower is the standard used for examining children. If a 6/9 VA becomes the norm in developing countries, the number of children needing eye care increases. The number of children in need of refractive correction would increase significantly if a 6/9 cut-off is used instead of 6/12.

While much of what a child learns is through the visual system, many studies reveal that only 20% to 50% of children who require spectacles actually have them.[25,29-31] The causal factors for this can vary but are typically linked to lack of access – be it physical, economic or cultural. The majority of those lacking near vision correction reside in developing countries where access is more likely to be hampered by poverty, isolation and poor infrastructure.[32] In countries where there is routine screening and provision of vision correction is free of charge or easily accessible, compliance can still remain low due to cultural or social disincentives.[30,33-35] Even in economically advantaged societies, refractive errors can go undetected or uncorrected in children.[18] Hence, it is important that the barriers to good vision are explored relative to context and population group and solutions tailored as appropriate.

Myopia (near-sightedness) is an eye condition that commonly onsets in childhood and has been attributed to environmental and lifestyle factors such as excessive near work and reduced outdoor time.[36] This appears to be particularly problematic in East Asia where "myopia has emerged as a major health issue in east Asia, because of its increasingly high prevalence in the past few decades (now 80-90% in school-leavers), and because of the sight-threatening pathologies associated with high myopia, which now affects 10-20% of those completing secondary schooling in this part of the world".[37] The urbanization and development in Asia has been much more rapid over a shorter period, and the push for education in Asia is much more intensive with children in Singapore, Hong Kong, Taiwan and China studying and competing to enter pre-school and each new stage of education such as elementary school, junior high, high school and university.[37] Overall, myopia affects approximately 28% of the world's population and this incidence is predicted to rise to affect nearly 50% of the world's population by 2050 (Figure 1) due to increasing time spent indoors and on near activities. Current challenges in the provision of care have resulted in millions of children with uncorrected refractive error. As myopia is the leading cause of refractive error, this research indicates that millions of more children are likely to develop vision problems over the next 30 years, placing a greater strain on eye health systems.[25]

Figure 1: Projected prevalence of myopia, 2010 to 2050



SOURCE: Holden et al (2016)[25]

A key issue is that Myopia is a progressive condition and there is a risk of myopia progressing to high levels (≤ –5.00 diopters) where there is a significantly increased risk of potentially blinding conditions such as glaucoma, cataract and myopic macular degeneration later in life. If current trends continue, it is predicted that 1 in every 10 people worldwide will have high levels of myopia (≤ –5.00 diopters) by 2050 (1 billion people globally), and the number of people with vision loss from high myopia will increase seven-fold.[25] Table 2 demonstrates the expected increases by region.

Reaching children and adolescents with appropriate vision care is critical to mitigating against a future public health crisis of 1 billion people being high myopia patients with a high risk of developing permanent visual impairment or blinding conditions. Slowing or halting the progression of myopia using optical interventions can clinically reduce the risk of high myopia and the complications associated with it.[37] However, the intervention must be implemented while the eye is still developing, typically up to the age of 12 or 13.[37] At this stage there is no firm evidence of any gender related differences in the onset or progression

Table 2: Estimated prevalence of myopia 2000-2050

Global Burden of Disease Region	Estimated Prevalence of Myopia (%)					
	2000	2010	2020	2030	2040	2050
Oceania	5.0	6.7	9.1	12.5	17.4	23.8
South Asia	14.4	20.2	28.6	38.0	46.2	53.0
Southeast Asia	33.8	39.3	46.1	52.4	57.6	62.0
Central Latin America	22.1	27.3	34.2	41.6	48.9	54.9
Caribbean	15.7	21.0	29.0	37.4	45.0	51.7
Central Africa	5.2	7.2	10.1	14.1	20.7	28.2
East Africa	3.2	4.9	8.4	12.3	17.1	22.7
Southern Africa	5.3	8.2	12.4	17.5	24.0	30.8
West Africa	5.2	7.0	9.6	13.6	19.7	26.8

SOURCE: Holden et al (2016)[25]

Myopia has emerged as a major health issue in East Asia[37], because of its increasingly high prevalence in the past few decades (now 80–90% in school-leavers), and because of the sight-threatening pathologies associated with high myopia, which now affects 10–20% of those completing secondary schooling in this part of the world. Similar, but less marked, changes are occurring in other parts of the world. The higher prevalence of myopia in East Asian cities seems to be associated with increasing educational pressures, combined with life-style changes, which have reduced the time children spend outside. There are no clear genetic factors associated with mild-moderate amounts of myopia, although there are several genes that have been found to be associated with high myopia. Any genetic contribution related to ethnicity may be small. The extent that many genes of small effect and gene-environment interactions contribute to variations in myopia within populations remains to be established.[37]

of myopia, but research is being conducted in this area. Additionally, we also need to encourage healthy lifestyle changes to prevent or delay the onset of myopia, for example; increase time spent outdoors, increase exposure to sunlight, reduce time spent on reading or on devices like smartphones and computers or on near work, or take regular, frequent breaks.

Historically, child eye health programs have not received the same attention as adult-focused interventions. What interventions there were have primarily targeted childhood blindness, excluding those with uncorrected refractive error. Recently, there has been an increasing emphasis on child vision in the health sector and within the sub-sector of eye health; including vision impairment due to uncorrected refractive error. This is partly due to the relatively recent, yet long overdue addition of uncorrected refractive error on the WHO global blindness and vision impairment prevention agenda.[38]

Factors that Affect the Delivery, Access, Quality and Utilization of Child Eye Health Care Services

The following section provides a summary of various factors that influence and impact upon children having healthy vision including access to needed services, economic environment, presence of enabling policies, health and eye health financing, adequate infrastructure and human resources for eye health. Where regional data is quoted it is important to remember that this is not truly representative of a region due to the limited number of countries surveyed in each region. Data is summarized by World Bank regions.

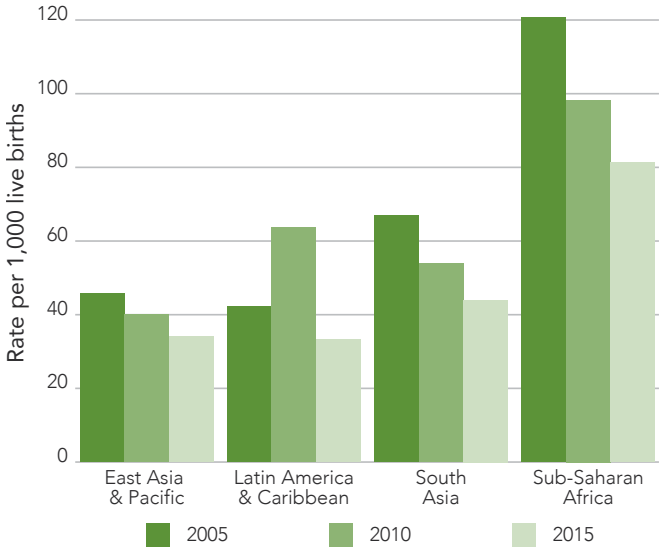
A number of financial and non-financial barriers may delay or prevent poor households from seeking health care for their children. Such barriers include geographical access or distance; financial barriers; sociocultural, language and ethnicity-related barriers; and lack of knowledge and awareness, which can together lead to low demand for and use of services, particularly by the poor.[39] A contributing factor in the eye care context was that child eye care was historically only viewed in the context of blindness and low vision and, although a priority, the absolute numbers affected were quite low when measured against adults going blind from operable cataract. It was not until 2006 that refractive error was even included in the Vision 2020 global action plan for the period 2006-11.[16] This plan extended the remit to focus not only on the elimination of avoidable blindness but to include vision impairment, particularly that caused by uncorrected refractive error. In addition, many eye health problems that occur in children require specialized health care procedures by specialist personnel. Access to these trained physicians and healthcare workers may be limited or nonexistent in the developing world, creating unique barriers for children in need.

Childhood eye health indicators

Child eye health is a sub-set of child health in terms of access to services, issues that impact on child health can impact on child eye health. In particular, childhood blindness is associated with conditions which can also increase childhood mortality including vitamin A deficiency, measles, meningitis and congenital rubella.[40] A relationship has been found between under-5 mortality rates and the prevalence of blindness in children (and hence estimated rates of blindness and low vision can be calculated from infant mortality data).[41]

Overall, infant mortality rates are lower in 2015 compared to 2005 in all regions (Figure 2). In most regions, we see a gradual decline over the three time periods reported (2005, 2010, 2015) except for the Latin America and the Caribbean where 2010 rates were highest. Hence, declining mortality rates would correlate with a reduction in blindness and low vision rates.

Figure 2: Under-five mortality rate (per thousand live births) 2005 - 2015

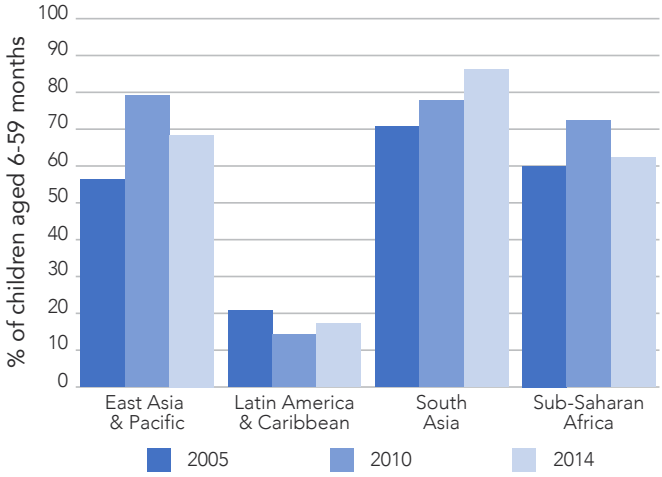


SOURCE: Estimates generated by the UN Inter-agency Group for Child Mortality Estimation (IGME) in 2015.[42]

Vitamin A deficiency is the leading cause of preventable blindness in children[43] by causing physical damage to the cornea and potentially the retina and contributes to morbidity and mortality from common childhood infections due to the weakening of the immune system. The WHO identifies Vitamin A as a major public health problem in over half of the world, especially in Africa and Southeast Asia.[43] Xerophthalmia is the ocular manifestation of vitamin A deficiency and includes signs such as impaired night vision, severe dry eye (conjunctival or corneal xerosis), Bitot's spots (grey-white foamy triangular deposits on the conjunctiva), corneal ulcers and in severe cases, and corneal opacification leading to blindness. Two-dose vitamin A coverage is shown in Figure 3, demonstrating some variability across regions.

In East Asia & Pacific and Sub-Saharan Africa, it appears there is a decrease in the percentage of children receiving the supplement. In our study sample, Vitamin A two dose coverage data was available for 34 countries of the countries surveyed. Of those, 17 countries fell below the recommended 70% two dose coverage rate. In 18 of the 34 countries, two dose coverage declined between 2010 and 2014, which indicates there could be a potential increase in child blindness and low vision in those countries over the next five years.

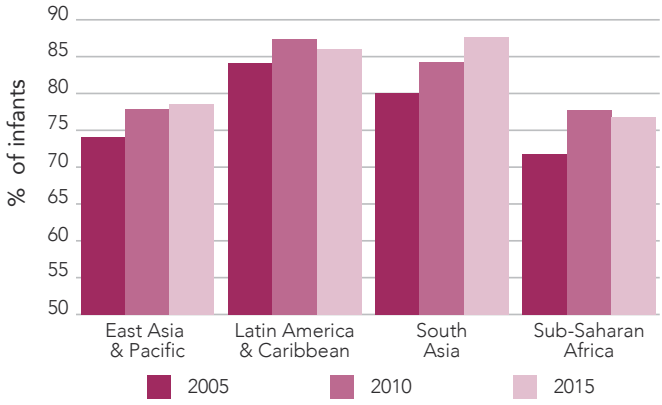
Figure 3: Percentage of children aged 6-59 months that received two high-dose vitamin A supplements, 2005-2014



SOURCE: UNICEF Data: Monitoring the Situation of Children and Women.[23]

Measles is also a leading cause of preventable blindness in countries where vaccine coverage is low. Measles vaccine coverage in 2005, 2010 and 2015 is presented in Figure 4. Whilst regional averages appear high (over 70% in all regions in 2015), by individual country we find very low rates in South Sudan (20%) and Somalia (46%). Countries with the best coverage in 2015 (almost complete coverage at 99%) include Nicaragua, Maldives, Tanzania and Guyana.

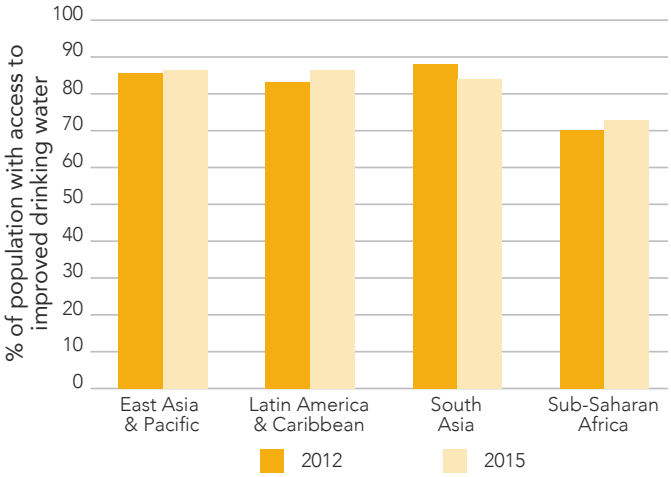
Figure 4: Percentage of infants who received the first dose of measles containing vaccine 2005-2015



SOURCE: UNICEF Data: Immunization coverage by antigen (including trends).[23]

Poor access to water or contaminated water supplies are linked with blinding conditions such as trachoma and can increase the risk of infection with other eye infections. Drought can be a cyclical cause of trachoma (among other diseases) making the diseases' permanent eradication difficult. In addition, civil war or economic deterioration can lead to the collapse of infrastructure resulting in increased water pollution, water shortages, etc. which can lead to an increase in trachoma. Whilst access to improved drinking water has increased for Sub-Saharan countries between 2012 and 2015 (Figure 5), rates still remain lower in these two regions compared to the others. Poor access to water or contaminated water supplies are linked with blinding conditions such as trachoma and can affect hygiene practices, increasing the chance of other types of eye infections. Whilst access to improved drinking water appear to have improved for all regions apart from South Asia between 2012 and 2015 (Figure 5), rates still remain lower Sub-Saharan Africa compared to the other regions. Countries such as Ethiopia[44] and Malawi[45] still experience a significant trachoma burden, whereas countries in East Asia such as Cambodia have reported less prevalence of trachoma.[46]

Figure 5: Percentage of the population with access to improved drinking water 2012-2015



Source: WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation.

Epidemiology of eye conditions

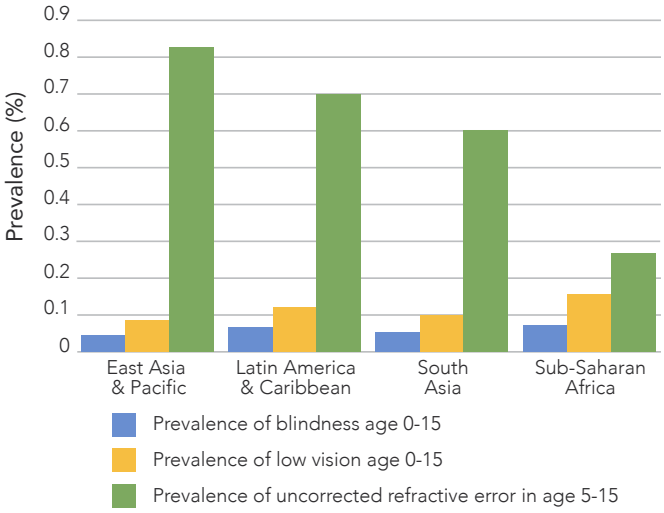
There is a paucity of data on the epidemiology of vision in children; as evidenced by having to use the under 5 mortality rate as a used as a measure for calculating child blindness prevalence and typically low vision prevalence is estimated to be double the blindness prevalence. The high costs of conducting epidemiological studies, the lack of human resources and competing health and eye care priorities often limit the number of studies conducted in child eye health, leading to a paucity of data. The focus has been on the 50 year and over group via the Rapid Assessment of Blindness (RAABS) studies that have provided a quick, cost effective way to determine the prevalence of adult blindness and vision impairment and the key causes such as cataract, glaucoma and refractive error. However, a similar rapid assessment technique in determining vision impairment in children has remained elusive and studies are prohibitively expensive. The Refractive Error Studies in Children (RESC) protocol has been the gold standard but implementing this has been costly. In addition, many of the countries do not have optometrists with the skills to conduct cycloplegic refractions, a precursor for accurately measuring refractive error in children. This lack of information was highlighted by Geoffrey Acaye, the UNICEF Health Manager for MCH during the respondent interviews;

'I'm not sure we even have sufficient statistics to identify the extent of the issue (child eye health). It's taken as a specialist issue in healthcare, and so it's done by private sector mainly. But then there's a lot of priorities, if you look at the National Health Strategy, maybe there's a paragraph on eye diseases? It's an area that needs refocus but there needs to be evidence to show what is the prevalence amongst the different ages, especially amongst school going age and then what is the impact.'

Currently, the Brien Holden Vision Institute, with support from USAID, is field testing a rapid assessment methodology for determining refractive error in children. This may provide a quick, efficient and affordable approach to determining the prevalence of RE among children so that more countries can have the necessary data to plan child eye health services. In addition, this will be a powerful tool in various advocacy efforts aimed at expanding refractive services among children.

Country prevalence data is presented for blindness, low vision and uncorrected refractive error in children 0-15 in Appendix G: Epidemiology Tables. Regional summary data is shown below (Figure 6). Blindness and low vision covers all causes of vision loss that cannot be corrected with spectacles (e.g. glaucoma, retinal disease, pediatric cataract). As mentioned above, under 5 mortality is used as a measure for calculating child blindness prevalence. A table showing the conversion from infant mortality rates to child blindness can be found in Appendix F: Conversion table; blindness prevalence and infant mortality. This conversion uses the under 5 mortality rate from five years previously, 2010 in this case. To give an example, in Afghanistan, the under 5 infant mortality rate in 2010 was 105 per thousand live births. Using the conversion table, we see this equates to a blindness prevalence of 0.8 per 1,000 children (0.08%).

Figure 6: Estimated prevalence of blindness, low vision and vision impairment due to uncorrected refractive error among children and adolescents 0-15 and 5-15. (2015)

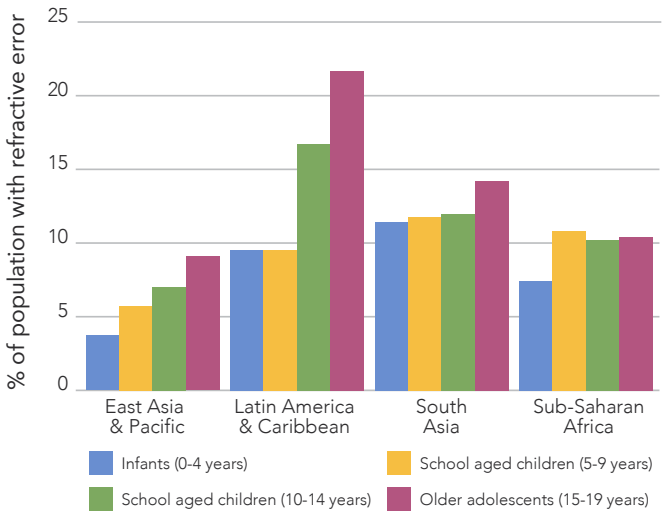


SOURCE: Estimated prevalence of blindness and low vision calculated from under-five mortality rates as previously shown by Chandna and Gilbert, 2010.[41] Estimated prevalence of uncorrected refractive error from Resnikoff et al 2008.[18]

Uncorrected refractive error is any condition that can be corrected with spectacles or contact lenses (e.g. myopia, hyperopia, astigmatism) but is not currently corrected. As can be observed in Figure 6, uncorrected refractive error is the leading cause of vision impairment in children. It is also the simplest form of vision loss to overcome. This is related to the high overall prevalence of refractive error (Figure 7), and the fact that not enough children have access to eye exams and corrective devices.

Sub-Saharan Africa (SSA) appears to have the highest rates of child blindness and low vision and the lowest rates of refractive error. This reflects the higher under 5 mortality rate discussed in CEH indicators which can also be linked to the demographic and development context of SSA which is discussed in the next section.

Figure 7: Prevalence of refractive error in children and adolescents

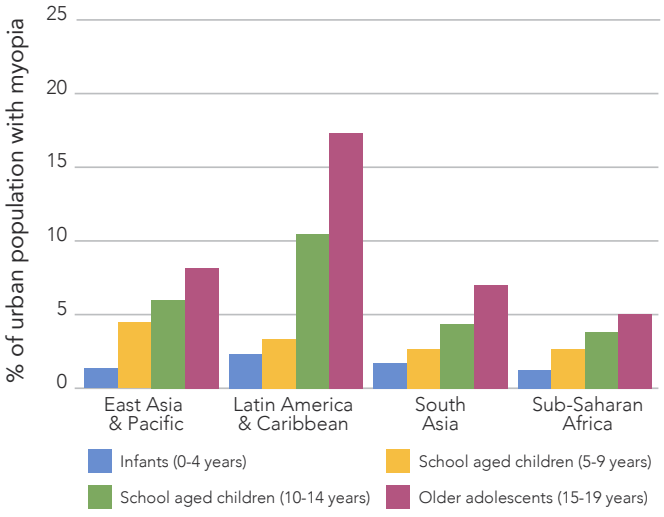


NOTE: Refractive error includes myopia (short-sightedness), hyperopia (long-sightedness) and astigmatism (irregular shaped corneas leading to distorted vision at all distances).

SOURCE: Meta-analysis by Brien Holden Vision Institute using data from Frick et al (2012)[26] and Holden et al (2016)[25]

Generally, there appears to be a rise in refractive error prevalence as children approach teenage years. This is largely attributable to a rise in myopia prevalence with increasing age (Figure 8 and Figure 9). In Appendix G: Epidemiology Tables, there is a detailed breakdown of myopia rates between urban and rural populations. In our sample countries, there are a couple of stand-out countries where we see a difference between urban and rural rates of myopia in children. Cambodia urban 18.33%, rural 13%; Timor Leste urban 10.43%, Rural 7.75%; Guyana Urban 10.93% rural 7.5%; Nicaragua urban 8.58%, rural 4.33%. Over time, if this difference in urban versus rural prevalence increases it may have implications for planning and implementation of eye health services for children and adolescents.

