Package of eye care interventions



World Health Organization

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ISBN 978-92-4-004895-9 (electronic version)
ISBN 978-92-4-004896-6 (print version)

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Cataloguing-in-Publication (CIP) data. CIP data are available at http://apps.who.int/iris.

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Acknowledgements

The World Health Organization (WHO) would like to thank the more than 100 public health, methods experts and clinical leaders in the field of eye care, WHO staff, and other contributors for their support and guidance. Without their dedication, support, and expertise the development of the Package of Eye Care Interventions (PECI) would not have been possible.

This resource was developed by Stuart Keel, Neha Misra, Andreas Mueller, Silvio Mariotti and Alarcos Cieza, Vision and Eye Care Programme, WHO.

WHO acknowledges valuable inputs and guidance on different aspects of the PECI from Gareth Lingham (Centre for Ophthalmology and Visual Science, Lions Eye Institute, University of Western Australia, Perth, Australia), Jennifer Evans (Cochrane Eyes and Vision, London School of Hygiene and Tropical Medicine, United Kingdom of Great Britain and Northern Ireland) and Sumrana Yasmin (Sightsavers, United Kingdom).

The resource benefitted from the contributions of a number of WHO staff: Yu Nandar Aung, Kratu Goel and Wajeeha Raza, Economic Evaluation and Analysis Unit, Department of Health Systems Governance and Financing; Vera Carneiro, Pauline Kleinitz, Alexandra Rauch and Mitasha Yu, Sensory Functions, Disability and Rehabilitation Unit, Department of Noncommunicable Diseases; Efstratios (Stratos) Chatzixiros, Technical Standards and Specifications Unit, Department of Health Product Policy and Standards; Fabrizio d'Esposito, Management of Noncommunicable Diseases, Regional Office for the Western Pacific; John Fogarty and Nuhamin Tekle Gebre, Clinical Services and Systems Unit, Department of Integrated Health Services; Taufique Joarder, Health Policy and System Support Unit, Department of Health Workforce; Amir Kello, Medical Officer (Trachoma), Regional Office for Africa; Susan Norris, Guidelines Review Committee, Methods and Standards Unit, Department of Quality Assurance of Norms and Standards; Anthony Solomon, Medical Officer (Neglected Tropical Diseases), Department of Control of Neglected Tropical Diseases; Emma Tebbutt, Assistive Technology and Medical Devices Unit, Department of Health Product Policy and Standards; Bente Mikkelsen, Director Department of Noncommunicable Diseases; and Minghui Ren, Assistant Director-General Universal Health Coverage/Communicable and Noncommunicable Diseases.

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The development and publication of this resource was made possible through financial support from (in alphabetical order) CBM, Sightsavers, The Fred Hollows Foundation and Zhongshan Ophthalmic Center, Sun Yat-sen University.

Abbreviations

AMD	age-related macular degeneration
Anti-VEGF	anti-vascular endothelial growth factor
CPG	clinical practice guidelines
DALY	disability-adjusted life years
ECCE	extracapsular cataract extraction
ECSAT	eye care service assessment tool
IPEC	integrated people centered eye care
LICs	low-income countries
LMICs	low- and middle-income countries
PECI	Package of Eye Care Interventions
SICS	small-incision cataract surgery
SDG	Sustainable Development Goals
TAG	Technical Advisory Group
TWG	Technical Working Group
UHC	universal health coverage
UN	United Nations
WHA	World Health Assembly
WHO	World Health Organization

Executive Summary

Globally, it is estimated that at least 2.2 billion people have a vision impairment and, of these, at least 1 billion people have a vision impairment that could have been prevented or is yet to be addressed. This figure represents only a fraction of the total need for eye care services globally; eye conditions are universal, and everyone, if they live long enough, will experience at least one eye condition that requires the appropriate care. Vision impairment poses an enormous global financial burden, with an estimated annual global productivity loss of US$ 410.7 billion purchasing power parity. This figure far outweighs the estimated cost gap of addressing the unmet need of vision impairment (estimated at US$ 24.8 billion).

Fortunately, there are effective public health strategies and clinical interventions covering promotion, prevention, treatment and rehabilitation which address the needs associated with eye conditions and vision impairment; some are among the most cost–effective and feasible of all health-care interventions to implement. Concerted efforts to increase the coverage of these interventions during the past 30 years have yielded considerable dividends, with an ongoing reduction in the age-adjusted prevalence of blindness due to preventable causes, and a substantial reduction in the number of children and adults who are blind due to vitamin A deficiency and infectious causes, such as onchocerciasis and trachoma.

Despite the successes, eye care services have been unable to keep pace with the increasing need associated with demographic, behavioural and lifestyle trends that have led, and will continue to lead, to an increase in the number of noncommunicable eye conditions. To accentuate these challenges, significant inequalities in access to eye care services exist – the burden of eye conditions and vision impairment being greater in low- and middle-income countries (LMICs) and underserved populations.

In many LMICs, a wide gap exists between evidence-based recommendations and current practice. Essential ophthalmic equipment to manage eye conditions is frequently not available, particularly in the government sector and eye care medicines and interventions are not integrated into the health insurance schemes. Thus, the costs associated with accessing eye care services pose a major barrier to addressing the inequities in access to, and provision of, these services across the population.

The reality that the vast majority of eye care services in LMICs are provided in secondary or tertiary hospitals, which are principally located in urban areas, adds to the inequity in access. This highlights the importance of both strengthening the inclusion of eye care services within primary health care, and ensuring an effective referral pathway to secondary and tertiary care settings for timely treatment of eye conditions.

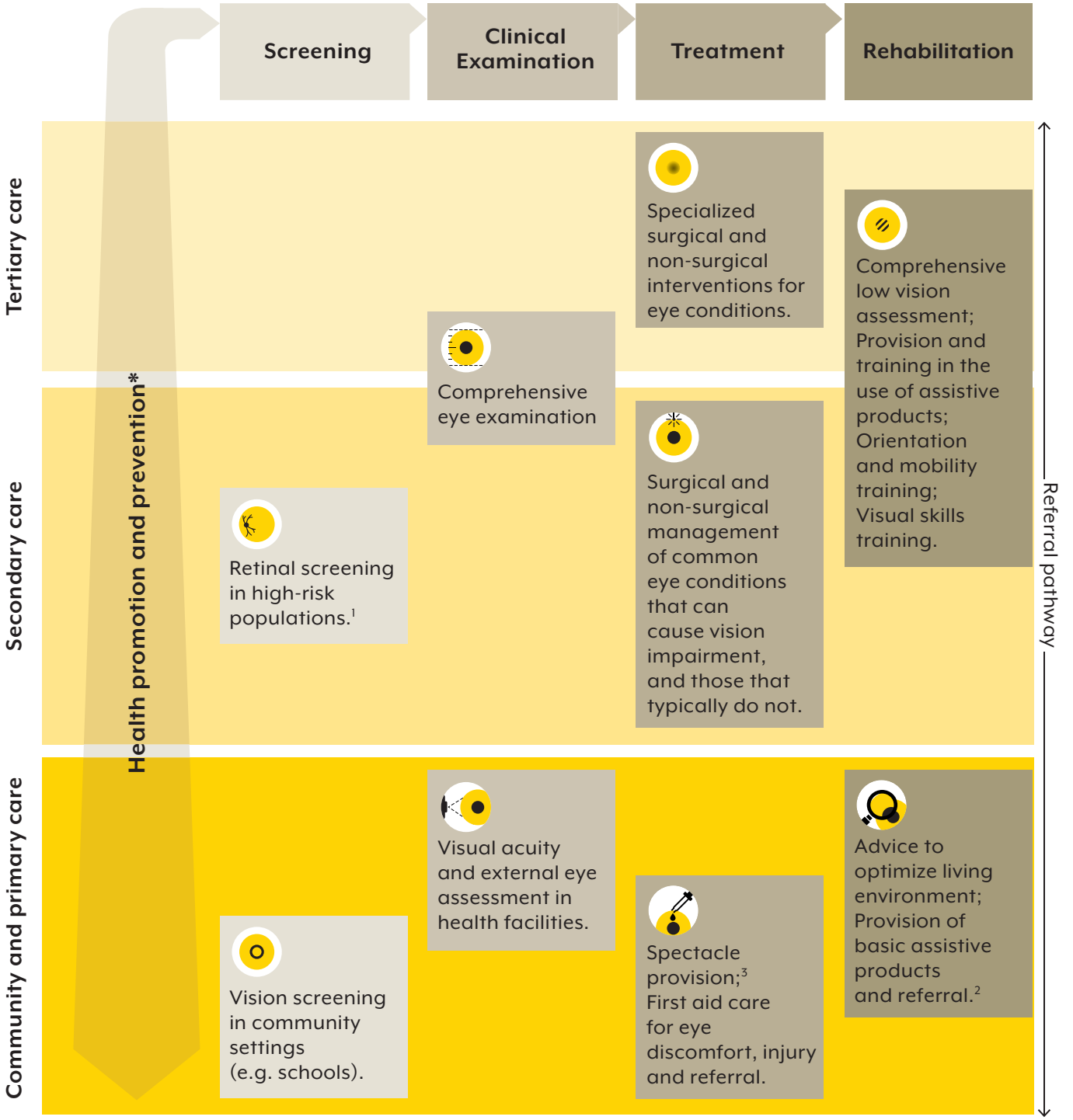
At the Seventy-third World Health Assembly in November 2020, WHO Member States adopted resolution WHA73 “Integrated people-centred eye care, including preventable vision impairment and blindness”. In recognition of the growing need for eye care services worldwide, the resolution requests

WHO to "develop guidance on evidence-based and cost–effective eye care interventions and approaches to facilitate the integration of eye care into universal health coverage". To this end, WHO, through consultation with international experts, developed this Package of Eye Care Interventions (PECI).

The PECI provides a set of recommended, evidenced-based eye care interventions with material resources required for implementation, presented across the following continuum of care: i) health promotion and prevention; ii) screening; iii) diagnosis and monitoring; iv) treatment; and v) rehabilitation. For each selected intervention, information is also provided on the relevant period of life-course; recommended level/s of care (i.e. community, primary, secondary and tertiary health care) for delivery; and potential links to health programme/s and sectors. The PECI recommendations for the integration of a range of eye care interventions within the health system are summarized below in Figure 1.

The PECI serves to facilitate policy-makers and technical decision-makers in LMICs to integrate eye care into the packages and policies of their national health services. Service providers can use the PECI to plan and implement eye care interventions in their service programmes; and the donor and development agencies can use it as a blueprint for eye care programmes.

Figure 1. Recommended integration of a range of eye care interventions within the health system, across the continuum of care



* It is recommended that eye health promotion and education be delivered across all levels of care, with an increased focus on integrating simple and effective education and counselling at the community and primary care level.

[1] Refers to screening of: i) preterm and/or low-birth-weight infants for retinopathy of prematurity; and ii) people with diabetes for diabetic retinopathy;

[2] The scope of vision rehabilitation interventions at community and primary level varies to that which can be delivered at higher levels of care.

[3] This includes the provision of ready-made reading spectacles in community settings and primary level health facilities. Given the high prevalence of distance refractive error in communities, the timely provision of prescription spectacles as close as is feasible to people's homes should also be prioritized to mitigate the impact of unaddressed vision impairment.

Background

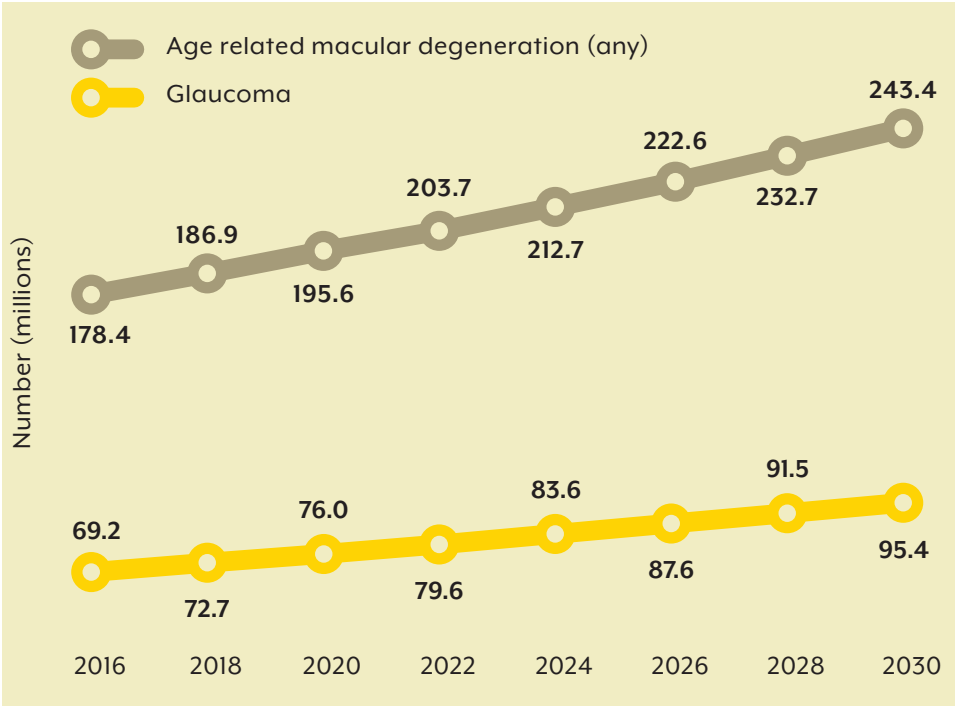
Eye care: global situation

Globally, it is estimated that at least 2.2 billion people have a vision impairment, and of these, at least 1 billion have a vision impairment that could have been prevented or is yet to be addressed *(1)*. This figure represents only a fraction of the total need for eye care services worldwide; eye conditions are universal, and everyone, if they live long enough, will experience at least one eye condition that requires the appropriate care.