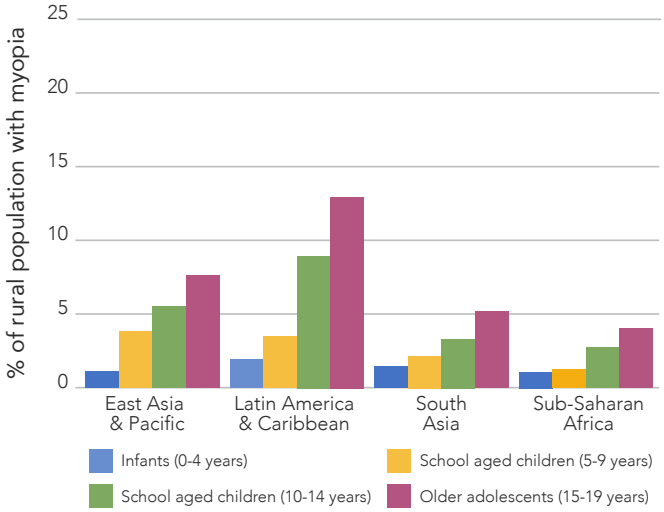
Figure 8: Prevalence of urban myopia in children and adolescents as a percentage



SOURCE: Meta-analysis by Brien Holden Vision Institute using data from Frick et al (2012)[26] and Holden et al (2016)[25]

Demographic and development indicators may impact upon a countries' ability to provide eye care services to children. Although further research is necessary to better understand the impact vision has on poverty and vice-versa,[3,4] 90% of the world's visually impaired live in low-income settings[5] and it has been found that poor eye health is likely to have a negative impact on mortality[3], quality of life,[4,6,7] and functionality,[8-10] economic situation of individuals[11] and regions[12], employment and productivity.[13,14]

Figure 9: Prevalence of rural myopia in children and adolescents as a percentage

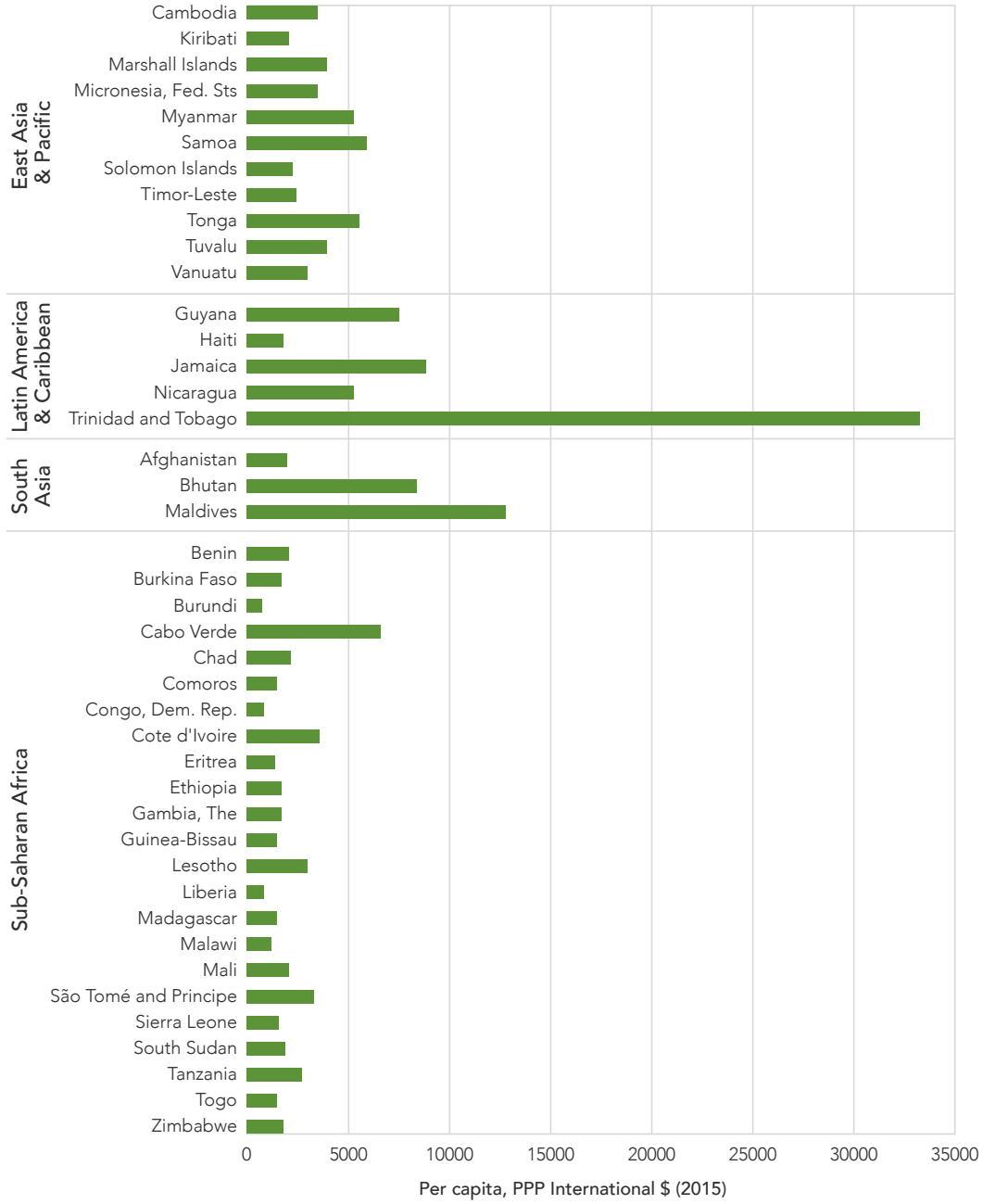


SOURCE: Meta-analysis by Brien Holden Vision Institute using data from Frick et al (2012)[26] and Holden et al (2016)[25] Demographics and development indices

A 2001 study linked preventable and avoidable blindness to socio-economic development level and demonstrated a correlation between lower socio-economic development and an increase in child blindness due to preventable and/or treatable causes.[15]

Figure 10 indicates the Sub-Saharan African (SSA) countries have lower GDP than the other regions, yet SSA bears a significant health burden. For example, Eastern and Southern Africa has only five percent of the world's population but is home to half the world's population living with HIV; with 48 per cent of the world's new HIV infections among adults, 55 per cent among children.[48] SSA has 90% of malaria cases and 92% of malaria deaths,[49] globally 69% of malaria deaths are children under five.[50] The region with the lowest GDP bears the highest health burden. This may also explain why although Sub-Saharan Africa has the lowest prevalence of refractive error in children they have the highest prevalence of blindness and low vision.

Figure 10: Average GDP per capita for 2015 (PPP International $)



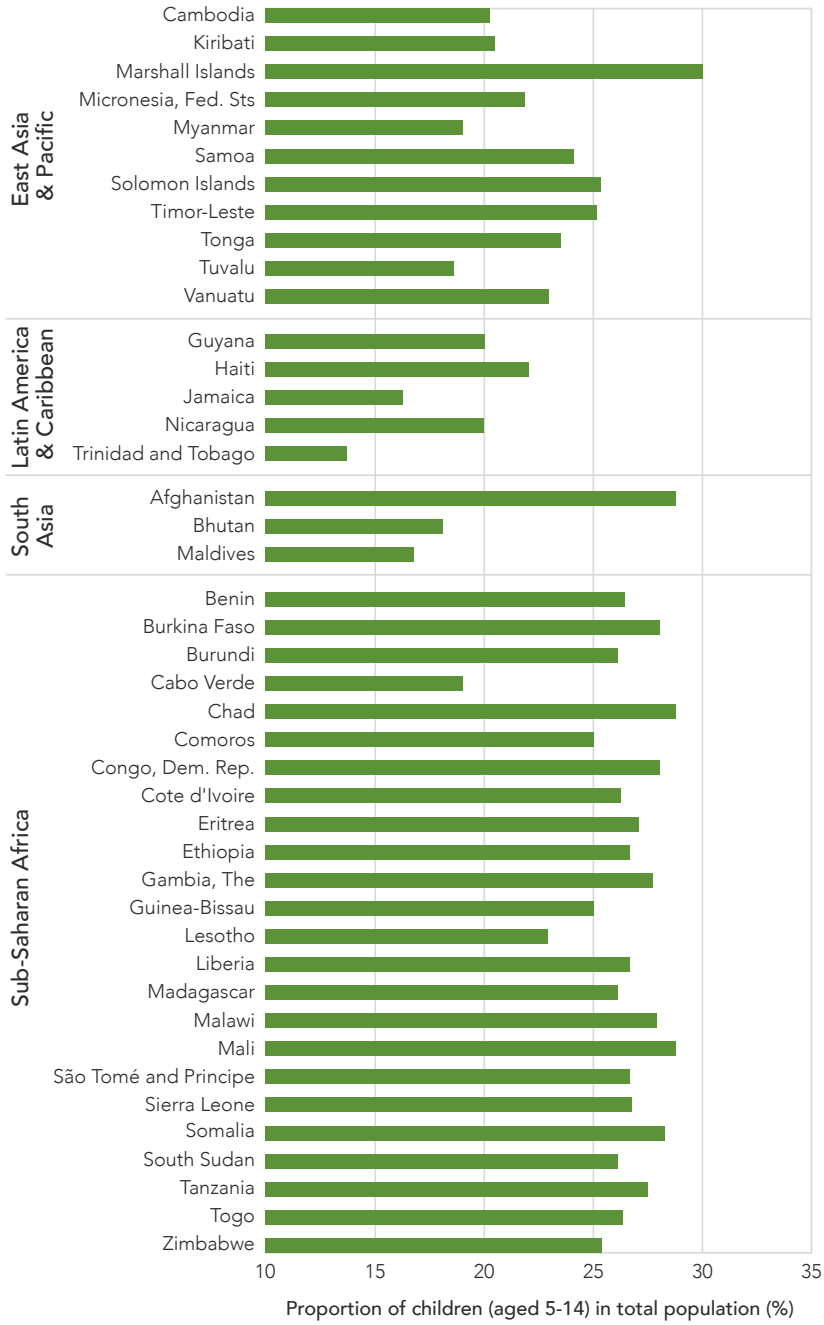
NOTE: No data was available from Somalia. Information for Eritrea is from 2011
SOURCE: World Bank, International Comparison Program database.[51]

Population

In the countries selected for analysis, the proportion of school aged children (5-14) years relative to the general population varies between 13% (Trinidad and Tobago, Latin America & Caribbean) to 30% (Marshall Islands, East Asia & Pacific), see Figure 11. On average, total child populations (0-18) run at around half of the total population.

Given that children represent, in many cases, 50% of the population, it is important that equal consideration is given to planning and resourcing of child eye health services.

Figure 11: Proportion of school aged children (5-14 years) as a percentage of total country population (2015)



NOTE: No data was available for Tuvalu
SOURCE: United Nations Department of Economic and Social and Economic Affairs Population Division.[2]

Gender

In general, the gender balance between girls and boys in our sample countries is evenly split with only a slight percentage of difference. Jamaica is the exception, with girls making up 55.3% of the child population and boys 44.7%. Further on in the document, we discuss gender issues around school enrolment and how this factors into service planning, but good monitoring of disaggregated data is important to ensure equitable access of services. Typically, women and girls bear the burden of blindness: of the estimated 32.4 million people around the world who are blind[52] almost two-thirds of them are women and girls.[53] This is due to a combination of cultural factors, including being deprioritized within the family in terms of health spending, being unable to leave the family to access specialist care and culturally being unable to travel to specialist centers, but also because women live longer on average, and so are more likely to develop blinding conditions such as cataract, glaucoma, etc. Even allowing for the longevity related issues, women are 40% less likely to utilize eye care services than men.[54] There is very little data that looks specifically at current gender inequities among children but a 2001 study, states that Gender based blindness begins in childhood with girls having less access to medical and surgical services than boys.[55]

Typically, women and girls bear the burden of blindness: of the estimated 32.4 million people around the world who are blind[52] almost two-thirds of them are women and girls.[53]

Gender awareness is critical in planning and implementing services and good monitoring is critical to pick up early if any imbalances are occurring. It is important to note that it may be either gender that is being under-represented. For example, in a recent East Asia Vision Program (EAVP) more girls than boys in Vietnam were being screened at outreach sites, but fewer girls than boys were receiving spectacles. Under the same program in Timor-Leste, more boys were being screened but more girls were receiving spectacles.[56] Where inequities are identified it is important to try to understand what issues are contributing to inequitable access and consider locally appropriate strategies to address this. School based eye health interventions should be cognizant of gender equity issues and, if one or the other gender is significantly under-represented, consider ways to reach those children and adolescents.

Gender based blindness begins in childhood with girls having less access to medical and surgical services than boys.55

The reasons for inequity are varied and can include, but are not limited to, cultural barriers, financial barriers – which can range from families only being able to afford to send one or two children to school to children leaving school early to start working, perceived value on benefit of correcting vision (by both parents and / or the child), resistance to wearing spectacles due to physical appearance etcetera. No comprehensive study on barriers to equitable access to eye care in children has been undertaken.

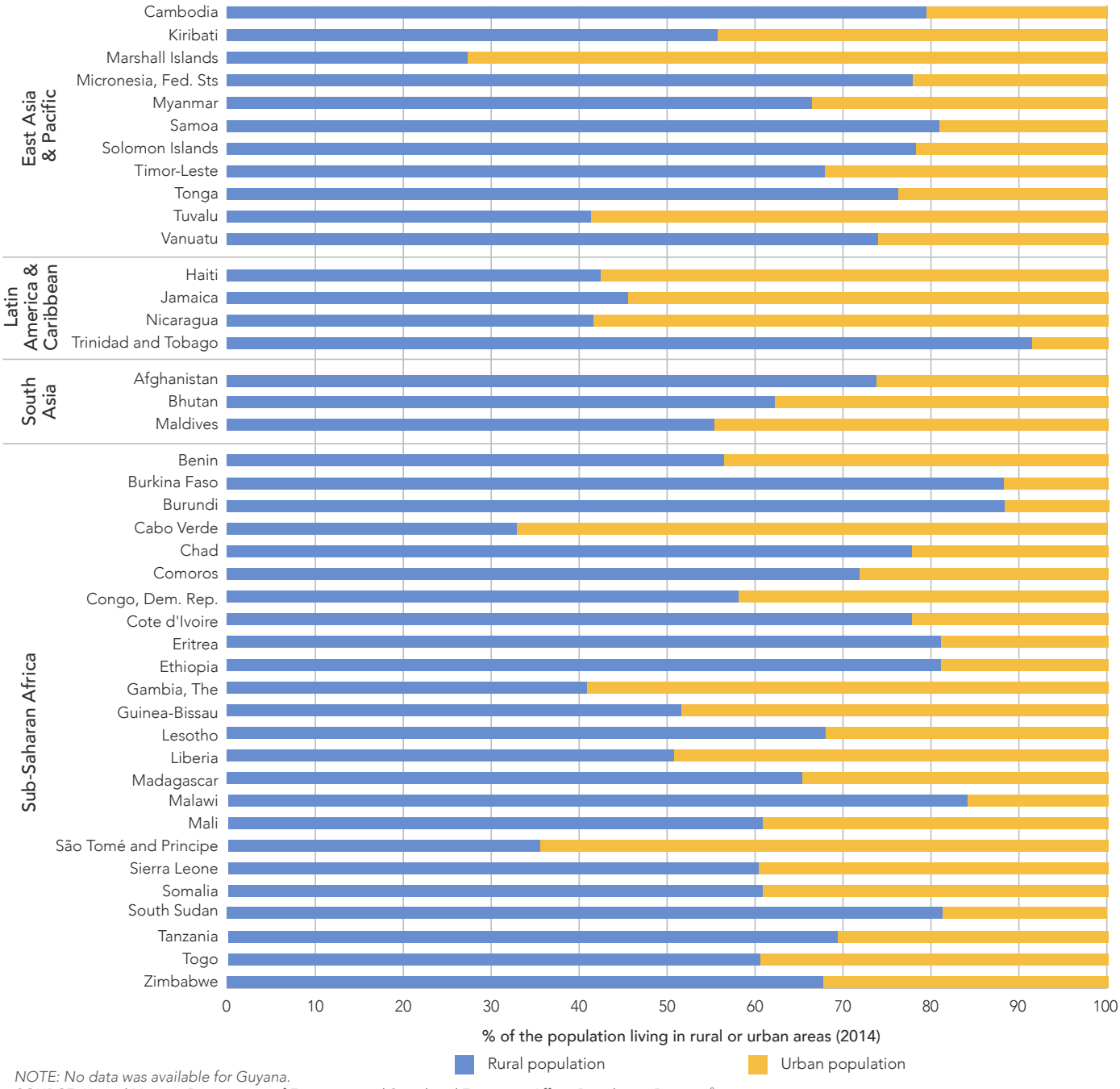
Urban versus Rural access to services

The majority of countries in the survey (70%) have a greater proportion of their population living in rural areas (see Figure 12); four countries (9%) have more people living in urban areas.

It is generally considered that people living in rural areas have reduced access to health services due to a number of factors including practitioners focused in urban centers, distance from health facilities, lack of clinical equipment, electricity and water supply, reduced access to medicines and corrective devices and less access to health information. Distance and time to reach services is a particular challenge with children as they need to be accompanied, increasing the cost and also the difficulty in parent/caretaker taking time away from work or leaving other children unattended among other factors. This is also a challenge for the island nations where patients may need to travel by boat or flight to access the eye care they need.

Although the split in this particular sample of countries was 70% rural to 40% urban, globally 54% of the world's population lives in urban areas.[57] By 2050, 70% of the world's population will be living in towns and cities.[58] This trend is important to consider when planning child eye health services, the 2008 UNICEF State of Latin American and Caribbean Children report identified inequity in access to health within the urban city, that health and education for the poorest communities in a city could be three to five times worse than in the wealthiest suburbs, particularly in the Latin American context with its large 'mega-cities'.[59]

Figure 12: Proportion of the population living in urban or rural populations in 2014 (%)



NOTE: No data was available for Guyana.
SOURCE: United Nations Department of Economic and Social and Economic Affairs Population Division.[2]

The UNICEF SOWC – Children in an Urban World report (2012) states; *'The hardships endured by children in poor communities are often concealed – and thus perpetuated – by the statistical averages on which decisions about resource allocation are based. Because averages lump everyone together, the poverty of some is obscured by the wealth of others. One consequence of this is that children already deprived remain excluded from essential services. Increasing numbers of children are growing up in urban areas.'*[60]

A 2013 study in China, for example, found increased rates of myopia in urban children versus rural children, particularly at the secondary school level.[61] Studies are underway to try and determine the key factors impacting on this, hypotheses include: less time spent outdoors/reduced access to sunlight, more time spent on devices or close study of text books.

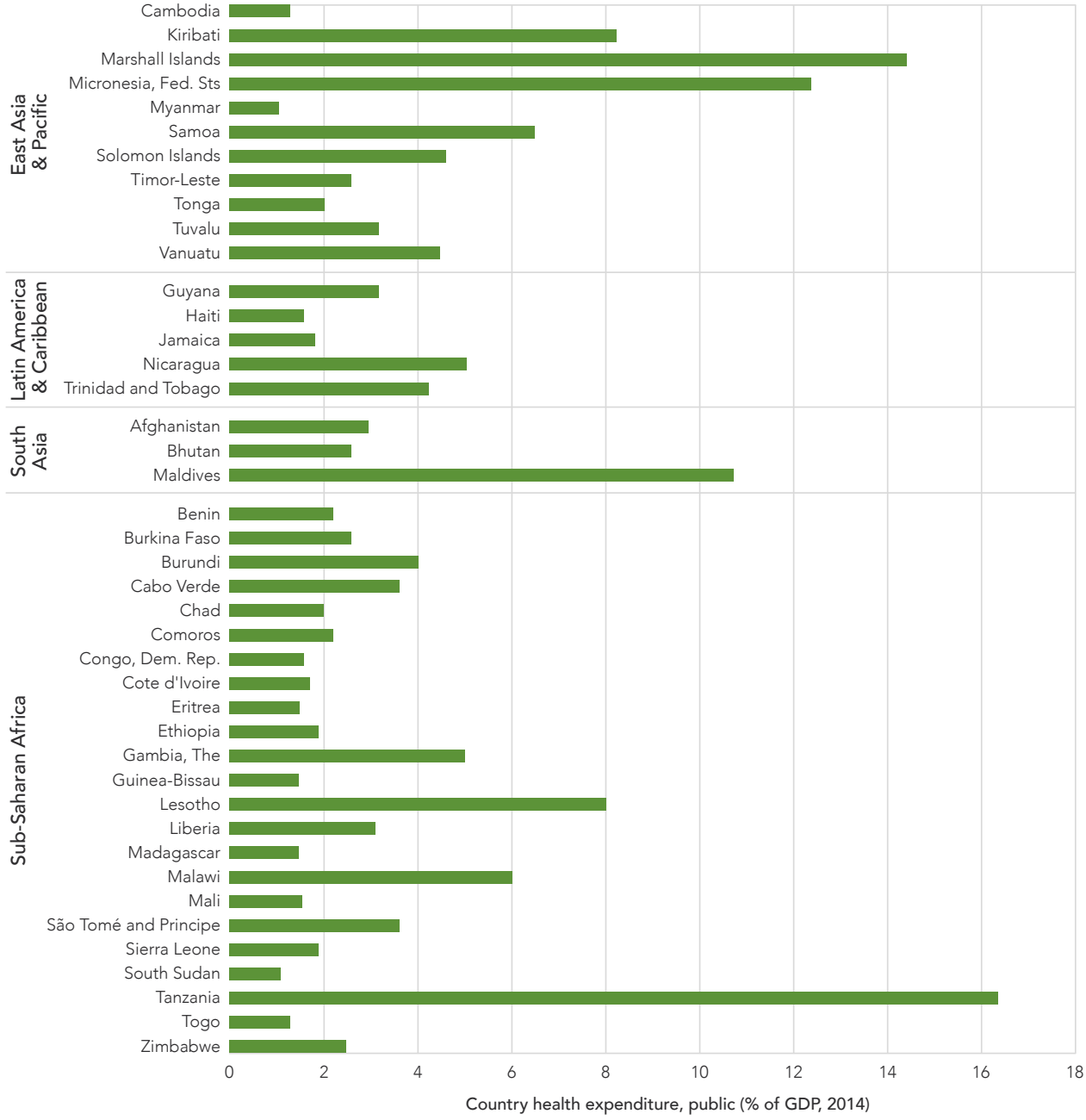
Urban planning for child eye health services may need to take a different approach to that applied to rural services. We cannot assume that the inequities in access and health outcomes found in the UNICEF 2008 report would apply to all major urban environments, but planning for child eye health in a major or 'mega' city should consider these issues and potential relevance to their context.

Health financing and policies

The percentage of GDP expenditure on health varies considerably across the sample but the majority of countries (29) invest 4% or less or less of GDP in health, half of these are investing 2%. (Figure 13), from Nicaragua being the highest with just over 5% of national GDP invested in health, down to Myanmar with just over 1%.

There is no consistency within regions, for example, Lesotho in Sub-Saharan Africa invests 8% of its GDP in health while Guinea Bissau, also in Sub-Saharan Africa, less than 2% of GDP. This highlights the fact that each country is at a unique stage of health investment and any planning interventions need to be cognizant of the level of resources available, or likely to be available, for strengthening the health system.

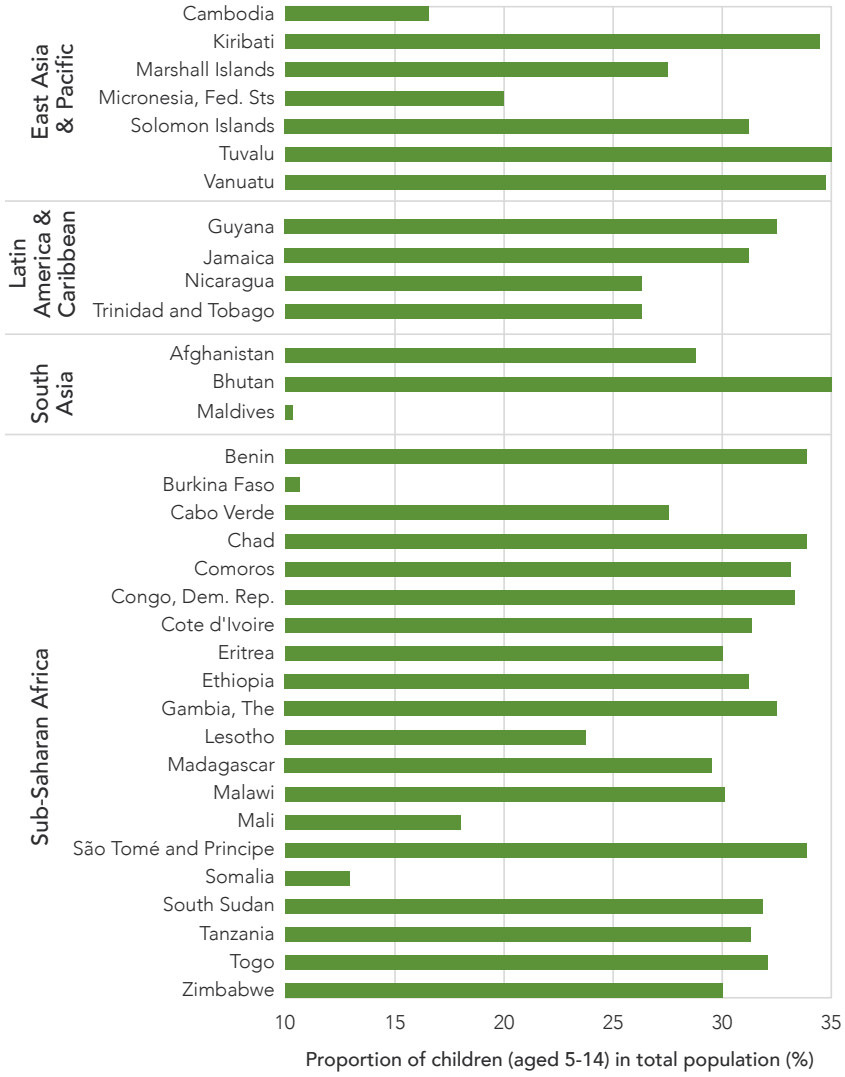
Figure 13: Country health expenditure, public (% of GDP, 2014)



NOTE: No data was available for Somalia
SOURCE: World Health Organization Global Health Expenditure database.[62]

In all of our sample countries, the majority of the population depend on government (public) health services, (Figure 14) and in order for child eye health services to reach the majority of children in the country, they need to be embedded within existing and planned government child health programs. Due to limited government health finance, much of the financial resources may come from bilateral donors, either directly or via NGOs, but the programs should be in partnership with the government and align with their referral systems and recognized health cadres. It is important to align with both the education and health departments/ministries policies and approach. Notwithstanding this, the private sector plays an important role in service provision but typically only reaches between 20-30% of the population.

Figure 14: Percentage of the population using public health services in 2016 (%)



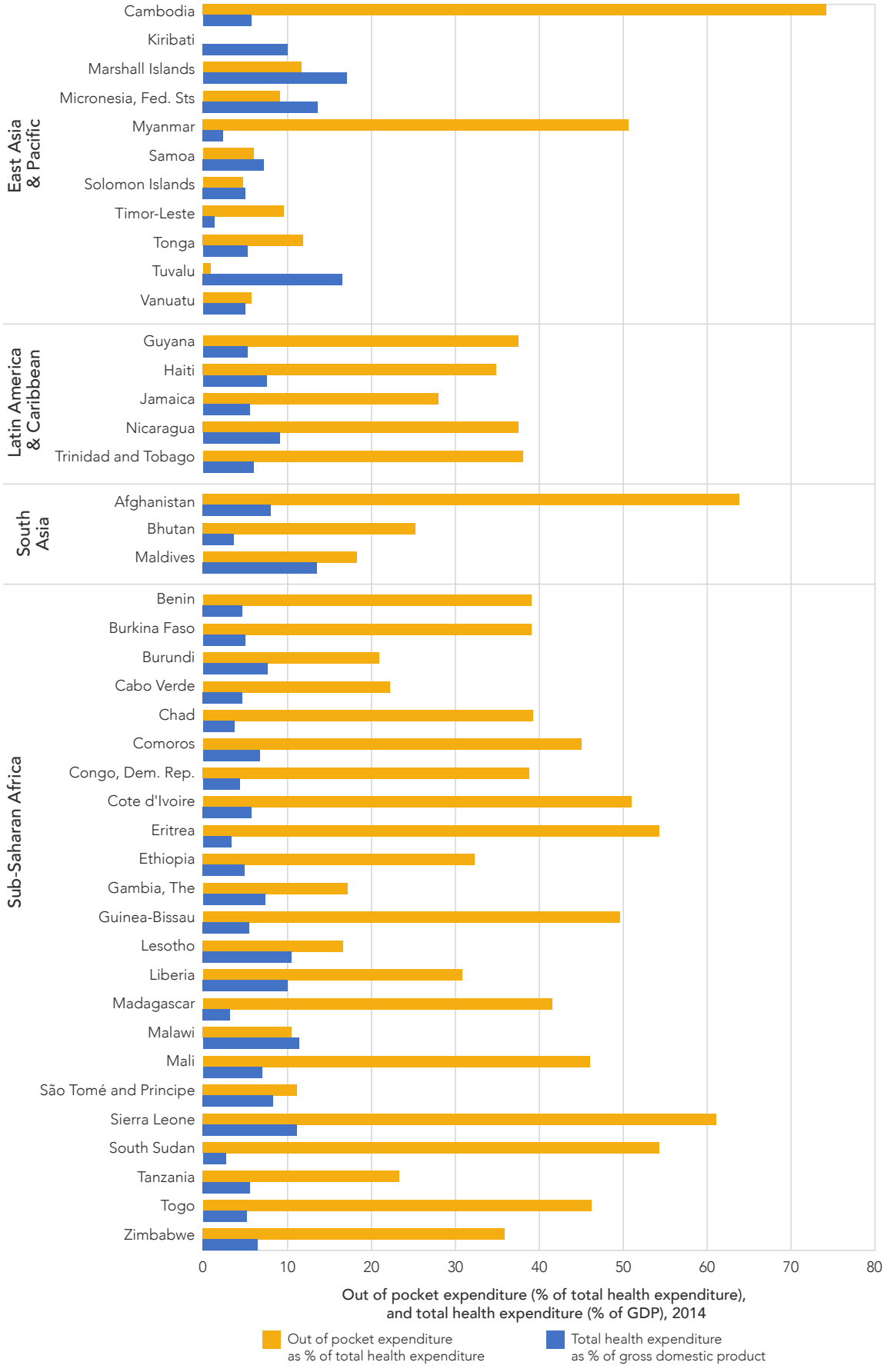
NOTE: No data was available for Burundi, Guinea-Bissau, Haiti, Liberia, Myanmar, Samoa, Sierra-Leone, Timor-Leste or Tonga.
SOURCE: 'Situational Analysis Questionnaire: Prevalence, policies, practice and financing for child eye health' survey, conducted 2016

Most government health systems still have associated out-of-pocket expenditure, whether it be registering at the hospital, the cost of medicines, etc., which can translate into significant out-of-pocket expenses for patients and become a barrier to people accessing services. In recognition of this, over the last 10 years countries have been moving toward the introduction of essential services packages – free treatment for key conditions, or free or discounted care for certain age groups. In respect to eye care, one of the biggest challenges is that although an eye exam might be provided free to children, usually there is a cost associated with spectacles, low vision devices, inter-ocular lenses (IOLs), etcetera, (unless donated under an NGO/ donor program). With children, a continuum of care is particularly critical. For example, if a child has congenital cataracts removed and IOLs inserted, they need to have a follow up refraction and spectacles prescribed on a regular basis as the eye grows and changes; initially, this may mean new glasses every six months, and then annually. Without this, you might only shift a child from blindness to low vision, whereas with surgery at an early age and proper refractive follow up, the child can have functional vision and a relatively normal life. Several other child eye conditions such as strabismus, astigmatism, myopia and high hyperopia all require regular eye exams and new prescriptions as the child's eye grows and changes.

In-depth country respondents indicated that very poor children can apply for free devices, but that this can be a cumbersome process, especially for people in rural areas and people with low levels of literacy; public service departments are often under-staffed and under-resourced, sometimes taking months for action. In children, timely intervention is often critical to achieve best outcomes.

Figure 15 looks at health expenditure as a % of GDP, in 36 countries of the countries, national health expenditure is less than 10% of GDP. In the seven countries with health expenditure above 10%, they also tend to have lower out of pocket expenditure (OOP), with Sierra Leone and Lesotho as exceptions. Note we cannot say this is a causal relationship. As we can see below OOP varies considerably, in seven countries it is above 50% of total health expenditure, for 16 countries it is between 30 and 49%, in only six countries (all in East Asia and Pacific) is it below 10% of total health expenditure.

Figure 15: Out of pocket expenditure as a % of total health expenditure, and total health expenditure as a % of GDP (2014)



NOTE: Our of pocket expenditure data not available for Kiribati
SOURCE: World Health Organization, Global Health Expenditure Database[62]

Spectacle prices and affordability

There are currently no clear policies or guidelines on determining the most appropriate pricing structure for spectacles so that affordable spectacles can be provided to all who need them in a cost-effective and sustainable manner. Spectacles can represent a significant out of pocket expense to patients.

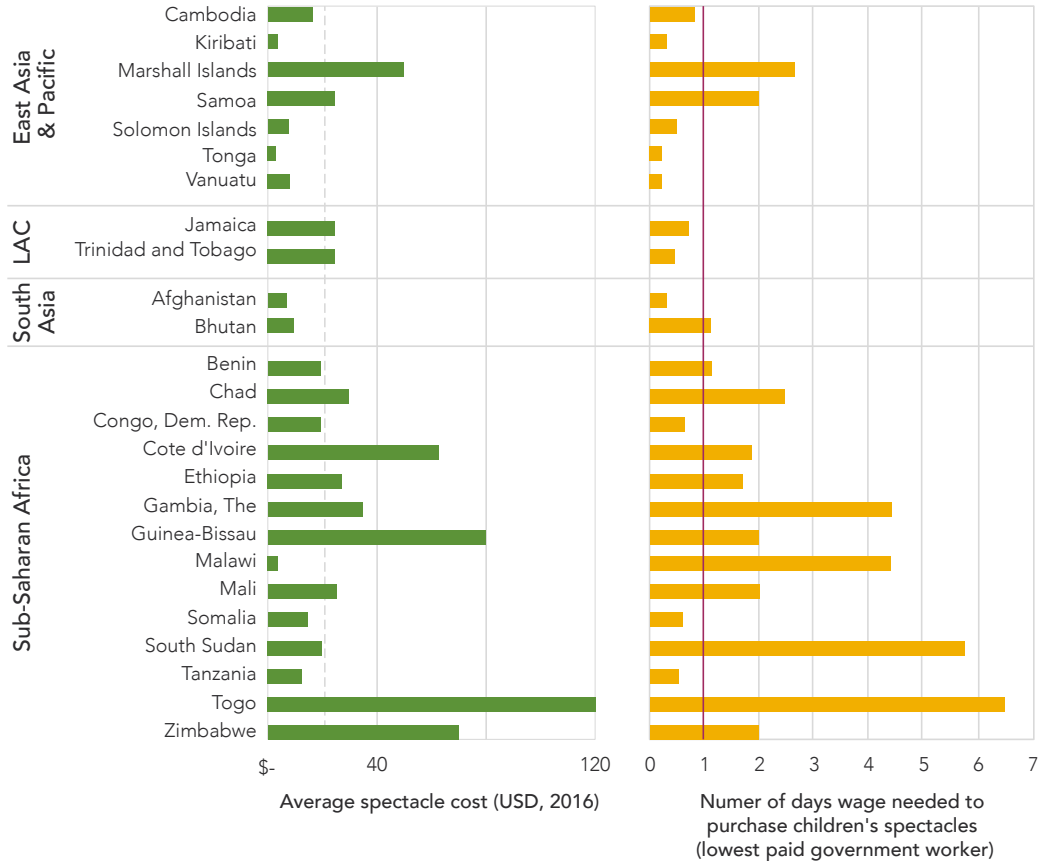
Average spectacle prices are shown in Figure 16. Spectacle pricing and affordability data was not available from Burkina Faso, Burundi, Cabo Verde, Comoros, Eritrea, Guyana, Haiti, Lesotho, Liberia, Madagascar, Maldives, Micronesia, Fed. Sts, Myanmar, Nicaragua, São Tomé and Principe, Sierra Leone, Timor-Leste and Tuvalu.

These prices are just the cost of the actual spectacles (frame and prescription lenses) and do not include any associated costs such as the cost of an eye exam, or travel to the eye clinic.

Affordability of Spectacles

Pricing of spectacles on its own is not a measure of affordability as income relative to cost needs to be considered. This is not an area that has previously been analyzed in eye health. To do this we used the WHO/Health Action International manual on medicine prices – a measurement approach for assessing retail prices and affordability of 'core medicines'.[22] Affordability is assessed by comparing the cost of a typical course of treatment with the daily wage of the lowest-paid unskilled government worker. Pharmaceuticals are generally considered 'affordable' if treatment costs one day's wage or less (for a full course of treatment for an acute condition or a 30-day supply of medicine for chronic disease).[22] Figure 16 shows that for the 25 countries where wages data was available, 11 countries (44%) have 'affordable' custom-made single vision children's spectacles, costing one days' wage or less for the lowest paid government workers. Eight countries (32%) were between one to two days wage, with six countries (24%) needing more than two days wage to purchase spectacles.

Figure 16: Average spectacle costs in 2016 (USD) and Spectacle affordability in 2016 expressed as the number of days wage of the lowest paid Government worker



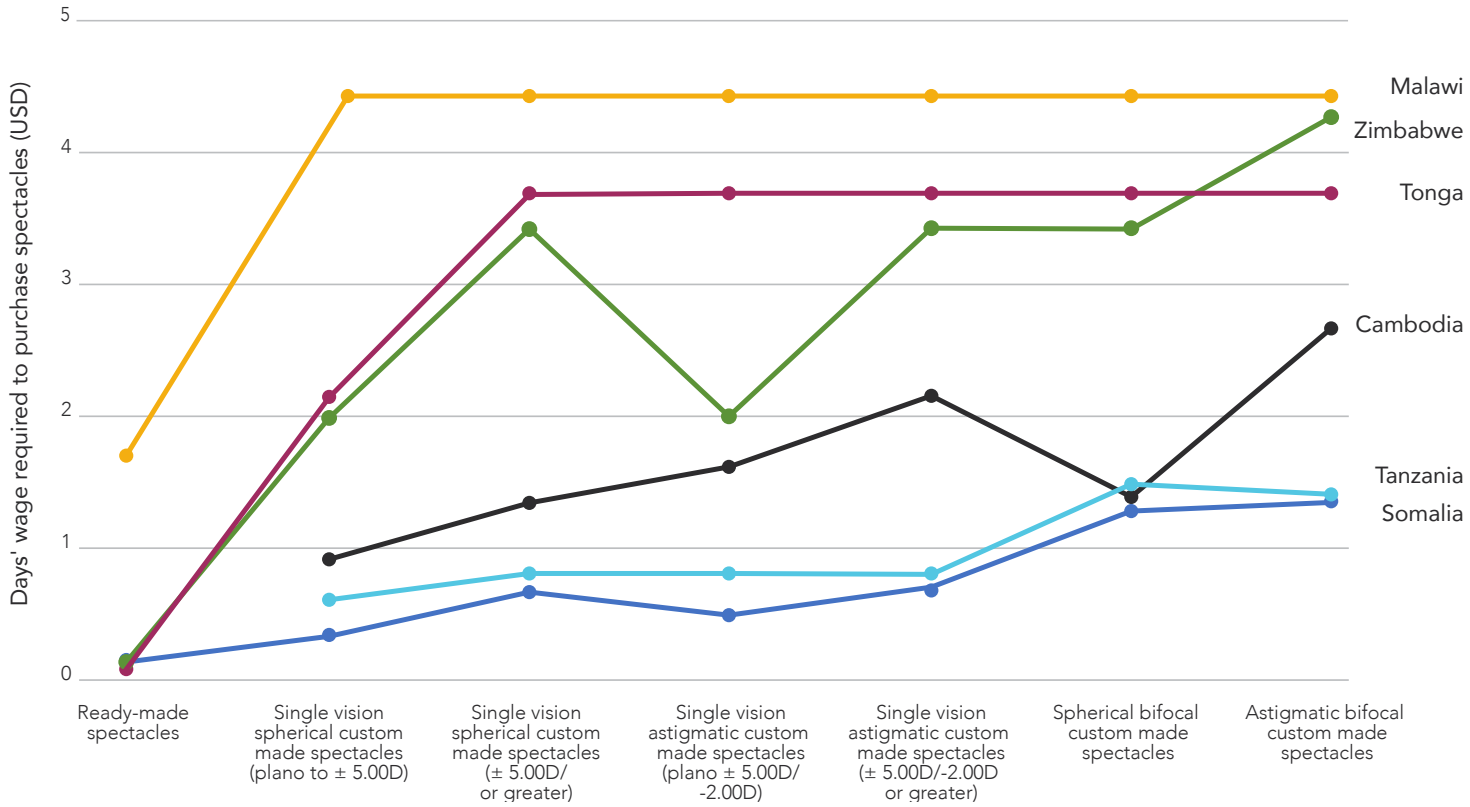
NOTE: LAC – Latin America & Caribbean. Spectacle pricing information was not available from Burkina Faso, Burundi, Cabo Verde, Comoros, Eritrea, Guyana, Haiti, Lesotho, Liberia, FS Micronesia, Myanmar, Nicaragua, São Tomé and Principe, Sierra Leone, Timor-Leste, Tonga, or Tuvalu
SOURCE: 'Situational Analysis Questionnaire: Prevalence, policies, practice and financing for child eye health' survey, conducted 2016
United Nations Office of Human Resources Management: salary scales for staff in the general service and related categories (2017)

By using these WHO/HAI measurement approaches, spectacle 'affordability' is presented in Figure 17 according to the pharmaceutical industry paradigm. All prices are presented in US dollars (as of December 2016). 'Spectacles' refers to the finished product, frame, lenses and cut and fit costs where relevant.

Figure 17 refers to the situation in five of the report's six in-depth countries plus Somalia, (data was unavailable for Haiti). While this metric is a crude approach, it does illustrate that the 'ready-made' spectacles typically cost between one and two days' wage for parents/guardians earning an equivalent to the lowest paid government worker's daily salary. The spectacle cost could be considered 'affordable' using the pharmaceutical paradigm, however, 'ready-made' spectacles are not suitable for the majority of children and should not be used in myopic children.[63] Conversely, custom-made spectacles (single vision spherical and astigmatic custom-made spectacles) are likely to be a lot less affordable and can cost up to a week's salary in some countries (Figure 16).

We see significant differences in spectacle prices between the countries and it demonstrates the value of using an 'affordability' comparison model that takes into account relevant economic factors in each country. For example, by applying the WHO/HAI measurement method to compare the cost of a pair of single vision custom made spectacles in Zimbabwe and Malawi, the results would be as follows: in Zimbabwe the absolute cost of the spectacles is USD$120 whereas in Malawi is USD$13. Once the method is applied, we see that in reality, a person would have to work 4.5 days to be able to afford the spectacles in Malawi, and only 2 days in Zimbabwe; therefore, in reality that particular type of spectacle is less affordable in Malawi. In all countries (except Malawi), the major decrease in affordability is where patients require more complex spectacle prescriptions, such as custom made spectacles with bifocal lenses, or higher power prescriptions. Unfortunately, these patients are the ones who are in the most need of spectacles in order to be able to function properly in their daily lives.

Figure 17: Spectacle affordability in 2016 expressed as the number of days wage of the lowest paid Government worker



NOTE:. Only ready-made spectacles are available in Tonga – these prices are for purchasing spectacles from Fiji.
SOURCE: 'Situational Analysis Questionnaire: Prevalence, policies, practice and financing for child eye health' survey, conducted 2016

National health plans

A National Health Plan was reported to be available for all 43 countries included in this report. There were 27 countries that had a National Health Plan that includes eye health, 13 countries did not include eye health in the National Health Plans (Table 3), and 3 countries (FS Micronesia, Tuvalu and Mali) for which that information is currently unavailable.