Eye conditions and vision impairment pose a significant personal and societal burden. The Global Burden of Disease Study 2017 ranked vision impairment the third cause among all impairments for years lived with disability, and studies have consistently established that eye conditions and vision impairment severely impact well-being *(2)*. In addition, vision impairment poses an enormous financial burden: conservative estimates suggest that the annual global productivity loss from vision impairment is approximately US$ 410.7 billion purchasing power parity *(3)*. This figure far outweighs the estimated cost gap of addressing the unmet need of vision impairment (estimated at US$ 24.8 billion) *(1)* thus providing a strong health economic rationale for increasing coverage of eye care interventions.

Global demographic trends, including population ageing and growth, and behavioural and lifestyle factors will cause a substantial increase in the number of people with eye conditions that can cause vision impairment. Currently, more than 800 million people have distance- or near-vision impairment that could be addressed with an appropriate pair of spectacles *(1)*, while an estimated 100 million people have moderate-to-severe distance vision impairment or blindness that could be corrected through access to cataract surgery *(4)*. These figures are expected to increase, since presbyopia and cataract development are part of the ageing process, while growing evidence suggests that projected increases in myopia in the younger population will be driven largely by lifestyle-related risk factors *(1)*. Substantial increases are also expected in the number of people with noncommunicable chronic eye conditions, such as glaucoma, age-related macular degeneration (Figure 2), diabetic retinopathy, and complications of myopia. These conditions require a comprehensive range of interventions for their management, as well as long-term care, and these will have a profound impact on an already strained health system and eye care workforce. For example, based on the projected burden of diabetes alone, it is estimated that, by 2040, there will be an increase of 50% in the number of people worldwide requiring access to routine (i.e. annually or biennially, depending on the setting) retinal examination for diabetic retinopathy *(5, 6)*.

Figure 2. Projected number of people worldwide with glaucoma and age-related macular degeneration (to year 2030)*



* Adapted from: Tham YC, Li X, Wong TY, Quigley HA, Aung T, Cheng CY. Global prevalence of glaucoma and projections of glaucoma burden through 2040: a systematic review and meta-analysis. Ophthalmology. 2014;121(11):2081–90; and Wong WL, Su X, Li X, Cheung CM, Klein R, Cheng CY, et al. Global prevalence of age-related macular degeneration and disease burden projection for 2020 and 2040: a systematic review and meta-analysis. Lancet Glob Health. 2014;2(2):e106–16.

Availability of, and access to, eye care interventions

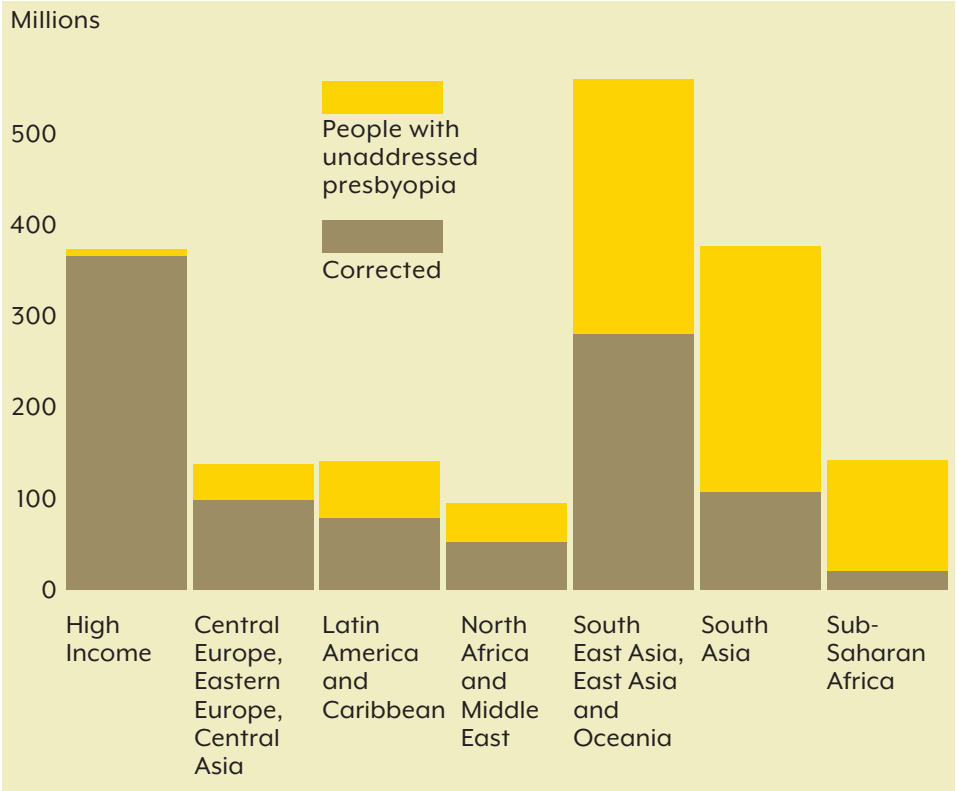
Fortunately, there are effective public health strategies and clinical interventions covering promotion, prevention, treatment and rehabilitation which address the needs associated with eye conditions and vision impairment; some are among the most cost–effective and feasible of all health-care interventions to implement. For example, cataract surgery has been identified as one of only a select few surgical interventions costing less than US$ 200 per disability-adjusted life years (DALYs) averted *(3)*.

Concerted efforts to enhance service provision in the field of eye care during the past 30 years have yielded considerable dividends. For example, many LMICs have seen substantial increases in rates of cataract surgery *(7, 8)*, while the implementation of large-scale public health initiatives has resulted in a substantial reduction in the number of children and adults who are blind due to vitamin A deficiency, onchocerciasis, and trachoma in all regions *(9–12)*. These efforts have resulted in modest reductions in the proportion of adults with vision impairment or blindness specifically due to preventable or treatable causes *(4)*.

Despite these efforts, services have been unable to keep pace with the growing need for eye care, and inequities in access persist *(1)*. The gap between existing eye care needs and access to services is notably greater in LMICs; the age-standardized prevalence of blindness in regions of western and eastern sub-Saharan Africa (11.1 and 10.7 per 1000, respectively) and south-east Asia (10 per 1000) are more than five times higher than in all high-income regions (<2.0 per 1000) *(13)*. Similarly, the greatest burden of uncorrected near-vision impairment occurs in LMICs (Figure 3) *(14)*. As with many other health conditions, such as hypertension, HIV and tuberculosis

(15), the burden of vision impairment also tends to be greater in underserved populations, such as people living in rural areas, those with low incomes, women, older people, people with certain kinds of disability, indigenous populations, and ethnic minorities *(1)*.

Figure 3. Regional comparison of presbyopia showing total number of people with presbyopia and proportion of cases with near vision impairment resulting from uncorrected presbyopia*



* Adapted from: Fricke T, Tahhan N, Resnikoff S, Papas E, Burnett A, Ho S, et al. Global prevalence of presbyopia and vision impairment from uncorrected presbyopia: systematic review, meta-analysis and modelling. Ophthalmology. 2018; 125:1492:99.

In many LMICs, a wide gap exists between evidence-based recommendations and current practice. Essential ophthalmic equipment and medicines to manage the most common eye conditions are frequently not available, particularly in the government sector of some low- and middle-income settings *(1)*. For example, the results of the 2019 global survey to assess the national capacity for the prevention and control of noncommunicable diseases in all 194 WHO Member States *(16)*, revealed that only 58% of countries reported retinal photocoagulation – a primary intervention for vision-threatening diabetic retinopathy – as being generally available in the publicly-funded health system. Disparities across income groups were marked: over 90% of high-income countries reported retinal photocoagulation being generally available compared with less than 10% of low-income countries *(16)*. A recent national survey of practice patterns and management of glaucoma in Nigeria reported that only approximately 30% of ophthalmologists had access to laser equipment, while basic diagnostic equipment was not available in 15–20% of clinics *(17)*.

The costs associated with accessing eye care services is often reported as a major barrier to the access, and provision, of eye care services across the population. Eye care medicines and interventions are not integrated into the health insurance schemes in many LMICs: of 29 countries (59% low-income or low- to middle-income) that completed the WHO eye care service assessment tool between 2014 and 2016, more than 20% reported that health insurance schemes did not cover any eye care services; several other countries reported that eye care services were only minimally covered *(1)*.

The reality that the majority of eye care services in LMICs are provided in secondary or tertiary hospitals, which are principally located in urban areas, risks adding to inequity in access. This highlights the importance of both strengthening the inclusion of eye care services within primary health care, and ensuring an effective referral pathway to secondary and tertiary care settings for timely treatment of eye conditions.

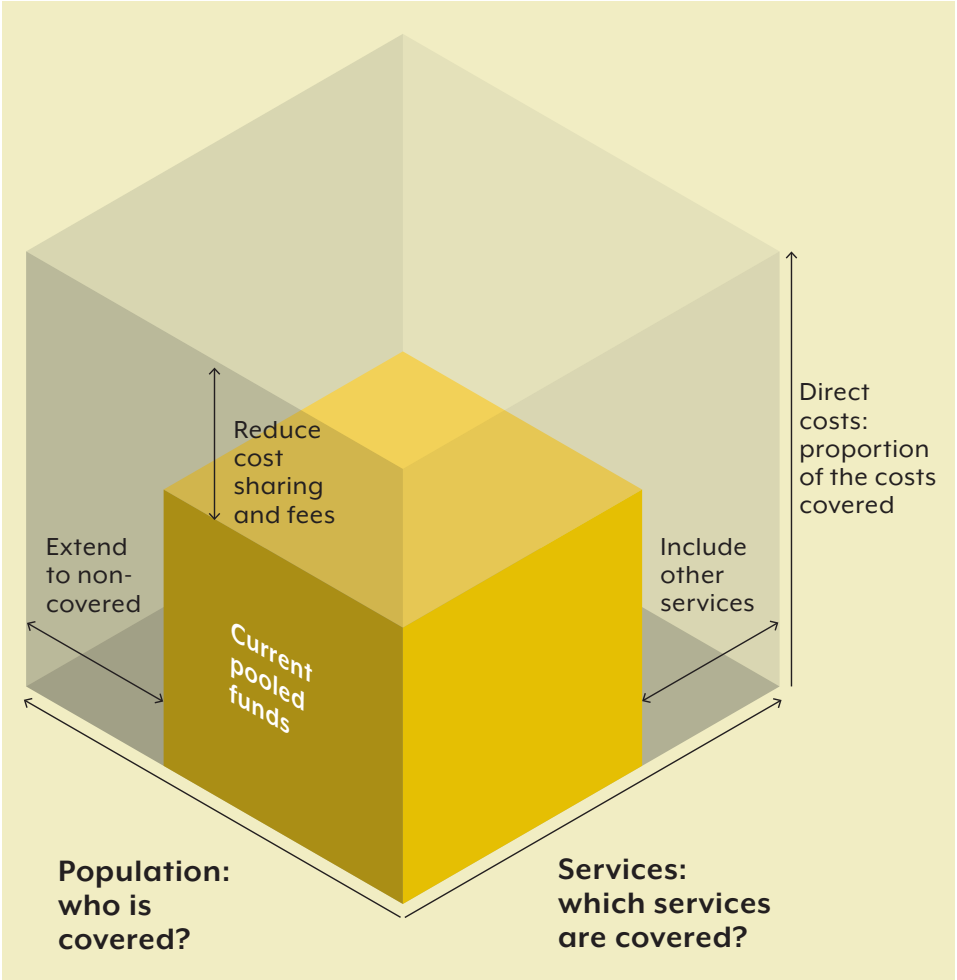
Universal health coverage and eye care

The United Nations (UN) Sustainable Development Goals (SDGs) define targets for priority areas of action that all 193 UN Member States agreed to achieve by 2030 *(18)*. Eye care is relevant to Sustainable Development Goal 3 (SDG3) which addresses health and well-being, including target SDG3.8 on universal health coverage (UHC). The objective of UHC is to ensure that all people have access to the promotive, preventive, curative and rehabilitative services they need, when and where they need them, without being exposed to financial hardship, particularly from unaffordable out-of-pocket payments. The eye care sector is well positioned to contribute to the advancement of UHC within countries given that i) there is a large unmet need for eye health services; and ii) effective interventions are available to address the needs associated with eye conditions and vision impairment *(1)*.

To address many of the challenges facing the eye care sector – particularly those relating to changing demographics, inequities in access, and lack of integration – eye care needs to be an integral part of UHC. Thus, in order to promote equitable access to services, including protection against financial hardship, a shift is required to ensure that high-priority eye care interventions are included in service packages covered by pre-paid pooled financing. This is particularly important for the poorest and neglected segments of the population.

For countries to move towards UHC, including eye care, they need to advance in three dimensions (Figure 4). Firstly, priority eye care interventions and services included within health benefit packages need to be expanded; secondly, a greater proportion of the population needs to be covered; and thirdly, out-of-pocket payments need to be reduced. Countries are required to make important choices when addressing these dimensions, such as which interventions and population groups should be prioritized.

Figure 4. Dimensions of universal health coverage



In November 2020, at the Seventy-third World Health Assembly, WHO Member States adopted resolution WHA73, "Integrated people-centred eye care, including preventable vision impairment and blindness". This resolution requests WHO to "develop guidance on evidence-based and cost–effective eye care interventions and approaches to facilitate the integration of eye care into universal health coverage" *(19)*. With this in mind, WHO, through consultation with international experts, developed this PECI, thus providing information on evidence-based eye care interventions, including resource requirements for their implementation, that are applicable to most low- and intermediate-resource settings. The PECI serves to facilitate policy-makers and technical decision-makers to integrate eye care into national health services packages and policies.