Typically, where eye health is referenced in a National Health Plan it is very limited, for example referencing blindness prevention with no detail, or only referring to increasing the cataract surgical rate, however in countries where trachoma or onchocerciasis are endemic there is more detail included in the national plans, with clear references to control programs as part of Neglected Tropical Diseases (NTDs) health initiatives. No national plans refer specifically to child eye health.

Table 3: Countries where the National Health Plan includes eye health in 2016

Region	Country With a National Health Plan That Includes Eye Health (n=27)	Country With a National Health Plan That Does Not Include Eye Health (n=13)
East Asia & Pacific	Cambodia, Kiribati, Myanmar, Solomon Islands, Timor-Leste	Marshall Islands, Samoa, Tonga, Vanuatu
Latin America & Caribbean	Nicaragua, Trinidad and Tobago	Guyana, Haiti, Jamaica
South Asia	Afghanistan, Bhutan, Maldives	
Sub-Saharan Africa	Burkina Faso, Burundi, Chad, Comoros, Cote d'Ivoire, Eritrea, Ethiopia, The Gambia, Guinea-Bissau, Lesotho, Liberia, Malawi, Sierra Leone, South Sudan, Tanzania, Togo, Zimbabwe	Benin, Cabo Verde, Dem Rep of Congo, Madagascar, São Tomé and Principe, Somalia

SOURCE: WHO Country Planning Cycle Database,[64] 'Situational Analysis Questionnaire: Prevalence, policies, practice and financing for child eye health' survey, conducted 2016

Prevention of Blindness/Vision 2020 Plans

VISION 2020 is a global initiative that aims to eliminate avoidable blindness by the year 2020. A key strategy is to work with national ministries of health and key in-country stakeholders to develop national Vision 2020 plans. The plans focused on the three core strategies of Vision 2020: Disease control, Human resource development and Infrastructure and appropriate technology development. National PBL plans are an important tool in achieving eye care services for the country and it is important that plans include eye care services for children if resources are to be allocated toward this from both Ministry of Health and NGOs. From our review of 43 countries, 22 reported that they have a current PBL plan, eight countries say they have no plan but are developing one.

Out of 43 countries, only ten (23%) reported having a budget allocation for eye health and there only were three countries, Ethiopia, Malawi, and Sierra Leone, that reported having a specific allocation for child eye health. The issue of budget allocation reflects the earlier discussion regarding eye health not traditionally being a focal area within Health, with NTDs and cataract surgery being the exceptions.

Table 4: Presence of absence of a Vision 2020 or PBL plan (2016)

Region	Countries With a Current Vision 2020 or PBL Plan (n=22)	Countries Without a Current Vision 2020 or PBL Plan (n=21)
East Asia & Pacific	Cambodia, Kiribati, Myanmar, Solomon Islands	Marshall Islands, FS Micronesia*, Samoa*, Timor-Leste*, Tonga, Tuvalu, Vanuatu*
Latin America & Caribbean	Guyana, Haiti, Jamaica, Trinidad and Tobago	Nicaragua
South Asia	Afghanistan, Maldives	Bhutan*
Sub-Saharan Africa	Burkina Faso, Cabo Verde, Cote d'Ivoire, Eritrea, Ethiopia, The Gambia, Lesotho, Liberia, Malawi, Tanzania, Togo, Zimbabwe	Benin, Burundi, Chad, Comoros, Dem Rep of Congo, Guinea-Bissau, Madagascar, Mali*, São Tomé and Principe, Sierra Leone*, Somalia*, South Sudan

**Countries marked with an asterisk are without any plan but have one in development*
NOTE: No information was available for Nicaragua: 'Situational Analysis Questionnaire: Prevalence, policies, practice and financing for child eye health' survey, conducted 2016

Budget allocations aside, having a national Vision 2020 or PBL plan is a good step towards both identifying a roadmap for improving eye health outcomes for a country, and as a tool to advocate for government investment in eye health, whether it be in infrastructure, trained personnel, service delivery or spectacle subsidies. Regional IAPB offices are frequently key supporters in developing national plans.

Policies on disability inclusiveness and inclusive education

Disability inclusiveness for child education is a growing focal area for many countries, however, it is often under-resourced, with limited facilities for people with disabilities and ongoing social stigma still prevalent in some cultures. In recent times, the approach to disability has moved away from a medical understanding towards a social understanding. Disability arises from the interaction between people with a health condition and their environment. The Convention on the Rights of Persons with Disability (CRPD) reflects this emphasis on removing environmental barriers which prevent inclusion.[65]

Around 15% of the world's population, or 1 billion people, live with a disability. WHO defines disability as 'an umbrella term, covering impairments, activity limitations, and participation restrictions'. Impairment is a problem in body function or structure; an activity limitation is a difficulty encountered by an individual in executing a task or action; while a participation restriction is a problem experienced by an individual in involvement in life situations. Disability is a complex phenomenon, reflecting the interaction between features of a person's body and features of the society in which he or she lives. 'Overcoming the difficulties faced by people with disabilities requires interventions to remove environmental and social barriers'.[66] The WHO also states that 'evidence suggests that people with disabilities face barriers in accessing the health and rehabilitation services they need in many settings'.[65]

Between 110 million and 190 million adults have significant difficulties in daily living. In addition, there are at least 93 million with disabilities in the world, but numbers could be much higher, according to UNICEF estimates.[67] They are often likely to be among the poorest members of the population, they are less likely to attend school, access medical services, or have their voices heard in society. 'Their disabilities also place them at a higher risk of physical abuse, and often exclude them from receiving proper nutrition or humanitarian assistance in emergencies'.[66]

Children with blindness or severe to moderate vision impairment (SMVI) require assistive devices and rehabilitation and education assistance. Around 1.4 million children worldwide are blind and 2.8 million with severe to moderate vision impairment that cannot be corrected by surgery or spectacles. Although the prevalence of blindness among children is about 10 times lower than that among adults, childhood blindness is a high priority because of the expected number of years to be lived in blindness. The major causes of blindness in children include cataract, retinopathy of prematurity (ROP), and vitamin A deficiency. Approximately half of all childhood blindness and can be avoided or treated.[68] As discussed earlier, in our study sample, Vitamin A two dose coverage data was available for 34 countries. Of those, 17 countries fell below the recommended 70% two dose coverage rate. In 18 of the 34 countries, two dose coverage declined between 2010 and 2014, which indicates there could be a potential increase in child blindness and low vision in those countries over the next five years.

If a child with refractive error does not receive the spectacles, or the spectacle prescription is not accurate, there can be both social and physical consequences. A significant decrease in vision can restrict a child's participation in education and social activities, they cannot see the board or read text books clearly, they may have restricted mobility, be unable to play sports and they are unable to see faces clearly. This can lead to social exclusion, a major contributor to the level of poverty which people with disability experience, particularly those in developing countries. It may include being unable to access education or health services, unable to earn a living, or unable to participate in decision making, or in family, community and political life.[69]

On a physical level, high refractive error, if uncorrected in early childhood, can lead to amblyopia and permanent vision loss. We cannot prevent myopia progressing but with timely preventative and corrective measures it can be slowed down so that someone doesn't become highly myopic. However, this can only happen if intervention occurs while the eye is still developing typically up to the age of 12 or 13. As discussed in the background section, myopia, if uncorrected while the eye is still developing in childhood and early adolescence, can progress to high myopia which puts an adult at risk of contracting blinding conditions later in life.

Whilst improvements in child mortality may lead to fewer children becoming blind or SVI due to preventable or treatable conditions, children already affected should have the opportunity to access the rehabilitation, education and psycho-social support they need. Under SDGs, there is an increased focus on rehabilitation and equal opportunities for all children with disabilities and centers on the key aspects of early childhood: health, education, livelihood, sociality and empowerment.

Although WHO categorizes vision impairment under disability, of the 32 countries we could extract current data on, only 18 (56%) made specific reference to blindness and low vision in their National Policy on Disability (Table 5).

Schools for children with disabilities/special needs and/or blindness/severe vision impairment are found in 31 of the selected 43 countries (72%) (Table 6). The information is not available for Comoros, Ethiopia and the Marshall Islands. The countries without a special needs school for children with vision impairment are Guinea-Bissau, Timor-Leste, Haiti, Nicaragua, Samoa, Tonga, Tuvalu and Vanuatu.

Table 5: Reference to blindness/ low vision or vision impairment in national policy on disability (2016)

Region	Reference to Blindness/Low Vision	No Reference to Blindness/LowVision
East Asia & Pacific	Cambodia, Fed States Micronesia	Marshall Islands, Myanmar
Latin America & Caribbean	Guyana, Jamaica, Trinidad and Tobago	Haiti
South Asia	Afghanistan, Maldives	Bhutan
Sub-Saharan Africa	Benin, Cabo Verde, Comoros, Dem Rep of Congo, Cote d'Ivoire, Eritrea, The Gambia, South Sudan, Tanzania, Togo, Zimbabwe	Burkina Faso, Chad, Guinea-Bissau, Lesotho, Liberia, Madagascar, Malawi, Mali, São Tomé and Principe, Sierra Leone

NOTE: No information was available for Burundi, Ethiopia, Kiribati, Nicaragua, Samoa, Solomon Islands, Somalia, Timor-Leste, Tonga, Tuvalu, or Vanuatu
SOURCE: 'Situational Analysis Questionnaire: Prevalence, policies, practice and financing for child eye health' survey, conducted 2016

Table 6: Availability of schools for children with disabilities (2016)

Region	Country	Schools for Children with Disabilities/Special Needs	Schools for Children with Blindness/Severe Vision Impairment
East Asia & Pacific	Cambodia	0	5
	Kiribati	1	0
	Marshall Islands	0	0
	FS Micronesia	Unknown	8
	Myanmar	Unknown	Unknown
	Samoa	2	0
	Solomon Islands	1	1
	Timor-Leste	1	0
	Tonga	1	0
	Tuvalu	0	0
	Vanuatu	0	0
Latin America & Caribbean	Guyana	Unknown	Unknown
	Haiti	Unknown	1
	Jamaica	17	3
	Nicaragua	Unknown	1
	Trinidad and Tobago	2	1
South Asia	Afghanistan	0	1
	Bhutan	Unknown	1
	Maldives	0	1
Sub-Saharan Africa	Benin	4	1
	Burkina Faso	0	1
	Burundi	Unknown	3
	Cabo Verde	Unknown	Unknown
	Chad	2	1
	Comoros	Unknown	Unknown
	Dem Rep of Congo	5	5
	Cote d'Ivoire	0	1
	Eritrea	1	0
	Ethiopia	Unknown	7
	The Gambia	2	1
	Guinea-Bissau	2	1
	Lesotho	2	1
	Liberia	10	4
	Madagascar	Unknown	3
	Malawi	7	5
	Mali	2	1
	São Tomé and Principe	Unknown	Unknown
	Sierra Leone	8	5
	Somalia	2	2
	South Sudan	Unknown	1
	Tanzania	6	12
	Togo	Unknown	1
	Zimbabwe	22	2

NOTE: In Cambodia, there are schools for children with special needs run by NGOs.
SOURCE: 'Situational Analysis Questionnaire: Prevalence, policies, practice and financing for child eye health' survey, conducted 2016

Strategies to combat exclusion within Education Policies

The commentary from our in-depth country interviews shows an awareness of the need for greater focus on inclusive disability practices, in line with the WHO Global Disability Action Plan 2014-2016[68], and of the importance of collaboration across health, education, and rehabilitation sectors. It also reveals limitations for implementation of the practices due to a lack of funding and adequate numbers of trained personnel, including administration and management, infrastructure and geographic and cultural issues. However, progress is being made in the right direction, as evidenced by the inclusion of disability inclusive and integrated education strategies and financing within the national education policies (Table 7) and reference to children with special needs in education policies.

Information wasn't available for all 43 countries, but from the data we could gather, 26 countries (60%) refer to children with special needs in their education policy 25 have integrated education programs in their policies and 30 (70%) reference inclusive education programs (Inclusive education seeks to address the learning needs of all children, youth and adults with a specific focus on those who are vulnerable to marginalization and exclusion), see Table 7. There were six countries (Ethiopia, Kiribati, Togo, Tuvalu, and Vanuatu) for which there is either no references to children with special needs or this information is unknown. Typically children with Vision Impairment due to blindness or low vision are included in the list of groups that inclusive education seeks to reach.

School health policies

The importance of a good health to improving educational outcomes for children has long been recognized. The launch of the FRESH, (Focusing Resources on Effective School Health), at the Education for All conference in Dakar in 2000, recognized that children being in good health was an essential component of achieving the Millennium Development Goal of Education for All. The FRESH framework provides unifying principals and strategic guidance for school health policies and programs. The practical implementation of the programs may vary from country to country, reflecting differences in local needs and capacity. This consensus approach has increased significantly the number of countries implementing school health reforms, and the simplicity of the approach has helped ensure that these programs go to scale.[70] A survey of 36 countries in Sub-Saharan Africa in 2000 suggested that only 8 percent implemented a school health and nutrition program that met the new criteria for equity and effectiveness. By 2007, some 44 percent of these countries had fully compliant programs and many of the remainders were well on their way to achieving a comprehensive approach.[71] In our study sample, just over half the countries have a school health policy (22 countries). It should be noted that a policy does not necessarily translate into an active, comprehensive national program, the reverse is also true, for example in Zimbabwe, a school health program is running but the policy has not yet been ratified by the government.

In our focal countries, where school health programs exist, they are run by the Ministry of Education with Ministry of Health providing specialist health personnel where required. There was also technical and financial support from key International non-government organizations (INGOs) in relevant areas. Typically cross-sectoral working groups are convened to develop policy and plan implementation. These groups represent key areas of child health such as nutrition, water and sanitation, immunization, HIV/AIDS, disability, dental and oral, as well as eye care. The constitution of such groups will vary depending on local health priorities. Working groups include relevant government ministries, INGOs and local NGOs. It is important for NGOs or INGOs active in eye health to ensure they are represented in these working groups.

Table 7: Disability inclusiveness in schools (2016)

Region	Country	National Education Policy Refers Specifically to Children with Special Needs	Integrated Education Programs	Inclusive Education Programs
East Asia & Pacific	Cambodia	Yes	Yes	Yes
	Kiribati	No	No	No
	Marshall Islands	Yes	Yes	Yes
	FS Micronesia	Yes	No	Planned
	Myanmar	Yes	Planned	Planned
	Samoa	Yes	Unknown	Yes
	Solomon Islands	Yes	Yes	Yes
	Timor-Leste	Yes	No	Yes
	Tonga	Yes	Yes	Yes
	Tuvalu	Yes	No	No
	Vanuatu	Yes	Unknown	Planned
Latin America & Caribbean	Guyana	Yes	Yes	Yes
	Haiti	No	No	Yes
	Jamaica	Yes	Yes	Yes
	Nicaragua	Unknown	No	yes
	Trinidad and Tobago	Yes	Yes	Yes
South Asia	Afghanistan	Yes	No	Yes
	Bhutan	Yes	Yes	Yes
	Maldives	Yes	Yes	Yes
Sub-Saharan Africa	Benin	Yes	Yes	Yes
	Burkina Faso	Yes	Yes	Yes
	Burundi	Yes	Unknown	Unknown
	Cabo Verde	Yes	Yes	Yes
	Chad	Yes	No	No
	Comoros	Yes	Unknown	Yes
	Dem Rep of Congo	Yes	Yes	Yes
	Cote d'Ivoire	Unknown	Yes	Yes
	Eritrea	Yes	No	No
	Ethiopia	Unknown	Unknown	Unknown
	The Gambia	Yes	Yes	Yes
	Guinea-Bissau	No	No	Yes
	Lesotho	No	Yes	No
	Liberia	Yes	Yes	Yes
	Madagascar	Yes	Unknown	Unknown
	Malawi	Yes	Yes	Yes
	Mali	Yes	Yes	Yes
	São Tomé and Principe	Yes	Unknown	Yes
	Sierra Leone	Yes	Yes	Yes
	Somalia	Yes	Yes	Yes
	South Sudan	Yes	Yes	Yes
	Tanzania	Yes	Yes	Yes
	Togo	Yes	No	Planned
	Zimbabwe	Yes	Yes	Yes

SOURCE: 'Situational Analysis Questionnaire: Prevalence, policies, practice and financing for child eye health' survey, conducted 2016

School eye health

School health interventions have been recognized as the only institutional pathway for reaching a majority of children on a regular basis, particularly with preventative interventions.[72] In the initial development of the FRESH framework, eye health or vision was not listed as a core health barrier to a child achieving improved educational outcomes.[73,74] Blindness was mentioned as a possible outcome of other conditions such as Vitamin A deficiency or helminth infections. By 2010 this had shifted to recognizing that vision impairment and particularly refractive error can be a barrier to learning and should be considered as part of school health programs.[71] Typically, however, where school eye health programs are occurring they are ad hoc and stand-alone vertical processes that have not been integrated into broader school health programs.

In the sample countries, 22 (51%) have a school health policy (Table 8). Of these, 15 (65%) include eye health as part of the package of health interventions in the policy.

Although the recommendation is to have school eye health included in a comprehensive school health program, the challenge is that 20 of the 43 sample countries do not yet have a comprehensive school health program in place within which eye care can occur. Tanzania, Cambodia and Zimbabwe have drafted school health policies in 2016, (inclusive of eye health), which are in the process of being ratified by the Ministry of Education. This seems to be a process that is gaining momentum, but it demonstrates the need for ongoing advocacy to:

1. Create school health policy (inclusive of eye health) where none currently exists
2. Advocate for inclusion of eye health in existing school health policies that do not currently include it as an intervention.

However, even with the inclusion of eye health in the school health policy, the challenge will be translating policy to action. Comments from our focal country respondents (see supplementary tables) indicate that school eye health programs are still somewhat ad hoc and suffer from a myriad of challenges, including but not limited to:

- Lack of trained eye care personnel to provide eye exams and required treatment.
- Costs and challenges of geographic distance between nearest eye unit or practitioner and the child needing treatment. This can add considerable cost and time delays to children accessing the care they need.
- Lack of quality, affordable spectacles, particularly outside major centers.
- An often-overlooked challenge is that spectacles are not provided on the spot in many instances and so a second trip is needed to deliver or collect the spectacles. (Note, the IABP Refractive Error Working Group (REWG) does not recommend the prescribing of adjustable spectacles for children.[75])

Providing eye health to children is dependent on trained eye care personnel and corrective devices and treatments, that requires children to leave the school to attend clinics, or for clinicians to go to them, (although specialist ophthalmic treatment and surgery need a child to travel to a specialist center). Given the significant gaps in eye care personnel in the majority of the sample countries (see Human Resources for Eye Health) comprehensive implementation of child eye health interventions will remain a challenge for many countries unless more personnel are trained.

Spectacle availability and affordability is another key area (Figure 17) and could be considered in the context of budgeting for essential medical lists for children. Tonga, for example, cited lack of optical workshops in the country as a key barrier to spectacle affordability and availability. Ready-made or adjustable spectacles may be put forward as a solution to this but recently released position statements from the International Agency for the Prevention of Blindness specify that the use of ready-made or adjustable spectacles is not considered a viable solution for children.[63,75] Adjustable spectacles rely on the child 'adjusting' the spectacles until they think they can see clearly, the child may not end up with the correct refractive correction they need. Under or over correction can do further damage to the eye and can also contribute to increased progression of myopia. There is also a risk if the spectacles are used without an eye exam being performed of potentially serious eye conditions will not be identified. If children are to be prescribed ready-made spectacles (most likely in low-resource settings) they should be of an appropriate size and particular consideration should be made of the Pupillary Distance. They are not suited to children with more complex refractive error conditions and they do not allow for children that have a different level of refractive error in each eye. They should never be prescribed in the absence of an eye exam by a qualified practitioner.

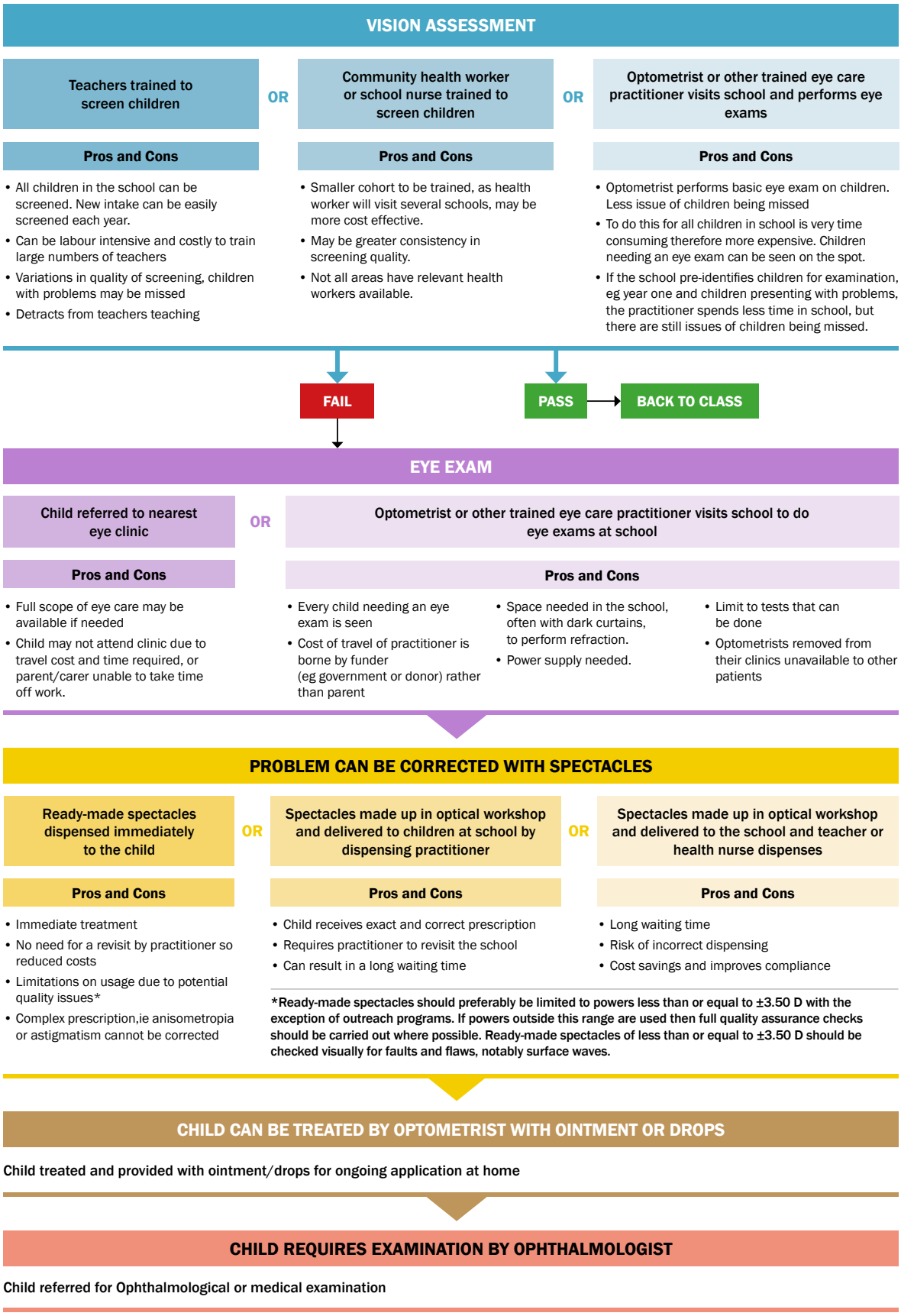
Child eye health requires repeat, ongoing interventions. A child's eyes are growing and changing as they develop requiring regular eye exams and possibly updated spectacles. They often have different prescriptions in each eye. The American Optometric Association recommends an eye exam every year for a child when starting school and every two years after that. For children with an eye condition, the recommendation is an eye exam every year.