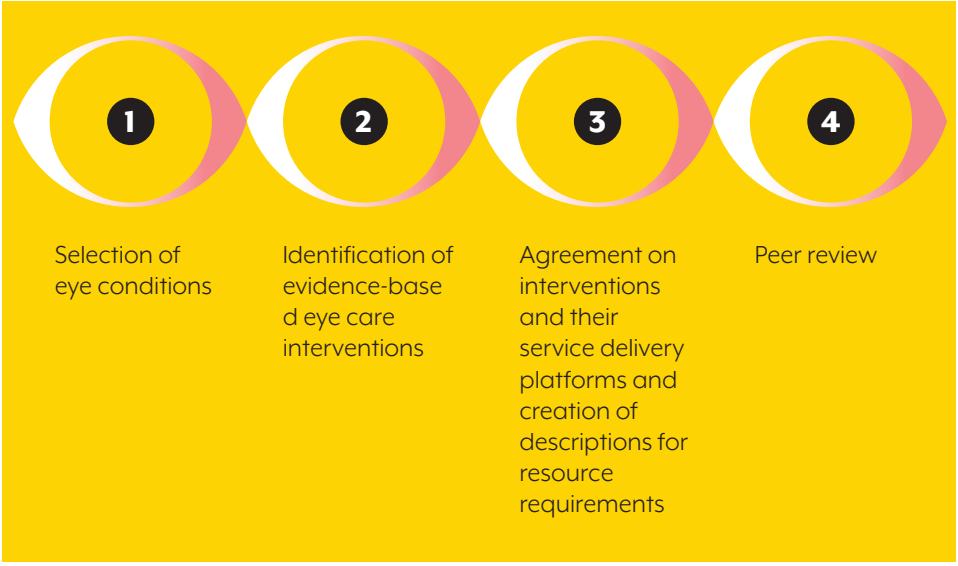
Methodology

The methodology for the PECI was developed in collaboration with the WHO Guideline Review Committee *(20)*. A stepwise approach was followed with the involvement of a broad range of stakeholders (Figure 5). In brief, this included: i) a selection of eye conditions (for which interventions will be included in the package) based on epidemiological data on the causes of vision impairment and blindness, prevalence estimates of eye conditions, and health facility data; ii) identification of interventions and related evidence for the selected eye conditions from clinical practice guidelines (CPGs) and high quality systematic reviews by a technical working group *(21–25)*; iii) expert agreement on the inclusion of eye care interventions in the package and the description of resources required for the provision of the selected interventions; and iv) peer review.

The selection of evidence-based eye care interventions for inclusion in the PECI was guided by the following overarching criteria: i) evidence on the effectiveness of the intervention was evaluated as sufficient based on the strength of the recommendation and quality of evidence; and ii) it was considered practical and realistic that the intervention can be implemented within low- and intermediate-resource settings.

Additional details on each stage of the development process can be found in Annex 1. The final list of selected guidelines and systematic reviews used to help inform the PECI can be found in Annex 2.

Figure 5. Phases of development of the Package of Eye Care Interventions



Development and criteria for the selection of eye care interventions for primary care

WHO convened a specific working group comprising individuals with expertise in primary eye care with the objective of defining a set of low-cost, high-impact, evidence-based eye care interventions/resources that can be delivered easily, safely and effectively in health facilities at a primary-care level in low-resource settings. The target population implementing the interventions recommended would be health professionals and allied

health personnel at primary-care level health facilities in such settings. This model promotes task-shifting, and is thus aimed at personnel at primary-care level health facilities who have a health-related qualification that is not in a field related to eye care.

The development of this primary care package involved an initial review of existing WHO guidance and documents on the topics of primary eye care and primary health care *(26–30)*, followed by independent feedback and group discussions with a specific working group comprising individuals with expertise in primary eye care. The following criteria were used as a guide for selection:

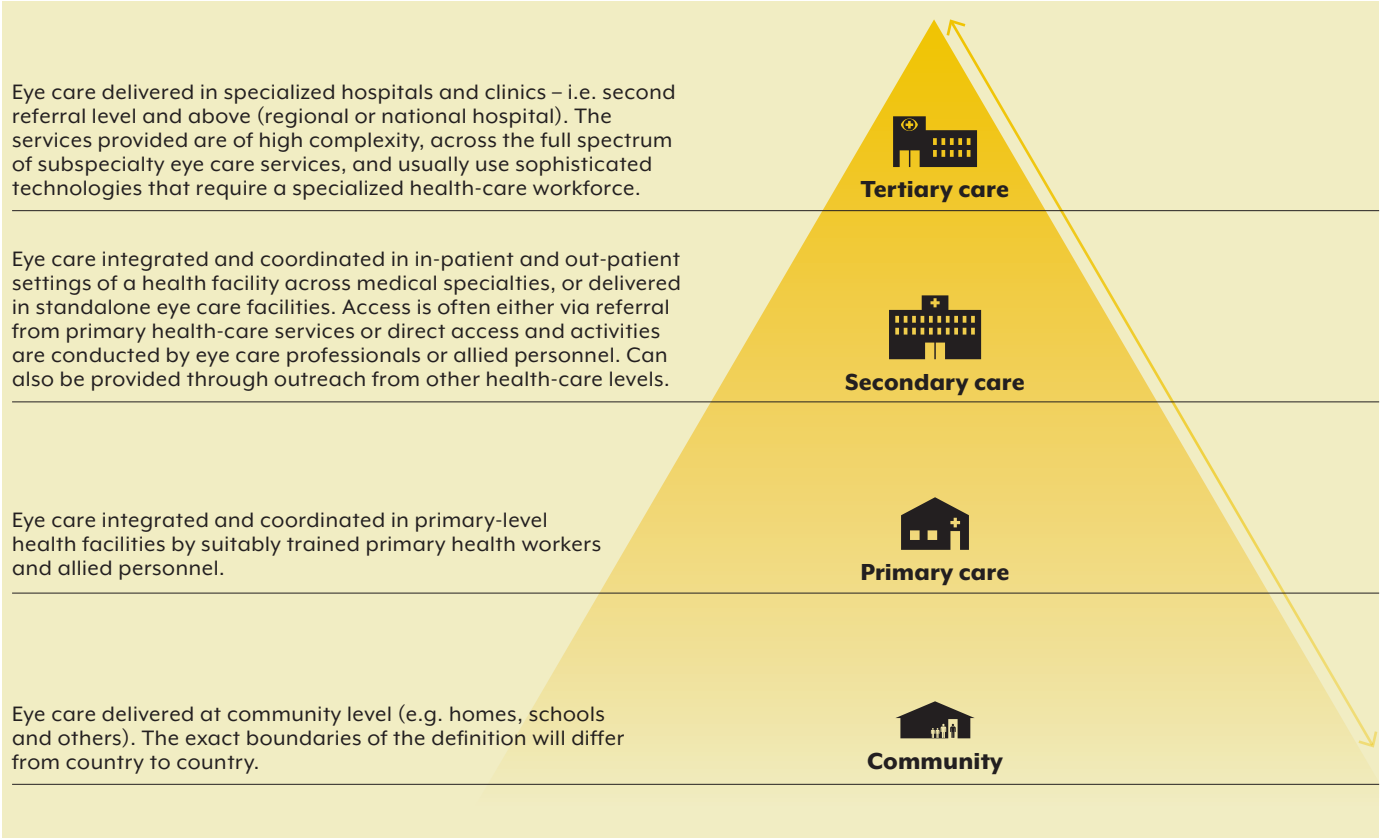
1. The intervention addresses the common eye conditions that can cause vision impairment and/or significant discomfort.
2. The intervention can be delivered safely and effectively (with rare adverse events or minimal side effects) with simple clinical reasoning, assisted through the use of protocols and short training courses.
3. Indication for the intervention is easy to identify through basic screening, with or without a definitive diagnosis.
4. The time-intensity of the intervention is feasible to deliver within the usual clinical role of health professionals and allied health personnel at primary-level health facilities.
5. The intervention can be delivered using only locally-available equipment or consumables at low cost, or that require minimal investment.

Scope and target audience

Scope

This PECI presents a set of recommended, evidenced-based eye care interventions provided along the continuum of care from i) health promotion and prevention, ii) screening, iii) diagnosis and monitoring, iv) treatment and (v) rehabilitation. For each selected intervention, information is provided on the relevant period of life-course, recommended level/s of care (i.e. community, primary, secondary and tertiary health care, Figure 6) for delivery, and potential links to health programme/s and sectors. A list of the material resources required for the implementation of the selected eye care interventions, including equipment, medicines, consumables and assistive technologies, is provided in annexes 3–6 of this publication.

Figure 6. Integrated eye care at all service delivery levels



Box 1. A note on primary care

It is acknowledged that the exact boundaries of the primary eye care definition differs from country to country, and there is no single path countries can follow to achieve a strong primary care that includes eye care. Thus primary eye care services may be included within primary level health facilities, achieved through enhanced supervision and the training of existing staff, or the adoption of standalone primary eye care services, either in fixed facilities or through mobile units. It is important to note that the focus of this document is on the former, i.e. inclusion of primary eye care services within primary level health facilities in low-resource settings.

In addition to the "essential" eye care interventions recommended to be carried out in primary-level health facilities, additional elements of care are recommended under "assessment", "treatment" and "rehabilitation" to enhance eye care service provision at the primary level. These are categorized as "primary plus". Interventions under "primary plus" should be considered in addition to the recommended essential primary services and provided in a wide range of communities and settings in order to meet the most common eye care needs of the population.

The list of interventions outlined in the PECI is not intended to be exhaustive or exclusive; rather it represents eye care interventions that are applicable to most low- and intermediate-resource settings for which high-quality evidence is available. Future work will involve refining and expanding the PECI, drawing on newly available evidence and newly collected data on service provision. It is acknowledged that countries have different starting points when implementing these strategies, depending on the maturity of their health system, the resources available, and local needs. This document serves as a basic resource to help guide countries when selecting and prioritizing eye care interventions.

To assist countries in the process of selecting and prioritizing interventions to meet general population eye care needs, interventions listed under "screening", "treatment" and "rehabilitation" have been categorized as "essential". A classification of "essential" was made according to feedback from the subspecialty expert groups after considering the following criteria:

- The intervention is of high priority due to the prevalence, or the risk of vision impairment, of the related eye condition and should be included within national health services packages and/or policies in all countries;
- There is a favourable ratio between the benefits to patients, and the required resources at a public health level.

Target audience

The primary audience for the PECI is the Ministry of Health and other ministries involved in planning for the delivery of eye care services in low- and middle-income settings. Other potential end-users of the PECI include: i) government service providers who can use the PECI to plan and implement specific eye care interventions in their service programmes; ii) training facilities who can use the PECI to develop their curricula for the training of health workers involved in eye care; iii) researchers who will be able to identify current gaps in evidence and define research strategies to address these gaps; and iv) donors and development agencies who can use the package as a blueprint for eye care programmes in low- and intermediate-resource settings.

Health promotion and prevention

This section provides an overview of evidence-based areas for health promotion, education and prevention (including clinical and non-clinical measures) in the field of eye care, and highlights opportunities for integration across various health programmes and sectors.

Health promotion and education

The strategies for health promotion, education and clinical counselling aim to promote the necessary knowledge, motivation and skills to empower people to increase control over their eye health and its promotive factors through health literacy efforts. Health literacy is an essential component of empowering individuals and their families, specifically underserved populations; it is crucial to increase the adoption of healthy behaviours, and to promote optimal self-care and the uptake of services.

Traditionally, interventions aimed at health promotion and education in the field of eye care have received less attention and investment than those for treatment. In light of this, a key WHO recommendation in the *World report on vision* (2019) is to strengthen general awareness and engage and empower people and communities *(1)*. There is a strong rationale to strengthen health promotion and education in the field of eye care given the majority of cases of vision impairment and blindness can be prevented through early detection and timely management. Therefore, improving awareness of the importance of regular eye examinations among populations at a high-risk of vision impairment (e.g. older people, those with diabetes or a family history of eye conditions), and addressing common misconceptions – for example, the tendency for individuals to consider reduced vision as part of the normal ageing process – is critical to improving the eye health of the population. Poor eye health literacy can limit adherence to medications and routine assessment among people with chronic eye conditions *(31–33)*; furthermore compliance with spectacle-wear among children and adolescents is often suboptimal, commonly attributable to misconceptions, particularly with parents, that using spectacles worsens the child's vision, and stigma *(34, 35)*.

Clinical and non-clinical preventative interventions

A range of non-clinical measures can be taken for the prevention of certain eye conditions, including myopia, ocular infections and ocular injuries. For example, preventative lifestyle changes among children, including a combination of increased time spent outdoors and decreased near-work activities, can slow the progression of myopia which reduces the risk of high myopia and its complications *(36–38)*. In addition, targeted campaigns to improve awareness of trauma prevention strategies, together with interventions focused on public and occupational safety through regulatory and policy measures, can be effective in reducing ocular injuries *(39–41)*. Importantly, the management of some health conditions can also be effective in reducing the incidence of secondary ocular conditions. Interventions to prevent health conditions such as vitamin A deficiency, measles and rubella, through vitamin A supplementation and

immunization, are highly effective in reducing the risk of corneal opacities that can occur secondary to these conditions *(42, 43)*. In addition, after diabetes onset, the management and control of key risk factors for diabetic retinopathy, including hyperglycemia, hypertension, and hypercholesterolaemia, can prevent or delay the onset and progression of this eye condition *(44)*.

For trachoma, an effective package of interventions (the "SAFE" strategy) is available for endemic populations, which decreases the risk of ongoing visual impairment (by eyelid surgery [S]) and lowers the prevalence (antibiotic [A] mass drug administration) and transmission of infection (through facial cleanliness [F] and environmental improvement [E]) *(12, 45)*. Other eye conditions that can be targeted effectively with preventive clinical interventions include ophthalmia neonatorum and retinopathy of prematurity.

Priority areas of health promotion and prevention in the field of eye care

Table 1 outlines key evidence-based areas for health promotion and prevention in the field of eye care, stratified by those that are highly relevant to children, adults and people of all ages. The areas for health promotion and education outlined in Table 1 may occur at the individual level (e.g. by health professionals during routine clinical practice) and/or the population group level (e.g. public health campaigns). With the former, it is recommended that eye health promotion and education be delivered across all levels of care, with an increased focus on integrating simple and effective education and counselling at the community and primary care level. As regards to the latter, while some areas of eye health education and promotion may be delivered in standalone educational campaigns (Box 2), a significant number of opportunities exist for the integration of eye care education across other health programmes areas (as outlined in Table 1), such as occupational health, nutrition and immunization, tobacco cessation and sun protection initiatives. Regardless of the approach, strategies for health promotion, education and prevention in the field of eye care should not be conducted in isolation; rather they should be complementary to the existing clinical interventions, policies and awareness in countries.