Table 8: Countries with National School Eye Health/Vision Screening Policies and programs (2016)

Region	Country	Education Policy Available	Includes or Mentions School Health	School Health Policy	Includes Eye Health	Ministry Responsible
East Asia & Pacific	Cambodia	Yes	Yes	Drafted	Yes	MOE
	Kiribati	Yes	No	No	-	-
	Marshall Islands	Yes	Yes	Yes	No	MOH
	FS Micronesia	Yes	Yes	No	-	-
	Myanmar	Yes	Yes	No	-	-
	Samoa	Yes	Yes	No	-	-
	Solomon Islands	Yes	No	Yes	No	MOH
	Timor-Leste	Yes	Yes	No	-	-
	Tonga	Yes	Yes	Yes	No	MOE
	Tuvalu	Yes	Yes	No	-	-
	Vanuatu	Yes	Yes	Yes	N/A	MOH&MOE Nat Committee
Latin America & Caribbean	Guyana	Yes	Yes	Yes	N/A	N/A
	Haiti	Yes	Yes	No	-	-
	Jamaica	Yes	Yes	Yes	Yes	MOH
	Nicaragua	Yes	Yes	No	-	-
	Trinidad & Tobago	Yes	Yes	Yes	Yes	MOH
South Asia	Afghanistan	Yes	Yes	Yes	Yes	MOE
	Bhutan	Yes	Yes	Yes	Yes	MOE
	Maldives	No	N/A	Yes	Yes	MOE
Sub-Saharan Africa	Benin	Yes	Yes	Yes	No	MOH
	Burkina Faso	Yes	Yes	Yes	Yes	MOH
	Burundi	Yes	No	No	-	-
	Cabo Verde	No	-	No	-	-
	Chad	Yes	Yes	Yes	No	MOH
	Comoros	Yes	Yes	No	-	-
	Dem Rep of Congo	Yes	Yes	No	-	-
	Cote d'Ivoire	Yes	Yes	Yes	Yes	MOH
	Eritrea	Yes	Yes	Yes	Yes	MOE
	Ethiopia	Yes	Yes	Yes	Yes	MOE
	The Gambia	Yes	Yes	Yes	Yes	MOH
	Guinea-Bissau	Being developed	N/A	No	-	-
	Lesotho	Yes	Yes	Yes	No	MOE
	Liberia	Yes	Yes	No	-	-
	Madagascar	Yes	Yes	Yes	No	MOH
	Malawi	Yes	Yes	Yes	Yes	MOE
	Mali	Being developed	N/A	Yes	Yes	MOH
	São Tomé & Principe	Yes	Yes	Yes	-	Ministry of Education, Culture, Science and Communication
	Sierra Leone	Yes	Yes	Yes	Yes	MOH
	Somalia	Yes	Yes	In progress	No	MOH & MOE Dept of School health formed
	South Sudan	Yes	Yes	No	-	-
	Tanzania	Yes	Yes	Drafted	Yes	MOE
	Togo	Yes	Yes	Planned	-	N/A
	Zimbabwe	Yes	Yes	Drafted	Yes	MOE

SOURCE: 'Situational Analysis Questionnaire: Prevalence, policies, practice and financing for child eye health' survey, conducted 2016

The infographic below School Eye Health – common approaches to service delivery, illustrates the three most common models for delivering school based eye health services and provides a top-line of some of the key pros and cons to each model.



School attendance

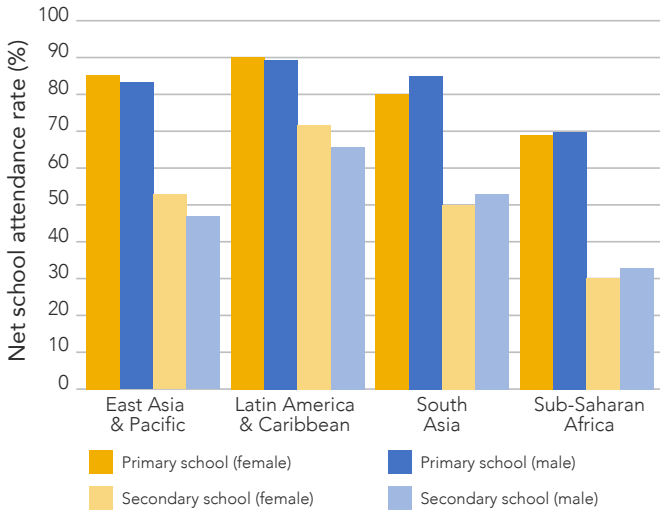
School eye health interventions are considered a key mechanism for reaching large numbers of children with eye care. When considering universal access for children to eye care services it is important to consider the number of children who may not be attending school, and if an additional intervention to reach out of school children and adolescents is warranted. Gender imbalances in attendance rates should also be considered in this planning as it may result in gender inequities in the children getting eye care services.

School enrolment and school attendance rates are presented in (Table 9). Primary school enrolment and attendance is usually much higher than secondary school enrolment and attendance and reflects the gains made under the MDGs and now the SDGs in increasing access to education. The data considers both enrolment and attendance rates as in some instances children will be enrolled in the school but unable to attend for financial or other reasons. For the 41 countries with data, only six countries have primary school attendance rates below 50%, with the lowest being Somalia at 21% of girls and 23% of boys and South Sudan at 23% of girls and 29% of boys. At the secondary school level, this changes. Data is available for 39 countries of which 30 (77%) have attendance rates below 50%. In these countries, any eye health interventions aimed at adolescents would need to include strategies for reaching out of school youth. Similarly, in the six countries with low primary school attendance rates, planning for child eye care services needs to consider how to reach those out of school children.

On the whole, there is a fairly equal gender balance for net attendance rate at primary school level, with Afghanistan being the exception (48% girls, 64% boys) and some variation in Chad (48% girls, 55% boys) and Cote d'Ivoire (66% girls, 72% boys). At the secondary school level, we see some marked gender imbalances appearing, typically more boys enrolled than girls at secondary school level, but some of the Pacific Islands and parts of the Caribbean stand out with more girls at secondary school than boys. This data has implications for planning any gender focused initiatives.

Figure 18 demonstrates the drop off in attendance at secondary school and any gender differences in the attendance rates.

Figure 18: School attendance rate (2009-2013)



SOURCE: UNICEF.[23]

Table 9: School attendance and enrolment (2006-2014)

Region	Country	Net School Attendance Rate: Primary		Net School Attendance Rate: Secondary		Net School Enrolment Rate: Primary		Net School Enrolment Rate: Secondary	
		Female %	Male %	Female %	Male %	Female %	Male %	Female %	Male %
East Asia & Pacific	Cambodia	84	86	45	46	97	100	36	40
	Kiribati	87	83	65	54	NA	NA	NA	NA
	Marshall Islands	NA	NA	NA	NA	NA	NA	NA	NA
	FS Micronesia	NA	NA	NA	NA	84	82	NA	NA
	Myanmar	91	90	59	58	NA	NA	48	46
	Samoa	89	88	70	51	97	95	84	75
	Solomon Islands	69	63	30	29	87	88	NA	NA
	Timor-Leste	83	80	25	26	86	83	NA	NA
	Tonga	87	90	41	52	NA	NA	NA	NA
	Tuvalu	98	98	90	84	98	99	NA	NA
	Vanuatu	78	76	26	22	NA	NA	53	51
Latin America & Caribbean	Guyana	97	97	88	81	80	70	100	86
	Haiti	84	83	39	33	NA	NA	NA	NA
	Jamaica	99	97	92	91	NA	NA	76	72
	Nicaragua	70	71	48	38	94	93	49	42
	Trinidad & Tobago	93	93	84	82	86	83	71	67
South Asia	Afghanistan	48	64	23	41	NA	NA	33	60
	Bhutan	95	96	56	54	92	89	64	56
	Maldives	95	94	70	63	NA	NA	NA	NA
Sub-Saharan Africa	Benin	73	77	38	50	NA	NA	34	50
	Burkina Faso	50	54	17	22	67	69	20	23
	Burundi	84	85	14	20	90	100	21	22
	Cabo Verde	NA	NA	NA	NA	97	99	75	65
	Chad	48	55	12	22	75	96	NA	NA
	Comoros	85	85	56	51	81	86	49	46
	Dem Rep of Congo	85	88	41	54	NA	NA	NA	NA
	Cote d'Ivoire	66	72	23	32	75	81	NA	NA
	Eritrea	56	57	21	23	NA	NA	NA	NA
	Ethiopia	67	64	18	13	NA	NA	NA	NA
	The Gambia	64	61	34	34	72	67	NA	NA
	Guinea-Bissau	62	62	NA	NA	69	73	NA	NA
	Lesotho	96	92	47	34	82	78	42	27
	Liberia	43	42	24	27	37	39	15	18
	Madagascar	71	68	28	27	NA	NA	31	30
	Malawi	94	93	34	32	NA	NA	30	32
	Mali	55	60	23	36	NA	NA	32	39
	São Tomé & Principe	94	94	65	55	97	97	53	46
	Sierra Leone	78	74	42	48	NA	NA	36	40
	Somalia	19	24	4	7	NA	NA	NA	NA
	South Sudan	21	26	6	10	34	48	NA	NA
	Tanzania	99	97	47	35	87	85	89	70
	Togo	73	71	48	43	91	92	40	36
	Zimbabwe	94	93	50	46	95	93	44	44

SOURCE: UNICEF: Administrative data on school participation.[23,76]
NOTE: NA – Not Available.

Human resources for eye health

School eye health interventions are considered a key mechanism for reaching large numbers of children with eye care. Large numbers of children can be quickly and simply screened at school by teachers, school health nurses or other trained personnel. This means that only those identified as having a potential vision problem need to be referred to be seen by specialist eye care personnel. This reduces both costs and the burden on the available eye care personnel. For an effective CEH program to function, sufficient numbers of adequately trained personnel are needed to do the comprehensive eye exam and provide follow up treatment; it is against public health best practice to identify a health issue and then not be able to treat it. Within eye health, the cadres that serve the adult population also serve children, with the addition of pediatric Ophthalmology.

It is always difficult to get accurate Human Resource numbers for all cadres, but Table 10 is a combination of in-country survey data, International Council of Ophthalmology and the IAPB Africa Human Resources for Health strategic plan 2016. When Vision 2020 was launched, the WHO provided a guide for the minimum numbers of eye health personnel required per population, based on estimated service needs. Table 10 compares the actual (or estimated) personnel numbers in each country, the WHO recommended minimum ratios per population and the human resources gap in each area. The personnel numbers include both public and private sector practitioners. A simple estimate from this data indicates a shortfall of at least 11,340 trained personnel across the 43 countries. This is probably an underestimate as current numbers of all cadres, and particularly mid-level cadres was often unavailable so this data is not counted in the shortfall.

Smaller countries face particular challenges as their populations are often too small to support sub-specialists such as ophthalmologists, they may end up contracting care to neighboring countries but this brings significant cost and time challenges in accessing services. In the majority of countries, there are significant gaps between the minimum numbers needed and actual numbers of personnel.

The shortfall of pediatric ophthalmologists is a major barrier to child eye health with regards to more complicated ophthalmic conditions, particularly congenital cataracts, for a child to achieve functional vision post cataract removal the surgery should be done as early as possible, ideally before the age of one, and the child provided with appropriate refractive correction as the eye develops. It is not broken out in this survey, but ICO identifies that in many countries (particularly ex French colonies) some ophthalmologists do not do surgery, so although the absolute number of ophthalmologists may be relatively high, the personnel available to do surgery is lower. This is the case in Haiti and the Democratic Republic of Congo for example.

Personnel to provide initial eye exams at the primary clinic and secondary hospital level appears to be a key gap in the government health systems. Historically ophthalmology and ophthalmic nursing or ophthalmic clinical officer have been the only cadres recognized within the public health system. This means that in many countries optometry posts do not exist in the government health system so that the population depending on public health has limited access to refractive services. The projected increase in myopia indicates the importance of a population having access to the required refraction exams and corrective devices from childhood onwards. Increasingly this is being recognized with 10 new schools of optometry established in Africa alone since 2008, but the corresponding challenge is personnel being available in the government system rather than private practice. Tanzania is quite unique in that optometrists have been employed in the public health system for many years. There are more optometrists in the public health system than practicing privately. This is the reverse of Zimbabwe for example where there are 80 optometrists practicing privately and not a single optometrist employed in the public health system.

Child eye exams are more difficult to conduct than for adults. Some practitioners may need refresher training in pediatric refractions. For example in Tanzania, the Seeing is Believing CEH project has been providing refresher training to existing government hospital optometrists. In Cambodia, the Brien Holden Vision institute is providing refresher training to ophthalmologists. Hence, even if the required numbers of eye health personnel are available to service a child eye health program, refresher training or upskilling may also be needed.

The challenge of attrition of health workers in developing countries to emigration is a well identified problem and, although no direct studies have been done it would be fair to assume this would also affect ophthalmologists and optometrists. Attrition due to emigration may be less in mid-level and primary/community health cadres, but this level has other challenges. Ophthalmic nurse training, primary eye care nurses and community case finders are typically nurses who receive additional training in eye care, anecdotal evidence suggests that this personnel may be re-directed back to other areas of health such as midwifery and MCH.

Table 10: Eye care human resource ratios by country

Region	Country	Population	WHO Ratio	Pediatric Ophthalmologist	Ophthalmologist	Optometrist / Refractionist	Mid-level cadres
East Asia & Pacific	Cambodia	15,578,000	Needed	2	62	156	312
			Actual	0	29	70	112
			Gap	2	33	86	200
	Kiribati	112,000	Needed	0	0	1	2
			Actual	NA	0	1	NA
			Gap	NA	0	0	NA
	Marshall Islands	53,000	Needed	0	0	1	1
			Actual	0	0	2	NA
			Gap	0	0	0	NA
	FS Micronesia	105,000	Needed	0	0	1	2
			Actual	NA	1	1	NA
			Gap	NA	0	0	NA
	Myanmar	53,897,000	Needed	5	216	539	1,078
			Actual	2	166	200	NA
			Gap	3	50	339	NA
	Samoa	194,000	Needed	0	1	2	4
			Actual	NA	1	3	6
			Gap	NA	0	0	0
	Solomon Islands	583,000	Needed	0	2	6	12
			Actual	NA	5	1	39
			Gap	NA	0	5	0
	Timor-Leste	1,185,000	Needed	0	5	12	24
			Actual	NA	4	6	NA
			Gap	NA	1	6	NA
	Tonga	106,000	Needed	0	0	1	2
			Actual	0	1	2	NA
			Gap	0	0	0	NA
	Tuvalu	10,000	Needed	0	0	0	0
			Actual	NA	0	0	-NA
			Gap	NA	0	0	NA
	Vanuatu	265,000	Needed	0	1	3	5
			Actual	NA	1	2	6
			Gap	NA	0	1	0
Latin America & Caribbean	Guyana	767,000	Needed	0	3	8	15
			Actual	NA	5	32	NA
			Gap	NA	0	0	NA
	Haiti	10,711,000	Needed	1	43	107	214
			Actual	0	60	10	NA
			Gap	1	0	97	NA
	Jamaica	2,793,000	Needed	0	11	28	56
			Actual	NA	43	15	8
			Gap	NA	0	13	48
	Nicaragua	6,082,000	Needed	0	24	61	122
			Actual	NA	101	58	NA
			Gap	NA	0	3	NA
	Trinidad & Tobago	1,360,000	Needed	0	5	14	27
			Actual	1	16	150	60
			Gap	0	0	0	0
South Asia	Afghanistan	32,526,000	Needed	3	130	325	651
			Actual	NA	143	53	65
			Gap	NA	0	272	586
	Bhutan	775,000	Needed	0	3	8	16
			Actual	1	9	59	4
			Gap	0	0	0	12
	Maldives	363,000	Needed	0	1	4	7
			Actual	NA	18	13	4
			Gap	NA	0	0	3
Sub-Saharan Africa	Benin	10,880,000	Needed	1	44	109	218
			Actual	NA	28	58	3
			Gap	NA	16	51	215
	Burkina Faso	18,106,000	Needed	2	72	181	362
			Actual	1	30	6	186
			Gap	1	42	175	176
	Burundi	11,179,000	Needed	1	45	112	224
			Actual	1	19	12	56
			Gap	0	26	100	168
	Cabo Verde	521,000	Needed	0	2	5	10
			Actual	NA	4	2	NA
			Gap	NA	0	3	NA

Region	Country	Population	WHO Ratio	Pediatric Ophthalmologist	Ophthalmologist	Optometrist / Refractionist	Mid-level cadres
Sub-Saharan Africa	Chad	14,037,000	Needed	1	56	140	281
			Actual	NA	2	10	NA
			Gap	NA	54	130	NA
	Comoros	789,000	Needed	0	3	8	16
			Actual	NA	1	5	NA
			Gap	NA	2	3	NA
	Dem Rep of Congo	77,267,000	Needed	8	309	773	1,545
			Actual	NA	350	50	80
			Gap	NA	0	723	1,465
	Cote d'Ivoire	22,702,000	Needed	2	91	227	454
			Actual	NA	121	25	NA
			Gap	NA	0	202	NA
	Eritrea	5,228,000	Needed	1	21	52	105
			Actual	NA	2	49	NA
			Gap	NA	19	3	NA
	Ethiopia	99,391,000	Needed	10	398	994	1,988
			Actual	7	145	275	279
			Gap	3	253	719	1,709
	The Gambia	1,991,000	Needed	0	8	20	40
			Actual	NA	2	13	NA
			Gap	NA	6	7	NA
	Guinea-Bissau	1,845,000	Needed	0	7	18	37
			Actual	NA	4	9	29
			Gap	NA	3	9	8
	Lesotho	2,135,000	Needed	0	9	21	43
			Actual	NA	3	9	46
			Gap	NA	6	12	0
	Liberia	4,503,000	Needed	0	18	45	90
			Actual	NA	5	19	NA
			Gap	NA	13	26	NA
	Madagascar	24,235,000	Needed	2	97	242	485
			Actual	NA	44	32	NA
			Gap	NA	53	210	NA
	Malawi	17,215,000	Needed	2	69	172	344
			Actual	1	8	85	84
			Gap	1	61	87	260
	Mali	17,600,000	Needed	2	70	176	352
			Actual	2	54	29	130
			Gap	0	16	147	222
	São Tomé & Principe	191,000	Needed	0	1	2	4
			Actual	NA	1	2	NA
			Gap	NA	0	0	NA
	Sierra Leone	6,453,000	Needed	1	26	65	129
			Actual	NA	3	22	50
			Gap	NA	23	43	79
	Somalia	10,787,000	Needed	1	43	108	216
			Actual	NA	8	67	151
			Gap	NA	35	41	65
	South Sudan	12,340,000	Needed	1	49	123	247
			Actual	NA	3*	25	20
			Gap	NA	45	98	227
	Tanzania	53,470,000	Needed	5	214	535	1,069
			Actual	4	55	124	230
			Gap	1	159	411	839
	Togo	7,305,000	Needed	1	29	73	146
			Actual	1	26	82	NA
			Gap	0	3	0	NA
	Zimbabwe	15,603,000	Needed	2	62	156	312
			Actual	3**	35	80	1,402
			Gap	0	27	76	0

*NOTE: Ophthal. – Ophthalmologist; Optom.- Optometrist; NA – Not Available; International Council of Ophthalmology data used where in country ophthalmologist data was unavailable; * There are 2 government and 1 NGO/ Mission ophthalmologist; ** This number corresponds to the pediatric ophthalmologists practicing in the private sector. The country currently does not have a pediatric ophthalmologist in the public sector.*
SOURCE: 'Situational Analysis Questionnaire: Prevalence, policies, practice and financing for child eye health' survey, conducted 2016; International Council of Ophthalmology (2016)[77]; International Centre for Eye Health, London School of Hygiene and Tropical medicine and African Vision Research Institute (2014)08.[78]

Any program targeting increased services to children needs to determine if the personnel to do the needed eye exams and/or follow up treatment are available, particularly outside major urban centers.

Infrastructure for eye health

Delivery of services for any health intervention is dependent on adequately equipped and staffed health facilities and this applies to child eye health services. In resource poor countries this can be a challenge. Getting accurate data can be difficult but in Table 11 we can see that of the 39 countries who have a government tertiary hospital located within the country, in 13 countries, 100% of their tertiary hospitals have an eye unit. There are seven countries where 50% to 99% of tertiary hospitals have an eye unit. Twelve countries have no eye unit at the tertiary hospital level. At the secondary (provincial, general hospital) level, there are far fewer eye units. These are the centers that are typically more accessible to the majority of the population and represent a key infrastructure gap for service provision. Competently trained personnel and good basic equipment at the district and primary level are also critical but we were not able to get reliable data for that level. Typically eye units are at the tertiary and secondary health facilities with pediatric ophthalmologists usually located at the tertiary level. This can mean that children are a long way from their nearest eye unit which can be a physical and a financial barrier to children accessing care.