Box 2. Case study: An initiative to delay the onset and progression of myopia in Singapore: using public education awareness and vision screening*

The Singapore School Health Service took up the mandate of the National Myopia Prevention Programme, a large-scale collaboration between various ministry departments, professional associations, academic and research institutions, to address high childhood myopia rates in Singapore. The initiative began in 2002 and used a two-pronged strategy of public education to raise awareness and delay the onset and progression of myopia, and vision screening for early detection and management of myopia.

Annual routine vision screening was instituted in all schools in 1996. Since the initiative began, it has been expanded to include pre-school children as young as 5 years of age. Evidence-based messages that focused on reducing time spent on near-work activities such as reading, writing and using electronic devices, together with messages encouraging outdoor activities to delay the onset and progression of myopia in children, became the key strategy in the educational initiative. The messages were directed towards children, parents, teachers, and the general public. Specifically, the vision care messages involved:

i age-appropriate fun activities such as dramas, jingles, dance and a mobile "health lifestyle" bus, developed for children, together with the use of a mascot to trigger recall of good eye care messages;

ii training programmes for teachers to gain an in-depth understanding of myopia and to encourage children to develop their own creative and novel approaches to promote good eye care habits among peers;

iii group counselling sessions, school-cluster seminars and public forums held to engage parents and families to promote good eye care habits at home; and

iv mass media used to deliver messages to encourage good eye care habits among the general public through television advertisements, radio, and parent's magazines. The Singapore Health Promotion Board's website delivered information on childhood myopia.

To gauge the impact of the programme in reducing childhood myopia rates, myopia prevalence rates were analysed between 2004 and 2015 among students from 12 primary and 12 secondary schools. The analysis revealed a statistically significant downward trend in myopia prevalence among the primary school students (only) from 37.7% to 31.6% during this period.

* Adapted from: Karuppiah V, Wong L, Tay V, Ge X, Kang LL. School-based programme to address childhood myopia in Singapore. Singapore Medical Journal. 2021;62(2):63–68.

Table 1. Priority areas for health promotion and prevention in the field of eye care, stratified by children, adults and people of all ages

Target	Short description	Educational	Clinical	Link to health programme
Children				
Behavioural change to delay the onset and progression of myopia[1]	Providing information to parents, caregivers and teachers of infants, children, and adolescents about the importance of lifestyle risk factors, including intensive near vision activity (as a risk factor) and longer time spent outdoors (as a protective factor), in the onset and progression of myopia, and prevention of high myopia.	x	–	Child Health; Adolescent Health; School Health; Primary Care; Health Promotion
Spectacle compliance	Providing information among children, and parents, caregivers and teachers of children and infants, of the importance of compliance to spectacle-wear to avoid the negative impact of uncorrected refractive error on academic performance and other aspects of their life.	x	–	Child Health; Adolescent Health; School Health; Primary Care; Health Promotion
Nutrition and immunization to prevent secondary eye conditions[2]	Educational: Nutritional education regarding a healthy, vitamin A-rich diet, and the importance of measles and rubella immunization and vitamin A supplementation to prevent secondary eye conditions.[3] Clinical: Rubella immunization; measles immunization; vitamin A supplementation.	x	x	Maternal and Newborn Health; Child Health; School Heath; Immunization; Nutrition; Primary Care; Health Promotion
Oxygen management to prevent retinopathy of prematurity	Monitoring of oxygen levels and saturation in preterm infants to prevent retinopathy of prematurity.	–	x	Maternal and Newborn Health
Prophylactic management to prevent ophthalmia neonatorum	Use of ophthalmic antibiotic ointment and lid cleaning at birth to prevent ophthalmia neonatorum in neonates.	–	x	Maternal and Newborn Health; Primary Care

Target	Short description	Educational	Clinical	Link to health programme
Adults				
Control of key risk factors for diabetic retinopathy[4]	Educational: Education and counselling on the importance of the management and control of key risk factors for diabetic retinopathy, including hyperglycemia, hypertension, and hypercholesterolaemia, and appropriate referral, where indicated. Clinical: Medical management of the aforementioned risk factors for diabetic retinopathy.	x	x	Noncommunicable disease; Primary care; Health promotion
Lifestyle or behavioural risk factors for eye conditions	Providing information and counselling on the well-established lifestyle and behavioural risk factors implicated in the onset and/or progression of eye conditions, including smoking (age-related macular degeneration, dry eye and cataract); exposure to ultraviolet light (cataract and pterygium); prolonged use of digital devices (dry eye disease); and long-term use of corticosteroids (cataract and glaucoma).	x	–	Primary care; Occupational health; Health promotion; Other (tobacco cessation; sun protection initiatives)
Persons at risk of developing acute angle-closure glaucoma	Providing information and counselling on the symptoms of developing acute angle-closure glaucoma for populations or persons at risk, with instructions to seek immediate ophthalmic attention if symptoms occur.	x	–	–
All ages				
Importance of regular comprehensive eye examinations	Health promotion initiatives to raise awareness of the importance of regular eye examinations among high risk population groups, such as older adults, people with diabetes, those with certain genetic conditions (e.g. sickle cell disease), and those with a family history of glaucoma or age-related macular degeneration.	x	–	Care of older people; Noncommunicable disease; Primary care; Health promotion
Adherence to treatment regimen for chronic eye conditions	Counselling of persons, and caregivers of persons, with chronic eye conditions (e.g. glaucoma and amblyopia) regarding the importance of adherence to the treatment regimen; this is an important strategy to improve long-term compliance with recommended treatments.	x	–	Primary care

Target	Short description	Educational	Clinical	Link to health programme
Increasing demand for eye care interventions	Generating demand for interventions through increasing awareness and engaging and empowering the public to be aware of common vision-related issues and the available interventions that exist to address them (e.g. spectacle-wear and cataract surgery).	x	–	Child health; Adolescent health; School health; Care of older people; Primary care; Occupational health; Health promotion
Ocular injury prevention	Targeted health promotion to improve awareness of trauma prevention strategies, including the provision and use of protective equipment (e.g. masks, protective goggles, visors, etc.) in high risk activities and industries (e.g. certain sports, agricultural activities, construction, welding).	x	–	Occupational health; Injury prevention; School health; Primary care; Health promotion
Counselling on good eye health practices and prevention strategies for the spread of eye infections[5]	Counselling persons on good eye health practices, avoiding irritants to prevent ocular allergies and inflammation; and measures to prevent the spread of ocular infections including facial cleanliness, hand washing and separate towel use.	x	–	Primary care; School health; Occupational health; Health promotion

[1] In 2022, WHO released the Be He@lthy, Be Mobile initiative for myopia (MyopiaEd) which includes evidence-based message libraries targeting myopia education and its prevention (see: https://www.who.int/initiatives/behealthy).

[2] The PECI does not include guidance on vitamin A supplementation to reduce the risk of corneal ulceration. Further guidance can be found in the following WHO guideline: Vitamin A supplementation in infants and children 6–59 months of age 2011 *(46)*.

[3] Where Vitamin A deficiency is a public health problem, please refere to WHO recommendations on maternal and newborn care for a positive postnatal experience. Geneva: World Health Organization; 2022 (https://www.who.int/publications/i/item/9789240045989).

[4] The PECI does not include interventions for the medical management of risk factors for diabetic retinopathy. Detailed guidance, including the equipment and medicines requirements, for the control of hypertension, hyperglycemia, and hypercholesterolaemia can be found in the following WHO documents: i) WHO list of priority medical devices for management of cardiovascular diseases and diabetes (2021); ii) WHO Package of essential noncommunicable (PEN) disease interventions; iii) Guideline for the pharmacological treatment of hypertension in adults (2021).

[5] In trachoma endemic populations, this should also include counselling and education on the appropriate disposal of human faeces to limit breeding sites for the eye-seeking flies that spread trachoma.

Strengthening efforts to provide sound and effective health promotion, education and prevention strategies in the field of eye care requires:

- building the capacity of health personnel to provide simple, effective education and counselling;
- including eye care education within public education campaigns in related health programme areas (e.g. school health, occupational health, noncommunicable diseases) and ensuring eye care-related outcomes are included in the evaluation of these programmes;
- engaging related sectors (e.g. education and labour sectors) as partners in raising awareness about the importance of eye health;
- developing appropriate, context-specific educational materials (e.g. posters, promotion material, and mHealth tools) for use in community settings and primary level health facilities to raise awareness on good eye health practices and prevention strategies; and
- where applicable, interventions to be supported by regulatory and/or policy measures. For example, this may include (a) the provision and use of protective equipment at work and restricted use of fireworks; (b) policies on minimum time spent outdoors during school hours to support myopia prevention; or (c) tax policies on unhealthy or harmful products such as tobacco.

Screening of high-risk populations

This section provides an overview of recommended screening strategies at critical stages throughout the life-course and among high-risk population groups.

Background

Due to a range of factors – for example, its often gradual progression in adults – vision impairment may go undetected and, if not diagnosed and treated in time, can have serious and permanent consequences for individuals across their life-course. Likewise, some eye conditions (e.g. diabetic retinopathy) often remain undiagnosed because they can be asymptomatic in their early stages *(1)*. As such, it is important to implement specific screening measures for early diagnosis of these eye conditions among high-risk populations, and for vision impairment at key stages throughout the life-course.

Neonatal period

In the neonatal period, screening to detect congenital and pediatric eye conditions, when followed by prompt and appropriate interventions including surgery, is effective in ensuring that children born with congenital eye conditions, such as congenital cataract, congenital glaucoma and retinoblastoma, do not experience the associated adverse impacts of delayed visual development. To support this, WHO recommendations on postnatal care of the mother and newborn include a recommendation of external examination of the eye and red reflex test for all infants at birth[1], or in well-baby clinics at first encounter, followed by prompt/urgent referral to an eye care professional for infants who screen positive.

Due to an increase in the number of preterm births, and survival of premature infants, retinopathy of prematurity has become a leading cause of blindness among children in many middle-income countries *(47)*, and is a newly emerging challenge in several African countries *(48)*. As a result, there is greater need for high-quality neonatal care, including integrated prevention strategies for retinopathy of prematurity (see Table 1) and systematic screening among preterm infants and/or newborns of low birth weight (see Table 2), together with timely referral for treatment interventions where indicated (see Table 4) with long-term follow-up.

Children and adolescents

The number of children and adolescents with refractive error, particularly myopia, is set to increase substantially in the coming decades *(1)*. A recent global systematic review and meta-analysis reported that the number of children and adolescents with myopia is projected to increase by 200 million between the years 2000 and 2050 *(49, 50)*. When considering the

[1] WHO recommendations on maternal and newborn care for a positive postnatal experience. Geneva: World Health Organization; 2022 (https://www.who.int/publications/i/item/9789240045989).

importance of vision in education and the frequency of refractive error in pre-school and school-age children, vision screening at pre-school age and the inclusion of vision screening in school health services and initiatives *(51)*, followed by the timely provision of correction and other eye care services (e.g. for the management of amblyopia), is important to mitigate the impact of unaddressed vision impairment. Vision screening and external eye examination, with the provision of spectacles or referral for care, in the context of school health services, often involves coordination with trained eye care professionals at other levels of care. This requires cooperation between ministries of health and of education. It is important to note that where school health programmes do not exist, the local epidemiological context (e.g. the prevalence of refractive error in school-age children) should guide decisions as to whether standalone vision and eye screening interventions are warranted in schools.

Older adults

The prevalence of near- and distance-vision impairment is much greater in older age groups *(1)*. It has been estimated that 80% of distance-vision impairment and blindness, and two-thirds of near-vision impairment, occur in persons aged 50 years or older *(52)*. In light of this, while general population screening of visual acuity is not considered to be cost–effective in most settings *(53)*, it is essential to provide active visual acuity assessment (followed by suitable interventions) for older adults in an easy and accessible manner. Such assessments can be undertaken by health-care providers, such as general practitioners, primary level doctors, or health workers at the community level. To support this, the WHO guidelines for integrated care of older persons recommend that older people (aged ≥60 years) should receive assessment of visual acuity in the primary care setting, and timely provision of comprehensive eye care *(54)*.

People with diabetes

Lifestyle changes have led to an increase in the number of people with diabetes across all countries during the past 30 years *(55)*. Diabetic retinopathy is the most common microvascular complication of diabetes and is a leading cause of preventable vision impairment and blindness globally *(4, 56)*. If trends continue, the number of people with diabetic retinopathy is estimated to increase 1.2-fold, from 146 million in 2014 to 180.6 million in 2030 *(57)*. Most vision impairment due to diabetic retinopathy is avoidable through the management and control of key risk factors (see Table 1), coupled with early detection and timely treatment. Thus, systematic retinal screening (i.e. annually or biennially, depending on the setting) among individuals with diabetes to detect the "vision-threatening" stages of the condition, followed by treatment (see Table 4) has long been endorsed by many national and international professional societies. Screening can be undertaken using ophthalmoscopy by trained eye-care personnel (e.g. ophthalmologists or optometrists) or retinal imaging with either local interpretation or telemedicine-based programmes with centralized grading. Several emerging technologies, including the increased availability of low-cost retinal cameras and the use of artificial intelligence technologies for the detection of diabetic retinopathy *(58–61)*, offer hope for enhancing access and quality of screening services for this condition closer to people's homes. Box 3 demonstrates the long-term impact of retinal screening on diabetes-related visual impairment in the working-age population.

Box 3. Long-term impact of retinal screening on diabetes-related visual impairment in the working-age population: the English National Screening Programme *(62)*

A national systematic diabetic retinopathy screening programme was established in England in 2003 whereby all individuals with diabetes aged ≥12 years are invited for an annual diabetic eye screening appointment. In line with current recommendations for high-resource settings, patients are sent reminders to attend screening. Since 2008, the programme has achieved near comprehensive (i.e. >80%) annual population coverage.

In the programme, screening is performed by well-trained screeners who measure visual acuity, instil drops for pupil dilation, and carry out two-field retinal photography. Images are then digitally transferred to a centralized location (e.g. an established grading centre) for retinal grading by specially-trained non-physician technicians. Prior to their involvement in the programme, a minimum qualification is required for screeners and graders (63). In addition, all graders undertake monthly test sets of images and their results are compared to a guide grade. Audit and internal and external quality assurance schemes are also embedded in the service.