Providing the required equipment for eye health personnel is not always considered in conjunction with the training of personnel. Money can be invested in training personnel in new eye skills, however, there is not enough available equipment to enable them to practice their new skills. This can be as basic as an ophthalmoscope or as critical as an operating microscope. Unfortunately, this situation can often be driven by NGOs being willing to invest in training but not equipment, or vice-versa. Another major challenge is equipment maintenance: equipment is often donated, but not the cost of ongoing maintenance or spares. For example, the bulb for an operating microscope can cost up to $100 USD. As one doctor in Tanzania asked, "how do you explain to procurement that a 'light bulb' costs $100?".[79]

The national hospital system can also influence the ability to implement national programs. Sometimes strategy and policy can be set at a national level, but health expenditure budgets are determined at a provincial level and are influenced by each province's particular needs or focal areas, which may deviate from the national policy.

Health information management systems have a role to play in tracking children to determine if treatment is received. Dr Macheka, Chief Government Ophthalmologist in Zimbabwe, highlighted this challenge, 'there are no national programs - a lack of coordination because I think while generally we know what should happen to these children, there is no coordination to say we have identified this child. We are trying to some extent, but still it falls short which means there is a big chunk of children that go through having problems in school because they can't access these services'.

Table 11: Hospital eye unit infrastructure

Region	Country	Tertiary Hospitals	Tertiary Hospitals with Eye Unit (n, %)	Secondary Hospitals	Secondary Hospitals with Eye Unit (n, %)
East Asia & Pacific	Cambodia	61	23 (37.7%)	0	NA
	Kiribati	1	1 (100%)	2	0 (0%)
	Marshall Islands	1	1 (100%)	2	0 (0%)
	FS Micronesia	0	NA	4	1 (25%)
	Myanmar	0	NA	0	NA
	Samoa	1	0 (0%)	0	NA
	Solomon Islands	1	1 (100%)	8	4 (50%)
	Timor-Leste	1	1 (100%)	5	5 (100%)
	Tonga	1	1 (100%)	3	1 (33.3%)
	Tuvalu	1	0 (0%)	0	NA
	Vanuatu	1	1 (100%)	1	1 (100%)
Latin America & Caribbean	Guyana	4	2 (50%)	2	1 (50%)
	Haiti	0	NA	0	NA
	Jamaica	3	2 (66.67%)	2	1 (50%)
	Nicaragua	0	NA	29	0 (0%)
	Trinidad and Tobago	5	5 (100%)	106	0 (0%)
South Asia	Afghanistan	59	0 (0%)	73	0 (0%)
	Bhutan	1	1 (100%)	2	2 (100%)
	Maldives	2	0 (0%)	9	0 (0%)
Sub-Saharan Africa	Benin	4	3 (75%)	39	0 (0%)
	Burkina Faso	4	3 (75%)	9	9 (100%)
	Burundi	6	0 (0%)	18	0 (0%)
	Cabo Verde	2	1 (50%)	4	0 (0%)
	Chad	4	1 (25%)	44	0 (0%)
	Comoros	4	0 (0%)	8	0 (0%)
	Dem Rep of Congo	6	1 (16.67%)	2	0 (0%)
	Cote d'Ivoire	9	3 (33.33%)	82	4 (4.9%)
	Eritrea	4	1 (25%)	6	1 (16.7%)
	Ethiopia	36	4 (11.11%)	73	47 (64.4%)
	The Gambia	7	2 (28.57%)	6	1 (16.7%)
	Guinea-Bissau	1	1 (100%)	5	3 (60%)
	Lesotho	1	1 (100%)	17	0 (0%)
	Liberia	2	0 (0%)	23	2 (8.7%)
	Madagascar	20	4 (20%)	52	6 (11.5%)
	Malawi	5	4 (80%)	26	8 (30.8%)
	Mali	1	1 (100%)	7	0 (0%)
	São Tomé and Principe	1	0 (0%)	2	0 (0%)
	Sierra Leone	7	4 (57.14%)	15	0 (0%)
	Somalia	2	2 (100%)	5	3 (60%)
	South Sudan	4	1 (25%)	2	2 (100%)
	Tanzania	5	20 (400%)	6	20 (333.3%)
	Togo	3	0 (0%)	6	0 (0%)
	Zimbabwe	5	3 (60%)	91	10 (11%)

SOURCE: 'Situational Analysis Questionnaire: Prevalence, policies, practice and financing for child eye health' survey, conducted 2016.
NOTE: NA – Not Available.

Summary

The countries in this review represent some of the most marginalized communities in the world and then demonstrate the core challenges preventing children accessing the eye care they need. From this review we have determined:

Epidemiology	Implications
Children 0-18 represent, on average, 50% of the population.	Equal consideration should be given to both child and adult eye health planning and resourcing.
An estimated 50% of child blindness and low vision is preventable or treatable.	Over time, current child blindness and low vision prevalence could be reduced by 50% with correct interventions to prevent blinding diseases and availability of required surgical interventions.
Reductions in under 5 mortality in the survey countries, which should reflect in a reduction in child blindness and low vision prevalence.	A rapid assessment methodology needed to determine if this is the case.
Two dose Vitamin A coverage is below 70% in 17 countries. In 18 countries Vit A coverage has been declining from 2010 to 2014 which may lead to a rise in child blindness and low vision in the next five years.	Need a rapid assessment methodology to determine if this is the case. Will impact significantly on resources needed for child eye health.
Uncorrected refractive error is the leading cause of vision impairment in children and is 100% correctable via spectacles.	Child's quality of life and educational prospects compromised due to uncorrected RE even though this can be easily treated.
Refractive error rates vary between countries and regions.	Country's to determine their level of need for services based on prevalence, determine current gaps in HR and infrastructure, and identify appropriate resourcing required
Of the surveyed countries, Sub-Saharan Africa countries had the lowest rates of refractive error but the highest rates of child blindness and low vision.	Reductions in under 5 mortality will reduce CB and LV, as some of the leading causes of U5 mortality can result in child blindness and low vision.
Myopia and high myopia rates are increasing globally and in our sample countries. Onset during childhood and adolescence.	Eye exams and spectacles need to be available to children and adolescents. Health promotion strategies such as encouraging more time outdoors will impact significantly.
Poor water and sanitation can result in trachoma and other eye infections.	Countries to ensure they have WASH and hygiene programs implemented within their school health programs.

Financing	Implications
69% of the survey countries invest 5% or less of GDP in health, half of these invest less than 2%. 31% of countries invest from 6% to 16% in health.	Majority of survey countries have under-resourced health systems.
Child eye health sits within child health budgets.	Scope to strengthen CEH integration with MCH.
Spectacles are unaffordable to the poor.	Need to identify barriers to affordable spectacle supply within a country and how to overcome these. May be subsidies for children, optical workshops, removal of tariffs, increased competition, decentralization of services etc.
No guidelines on determining affordable spectacle pricing.	Need an affordability guide for child spectacles to be developed.

Policy Environment	Implications
The WHO includes child blindness, low vision and uncorrected refractive error under disability. Of the 32 countries where data on disability policies was available, only 18 mentioned vision impairment or blind children.	Children with impaired vision due to uncorrected refractive error technically considered disabled. URE should be elevated as a cause of disability in advocacy efforts.
Only 51% of sample countries have a prevention of blindness / Vision 2020 plan.	Since plan identifies needs, gaps and supports planning and effective allocation of resources this is a major barrier to the development of services.
Child eye health may be deprioritized within child health planning compared to health conditions causing death.	Greater integration within MCH and School Health is needed.
Child health may be deprioritized in the family/community.	Community and parent focused education programs needed.

School Health and Eye Health	Implications
School health policies and interventions rapidly growing, 63% of policies in survey countries included eye health in standard list of interventions.	Opportunity to bring eye health into school health agenda at national level.
There is not an enabling policy environment for school eye health in two thirds of the sample. Only 53% of the sample countries had school health policies in place and the presence of a policy did not always mean a national school health intervention was occurring. Of the 22 countries with a school health policy, only 15 included eye health in the standard list of school health interventions	Opportunity to bring eye health into school health agenda at national planning level. Opportunity to advocate to School health Units to include eye health in existing policies and interventions.
Stand-alone school eye health interventions are usually ad-hoc and NGO/INGO supported.	Integration into school eye health could streamline systems and maximize resources. Teachers could be trained in signs that a child may have a vision problem as part of teacher training. Health promotion materials could be distributed to schools
Different models for providing school eye health services are being used.	Planning of interventions to consider the most appropriate model for local context.
Primary School attendance, from 41 countries, 6 countries had attendance rates below 50%.	Reaching out-of-school children should be considered in child eye health planning.
School attendance declined at secondary school level, data available for 39 countries and 30 countries (77%) had attendance rates below 50%.	Adolescent eye health interventions need to also reach out of school youth in these countries.
On average, gender parity in child population and at primary school attendance.	Should focus efforts to address gender parity in those countries that have a challenge.
Greater gender imbalance occurs more frequently in attendance rates at secondary school and can be for either sex.	Gender specific strategies may need to be considered for adolescents.
Spectacles may be expensive and difficult to obtain outside of urban centers.	Timely provision of affordable spectacles to be considered in planning. Placing optical workshops at eye units could be a strategy.
Schools may be a significant distance from the nearest eye unit.	Consider costs and barriers to the child receiving an eye exam.

Human Resources and Infrastructure for Child Eye Health	Implications
School eye health requires trained practitioners for eye exams.	Personnel such as teachers, school nurses or community health workers can be trained to screen children. However, trained eye health workers need to be made available to provide follow-up eye exams and treatment. If this personnel is not available then the benefits of conducting screening are minimal.
Significant gaps exist across all survey countries in the minimum numbers of trained eye health personnel needed.	Lack of trained practitioners to do the required vision assessments, full eye exams and surgical or medical treatment.
Attrition of trained personnel, both out of the health sector and, out of eye health into other health sectors.	Retention strategies need to be developed or alternate cadres trained.
Mal-distribution of available personnel, concentration in urban areas. Lack of trained personnel at primary and district level health facilities.	Geographical and financial barriers to children accessing a practitioner or a practitioner reaching them. Indicates that school based eye exams may be an appropriate platform give the lack of eye health facilities.
Limited in-country training facilities for required eye health personnel.	May limit scaling up of human resources for eye health.
Existing practitioners may require refresher training in child refraction.	Child refraction competencies to be considered in planning services.
Public health eye units typically only at Tertiary and Secondary health facilities. Specialist pediatric care only at tertiary facilities.	Children may be far from services. Cost implications. May cause delays in accessing services; impacting on the time critical conditions such as pediatric cataracts are addressed in.
Equipment challenges; lack of equipment or non-functional equipment.	Limited services available to children.
Eye units may lack access to adequate electricity and/or water supplies.	Interruption or non-provision of services, requiring children to re-visit the center another day. Flow on cost implications.
Eye units not accessible to children with physical disabilities.	A barrier to children accessing services.

Conclusions and Recommendations

Conclusion

The findings of the situation analysis indicate that child eye health services in the sample countries vary significantly and coverage remains far from adequate. Despite children representing, on average, half of the population in the sample countries, child eye health needs have been under-represented in eye health planning and financing. With the growing recognition of the potential public health challenge of myopia progression throughout the world, it is critical to start developing best practice models and guidelines for the inclusion of child eye health services within child health services.

School-based health interventions are an obvious vehicle for the inclusion of child eye health services. However, in many countries, there is no existing school health program into which eye health can be included and this has to be the starting point for child health advocates, policy makers and planners. Where school health programs do exist, thought needs to be given as to how to best incorporate child eye health into the package of interventions. For school eye health interventions to have a chance of success, there needs to be a cohort of appropriately trained individuals to conduct vision screening; adequate numbers of trained eye-health personnel to provide the needed eye exams and treatment; these services to be easily accessible; and an available supply of affordable drugs and spectacles.

This report provides a starting point for a conversation with relevant education, health and child welfare ministries, bilateral and multilateral donor agencies, health profession councils and other stakeholders on how to strengthen the child eye health agenda. Extending this situational analysis to additional countries would build a compelling body of evidence to support relevant advocacy at a global and national level. The following recommendations are intended to help set the scope for future advocacy and programming work.

Recommendations

Service delivery

The lack of service delivery identified by the report flags the critical need for interventions and approaches that scale up services, but also to ensure that those approaches are adopted within a paradigm that sustains them. In this respect, the following should be considered:

- When designing school eye health programs, it is important to determine the existing eye health HR and infrastructure services available and identify areas that may need strengthening. As indicated in the infographic School Eye Health – common approaches to service delivery (pg 39) this should include the detection, referral and treatment pathways.
- A review of existing service delivery policies and resources would help identify opportunities for engaging with relevant stakeholders at appropriate stages, including health, education and child welfare ministries and private sector service providers.
- Approaches are not automatically implemented to scale. Initial planning should be for medium-scale child eye health projects, learn from adopted strategies, determine requirements for scale-up and plan accordingly.
- Given the need to prevent duplication of efforts, child eye health initiatives will benefit from engagement with existing initiatives such as Saving Newborn Lives, Maternal and Child Health, Integrated Management of Childhood Illnesses, Child Survival, School Health interventions and other child health initiatives.
- Child health programs need to be designed and delivered in collaboration with all relevant government ministries in order to foster coordination, collaboration and joint ownership of initiatives and greater cohesion in the provision of the continuum of child health services, particularly between ministries of health and education. The ownership of school health and nutrition lies with the Ministry of Education. School eye health should be part of the broader school health package. The Ministry of Education should bring on board all the relevant stakeholders including the Ministry of Health, to ensure that best practice eye health (inclusive of eye exams and corrective treatment) is delivered as part of school health interventions. This should also be reflected in the school health policy and budgets.

- Best practices need to be identified, documented and disseminated at local, national, regional and global levels.
- CEH programs should be inclusive of marginalized children and engage proactively with public and private sectors at policy, planning and implementation levels and work as part of coalitions and alliances in social welfare and disability sectors. Physical accessibility should be ensured when planning child eye health services and addressed in existing services.
- Sources of referrals to child eye health services from types of services, a cadre of workers and locations can be recorded to establish groups or areas where advocacy and awareness activities are needed.

Health workforce

The inadequate numbers of trained personnel for child eye health and mal-distribution the existing workforce highlights the need for a coordinated approach between health and education ministries to advance training and development of needed cadres. In this respect, the following should be considered:

- Sustained supply and retention of eye health professionals is critical to ensure the provision of good quality child eye care. Enabling policies and planned human resource investments should be implemented by engaging key stakeholders.
- Teachers and other professionals who engage with children could be trained, at a minimum, to identify children who are experiencing vision problems. Where appropriate teachers, school health nurses or community health workers can be trained to conduct screening and refer those who need an eye health exam to ensure early identification of child eye health issues.
- Careful consideration should be given to workloads and training needs when teachers and other non-traditional health cadres are mobilized to support child eye health services.
- A useful approach for health workforce programs might include engagement with the central and provincial health administration and supporting joint stakeholder planning for human resources for child eye health. This engagement will facilitate development and accreditation of appropriate training programs, articulation of relevant job descriptions, knowledge about recruitment and deployment procedures, support systems and initiatives for retaining human resources for eye health. Consider integration with private sector service providers.
- Link child eye health to existing child health, education and disability events.

Health and education information management systems

This study highlights the gaps and challenges in accessing information on child eye health, a major barrier to policy development and appropriate planning for child eye health. In developing a response to this, reasonable and cost effective approaches that build on current efforts and resources need to be considered. One of the key health sector investments that health ministries are placing great emphasis on is the National Health Management Information System (NHMIS). The same applies to the National Education Management Information System (NEMIS). In some countries, they are in the piloting stage, while in others there is a more general rollout taking place. Reports from the NHMIS and NEMIS influence health policy, planning and allocation of resources.

- Eye health bodies should work with NHMIS to include one or two child eye health indicators at primary, secondary and tertiary levels of eye health care. Countries setting up new NHMIS to ensure they include child eye health indicators. This might involve piloting or setting up a demonstrative approach with the NHMIS team for scaling-up later. Discussions could be held with NEMIS to determine if key data from school eye health interventions could be captured.
- Information on child eye health needs to be disseminated more widely among key stakeholders, including teachers, parents and caregivers. There needs to be increased awareness and understanding about the importance of vision screening and eye examinations so that eye health conditions that are treatable or preventable can be identified and addressed early and do not cause unnecessary disruption to a child's development. Eye health awareness and education materials should be included in school health interventions as a first step.

Access to essential medicines

Access to appropriate drugs and spectacles is a major challenge for most countries. Spectacles, in particular, are often unaffordable and/or inaccessible. The lack of national programs to provide free or subsidized spectacles to children is a major barrier to addressing child eye health, especially in impoverished societies. Based on this, the following should be considered:

- Medical products like drugs for eye diseases are usually included on essential drug lists. However, these may be outdated and not always inclusive of the most relevant ones. A joint project with the Ministry of Health to pilot the development of a district eye health list as part of an essential drugs list might be undertaken to ensure that necessary child eye health drugs are factored in.
- Provision of spectacles to children as part of the basic health package offered to any child with significant refractive errors as a defined component of the essential drug package.
- Relaxing of import duties and other restrictions that escalate the price of spectacles for children.
- Consider creation of optical workshops at secondary level hospitals, with the distribution of spectacles to district hospitals and health clinics to bring services closer to the community.

Financing

The fact that the majority of the population in the countries surveyed relies on public health facilities for their health care needs, the competing priorities in the public health arena and the general limitations on financing for health in developing countries, are all significant barriers to expanding child eye health services. In this respect, the following should be considered:

- The identification of various health-financing options at the child eye health program design stage. Both supply and demand financing would need to be reviewed to determine areas that require strengthening. While health insurance or demand-led incentives may be wider health issues, local health financing options could be identified and incorporated into the design of child eye health programs.
- At a national or state level, certain mechanisms and procedures for new projects and development funding are likely to exist. These would include existing bureaucratic procedures for developing a public sector project or program, a concurrence or approval process from a health planning section within the Ministries of Health and Education, and subsequent submission to the Ministry of Planning/Planning Commission and Ministry of Finance on a standard project format. The child eye health programs would benefit from familiarizing themselves with the procedures, structures, stakeholders and deadlines for project submissions and approval process for development expenditure. In this way, the advocacy could be more focused and would ensure institutionalization of child eye health interventions once approved and funded. New public spending on child eye health and its inclusion in public sector development plans are most likely to come through this route.
- There is a need to build evidence through health economics studies regarding the cost-effectiveness of various child eye health approaches and, in the long term, the cost-benefit. Various aspects about the social determinants of health also need to be considered. There are limited studies demonstrating the direct linkages between the impact of poor vision on educational outcomes, further evidence in this area could be a strong advocacy tool for increased financing for this area.

Leadership / Governance

The disparities identified in this report mitigate for advocacy, policy change and service delivery development to deliver school health, and eye health within that. However, such development cannot happen in isolation of education and health sector reforms where school health is reflected as part of the broader development package. With regards to this, the following should be considered:

- A joint effort is needed to develop and implement standard guidelines for the development of child eye health programs in various settings with varying resources. Advocacy efforts need to be directed towards the endorsement of recently developed Standard School Eye Health Guidelines[80] by international, national and relevant stakeholders, including Ministries of Health and Education. The roll out of these guidelines will strengthen existing and new child eye health initiatives.

- Continuous sensitization of health and education officials is needed at all levels due to frequent transfers of personnel. Decision-making structures exist in almost every country, from the level of village health committees and local councils through to the sub-district, district, divisional, provincial and central health administrations. In order to ensure institutionalization and sustainability of CEH interventions, engagement and interaction with the different decision-making layers is necessary. This requires a good understanding of existing structures and the bureaucratic processes that sustain them.
- Pilot programs or demonstration approaches might also strengthen local governance mechanisms and leadership capacity of health and education officials via short trainings and planning/review workshops. This would ensure ownership and facilitation for interventions and would embed child eye health within existing systems and structures.
- As development assistance moves towards more sector-wide approaches, linking debt relief with assuring finance for health and education, it becomes imperative for child eye health programs to enhance their advocacy in these areas and find inroads to Health Sector Reforms (HSRs). Some of the key opportunities for interacting with HSRs may include: (i) development of sustainable financing strategies for priority countries – child eye health programs could provide demonstration approaches for this; (ii) improving governance in Ministries of Health and Education, local health and education departments and health care provider organizations – developing new tools, strategies and training to improve governance through child eye health programs.
- Developing countries are now making a renewed commitment to strengthening Primary Health Care (PHC). The emphasis of the Health Sector Reforms in the developing world is on the strengthening of health systems, with a key focus on PHC. Child eye health programs can build on the eye health component of PHC. Information-sharing across the board will enable cross-sector fertilization and interaction across education, social welfare, social protection, etc.

The countries included in this report are at different stages in terms of provision of child eye health services, infrastructure, human resources and policies. Efforts should be established to support developing countries by sharing experiences and ideas from other countries where success has been proven. Investments in evaluating different approaches and their relevance to various settings will also be necessary, however no matter how big the need in child eye health, we should be cautious of imposing global approaches on individual countries that are simply not sustainable. National level situational analysis, advocacy, planning, policy development and financing is ultimately the key to creating greater access for child eye health services globally.

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Appendices

Appendix A: Sources for demographic and development data and indicators

Indicator	Source
Country GDP (per capita, PPP International $)	http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD?view=chart
Country health expenditure (% of GDP)	http://data.worldbank.org/indicator/SH.XPD.PUBL.ZS
Population figures	https://esa.un.org/unpd/wpp/Download/Standard/Population/
Under 5 mortality rate (rate per thousand live births)	https://data.unicef.org/topic/child-survival/under-five-mortality/
Percentage of infants who received the first dose of measles containing vaccine	http://data.unicef.org/topic/child-health/immunization/
Two dose vitamin A coverage	http://data.unicef.org/resources/vitamin-supplementation-interactive-dashboard/
% of the population with access to improved drinking-water	http://www.wssinfo.org/data-estimates/tables/
School attendance and enrolment	https://data.unicef.org/topic/education/overview/
Number of ophthalmologists (when local survey data not available)	http://www.icoph.org/ophthalmologists-worldwide.html
Number of optometrists/refractionists (when local survey data not available)	Fricke et al, 201226 – Raw data accessed through Brien Holden Vision Institute database

Appendix B: 'Situational Analysis Questionnaire: Prevalence, policies, practice and financing for child eye health'

In order to investigate the prevalence, policies, practice and financing for child eye health, the following data collection tool was designed, based on previous situational analyses that were conducted for similar purposes.[27] The following in-country quantitative questionnaire was completed in English by all 43 countries. It is anticipated that this tool could be used by other countries to assess the factors involved in child eye health, as well as monitor change in the future.