Robust sensitivities and specificities for the detection of diabetic retinopathy and sight-threatening diabetic retinopathy (moderate disease or worse) have been reported in this programme *(64)*. Individuals with sight-threatening diabetic retinopathy are referred for timely ophthalmology assessment and management. In addition, all those with poor-quality images are referred for assessment of retinal status via slit lamp examination.

During 2015–16, the diabetic retinopathy screening programme in England screened 2 144 007 people with diabetes (83% coverage) *(62)*. After 7 years of screening for treatable diabetic retinopathy, a review of the blindness registry in England revealed that the condition was no longer the most common cause of blindness in the working age population *(65)*. This provides compelling evidence that systematic screening for diabetic retinopathy, coupled with timely treatment of sight-threatening disease, can reduce vision impairment and blindness.

Priority screening interventions in the field of eye care

Table 2 below provides an overview of the recommended screening strategies at critical stages throughout the life-course, and among high-risk population groups, that are applicable to all resource settings. The objective of these strategies is to ensure the timely detection of eye conditions and vision impairment in those most at risk. Under the column headed “Level of care”, columns 1, 2, and 3 indicate primary, secondary and tertiary level of care accordingly; it is proposed that the intervention should take place under the level marked with an “x”. Throughout this document, unless stated otherwise, the age ranges for the life-course stages are as follows: Neonatal (up to 4 weeks of birth), Early childhood (28 days to 4 years), Later childhood (5–9 years), Early adolescence (10–14 years), Later adolescence/ early youth (15–19 years), Later youth (20–24 years), Early adulthood: 25–49 years, Middle adulthood: 50–64 years, and Later adulthood: 65 years and above.

Table 2. Priority areas for screening in the field of eye care, stratified by critical stages of the life-course and high-risk populations

Intervention	Short description	Essential	Life-course	Level of care				Link to health programme
				Community	1	2	3	
Screening (general population)								
Screening of newborns to detect pediatric eye conditions	Screening of newborns for the detection of neonatal infections, congenital and/or acquired eye conditions and timely referral where indicated.	x	Neonatal (<1month, preferably within 72 hrs of birth); Or at first encounter with a well-baby clinic (or equivalent);	–	x	x	x	Maternal and Newborn health; Child health; Immunization; Primary care
Vision screening and eye examination (pre-school age)	Screening of pre-school children for the detection of reduced visual acuity, infection/inflammation, amblyopia, and strabismus with timely referral where indicated.	x	Early childhood (aged 3–5 years)	x	x	–	–	Child health; Immunization; Primary care
Vision screening and eye examination (school age)	Vision screening and eye examination of school-age children for the detection of reduced visual acuity, infection/inflammation, amblyopia, and strabismus with timely referral where indicated.	x[1]	Later childhood to Later adolescence (aged 5–18 years)	x	x	–	–	School health; Child health; Adolescent health; Primary care
Provision of eye tests for older people and timely referral to appropriate services[4]	Vision assessment (both near and distance) among older adults with timely referral, where indicated	x	Middle adulthood to Later adulthood (aged ≥60 years)	x	x	x	x	Care for older people; Primary care

Intervention	Short description	Essential	Life-course	Level of care				Link to health programme
				Community	1	2	3	
Screening (high-risk populations)								
Screening of preterm infants and/or low-birth-weight infants for retinopathy of prematurity	Systematic retinal screening for retinopathy of prematurity in newborns that are preterm and/or of low birth weight, and timely referral where indicated.[2]	x	Neonatal (aged <1 month, preferably at 4–5 weeks postnatal)[2]		–	x	x	Maternal and Newborn health; Child health; Adolescent health
Screening of people with diabetes for diabetic retinopathy	Systematic screening for early detection of diabetic retinopathy in individuals with diabetes and referral where indicated.	x	Later childhood to Later adulthood		x (plus)[3]	x	x	Noncommunicable disease; Other (diabetes)

[1] In the context of school health initiatives.

[2] Starting a few weeks after birth, using local, evidence-based criteria.

[3] While not currently a reality in most low- and intermediate-resource settings, screening for diabetic retinopathy at the primary level using non-ophthalmic, trained technicians with local or remote interpretation, would help in covering a larger population.

[4] Refers to providing active visual acuity assessment (followed by suitable interventions) for older adults in an easy and accessible manner (e.g. primary level doctors or health workers at the community level). Standalone programmes for vision screening among adult populations are not currently supported by evidence.

Clinical examinations for diagnosis and monitoring

This section provides an overview of the essential clinical examinations required for the general assessment, diagnosis and monitoring of a large range of priority eye conditions.

Background

The adverse impact of most eye conditions and vision impairment, at any stage during a person's life-course, can be mitigated through early identification followed by prompt and appropriate interventions. Community settings and primary level health facilities often serve as the first point of contact for people with ocular complaints and eye conditions. Thus, when sufficiently resourced, these facilities have the potential to meet a large number of people's eye care needs, locally and in time, and increase the efficiency of more comprehensive eye care services at secondary and tertiary levels. Strengthening eye care in community settings and primary care requires adequate funding, appropriate workforce training, a sustainable workforce *(26)*, coordination with other services and sectors, and effectively planned referral systems.

Essential eye care examinations that should be conducted at the community level and at primary-level health facilities include i) vision testing at critical periods throughout the life-course (e.g. newborn, pre-school and school-aged children, and older adults) and among individuals with visual complaints to identify vision impairment; and ii) external assessment of the eye and its surrounding structures with respect to shape, colour, size, position, direction, and lid closure to be able to identify any abnormalities, followed by timely referral to the appropriate level of care, where indicated. Annexes 7 and 8 provide further guidance on a recommended set of evidence-based eye care interventions and resources, across the continuum of care, that can be effectively delivered at primary-level health facilities in low-resource settings. In countries with more mature health systems, or where additional resources become available, the scope of eye examinations and interventions to be carried out at primary care level should be expanded (see "primary plus"). Given the large eye care needs of populations, it is recommended that the provision of refractive and optical services, and screening services for diabetic retinopathy, should be prioritized at, or be as close as possible to, primary care facilities.

Secondary level eye care services are important for diagnosing and managing common eye conditions that both can cause vision impairment and those that typically do not. Thus, a comprehensive range of eye examinations should be made available at the secondary, as well as the tertiary, level of care. This requires planned investment in training and the provision of equipment for eye care professionals.

Essential clinical examinations for diagnosis and monitoring of eye conditions

The recommended essential interventions for the diagnosis and monitoring of eye conditions and vision impairment stratified by the level of care are outlined in Table 3 below. Annex 3 of the PECI provides additional information and details on the equipment and consumable requirements for each of the listed examinations. Many of the listed interventions can be used for general assessment, diagnosis and monitoring of a range of eye conditions (e.g. visual acuity testing, slit lamp examination and ophthalmoscopy); however there are also some examinations that are disease-specific (e.g. corneal topography).

It is acknowledged that the assessments for primary care outlined in Table 3 must be accompanied by additional appropriate training of the workforce at primary-level health facilities, and inclusion in future health workforce training curricula. To this end, WHO will embark on the development of additional training resources that will include clear guidance (algorithms) for follow-up and referral pathways from primary care.

Table 3. Recommended essential interventions, at each level of care, for the diagnosis and monitoring of eye conditions and vision impairment

Clinical examination	Level of care			
	Community	1	2	3
Visual acuity measurement (distance, near and pinhole)	x	x	x	x
Preferential looking visual acuity testing (for infants and preverbal children)	–	–	x	x
Torchlight examination (external eye assessment)[1]	x	x	x	x
Slit lamp examination	–	–	x	x
Automated refraction	–	–	x	x
Subjective refraction	–	x (plus)	x	x
Retinoscopy	–	–	x	x
Visual field testing	–	–	x	x
Contrast sensitivity	–	–	x	x
Colour vision	–	–	x	x
Tonometry	–	–	x	x
Keratometry	–	–	x	x
Biometry (optical and/or ultrasound)	–	–	x	x

Clinical examination	Level of care			
	Community	1	2	3
Direct ophthalmoscopy	–	x (plus)	x	x
Indirect ophthalmoscopy	–	–	x	x
Gonioscopy	–	–	x	x
Ultrasonography	–	–	x	x
Pachymetry	–	–	x	x
Fundus photography	–	x (plus)	x	x
Binocular vision assessment[2]	–	–	x	x
Duochrome	–	–	x	x
Optical coherence tomography (OCT)*	–	–	x	x
Dry eye assessment[3]	–	–	x	x
Corneal topography	–	–		x
Functional vision assessment[4]	–	–	x	x

[1] Includes assessment of the eye and its surrounding structures with respect to shape, colour, size, position, direction, and lid closure in order to identify any abnormalities.

[2] Includes stereoacuity, ocular motility, fusion and prism test.

[3] Includes tear meniscus height, tear film break-up time, ocular surface staining score, and Schirmer's test.

[4] In addition to several of the already listed assessments, this includes functional assessments of vision for learning, work/occupational needs, parent/care-givers input, and activities of daily living.

* A note on OCT: While OCT is considered the gold standard in the diagnosis and monitoring of treatment regiments for a range retinal disorders, cost implications currently limit availability in many low- and middle-income countries. There are several promising developments in this area that offer great potential to reduce the costs of OCT devices in the future. At the tertiary level, additional OCT features and modules for glaucoma and anterior segment are desirable.

Treatment

This section provides an overview of evidence-based, non-surgical and surgical interventions for priority eye conditions.

Background

Once a patient is diagnosed with an eye condition, a medical doctor or suitably trained health professional will prescribe an appropriate treatment which, in many cases, will include medication, non-surgical interventions, surgical interventions, or a combination of the three. The treatment of eye conditions targets curing as well as addressing symptoms; it also aims to prevent or slow progression towards vision impairment.

Interventions that address the needs associated with uncorrected refractive error and unoperated cataract – the two leading causes of vision impairment globally – are among the most cost–effective of all health-care interventions to implement. Given the large unmet need for care, coupled with the fact that highly cost–effective interventions exist (i.e. spectacles and cataract surgery), the Seventy-fourth World Health Assembly in May 2021 endorsed two new global eye care targets for 2030 – namely, a 40% increase in effective coverage of refractive errors, and a 30% increase in effective coverage of cataract surgery *(66)*. The essential purpose of these indicators and related targets is to drive eye health coverage while delivering care of quality.

Reduced vision from refractive errors can be fully corrected with the use of spectacles or contact lenses, or corrected by laser surgery on reaching adulthood. Spectacles are a non-invasive assistive product and are part of the WHO Priority Assistive Products List *(67)*. Despite the cost-effectiveness of this intervention, most LMICs do not perceive spectacles as health or medical items (but rather as cosmetic products) and refractive and optical services are commonly only available in the private sector. This results in issues of availability, affordability and quality. Other key challenges to increasing spectacle coverage in LMICs include insufficient availability of qualified human resources (optometrists and optical technicians); limited government oversight and clinical regulation; scarce services points that are predominantly located in urban areas; and low awareness and acceptance of spectacles. Expanding the coverage of spectacles in LMICs is essential and requires a multisectoral approach that includes focusing on the increasing demand for spectacles; raising the number of access points for screening and provision; and accelerating the availability of affordable products *(68)*. In 2022, the WHO Vision Programme will launch the SPECS Initiative to support countries to increase spectacle coverage while delivering quality care. Specifically, this initiative aims to: (i) ensure equitable delivery of **S**pectacles; (ii) build capacity of **P**rofessionals; (iii) improve public **E**ducation targeting the prevention of refractive error and driving the demand for spectacles; (iv) reduce the **C**osts of optical services; and (v) strengthen research and **S**urveillance or refractive error.

Treatment for cataract is a surgical intervention involving the removal of the clouded lens in the eye and the implantation of an artificial intraocular lens. There are three surgical procedures for cataract: i) phacoemulsification; ii)

manual small-incision cataract surgery (SICS); and iii) extracapsular cataract extraction (ECCE). Phacoemulsification is the most commonly performed cataract surgery procedure in high-income settings *(3)*; in lower-resource settings, however, SICS and ECCE techniques are still commonly performed, mainly due to the costs of the instruments and consumables that are required for phacoemulsification surgery. While ECCE has been demonstrated as a safe and effective technique for the treatment of cataract *(69)*, evidence indicates that the recovery time and post-operative uncorrected vision are inferior to both phacoemulsification and SICS *(70, 71)*. The literature suggests that phacoemulsification and SICS procedures are comparable in terms of safety and efficacy *(72, 73)*. While increases in rates of cataract surgery have been seen in many low-income countries (LICs) and LMICs during the past two decades *(7, 8)*, these endeavours have resulted in only modest reductions in the global proportion of cases of vision impairment and blindness attributable to cataract due to concurrent demographic changes *(74)*. In addition, in some settings, people requiring surgery have resorted to adopting harmful traditional procedures due to a range of factors (e.g. cultural factors, convenience, costs, limited accessibility) *(75)*. Key challenges in expanding coverage of cataract surgery in LMICs include the high costs of accessing surgery, the ability to provide services for underserved populations, and ensuring quality service delivery over time, with evidence suggesting that post-operative vision results are suboptimal *(76)*.

In contrast to the single or short-term interventions required for cataract, treatment for other noncommunicable eye conditions that can cause vision impairment, such as diabetic retinopathy, glaucoma, age-related macular degeneration, complications of high myopia and retinopathy of prematurity, are often more challenging, with longer-term follow-up essential to slow the progression of the condition. In the case of glaucoma, this involves ongoing management to reduce the risk of further progression through a number of possible interventions including medical therapy, laser therapy, surgery, or a combination of these. For diabetic retinopathy and retinopathy of prematurity, routine screening followed by laser therapy or other treatments can reduce the risk of vision impairment or blindness. Effective therapeutic interventions, in the form of continuous or intermittent antivascular endothelial growth factor (anti-VEGF) intraocular injections, are currently available for the neovascular form of age-related macular degeneration (only) and myopic macular degeneration *(77, 78)*. Various treatment options, including surgical interventions, are also available for the common causes of vision impairment among pediatric populations (e.g. congenital cataract, congenital glaucoma, retinoblastoma and amblyopia); if implemented in a timely manner, these treatments are highly effective in preventing delayed visual development *(21, 22)*.

Treatment is also available for many eye conditions that do not typically cause vision impairment, for example dry eye, conjunctivitis and blepharitis. Treatment of these conditions is often directed at alleviating the symptoms. In advanced cases of pterygium when vision is affected, surgical intervention is often required. Access to acute surgical and non-surgical interventions for the management of ocular trauma (including blunt injury, corneal abrasions, foreign body, sharp or penetrating injury, and burns) is critical to preserve vision *(79, 80)*. Consideration of these conditions when planning eye care services within countries is extremely important given that they are frequently among the leading reasons for presentation to care.

Priority, evidence-based, treatment interventions in the field of eye care

Table 4 presents the priority non-surgical and surgical interventions for the priority eye conditions in Annex 1. Annexes 4 and 5 present further details of the equipment, consumable and medicine requirements for each of the listed treatment interventions.

Table 4. Priority non-surgical and surgical interventions for the priority eye conditions

Intervention	Short description	Essential	Life-course	Surgical	Level of care				Link to health programme
					Community	1	2	3	
Refractive error									
Spectacle correction of refractive error in adults	Spectacles for correction of near and distance refractive error in adults.	x	Later youth to Later adulthood	–	–	x (plus)	x	x	Occupational health; Care of older people
Spectacle correction for refractive error in children	Spectacles for correction of refractive error in children.	x	Early childhood to Later adolescence	–	x[1]	–	x	x	School health; Child health; Adolescent health
Readymade reading spectacles for the correction of presbyopia	Measuring and recording near visual acuity of persons aged >40 years using standard near reading chart with provision of readymade reading spectacles, where indicated.[2]	x	Early adulthood; Middle adulthood; Later adulthood (aged ≥40 years)	–	x	x	–	–	Occupational health; Rehabilitation; Primary health care; Care of older people
Amblyopia and strabismus									
Patching for the treatment of amblyopia	Patching of the nonamblyopic eye as a treatment option for children with amblyopia who do not improve with spectacles alone.	x	Early childhood to Early adolescence (28 days to 15 years)	–	–	–	x	x	Child health; School health; Adolescent health
Pharmacological (cycloplegic penalization) treatment for amblyopia	Pharmacological treatment that produces cycloplegia of the non-amblyopic eye for children who do not improve with spectacles alone.	–	Later childhood to Early adolescence (aged 3–15 years)	–	–	–	x	x	Child health; Adolescent health

Intervention	Short description	Essential	Life-course	Surgical	Level of care				Link to health programme
					Community	1	2	3	
Strabismus surgery	Extraocular muscle surgery for the treatment of strabismus where indicated.	–	Early childhood to Later adulthood	x	–	–	–	x	Child health; Adolescent health; Surgery and Anaesthetic care
Cataract[3]									
Large-incision, extra capsular cataract surgery with IOL (ECCE-IOL)	Extra capsular cataract extraction cataract surgery with intraocular lens (IOL) implantation for the management of cataract in adults, where indicated.	–	Early adulthood to Later adulthood	x	–	–	x	x	Surgery and Anaesthetic care
Small incision cataract surgery (SICS) with IOL Implantation	Small incision cataract surgery with IOL implantation for the management of cataract in adults, where indicated.	x	Early adulthood to Later adulthood	x	–	–	x	x	Surgery and Anaesthetic care
Suture less, small incision phacoemulsification with IOL implantation	Suture less, small incision phacoemulsification surgery with IOL implantation for the management of cataract in adults, where indicated.	–	Early adulthood to Later adulthood	x	–	–	x	x	Surgery and Anaesthetic care
Pediatric cataract surgery	Early cataract surgery for congenital, infantile, and pediatric cataract to prevent the development of deprivation amblyopia.	x	Early childhood to Early adolescence (For congenital cataract, preferably within first 3 months of life; For unilateral cataract, 4–6 weeks; For bilateral, up to 8 weeks)	x	–	–		x	Maternal and Newborn health; Child health; Surgery and Anaesthetic care

Intervention	Short description	Essential	Life-course	Surgical	Level of care				Link to health programme
					Community	1	2	3	
Management of posterior capsular opacification	Nd:YAG laser capsulotomy for the management of posterior capsular opacity post cataract surgery, where indicated.	x	Later childhood to Later adulthood	–	–	–	x	x	–
Glaucoma									
Medical therapy for persons with glaucoma	Medical therapy for management of glaucoma, singly or in combination, which is effective and tolerated and whose intraocular pressure lowering effect is sufficient to reach and maintain the target pressure.	x	All ages	–	–	–	x	x	–
Laser peripheral iridotomy	Laser peripheral iridotomy (Nd:YAG Laser or Argon Green Laser) for prevention and management of acute and chronic angle closure glaucoma, where indicated.	x	Early adulthood to Later adulthood	–	–	–	x	x	–
Cyclophotocoagulation	Diode laser cyclophotocoagulation for persons with glaucoma, where indicated.	–	Early adulthood to Later adulthood	x	–	–	–	x	–
Selective laser trabeculoplasty	Selective laser trabeculoplasty procedure for persons with glaucoma, where indicated.	x	Early adulthood to Later adulthood	–	–	–	x[4]	x	–

Intervention	Short description	Essential	Life-course	Surgical	Level of care				Link to health programme
					Community	1	2	3	
Filtration surgery (i.e. trabeculectomy) and iridectomy	Glaucoma filtration surgery and/or iridectomy with or without antifibrotic agents for persons with glaucoma, where indicated.	x	Early adulthood to Later adulthood	x	–	–	x[4]	x	Surgery and Anaesthetic care
Angle surgery (i.e. goniotomy or trabeculotomy) for children with congenital glaucoma	Goniotomy or trabeculotomy for the treatment of congenital and pediatric glaucoma.	x	Early childhood	x	–	–	–	x	Child health; Surgery and Anaesthetic care
Glaucoma surgery – glaucoma drainage devices	Glaucoma drainage devices for persons with uncontrolled glaucoma, where indicated.	–	All ages	x	–	–	–	x	Surgery and Anaesthetic care
Anterior segment and adnexa									
Irrigation of the eye in cases of chemical exposure and referral, where indicated	Urgent irrigation of the eye with Ringer lactate solution, normal saline, or clean water in case of exposure to chemicals.	x	All ages	–	x	x	x	x	Emergency care; Primary care
Management of corneal abrasions, erosions, and/or small perforations, where indicated.	Management of corneal abrasions, erosions, and/or small perforations, where indicated.	x	All ages	Surgical and non-surgical	–	x[5]	x	x	Emergency care; Surgery and Anaesthetic care; Primary care

Intervention	Short description	Essential	Life-course	Surgical	Level of care				Link to health programme
					Community	1	2	3	
Medical therapy for adnexa and ocular surface related disorders	Medical therapy for the management of adnexa and ocular surface related conditions that includes infective and allergic conjunctivitis, dry eye disease, blepharitis, ocular foreign body, and keratitis.	x	All ages	–	–	x[5]	x	x	Emergency care; Primary care
Contact lenses for keratoconus	Use of contact lens to improve best corrected vision for persons with keratoconus who do not improve with spectacles alone.	x	Early adolescence to Early adulthood	–	–	–	x	x	–
Punctal occlusion for dry eye	Punctal occlusion for symptomatic relief in persons with severe dry eye, where indicated.	–	Early adolescence to Later adulthood	–	–	–	x	x	–
Incision and drainage of hordeolum and chalazion	Incision and drainage/ curettage for the treatment of hordeolum and chalazion, where indicated.	–	Early childhood to Later adulthood	x	–	–	x	x	–
Probing for congenital nasolacrimal duct obstruction	Treatment for congenital nasolacrimal obstruction by probing, where indicated.	x	Early childhood (aged 6–12 months)	x	–	–	x	x	Surgery and Anaesthetic care

Intervention	Short description	Essential	Life-course	Surgical	Level of care				Link to health programme
					Community	1	2	3	
Pterygium surgery	Pterygium excision with conjunctival autograft (with or without the use of mitomycin C) for the surgical management of persons with pterygium, where indicated.	x	Early adolescence to Later adulthood	x	–	–	x	x	Surgery and Anaesthetic care
Corneal cross-linking for the treatment of keratoconus	Corneal cross-linking surgery for persons with demonstrated progressive keratoconus or corneal ectasia.	–	Early adolescence to Early adulthood	x	–	–	–	x	Surgery and Anaesthetic care
Corneal transplantation surgery – keratoplasty	Corneal transplant surgery which includes penetrating keratoplasty, partial thickness or lamellar keratoplasty, where indicated.	x	Early adolescence to Later adulthood	x	–	–	–	x	Surgery and Anaesthetic care
Amniotic membrane graft	Use of amniotic membrane graft transplantation, where indicated.	x	Early adolescence to Later adulthood	x	–	–	–	x	Surgery and Anaesthetic care
Eyelid surgery – general	Surgical treatment of eyelid related disorders that includes tarsorrhaphy, correction of pediatric ptosis, blepharoptosis, entropion, ectropion, blepharoplasty, trichiasis, and eyelid reconstruction.	–	Early childhood to Later adulthood	x	–	–	x	x	Surgery and Anaesthetic care

Intervention	Short description	Essential	Life-course	Surgical	Level of care				Link to health programme
					Community	1	2	3	
Uveitis									
Medical management for uveitis	Medical therapy for the management of infectious and non-infectious uveitis.	x	Later childhood to Later adulthood	–	–	–	x	x	–
Vitreoretinal disease									
Antivascular endothelial growth factor (anti-VEGF) therapy[6]	Use of intravitreal anti-VEGF therapy for the treatment of vitreoretinal disorders, such as neovascular age related macular degeneration, myopic macular degeneration, and diabetic eye disease, where indicated.	x	Early adulthood to Later adulthood	–	–	–	x	x	Noncommunicable disease; Other (diabetes)
Retinal laser photocoagulation	Laser therapy that includes pan retinal photocoagulation, focal laser, and grid laser photocoagulation for the treatment of vitreoretinal disorders, where indicated.	x	Early adulthood to Later adulthood	–	–	–	x	x	Noncommunicable disease; Other (diabetes)

Intervention	Short description	Essential	Life-course	Surgical	Level of care				Link to health programme
					Community	1	2	3	
Vitreoretinal surgery	Vitreoretinal surgery that includes vitrectomy and other surgical procedures for management of vitreoretinal disorders including retinal detachment, macular hole, advanced proliferative diabetic retinopathy, and complications from cataract surgery, penetrating and blunt ocular trauma where indicated (with or without the use of adjuncts such as dyes and/or triamcinolone).	x	Early childhood to Later adulthood	x	–	–	–	x	Emergency care; Surgery and Anaesthetic care
Transpupillary diode laser for the treatment of retinopathy of prematurity	Transpupillary diode laser therapy for treatment of retinopathy of prematurity in infants to reduce the risk of vision impairment or blindness.	x	Neonatal (aged <1 month); Treatment performed after 36 weeks post-menstrual age	x	–	–	–	x	Maternal and Newborn health; Child health
Ocular cancer									
Management for retinoblastoma	Surgery and/or chemotherapy, laser and cryotherapy for management of children with retinoblastoma	x	Neonatal to Early childhood (aged <5 years)	Surgical and non-surgical	–	–	–	x	Maternal and newborn health; Child health; Childhood cancer; Surgery and Anaesthetic care

Intervention	Short description	Essential	Life-course	Surgical	Level of care				Link to health programme
					Community	1	2	3	
General									
Management of post-operative infections/ Inflammation	Management of infection/ inflammation post ocular surgery, where indicated.	x	Early childhood to Later adulthood	Surgical and non-surgical	–	–	x	x	Emergency care; Surgery and Anaesthetic care
Evisceration and Enucleation	Surgery that includes evisceration and enucleation, where indicated, for intraocular malignancies or blind painful eye not amenable to alternative treatment.	x	Neonatal to Later adulthood	x	–	–	x	x	Maternal and Newborn health; Child health; Childhood cancer; Surgery and Anaesthetic care

[1] Refers to vision screening and the provision of spectacles in the context of school health programmes. This often involves coordination with trained eye care professionals at other levels of care for eye examinations (including refractions) and/or optical dispensing.

[2] Custom made reading spectacles are required for individuals with clinically significant anisometropia and astigmatism.

[3] Three different types of adult cataract surgery have been included in the PECI in recognition that the resource requirements and costs differ significantly between each surgery type. Pediatric cataract surgery has also been included as a separate entry in the package given that the human resources and equipment differ to that of adult cataract surgery.

[4] Depending on country availability, cost–effectiveness, and human resources available.

[5] The scope of this intervention at primary level varies to that which can be delivered at higher levels of care. Annex 7 provides further details.

[6] While intravitreal anti-VEGF is considered the gold standard in the treatment of a range retinal disorders, cost implications currently limit its availability in many low- and middle-income countries. There are several promising developments in this area that offer potential to reduce the treatment costs of anti-VEGF in the future.

Corneal transplantation

Corneal opacities remain a leading cause of blindness in LMIC. While the PECI includes the intervention of corneal transplantation surgery, it is important to acknowledge that a considerable shortage of corneal graft tissue exists in many countries due to non-existent or inadequate eye tissue donation, banking and transplantation programs; one study estimates that globally, there is only 1 donated cornea available for every 70 needed *(81)*. Out of pocket costs of transplant tissue, and related care, is also a major barrier for those in need of corneal transplantation.

Improved data on donation rates and population needs, coupled with clear policies and legislation and supportive governance oversight on both donation and transplantation, are required for Member States to establish sustainable corneal banking programmes. Given that some of the leading indications for corneal transplantation are avoidable (i.e. ocular trauma, corneal infection), a strong focus on prevention is also critical (see Table 1).

Emerging treatment interventions

It is important to acknowledge a growing number of promising treatment interventions that, at the time of development of the PECI, did not meet the criteria for inclusion. As an example, there are a number of emerging clinical interventions for the prevention and treatment of dry eye disease *(82)* and for the management of myopia *(38)*. Future work will involve refining and expanding the PECI, drawing on newly-available evidence and newly-collected data on service provision.