Please answer every question

Country Information

CI1. Country

Please mark one box

- ☐ Afghanistan
- ☐ Benin
- ☐ Bhutan
- ☐ Burkina Faso
- ☐ Burundi
- ☐ Cabo Verde
- ☐ Cambodia
- ☐ Chad
- ☐ Comoros
- ☐ Congo, Democratic Republic of
- ☐ Cote d'Ivoire
- ☐ Eritrea
- ☐ Ethiopia
- ☐ The Gambia
- ☐ Guinea-Bissau
- ☐ Guyana
- ☐ Haiti
- ☐ Jamaica
- ☐ Kiribati
- ☐ Lesotho
- ☐ Liberia
- ☐ Madagascar
- ☐ Malawi
- ☐ Maldives
- ☐ Mali
- ☐ Marshall Islands
- ☐ Micronesia, Federated States of
- ☐ Myanmar
- ☐ Nicaragua
- ☐ Samoa
- ☐ São Tomé and Principe
- ☐ Sierra Leone
- ☐ Solomon Islands
- ☐ Somalia Central South
- ☐ Somalia Puntland
- ☐ Somalia
- ☐ South Sudan
- ☐ Tanzania
- ☐ Timor-Leste
- ☐ Togo
- ☐ Tonga
- ☐ Trinidad and Tobago
- ☐ Tuvalu
- ☐ Vanuatu

CI2. How many states/provinces are in your country? _____

Respondent Information

RI1. Respondent name: _____

RI2. Respondent role: _____

RI3. Respondent organisation: _____

RI4. Respondent email: _____

RI5. Respondent telephone: _____

RI6. Respondent address: _____

_____

Epidemiology

E1. Please review the following data for your country. This data has been obtained from currently available reports, or Brien Holden Vision Institute models.

a. If you believe that any changes are required, please indicate what changes are required by either describing here, or using track changes in your word processor.
b. Where there is currently no response, would you please provide your best estimate in the space provided?

WHO Region _____

Country _____

UNDP Country Code _____

Country GDP (per capita, PPP International $) ____

Total population _____
(in thousands)

Female population _____
(in thousands)

Male population _____
(in thousands)

Female population _____%
(as a percentage)

Male population _____%
(as a percentage)

Total child population aged 0-18 _____
(in thousands)

Total child population aged 0-18 _____%
(as a percentage)

Child population aged 0-4 _____
(in thousands)

Child population aged 5-9 _____
(in thousands)

Child population aged 10-14 _____
(in thousands)

Child population aged 15-19 _____
(in thousands)

Total child population aged 0-19 _____
(in thousands)

Proportion of children aged 0-4 _____%
(as a percentage)

Proportion of children aged 5-9 _____%
(as a percentage)

Proportion of children aged 10-14 _____%
(as a percentage)

Proportion of children aged 15-19 _____%
(as a percentage)

Proportion of total population _____%
children aged 0-19 (as a percentage)

Percentage of child population: _____%
Female (as a percentage)

Percentage of child population: _____%
Male (as a percentage)

Females: aged 0-4 _____
(in thousands)

Females: aged 5-9 _____
(in thousands)

Females: aged 10-14 _____
(in thousands)

Females: aged 15-19 _____
(in thousands)

Males: aged 0-4 _____
(in thousands)

Males: aged 5-9 _____
(in thousands)

Males: aged 10-14 _____
(in thousands)

Males: aged 15-19 _____
(in thousands)

What percentage of the population _____%
lives in urban areas? (as a percentage)

What percentage of the population _____%
lives in rural areas? (as a percentage)

Under 5 mortality rate 2005 _____
(median rate per thousand live births)

Under 5 mortality rate 2010 _____
(median rate per thousand live births)

Under 5 mortality rate 2015 _____
(median rate per thousand live births)

Percentage of infants who received _____
the first dose of measles containing vaccine (2005)

Percentage of infants who received _____
the first dose of measles containing vaccine (2010)

Percentage of infants who received _____
the first dose of measles containing vaccine (2014)

Two dose Vitamin A coverage (2005) _____%
(as a percentage)

Two dose Vitamin A coverage (2010) _____%
(as a percentage)

Two dose Vitamin A coverage (2014) _____%
(as a percentage)

Percentage of the population with _____%
access to improved drinking-water 2012
(as a percentage)

Percentage of the population with _____%
access to improved drinking-water 2015
(as a percentage)

Female net school attendance rate: _____%
Primary 2008-2013 (as a percentage)

Male net school attendance rate: _____%
Primary 2008-2013 (as a percentage)

Female net school attendance rate: _____%
Secondary 2008-2013 (as a percentage)

Male net school attendance rate: _____%
Secondary 2008-2013 (as a percentage)

Female net school enrolment rate: _____%
Primary 2009-2013 (as a percentage)

Male net school enrolment rate: _____%
Primary 2009-2013 (as a percentage)

Female net school enrolment rate: _____%
Secondary 2009-2013 (as a percentage)

Male net school enrolment rate: _____%
Secondary 2009-2013 (as a percentage)

Prevalence of blindness among children _____%
(as a percentage)

Prevalence of low vision among children _____%
(as a percentage)

Prevalence of distance RE in children 0-4 _____%
(as a percentage)

Prevalence of distance RE in children 5-9 _____%
(as a percentage)

Prevalence of distance RE in children 10-14 _____%
(as a percentage)

Prevalence of distance RE in children 15-19 _____%
(as a percentage)

Total prevalence of distance RE in _____%
children 0-19 (as a percentage)

Prevalence of urban myopia in _____%
children 0-4 (as a percentage)

Prevalence of urban myopia in _____%
children 5-9 (as a percentage)

Prevalence of urban myopia in _____%
children 10-14 (as a percentage)

Prevalence of urban myopia in _____%
children 15-19 (as a percentage)

Total prevalence of urban myopia _____%
in children 0-19 (as a percentage)

Prevalence of rural myopia in _____%
children 0-4 (as a percentage)

Prevalence of rural myopia in _____%
children 5-9 (as a percentage)

Prevalence of rural myopia in _____%
children 10-14 (as a percentage)

Prevalence of rural myopia in _____%
children 15-19 (as a percentage)

Total prevalence of rural myopia _____%
in children 0-19 (as a percentage)

Estimated uncorrected rate for _____%
myopia in children 0-4 (as a percentage)

Estimated uncorrected rate for _____%
myopia in children 5-9 (as a percentage)

Estimated uncorrected rate for _____%
myopia in children 10-14 (as a percentage)

Estimated uncorrected rate for _____%
myopia in children 15-19 (as a percentage)

Policies and Financing

PF1. What percentage of the countries annual budget is allocated to Health _____
Please enter a number between 0 and 100

PF2. Percentage of population using public health _____
Please enter a number between 0 and 100

PF3. Please specify if the above is from a data source or an estimate?
Please mark one box.

- ☐ Based on Data
- ☐ Estimate
- ☐ Do not know

PF4. Does the national policy on disability refer specifically to children with blindness/low vision/vision impairment?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know

PF5. If yes, which condition does the national policy on disability specifically refer to?
Please mark at least one box.

- ☐ Disability
- ☐ Low vision
- ☐ Vision impairment
- ☐ Refractive error
- ☐ All of the above
- ☐ NA – national policy excludes all

PF6. Does the national education policy refer specifically to children with special needs?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know

PF7. If yes (PF5), within the special needs section; are children with vision impairment specifically mentioned?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know
- ☐ NA – national policy does not refer to special needs

PF8. If yes, (PF5), are special needs programs currently operating?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know
- ☐ NA – national policy does not refer to special needs

PF9. If yes, (PF7) are special needs children integrated into mainstream schooling or educated through separate special schools
Please mark one box.

- ☐ Mainstream
- ☐ Separate special schools
- ☐ Combination of both
- ☐ Do not know
- ☐ NA – special needs programs not currently operation

PF10. Number of children with vision impairment enrolled in special needs programs? _____
Please enter the total number

National Health Plan

NHP1. Is there a current national health plan?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know

NHP2. Does the current national health plan include eye health
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know
- ☐ NA – there is no national health plan

NHP3. Is disability included in the national health plan
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know
- ☐ NA – there is no national health plan

NHP4. Is there a current national V2020 or prevention of blindness plan?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know

NHP5. If no (NHP4), is a national V2020 or prevention of blindness plan being developed?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know
- ☐ NA – there is no national health plan

NHP6. If yes (NHP5) what is the expected date for finalization of the PBL/Vision 2020 plan? _____
Please provide expected date

NHP7. Is there a current national eye care coordinator?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know

NHP8. If no, does the government plan to appoint a national eye care coordinator?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know

Additional comments:

_____

Prevention of Blindness or Vision 2020 Plan

P1. Does the V2020 or PBL plan include refractive error?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know
- ☐ NA – there is no V2020/PBL plan

P2. Does the V2020 or PBL have a focus on child eye health services?

Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know
- ☐ NA – there is no V2020/PBL plan

P3. Does the V2020 or PBL plan recommend school eye health services?
Please mark one box

- ☐ Yes
- ☐ No
- ☐ Do not know
- ☐ NA – there is no V2020/PBL plan

P4. Does the V2020 or PBL plan have a budget allocation from government?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know
- ☐ NA – there is no V2020/PBL plan

P5. If yes, is there a specific allocation for child eye health
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know
- ☐ NA – there is no V2020/PBL plan

School Health Policies

SHP1. Are there special needs schools for children with vision impairment in the country?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know

SHP2. Is there an integrated education program?
Please mark one box

- ☐ Yes
- ☐ No
- ☐ Do not know

SHP3. Is there an inclusive education program?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know

SHP4. Is there a national school health policy?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know

SHP5. If so, who manages the school health policy?
Please mark one box.

- ☐ Ministry of Health
- ☐ Ministry of Education
- ☐ Do not know
- ☐ NA – there is no national school health policy
- ☐ Other (please record)

_____

SHP6. Does the national school health policy include vision screening?
Please mark one box

- ☐ Ministry of Health
- ☐ Ministry of Education
- ☐ Do not know
- ☐ NA – there is no national school health policy

SHP7. If there is not a national school health policy, are there any state or provincial school health policies?
Please mark one box.

- ☐ Ministry of Health
- ☐ Ministry of Education
- ☐ Do not know
- ☐ NA – there is no national school health policy

SHP8. If yes, how many states/provinces have school health policies? _____
Please enter the total number

SHP9. If yes, how many state/provincial school health policies include vision screening? _____
Please enter the total number

School Eye Screening

SEP1. Is there a national school eye health/vision screening policy?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know

SEP2. If there is no national school eye health /vision screening policy, are there any state or provincial school eye health/vision screening policies?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know

SEP3. If yes, how many states/provinces have school eye health/vision screening policies? _____
Please enter the total number

Infrastructure

I1. Number of tertiary hospitals _____
Please enter the total number

I2. Number of tertiary hospitals with a fully equipped eye unit _____
Please enter the total number

I3. Number of secondary hospitals _____
Please enter the total number

I4. Number of secondary hospitals with a fully equipped eye unit _____
Please enter the total number

I5. How many schools are there for children with disabilities/special needs? _____
Please enter the total number

I6. How many schools specifically for children with blindness/severe vision impairment are there in your country? _____
Please enter the total number

Human Resources

HR1. Do the following cadres exist in your country?
Please mark one box per row.

	Y	N	If yes, how many are in country? Please enter the total number	Percentage of the cadre employed by Government? Please enter a number between 0 and 100	Percentage of the cadre employed by Mission/NGO run eye units? Please enter a number between 0 and 100	Percentage of the cadre working in private sector? Please enter a number between 0 and 100
Paediatric ophthalmologist	☐	☐	_____	_____%	_____%	_____%
Ophthalmologist	☐	☐	_____	_____%	_____%	_____%
Basic eye doctor	☐	☐	_____	_____%	_____%	_____%
Optometrist	☐	☐	_____	_____%	_____%	_____%
Dispensing optician	☐	☐	_____	_____%	_____%	_____%
Ophthalmic clinical officer (OCO)	☐	☐	_____	_____%	_____%	_____%
Ophthalmic technician	☐	☐	_____	_____%	_____%	_____%
Ophthalmic nurse	☐	☐	_____	_____%	_____%	_____%
Primary eye care nurse	☐	☐	_____	_____%	_____%	_____%
Refractionist	☐	☐	_____	_____%	_____%	_____%
Other _____	☐	☐	_____	_____%	_____%	_____%
Other _____	☐	☐	_____	_____%	_____%	_____%
Other _____	☐	☐	_____	_____%	_____%	_____%

HR2. Are there in country training programs for the following cadres?
Mark one box per row.

	Yes	No	NA – this cadre does not exist
Paediatric ophthalmologist	☐	☐	☐
Ophthalmologist	☐	☐	☐
Optometrist	☐	☐	☐
Ophthalmic clinical officer (OCO)	☐	☐	☐
Ophthalmic nurse	☐	☐	☐
Primary eye care nurse	☐	☐	☐
Refractionist	☐	☐	☐

HR3. If there are in country training programs for paediatric ophthalmologists, how many training programs are there? _____
Please enter the total number

HR4. If there is NO in country training for paediatric ophthalmologists, does the government or do NGOs support training outside the country?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know
- ☐ NA – there are in-country training programs

HR5. If there are in country training programs for optometrists, how many training programs are there? _____
Please enter the total number

HR6. Are optometrists legally allowed administer dilation drops to children?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know

HR7. Are optometrists legally allowed to dispense spectacles?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know

HR8. Are training programs for primary eye care health workers available?
Please mark one box

- ☐ Yes
- ☐ No
- ☐ Do not know

HR9. Do school health nurses exist in government schools?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know

HR10. Do school health nurses exist in private schools?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know

HR11. Are teacher training programs for school health available?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know

HR12. Are teachers allowed to conduct vision screening in schools?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know

Services

S1. Is there a national School Health Program (SHP) currently running?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know

S2. If there are NO school health programs running, are there any state or provincial school health programs running?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know
- ☐ NA – there is a national SHP

S3. If yes, how many states/provinces have school health programs running? _____
Please enter the total number

S4. If yes, how many state/provincial school health programs are wholly run by government? _____
Please enter the total number

S5. If yes, how many state/provincial school health programs are wholly run by NGOs/charitable groups? _____
Please enter the total number

S6. If yes, how many state/provincial school health programs are run by government and NGOs/charitable groups working together? _____
Please enter the total number

S7. If there is a school health program, which of the following does it cover?
Please mark one box per row.

	Yes	No
School feeding	☐	☐
Food supplementation (e.g. Vit A)	☐	☐
Food and nutrition	☐	☐
Deworming	☐	☐
Dental/oral health	☐	☐
Immunisation	☐	☐
Hygiene	☐	☐
Vision Screening	☐	☐
Eye examinations be a qualified practitioner	☐	☐
Eye examinations that include dilation	☐	☐
Provision of spectacles	☐	☐
Free spectacles	☐	☐

S8. If the school health program DOES NOT cover eye examinations by a qualified practitioner, what processes are in place for the children who are identified in the vision screening? _____
Please describe, or enter NA

S9. If the spectacles are not provided free of charge, are they *subsidized*? _____
Please describe, or enter NA

S10. What do the spectacles cost on average? _____
Please provide costs, or enter NA

S11. Number of NGOs providing health services to children? _____
Please enter a whole number

S12. Number of NGOs providing eye health services to children? _____
Please enter a whole number

S13. Do primary health care centres generally provide eye health services?
Please mark one box.
☐ Yes
☐ No
☐ Do not know

S14. Do secondary health care centres generally have an eye unit?
Please mark one box.
☐ Yes
☐ No
☐ Do not know

S15. Is there a specialist paediatric eye unit in the public health sector?
Please mark one box.
☐ Yes
☐ No
☐ Do not know

S16. If there are specialist paediatric eye units in the public health sector, how many are there? _____
Please enter a whole number

S17. Is there a specialist paediatric eye unit in the private sector?
Please mark one box.
☐ Yes
☐ No
☐ Do not know

S18. If there are specialist paediatric eye units in the private sector, how many are there? _____
Please enter a whole number

Appendix C: 'Situational Analysis Interview Guide: Prevalence, policies, practice and financing for child eye health'

In order to investigate the prevalence, policies, practice and financing for child eye health, the following data collection tool was designed to explore in greater detail issues surrounding the policies, practice and financing for child eye health in six focal countries. The in-depth qualitative questionnaire was conducted in English in the six focal countries. It is anticipated that this interview tool can be used in other settings to assess the factors involved in child eye health, as well as identify key areas of change in the future.

Please answer every question

Country Information

CI1. Country

Please mark one box

- ☐ Malawi
- ☐ Cambodia
- ☐ Tanzania
- ☐ Haiti
- ☐ Tonga
- ☐ Zimbabwe

CI2. How many states/provinces are in your country? _____

Respondent Information

RI1. Respondent name: _____

RI2. Respondent role: _____

RI3. Respondent organisation: _____

RI4. Respondent email: _____

RI5. Respondent telephone: _____

RI6. Respondent address: _____

_____

Policies and Financing

PF1. Does the Ministry of Health allocate a budget for child health?
Please select one box

- ☐ Yes
- ☐ No
- ☐ Do not know

PF2. If yes, what is the percentage allocation? _____
Please enter a number between 0 and 100

PF3. Is there free health coverage?
Please select one box

- ☐ Yes
- ☐ No
- ☐ Do not know

PF4. If yes, please describe health coverage available? _____
Describe what types of services are available, and if any co-payments are necessary. Who administers the schemes

PF5. Are all children eligible for free health cover?
Please mark one box.

- ☐ Yes
- ☐ No – go to PF7
- ☐ Do not know

PF6. If no, are ANY children eligible for free health cover? _____
Please describe which children are eligible

PF1. What percentage of the countries annual budget is allocated to Health _____
Please enter a number between 0 and 100

PF8. If yes, (PF5), are special needs programs currently operating?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know
- ☐ NA – national policy does not refer to special needs

PF9. Average cost of spectacles for children? _____
Please provide the average cost

PF10. Average cost of an eye examination for children? _____
Please provide the average cost

Education & School Screening

E1. Is there an inclusive education program?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know

E2. If yes, is it being actively implemented?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know
- ☐ NA – there is no national health plan

E3. How widely are inclusive education programs being implemented?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know
- ☐ NA – there is no national health plan

E3. How widely are inclusive education programs being implemented? _____
Please describe in detail

E4. Do children in schools for the blind have access to routine eye examinations? Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know

SS1. Do school screenings routinely take place?
Please mark one box.

- ☐ Yes
- ☐ No
- ☐ Do not know

SS2. Describe the coverage of school screenings in your country? _____
Please describe how widespread screenings are in schools

SS3. Describe the examination provided during school screenings in your country? _____
Please describe who provides the examinations and what tests are provided (e.g. dilation, VA)

SS4. Describe how spectacles are provided during school screenings in your country? _____
Please describe logistics, waiting times, costs and financing

SS5. Describe how referrals are managed during school screenings in your country? _____
Please describe

SS6. Describe the challenges in the provision of school screenings in your country? _____
Please describe

SS7. Describe the barriers to the provision of school screenings in your country? _____
Please describe

Optical Shops & Workshops

OW1. How many optical shops are currently operating? _____
Please provide the total number

OOW2. Number of commercial surfacing (grind) laboratories? _____
Please provide the total number

OW3. Number of commercial laboratories that cut and fit only? _____
Please provide the total number

OW4. Number of suppliers of ophthalmic and optical equipment? _____
Please provide the total number

OW5. Number of in country suppliers of ready-made spectacles? _____
Please provide the total number

OW6. Please describe the barriers and gaps in providing spectacles and lenses in your country? _____
Please describe in detail

OW7. Please comment on the quality of spectacles and lenses available to children in your country? _____
Please describe in detail

Average Spectacle Costs

S1. Average cost of ready-made spectacles (all powers)? _____
Please provide the average cost

S2. Average cost of single vision spherical custom made spectacles (Plano to ± 5.00D)? _____
Please provide the average cost

S3. Average cost of single vision spherical custom made spectacles (± 5.00D or greater)? _____
Please provide the average cost

S4. Average cost of single vision astigmatic custom made spectacles (Plano to ± 5.00D/-2.00D)? _____
Please provide the average cost

S5. Average cost of single vision astigmatic custom made spectacles (Plano to ± 5.00D/-2.00D)? _____
Please provide the average cost

S6. Average cost of single vision astigmatic custom made spectacles (Plano to ± 5.00D/-2.00D)? _____
Please provide the average cost

S7. Average cost of astigmatic bifocal custom made spectacles (all powers)? _____
Please provide the average cost

S8. Currency for spectacle prices _____
e.g. USD, ZAR

S9. Daily wage of lowest paid government worker _____
Please provide in USD

S10. Source of wage information _____
Please provide details

Gaps and Priorities

Please identify what you believe are the three biggest gaps in policies, practice or financing for child eye health in your country.

G1. Gap one: _____

G1. Gap two: _____

G1. Gap three: _____

Please identify what you believe are the three biggest priorities for child eye health in your country.

P1. Priority one: _____

P2. Priority two: _____

P3. Priority three: _____

Please identify what you believe are the three biggest challenges/barriers are for child eye health in your country.

C1. Challenge/barrier one: _____

C2. Challenge/barrier two: _____

C3. Challenge/barrier three: _____

Appendix D: Letters of introduction

Level 4 North Wing
Rupert Myers Building
Gate 14 Barker Street, UNSW
Sydney NSW 2052 Australia
Tel +61 2 9385 7516
Fax +61 2 9385 7401

Dear [*to complete*],

My name is Prof. Kovin Naidoo and I am the CEO of Brien Holden Vision Institute and also the Chairperson of IAPB, Africa. Brien Holden Vision Institute has been commissioned by the World Bank to undertake a situational analysis to determine the extent and coverage of child eye health services in 43 Global Partnership for Education (GPE) focal countries, (see attached letter from the World Bank). The study aims to a build a body of evidence to provide an overview of the current status of child eye health and school eye health for use by GPE and World Bank in their strategic planning.

Brien Holden Vision Institute has an extensive history in both clinical and public health research (please visit our website, www.brienholdenvision.org to see the extent of our work), and I am principal investigator on this study.

We would appreciate your support in helping us to complete this study. Attached is a questionnaire that we need completed for the study. The questionnaire covers both eye health and school health and may need input from several personnel.

If you need to discuss the input required please feel free to contact either members of my research team, (copied above) who will be happy to respond via email or arrange a call with you if needed.

All respondents who participate in completing the survey will be acknowledged in the final report and will receive a copy of the report. At this stage it is an internal report to World Bank only, if the report is to be published at any time in the future then appropriate government approvals will be sought.

In order to meet the World Bank deadlines, we would like to receive the completed questionnaires by [*to complete*]. Your support and cooperation in this study is much appreciated and will go a long way to ensuring that the vision needs of our children is elevated on the global agenda.

Yours truly,

Prof. Kovin Naidoo
CEO, Brien Holden Vision Institute Foundation
Chairperson, IAPB Africa

Sent on Professor Naidoo's behalf by [*to complete*]

THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP

August 9, 2016

TO WHOM IT MAY CONCERN
LETTER OF INTRODUCTION: BRIEN HOLDEN VISION INSTITUTE

Dear Sir/Madam,

Within the framework of a School Health project, the World Bank has recently commissioned the Brien Holden Vision Institute to do an analysis of the current situation regarding child eye health and services in 43 countries which are members of the Global Partnership for Education (GPE).

The information from the above mentioned analysis will help the World Bank and relevant partners to better understand in-country needs and inform possible future interventions to support access to eye care for children.

I would like to request that you assist the Brien Holden Vision Institute in ensuring that the relevant questionnaire is completed as fully as possible for your country.

Best regards

Meskerem Mulatu
Practice Manager
Education Global Practice
The World Bank,
1818 H Street NW, Washington, DC 20433

WORLD BANK GROUP IFC International Finance Corporation MIGA Multilateral Investment Guarantee Agency

Appendix E: In-country informants

Respondents – In-country questionnaires

Country	Lead Respondent Name	Respondent Role	Respondent Organization
Afghanistan	Ahmad Shah Salam	National eye care coordinator	Ministry of Public Health
Benin	World Bank Study Team	Research team	Brien Holden Vision Institute
Bhutan	Dr. Ngawang Tenzin	Ophthalmologist and National Focal Person V2020	JDWNR Hospital, MoH
Burkina Faso	Dr SANKARA Paté	Responsible for the eye health unit	Directorate for the Fight against Disease
Burundi	Jean Claude Niyonzima	Ophthalmologist	None
Cambodia	Neath Kong	Country Coordinator	Brien Holden Vision Institute
Cabo Verde	World Bank Study Team	World Bank Study Team	Brien Holden Vision Institute
Chad	World Bank Study Team	World Bank Study Team	Brien Holden Vision Institute
Comoros	World Bank Study Team	World Bank Study Team	Brien Holden Vision Institute
Congo, Democratic Republic	World Bank Study Team	World Bank Study Team	Brien Holden Vision Institute
Cote d'Ivoire	Dr Kouakou Amenan Marie Madeleine	Coordinator Director	National eye health program and the fight against onchocerciasis (pnsolo) of the ministry of health and public hygiene
Eritrea	Dr Goitom Mebrahtu	Director of Health Care service Delivery	Ministry of Health
Ethiopia	Tsehaynesh Tiruneh Kissa	Technical Advisor for Eye Health	Federal Ministry of Health
The Gambia	World Bank Study Team	World Bank Study Team	Brien Holden Vision Institute
Guinea-Bissau	Wilson I. Sa	Administrative Assistant	Ministry of Health, Guinea Bissau
Guyana	World Bank Study Team	World Bank Study Team	Brien Holden Vision Institute
Haiti	Claudy Cadet	Doctor in Ophthalmology	Clinique Ophthalmology Jeannot Cadet
Kiribati	Dr. Rabebe Tekeraoi	Ophthalmologist	Ministry of Health
Lesotho	Wen Jun Fan	In charge of Eye Serves in Lesotho	Ministry of Health, Lesotho
Liberia	Aaron Marvolo	Program Officer	Sightsavers
Madagascar	World Bank Study Team	World Bank Study Team	Brien Holden Vision Institute
Malawi	Michael Peter Masika	National Eye care Coordinator	Ministry of Health
Maldives	Fathimath Shabana	Senior Public Health Program Officer	Heatlh Protection Agency, Ministry of Health
Mali	Traore Lamine	Coordinator	National Eye Health Program
Marshall Islands	World Bank Study Team	Research team	Brien Holden Vision Institute
Micronesia, Federated States of	Marcus Samo	Assistant Secretary of health	FSM Department of Health and Social Affairs
Myanmar	Dr. Hla Mar Lar	Program Manager	Trachoma Control & Prevention of Blindness Program
Nicaragua	Roger Montes Flores	Asesor Sistemas y Servicios de Salud	Organizacion Panamericana de la Salud OPS
Samoa	Mr Drew Keys	GM, PNG Eye Care	Brien Holden Vision Institute
São Tomé and Principe	World Bank Study Team	World Bank Study Team	Brien Holden Vision Institute
Sierra Leone	Dr. Matthew Jusu Vandy	Program Manager	National Eye Health Program
Solomon Islands	Kelvin Ray Jack	National eye coordinator	National eye care division Ministry of Health and Medical Services

Appendix E: In-country informants

Respondents – In-country questionnaires

Country	Lead Respondent Name	Respondent Role	Respondent Organization
Somalia	Dr. Abdirisak Ahmed Dalmar	National Coordinator, Prevention of Blindness Program	Ministry of Health, Federal Government of Somalia
South Sudan	World Bank Study Team	World Bank Study Team	Brien Holden Vision Institute
Timor-Leste	Ms. Veronica Bell	Independent Development Specialist	Independent
Togo	Dr. Awoussi Sossinou	Coordinator	Ministry of Health/National Eye Health Program
Tonga	Dr. Duke Mataka	Ophthalmologist in Training	Ministry of Health, Viaola Hospital, Nuku Alofa
Trinidad and Tobago	Dr. Subhash Sharma	Head of Optometry Clinic	University of the West Indies
Tuvalu	Drew Keys	GM, PNG Eye Care	Brien Holden Vision Institute
Tanzania	Eden Mashyo	Country Manager, Tanzania	Brien Holden Vision Institute
Vanuatu	Dr. Johnson Kasso	Currently on training	Pacific Eye Institute, Fiji
Zimbabwe	Dr Boniface Macheka	Chief Government Ophthalmologist; NPBC Chairman	Ministry of Health, Government of Zimbabwe

Respondents – In-depth interviews

Country	Respondent Name	Respondent Role	Respondent Organization
Cambodia	Dr. Kunthearith Yung	Deputy Director Department of School Health Ministry of Education Youth and Sport	Royal Government of Cambodia
	Dr. Seiha Do	National Coordinator, Prevention of Blindness & Vice-Chairman of National Program for Eye Health, MOH	Royal Government of Cambodia
	Mr D Facciolo	Regional Program Manger Asia Pacific	IAPB
	Mr Neat Kong	Country Manager	Brien Holden Vision Institute
	Ms Mitasha Yu	Regional Director	Brien Holden Vision Institute
Haiti	Dr. Cadet	Ophthalmologist, Dean of Medicine and Pharmacy	State University of Haiti
	Mr Zouti Bernard	Country Director	Charity Vision International
	Dr Juan Carlos Silva	Regional advisor eye health	PAHO
	Louis Pizzarello		IAPB Latin America
	Marie Lucienne Joseph	Eye and Ear Care Health Program Coordinator	CBM
	Dr. Michael Maingrette	Ophthalmologist, Chair of Conseil National de la Prevention Cecite (National Blindness Prevention Committee)	
	Dr. Valerie Blot	Committee member, Conseil National de la Prevention Cecite (National Blindness Prevention Committee)	
	Dr. Brigittre Hdicourt	Committee member, Conseil National de la Prevention Cecite (National Blindness Prevention Committee)	
Malawi	Mr Michael Masika	Assistant Director Clinical Services and Ophthalmology	National eye health coordinator (MOH)
	Carl Abraham, lecturer;	Head of Optometry Department	Malawi College of Health Sciences
	Ms Hilda Kazembe	Country Manager	Brien Holden Vision Institute
	Mr Robert Kanani;	Kamuzu Central Hospital Eye Unit	Ministry of Health Malawi.

Appendix E: In-country informants

Respondents – In-depth interviews

Country	Respondent Name	Respondent Role	Respondent Organization
Tanzania	Dr. Milka Mwafiri	Ophthalmologist	Muhambili Hospital
	Dr. Ursuline Unyandindi	Previous Programs Manager for National School Health Program	MOH
	Dr. Amal Berga Kasangat	Elderly and Children (Health Promotion Unit)	Community Dept for Gender
	Mr. Avit Maro	National School Health Program (Health Promotion)	Ministry of Health. Government of Tanzania
	Mr. Eden Mashayo	Previous President for Tanzanian Optometric Association.	Country Manager, Brien Holden Vision Institute
	Dr Mwakusa	National Eye Care Coordinator	Ministry of Health Tanzania
Tonga	Ms Pilimilose Balwyn Fa'otusia	EU Technical Adviser to Ministry of Finance & National Planning	CEO Ministry of Finance & National Planning.
	Dr Duke Mataka	Ophthalmologist in training	Pacific Eye Institute
	Sister Savelina Veamatahau	Eye Nurse, Diabetic Retinopathy Specialist and Head of Department	Vaiola National Hospital Ministry of Health Nuku Alofa.
	Sister Mieliane Eke	Eye Nurse	Vaiola National Hospital Nuku Alofa
	Ms Marianne Melevuki	Eye Clinic Manager	Vaiola National Hospital Nuku Alofa
Zimbabwe	Dr Boniface Macheka	Chief Government Ophthalmologist; National Prevention of Blindness Chairman	MOH
	Ms Kwadzanai Nyanungo	Principal Director Responsible for Learner Welfare, Psychological Services and Special Needs Education	Ministry of Primary and Secondary Education
	Zimbabwe Optometry Association	Group activity at AGM 19th November 2016	Zimbabwe Optometry Association
	Mr Tapiwa Madamombe	Headmaster	M. Hugo School for the Blind Capota, Masvingo
	Ms Sawa Iwakuni	Education Officer	UNICEF
	Mr Geoffrey Acaye	Health Manager, Maternal Newborn and Child Health	UNICEF
	Mr Lovemore Magwere	HIV and AIDS Specialist (Education)	UNICEF
	Mr Richard Mavaneka	President Zimbabwe Optometric Association	Private Optometrist
	Sister Felicity Banda	National Coordinator	Council for the Blind
	Mr Chris Kumora	Optometrist, Prevention of Blindness Committee	Brien Holden Vision Institute

Appendix F: Conversion table; blindness prevalence and infant mortality

A relationship has been found between under-5 mortality rates and the prevalence of blindness in children aged 0-15,[41] wherein the rates of blindness and low vision can be estimated. The table below shows the conversion table, which uses the under 5 mortality rate from five years previously to estimate current levels. For example, in Afghanistan, the under-5 infant mortality rate in 2010 was 105 per thousand live births. Using the conversion table, we see this equates to a blindness prevalence in 2015 of 0.8 per 1,000 children (0.08%), and a low vision rate of 1.6 per 1,000 (0.16%)

Under-5 Mortality Rate per 1,000 Live Births	Estimated Prevalence of Blindness per 1,000 Children Aged 0-15*	Estimated Prevalence of Low Vision per 1,000 Children Aged 0-15**
0–19	0.3	0.6
20–39	0.4	0.8
40–59	0.5	1
60–79	0.6	1.2
80–99	0.7	1.4
100–119	0.8	1.6
120–139	0.9	1.8
140–159	1	2
160–179	1.1	2.2
180–199	1.2	2.4
200–219	1.3	2.6
220–239	1.4	2.8
240+	1.5	3

*SOURCE: * Blindness and low vision rates are calculated based on Chandna and Gilbert, 2010.[41]*
***Personal communication (Clare Gilbert, 2016)*

Appendix G: Epidemiology Tables

Epidemiology of blindness, low vision and uncorrected refractive error

Region	Country	Child and Adolescent Population (0-15)					Child and adolescent Population (5-15)	
		Total population (0-15)	Blindness (%)	Blindness Total Children	Low Vision (%)	Low Vision Total Children	URE (%)	URE Total Children
East Asia & Pacific	Cambodia	4,921,000	0.05%	2,461	0.10%	4,921	0.79%	24,885
	Kiribati	37,000	0.06%	22	0.12%	44	0.79%	182
	Marshall Islands	25,000	0.04%	10	0.08%	20	0.79%	126
	FS Micronesia	34,000	0.05%	17	0.10%	34	0.79%	182
	Myanmar	14,847,000	0.05%	7,424	0.10%	14,847	0.63%	64,783
	Samoa	71,000	0.03%	21	0.06%	43	0.79%	371
	Solomon Islands	229,000	0.04%	92	0.08%	183	0.79%	1,169
	Timor-Leste	501,000	0.06%	301	0.12%	601	0.79%	2,354
	Tonga	37,000	0.03%	11	0.06%	22	0.79%	198
	Tuvalu	3,000	0.03%	1	0.07%	2	0.79%	16
	Vanuatu	95,000	0.04%	38	0.03%	29	0.79%	482
Latin America & Caribbean	Guyana	220,000	0.05%	110	0.10%	220	0.70%	1,071
	Haiti	3,613,000	0.13%	4,697	2.59%	93,494	0.70%	16,637
	Jamaica	657,000	0.03%	197	0.06%	394	0.70%	3,178
	Nicaragua	1,825,000	0.04%	730	0.08%	1,460	0.70%	8,540
	Trinidad and Tobago	282,000	0.04%	113	0.08%	226	0.70%	1,302
South Asia	Afghanistan	14,324,000	0.08%	11,459	0.16%	22,918	0.55%	51,557
	Bhutan	206,000	0.05%	103	0.10%	206	0.63%	888
	Maldives	98,000	0.03%	29	0.06%	59	0.63%	384
Sub-Saharan Africa	Benin	4,585,000	0.08%	3,668	0.16%	7,336	0.24%	6,907
	Burkina Faso	8,249,000	0.08%	6,599	0.16%	13,198	0.24%	12,254
	Burundi	5,006,000	0.07%	3,504	0.14%	7,008	0.24%	7,068
	Cabo Verde	152,000	0.04%	61	0.08%	122	0.24%	238
	Chad	6,695,000	0.11%	7,365	0.22%	14,729	0.24%	9,754
	Comoros	316,000	0.07%	221	0.14%	442	0.24%	473
	Dem Rep of Congo	35,535,000	0.08%	28,428	0.16%	56,856	0.24%	51,984
	Cote d'Ivoire	9,639,000	0.08%	7,711	0.16%	15,422	0.24%	14,335
	Eritrea	2,235,000	0.05%	1,118	0.10%	2,235	0.24%	3,410
	Ethiopia	41,186,000	0.06%	24,712	0.02%	8,237	0.24%	63,804
	The Gambia	919,000	0.07%	643	0.14%	1,287	0.24%	1,327
	Guinea-Bissau	750,000	0.08%	600	0.16%	1,200	0.24%	1,109
	Lesotho	769,000	0.08%	615	0.16%	1,230	0.24%	1,178
	Liberia	1,904,000	0.07%	1,333	0.14%	2,666	0.24%	2,887
	Madagascar	10,108,000	0.06%	6,065	0.12%	12,130	0.24%	15,211
	Malawi	7,772,000	0.07%	5,440	0.14%	10,881	0.24%	11,566

Appendix G: Epidemiology Tables

Epidemiology of blindness, low vision and uncorrected refractive error

Region	Country	Child and Adolescent Population (0-15)					Child and adolescent Population (5-15)	
		Total population (0-15)	Blindness (%)	Blindness Total Children	Low Vision (%)	Low Vision Total Children	URE (%)	URE Total Children
Sub-Saharan Africa	Mali	8,363,000	0.09%	7,527	0.18%	15,053	0.24%	12,221
	São Tomé and Principe	81,000	0.05%	41	0.10%	81	0.24%	122
	Sierra Leone	2,733,000	0.11%	3,006	0.22%	6,013	0.24%	4,150
	Somalia	5,037,000	0.11%	5,541	0.22%	11,081	0.55%	16,863
	South Sudan	5,192,000	0.08%	4,154	0.16%	8,307	0.55%	17,804
	Tanzania	24,167,000	0.06%	14,500	0.12%	29,000	0.24%	35,446
	Togo	3,086,000	0.07%	2,160	0.14%	4,320	0.24%	4,622
	Zimbabwe	6,489,000	0.07%	4542.00	0.14%	9,085	0.24%	9,564

NOTE: Blindness and low vision rates in children aged 0-15 are calculated based on under-five mortality rates five years prior to the current estimate, i.e. a 2015 estimate of childhood blindness vision is based on 2010 under-five mortality rates. URE = Uncorrected refractive error.
SOURCE: Blindness and low vision rates are calculated based on Chandna and Gilbert, 2010.[41] Estimated prevalence of uncorrected refractive error from Resnikoff, 2008.[18] which is calculated from ages 5-15.

Prevalence of myopia – Urban and Rural

Region	Country	Child and Adolescent Population (0-19)						
		Total population (0-19)	Myopia Prev Total (%)	Myopia Total Children	Urban Prev (%)	Urban Total	Rural Prev (%)	Rural Total 0-19
East Asia & Pacific	Cambodia	6,494,000	30.3%	1,964,350	17.7%	1,151,600	12.5%	812,750
	Kiribati	48,000	4.7%	2,256	2.4%	1,126	2.4%	1,130
	Marshall Islands	32,000	4.7%	1,517	2.4%	757	2.4%	760
	FS Micronesia	47,000	4.9%	2,304	2.5%	1,154	2.5%	1,150
	Myanmar	19,829,000	18.5%	3,669,906	8.4%	1,655,846	10.2%	2,014,060
	Samoa	91,000	4.8%	4,363	2.4%	2,183	2.4%	2,180
	Solomon Islands	291,000	4.7%	13,800	2.4%	6,900	2.4%	6,900
	Timor-Leste	628,000	16.3%	102,216	9.4%	58,896	6.9%	43,320
	Tonga	48,000	4.8%	2,324	2.4%	1,164	2.4%	1,160
	Tuvalu	4,275,000	4.8%	203,380	2.4%	101,690	2.4%	101,690
	Vanuatu	120,000	4.7%	5,664	2.4%	2,834	2.4%	2,830
Latin America & Caribbean	Guyana	315,000	20.6%	64,885	12.2%	38,475	8.4%	26,410
	Haiti	4,733,000	14.6%	691,000	7.3%	345,500	7.3%	345,500
	Jamaica	929,000	16.2%	150,140	8.1%	75,070	8.1%	75,070
	Nicaragua	2,428,000	12.9%	312,505	8.5%	207,435	4.3%	105,070
	Trinidad and Tobago	368,000	14.5%	53,400	7.3%	26,700	7.3%	26,700
South Asia	Afghanistan	18,157,000	5.0%	902,377	2.3%	415,627	2.7%	486,750
	Bhutan	279,000	2.5%	7,095	1.3%	3,545	1.3%	3,550
	Maldives	130,000	13.0%	16,900	8.1%	10,490	4.9%	6,410

Prevalence of myopia – Urban and Rural

Region	Country	Child and Adolescent Population (0-19)						
		Total population (0-19)	Myopia Prev Total (%)	Myopia Total Children	Urban Prev (%)	Urban Total	Rural Prev (%)	Rural Total 0-19
Sub-Saharan Africa	Benin	5,757,000	1.0%	57,575	0.5%	28,785	0.5%	28,790
	Burkina Faso	10,217,000	3.9%	393,335	3.0%	303,385	0.9%	89,950
	Burundi	6,114,000	6.6%	401,844	3.3%	200,924	3.3%	200,920
	Cabo Verde	205,000	4.1%	8,299	3.1%	6,359	1.0%	1,940
	Chad	8,257,000	5.3%	438,509	3.8%	310,309	1.6%	128,200
	Comoros	398,000	7.0%	27,682	3.5%	13,842	3.5%	13,840
	Congo	43,733,000	6.7%	2,940,836	3.4%	1,470,416	3.4%	1,470,420
	Cote d'Ivoire	12,148,000	7.0%	846,159	3.5%	423,079	3.5%	423,080
	Eritrea	2,759,000	5.6%	155,536	2.8%	77,766	2.8%	77,770
	Ethiopia	52,936,000	7.2%	3,816,363	3.6%	1,908,183	3.6%	1,908,180
	The Gambia	1,131,000	3.8%	42,926	2.9%	33,096	0.9%	9,830
	Guinea-Bissau	943,000	3.9%	36,458	3.0%	28,058	0.9%	8,400
	Lesotho	1,019,000	8.3%	84,217	4.1%	42,107	4.1%	42,110
	Liberia	2,380,000	3.9%	92,793	3.0%	71,513	0.9%	21,280
	Madagascar	12,811,000	3.9%	500,498	3.0%	385,028	0.9%	115,470
	Malawi	9,676,000	3.9%	377,098	2.0%	188,548	2.0%	188,550
	Mali	10,222,000	5.3%	539,682	3.7%	382,572	1.5%	157,110
	São Tomé & Principe	101,000	3.9%	3,928	3.0%	3,028	0.9%	900
	Sierra Leone	3,431,000	3.9%	133,980	3.0%	103,270	0.9%	30,710
	Somalia	6,238,000	4.3%	270,060	2.2%	135,030	2.2%	135,030
	South Sudan	6,546,000	4.5%	292,236	2.2%	146,116	2.2%	146,120
	Tanzania	29,707,000	6.6%	1,968,659	3.3%	984,329	3.3%	984,330
	Togo	3,843,000	3.9%	148,784	3.0%	114,714	0.9%	34,070
	Zimbabwe	8,157,000	7.6%	619,901	3.8%	309,951	3.8%	309,950

NOTE: Prev. - Prevalence
SOURCE: Meta-analysis by Brien Holden Vision Institute using data from Frick (2012)[26] and Holden (2016)[25]