Rehabilitation

This section provides key information on the priority, evidence-based, vision rehabilitation interventions.

Background

Universal health coverage necessitates health services addressing the full range of health needs of the population, including the availability of rehabilitation services. For individuals with vision impairment or blindness, rehabilitation aims to optimize their everyday functioning in their environment by maximizing the use of residual vision and providing practical adaptations to address the social, psychological, emotional, and economic consequences of vision impairment *(83)*. The WHO International Classification of Functioning, Disability and Health model *(84)* can help to contextualize the impact of vision impairment on a person's life, including activities of daily life, education, employment, and social participation.

It is estimated that approximately 60 million adults globally have moderate or severe distance vision impairment or blindness that is irreversible, and rehabilitation is required *(4)*. The main eye conditions causing vision impairment and blindness in adults, and addressed by vision rehabilitation, are glaucoma, macular disease, corneal opacities and diabetic retinopathy. The main conditions in children and young adults include congenital and genetic conditions, acquired eye conditions, and cerebral vision impairment.

A broad range of effective vision rehabilitation interventions are available, such as the provision of optical, non-optical and electronic assistive products, environmental modification (e.g. improved lighting), and orientation and mobility training *(85, 86)*. These interventions can greatly improve the functioning of people with irreversible vision impairment and blindness, enabling them to participate more in community life, education and employment. Despite this, evidence suggests that current coverage of vision rehabilitation services is either poor, or non-existent, in most LMICs *(3)*. To further compound this situation, the change in population demographics, and subsequent rise in the number of people with irreversible vision impairment, will see an increasing demand for such services. In addition, where vision rehabilitation services do exist, they tend to be located in tertiary facilities in both public and private sectors and/or provided and funded by nongovernmental organizations, raising issues of accessibility and sustainability.

Priority, evidence-based, vision rehabilitation interventions

Table 5 provides key information on the priority vision rehabilitation interventions. A breakdown of the assistive products and consumable requirements for the provision of these interventions can be found in Annex 6. It is important to note that many eye conditions can impact different components of vision function (e.g. visual acuity, contrast sensitivity, peripheral vision, etc.), thus the vision rehabilitation interventions outlined below need to be tailored to individual needs and priorities.

Table 5. Priority vision rehabilitation interventions

Intervention	Short description	Essential	Life-course	Level of care				Link to health programme
				Community	1	2	3	
Referral to vision rehabilitation specialists, group programmes and psychological supports for persons with vision impairment or blindness	Referral and/or delivery of mental health support aimed at the prevention, treatment and/or counselling of depression, anxiety, fatigue or grief related to (progressive) vision loss, either individually or in groups, led by mental health-care professionals or peers.	x	Early childhood to Later adulthood	x	x	x	x	Rehabilitation; Disabilities; Primary care
Provision of optical assistive products, including filters	Prescription, and training in the use of (where applicable), optical devices including magnifiers and/or telescopes.	x	Early childhood to Later adulthood	x[1]		x	x	Rehabilitation; Disabilities; School health; Primary care; Care for older people
Provision of non-optical assistive products	Prescription, and training in the use of non-optical assistive products, including devices for daily living such as braille books and writers, reading stands, lamps, high contrast items such as bold pens or high-contrast toys, or talking/ tactile watches.	x	Early childhood to Later adulthood	x[1]		x	x	Rehabilitation; Disabilities; School health; Care for older people
Provision of electronic assistive products	Advice, recommendation and training in the use of electronic assistive products, including digital magnifiers, audiobooks, smartphones, tablets, computers, braille displays, and application and accessibility software.	x	Early childhood to Later adulthood	x[1]		x	x	Rehabilitation; Disabilities; School health; Care for older people
Advice to optimize the living environment for persons with vision impairment	Education and advice to optimize the living, educational, and working environment and minimize the risk of falls for persons with vision impairment. Recommendations can be offered on how to best manage daily activities; improvements to lighting; and modification of environments to facilitate accessibility and independence.	–	Early childhood to Later adulthood	x[1]	x	x		Rehabilitation; Disabilities; School health; Occupational health; Primary care; Care for older people

Intervention	Short description	Essential	Life-course	Level of care				Link to health programme
				Community	1	2	3	
Orientation and mobility training	Orientation and mobility training for persons with vision impairment to help them develop the orientation in space as well as movement and safety in independent travelling. Instructions such as sighted guide technique or basic protection technique can be offered.	x	Early childhood to Later adulthood	–	–	x	x	Rehabilitation; Disabilities
Vision skills training	Training skills such as scanning skills for individuals who have visual field loss, those to address primary convergence insufficiency or reading skills for individuals with central field loss.	–	Early childhood to Later adulthood	–	–	x	x	Rehabilitation; Disabilities

[1] Refers to the provision, and replacement of, assistive products in the context of school health and community-based rehabilitation programmes. This involves coordination and referral to trained eye care professionals, at higher levels of care, for eye examinations, diagnosis, prescription and training in the use of such products.

Increasing access to vision rehabilitation services requires not only renewed efforts to integrate such services into the planning of the health sector in general, but also, as outlined in Table 5, into specific health programmes (e.g. primary care, school health, rehabilitation, care for older people) and sectors, such as education. A case example of an integrated vision rehabilitation service is provided in Box 4. Given that improvements in the external environment are important for persons with vision impairment or blindness, vision rehabilitative services must also be accompanied by public policy and well-resourced implementation plans to enable vision impaired people to play a full role in society *(87)*. For example, when designing and building public spaces, a number of important design elements should be considered, such as blistered pavers before crosswalks, audible signals at pedestrian crossings, and tactile signage, to ensure that these spaces are accessible for people with vision impairment and blindness.

In order to translate these recommendations into actions, additional appropriate training materials for community and primary care health workers are required, along with guidance and support to assist in academic settings (e.g. education for teachers on seat placement, large books or printed materials, support for exams, etc.). Of note, WHO is currently developing a "Basic Rehabilitation Package" that supports the implementation of rehabilitation interventions, including those for vision rehabilitation, into primary level health facilities *(88)*.

Box 4. An integrated low-vision rehabilitation service: a case example from Sri Lanka*

Prior to 2008, vision rehabilitation services for the whole of Sri Lanka were provided by three low-vision clinics only, located within tertiary hospital settings. However, when Sri Lanka's first national eye care plan was developed in 2007, low vision was included, and the necessary links with education, rehabilitation, and social services were established.

With support from international nongovernmental organizations and the Ministry of Health, the strengthening of Sri Lanka's vision rehabilitation services began in 2008. Initially, this involved solidification of the existing tertiary level services so that they could competently provide visual skills training, orientation and mobility training, and counselling services for people with low vision. Following this, 10 secondary level clinics, with strong referral links to the three tertiary clinics, were then established within existing district hospitals. Existing eye care practitioners from the eye units of these hospitals were trained to provide the services, including comprehensive low-vision assessment, prescription and dispensing of assistive products, as well as training in the use of such products. People with complicated needs were referred to the nearest tertiary low-vision clinic for further management.

The establishment of these clinics improved the accessibility of vision rehabilitative services across the country and, within two years only, following implementation, nearly 8000 people (of whom 10% were children) with vision impairment had received low-vision rehabilitation services. While it is acknowledged that this is a small proportion of the total number of people with vision impairment in Sri Lanka, it represents a five-fold increase in the number of people accessing low-vision rehabilitation services when compared with the previous three years.

* *Adapted from:* Yasmin S. An integrated low vision service: Sri Lanka. Community Eye Health. 2012;25(77):16.

Implementation strategy

This section outlines a general implementation strategy for the PECI and additional considerations to reach pragmatic decisions.

Background

The PECI provides a set of recommended, evidence-based eye care interventions and the material resources required for their implementation. The interventions listed in the PECI are comprehensive, covering most eye conditions that can significantly impact a person's well-being. For each selected intervention, information is also provided on the recommended level/s of care (i.e. community, primary, secondary and tertiary) for delivery and potential links to health programme/s and sectors. All recommendations have been made with LICs and LMICs in mind.

The PECI defines priority eye care interventions and although the lists are not exclusive, they can serve as guidance for countries seeking to develop or implement a management policy or strategic plan. As such, the PECI provides guidance to policy-makers, service planners and service providers to a) integrate eye care into wider health-care packages and policies; and b) to plan and implement integrated eye care services. It is important that each country defines an implementation plan based on PECI recommendations that will consider their country-specific needs, epidemiological situation, health system regulations, availability of infrastructure, and related human resources and finances, as well as affordability to patients.

The PECI in the context of the WHO Eye care in health systems: Guide for action

The WHO Eye care in health systems: Guide for action was developed by WHO as a practical guide for countries to plan and implement integrated people-centred eye care (IPEC). The guide outlines a four phases approach toward IPEC:

Phase 1: Analyse the situation

Phase 2: Develop an eye care strategic plan and monitoring framework

Phase 3: Implement the eye care strategic plan

Phase 4: Establish and implement eye care evaluation and review processes.

WHO recommends that countries develop a national eye care sector strategic plan. This plan will guide mid-term activities and should be revised every four to five years, or as needed. The planning process should be led by the government and should ensure involvement of relevant sectors and programmes. The timing of the development of the eye care sector plan should be aligned with the wider health sector planning exercise and funding flows. The eye care strategic plan should be accompanied by a monitoring framework.

Prior to the planning of the eye care sector strategic plan, WHO recommends the implementation of the Eye Care Situation Analysis Tool (ECSAT) *(89)* to provide a snapshot of the sector and to identify priority areas of action towards IPEC in the country – Phase 1. Using ECSAT findings to identify priority areas, the eye care sector strategic plan (Phase 2) should be developed to establish clear goals, objectives and activities. WHO recommends using the PECI as a guide to develop and implement operational plans, including budgeting for eye care at each level of the health system (Phase 3).

Of note, the PECI has been integrated into WHO's UHC compendium of interventions which contains interventions (and the resources required for implementation) across all WHO programmatic health areas *(90, 91)*. In addition to the details outlined in this document, the UHC compendium also contains details on the human resource requirements and estimates of the average time required for implementing each intervention. In the future, this will be linked with a tool for planning, costing, impact analysis, budgeting and financing. This tool can be used by planners in response to the following questions:

- What health system resources are needed to implement the strategic health plan?
- How much would the strategic plan cost, by year, and by input?
- What is the estimated health impact?
- How do costs compare with estimated available financing?

These resources will facilitate discussions in LMICs around the most cost–effective actions to develop a comprehensive package suited to national context.

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Annexes

Annex 1. Development process for the Package of Eye Care Interventions

The WHO Vision and Eye Care Programme was responsible for the overall coordination of the project as well as for technical and developmental work. Cochrane Eyes and Vision provided methods and evidence expertise. A technical advisory group (TAG), comprising public health professionals, academics, and clinical specialists in the field of eye care from all six WHO regions, provided technical input throughout the different stages of development. Eye care experts also provided technical expertise to WHO in the identification of evidence on eye care interventions, the selection of interventions, and creating descriptions of resources required for the provision of each intervention. The declaration of interests of all external contributors was assessed. In the event where a conflict of interest (COI) was identified, depending on the nature, the inputs of those concerned were either managed or, in some cases, individuals where excluded from participation. In total, 114 public health, academic and clinical professionals from 45 countries contributed to the development of the PECI.

Stages of development of the Package of Eye Care Interventions

Stage 1: Selection of eye conditions

The final list of eye conditions for which interventions were considered for inclusion in the PECI (Table A1.1) was based on i) existing evidence, including epidemiological data on the causes of vision impairment and blindness, prevalence estimates of eye conditions and health facility data; and ii) consensus among TAG members after reviewing the related evidence. In addition to this list, interventions for vision rehabilitation were also considered for inclusion in the PECI.

Of note, the scope of interventions included in the PECI goes beyond those for the leading causes of vision impairment and blindness. The inclusion of interventions for eye conditions that may not typically cause vision impairment (e.g. dry eye disease, conjunctivitis, pterygium and blepharitis), is important as these conditions not only are troublesome, painful and often severely impact an individual's well-being, they are also frequently among the leading reasons for presentation to eye care services in all countries and thus can expose individuals to financial burden *(1)*.

Table A1.1 Selection of eye conditions for inclusion in the Package of Eye Care Interventions*

1. Cataract
2. Congenital cataract
3. Refractive error
4. Diabetic retinopathy
5. Glaucoma
6. Congenital glaucoma
7. Retinoblastoma
8. Age-related macular degeneration
9. Myopic macular degeneration
10. Amblyopia
11. Strabismus
12. Retinopathy of prematurity
13. Uveitis
14. Ocular trauma
15. Ocular surface disorders[1]
    a. Conjunctivitis (infective and allergic)
    b. Dry eye disease
    c. Keratoconus
    d. Keratitis and corneal ulcer
    e. Pterygium
6. Disorders of the eyelid and lacrimal system[1]
    a. Ptosis, entropion and ectropion
    b. Congenital anomalies
    c. Blepharitis
    d. Chalazion and hordeolum

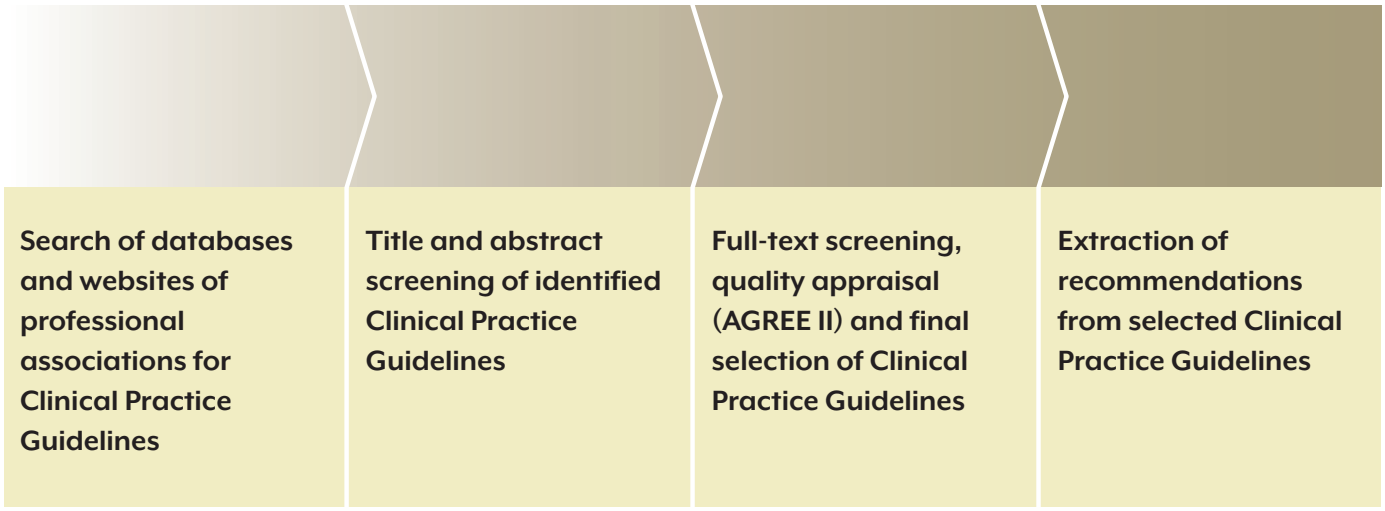
* Not in order of priority

1 Key conditions were defined under the broader categories of "ocular surface disorders" and "disorders of the eyelid and lacrimal system" in recognition of the different treatment approaches required and to facilitate the identification of evidence on interventions for each condition.

Stage 2: Identification of evidence-based interventions

The aim of the development of Stage 2 was to identify and select clinical practice guidelines (CPGs) and extract evidence-based recommendations for eye care interventions. These extracted recommendations were used by the subspecialty development groups in Stage 3 to inform the selection of interventions to be included in the PECI. Figure A1.2 shows the key events in Stage 2.

Figure A1.2 Broad overview of the key events in Stage 2 of the development of the Package of Eye Care Interventions



Outcomes of the systematic literature search, guideline screening, and quality appraisal

In 2019, separate systematic literature searches and screening and quality appraisal processes were carried out to identify CPGs for refractive error (Figure A1.3) and vision rehabilitation (Figure A1.4). Based on the lessons learnt from this process, coupled with feasibility considerations, an additional single systematic literature search was conducted in 2020 encompassing all remaining priority eye conditions selected for inclusion in the PECI (Figure A1.5). A manual search of selected guideline databases and websites of professional associations was conducted. The titles and abstracts of all identified documents from the systematic literature search were screened centrally by two members of the WHO Vision Programme and the exclusion criteria were applied. A technical working group of 33 experts was formed to undertake full-text screening and quality appraisal of identified CPGs for each eye condition. The number of guidelines identified, screened, and later appraised and selected is provided below.

Figure A1.3 Flowchart of CPGs identified from the literature search, appraised for methodological quality and selected for data extraction for refractive error

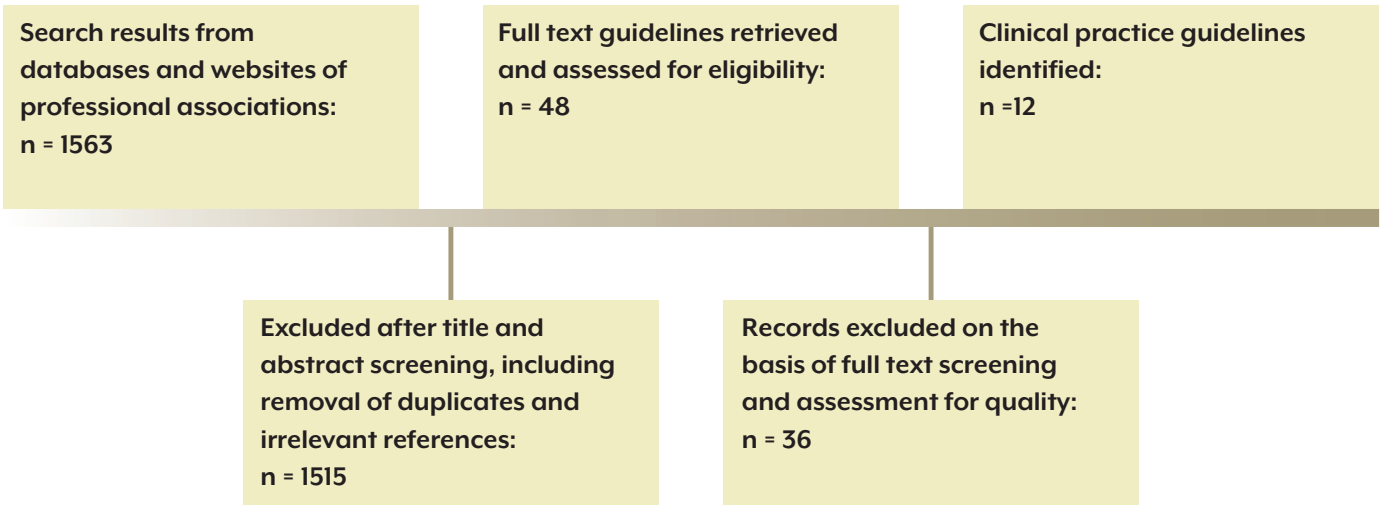


Figure A1.4 Flowchart of CPGs identified from the literature search, appraised for methodological quality and selected for data extraction for vision rehabilitation

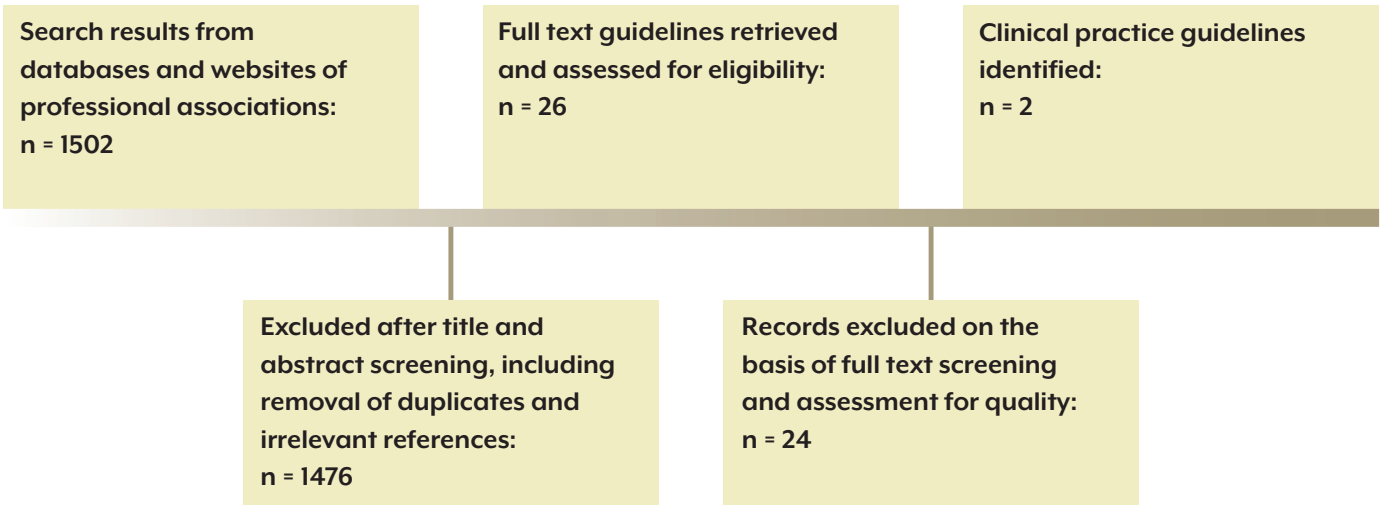
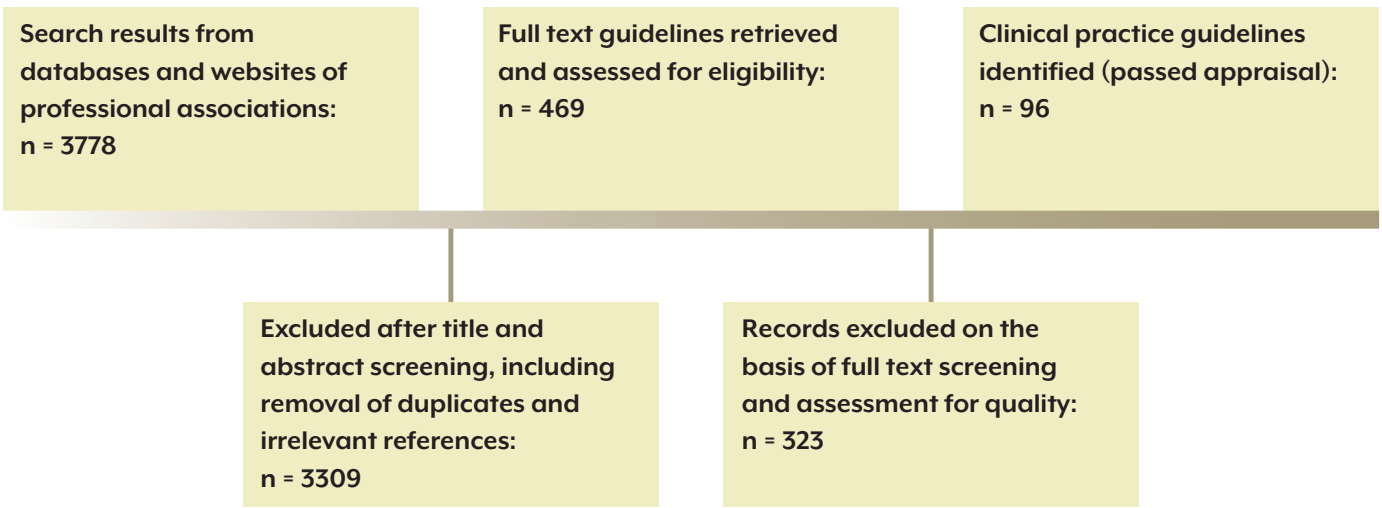


Figure A1.5 Flowchart of CPGs identified from the literature search, appraised for methodological quality, and selected for all remaining priority eye conditions included in the PECI



Systematic reviews (Cochrane and non-Cochrane) were used to complement the evidence of CPGs, particularly when: i) the selected high-quality CPG provided contradictory recommendations for a given intervention; and/or ii) the CPG makes a recommendation on a given intervention based on evidence that is older than 10 years. In total, data were extracted from 44 systematic reviews.

Data extraction and preparation
Recommendations for eye care assessments and interventions were extracted from selected CPGs and systematic reviews and were categorized as either an assessment, health promotion, prevention, or treatment. For each intervention, additional information was extracted including intervention target, setting, dosage/frequency, the strength of recommendation, and quality of evidence used to inform the recommendation. The extracted information, including full texts of the selected CPGs and systematic reviews, was presented to the subspecialty development groups to assist in informing the selection of interventions for inclusion in the PECI.

Stage 3: Selection of interventions and defining the resource requirements
Specific working groups were formed for each subspecialty area of eye care, including anterior segment, glaucoma, pediatric, vitreoretinal disorders, refractive error and vision rehabilitation. A stepwise process was carried out among each subspecialty-specific group that included an initial online survey, followed by virtual group consultations and the provision of independent written feedback in order to achieve the following two outcomes:

1. Achieve consensus on the selection of evidence-based eye care interventions for inclusion in the PECI; and
2. Define the service delivery platforms, workforce, time, and resource (equipment, medicines, consumables, and assistive technologies) requirements to provide each of the selected interventions.

The selection of evidence-based eye care interventions for inclusion in the PECI was guided by the following overarching criteria; i) evidence on the effectiveness of the intervention was evaluated as sufficient based on the strength of the recommendation and quality of evidence; and ii) it was considered practical and realistic that the intervention could be implemented within low- and intermediate-resource settings.

Annex 2. The final list of selected guidelines and systematic reviews used to help inform the Package of Eye Care Interventions

Eye condition	Guidelines and Systematic Reviews identified
Refractive error	**Clinical Practice Guidelines** 1. Chuck RS, Jacobs DS, Lee JK, Afshari NA, Vitale S, Shen TT, et al. Refractive errors and refractive surgeries PPP – 2017. American Academy of Ophthalmology; 2017 (https://www.aao.org/preferred-practice-pattern/refractive-errors-refractive-surgery-ppp-2017, accessed 17 March 2022). 2. Laser correction of refractive error following non-refractive ophthalmic surgery. National Institute for Health and Care Excellence (NICE); 2011 (https://www.nice.org.uk/guidance/ipg385, accessed 17 March 2022). 3. Intraocular lens insertion for correction of refractive error, with preservation of the natural lens. National Institute for Health and Care Excellence (NICE); 2009 (https://www.nice.org.uk/guidance/ipg289, accessed 17 March 2022). 4. Corneal inlay implantation for correction of presbyopia. National Institute for Health and Care Excellence (NICE); 2013 (https://www.nice.org.uk/guidance/ipg455, accessed 17 March 2022). 5. Chou R, Dana T, Bougatsos C, Grusing S, Blazina I. Screening for impaired visual acuity in older adults: updated evidence report and systematic review for the US Preventive Services Task Force. JAMA. 2016 Mar 1;315(9):915–33. 6. Comprehensive adult eye and vision examination. American Optometric Association; 2015 (https://www.aoa.org/practice/clinical-guidelines/clinical-practice-guidelines?sso=y, accessed 17 March 2022). 7. Chuck RS, Dunn SP, Flaxel CJ, Gedde SJ, Mah FS, Miller KM, et al. Comprehensive adult medical eye evaluation PPP – 2020. American Academy of Ophthalmology; 2020 (https://www.aao.org/preferred-practice-pattern/comprehensive-adult-medical-eye-evaluation-ppp, accessed 17 March 2022). 8. Grossman DC, Curry SJ, Owens DK, Barry MJ, Davidson KW, Doubeni CA, et al. Vision screening in children aged 6 months to 5 years: US Preventive Services Task Force recommendation statement. JAMA. 2017 Sep 5;318(9):836–44. 9. Comprehensive pediatric eye and vision examination. American Optometric Association, 2017 (https://www.aoa.org/practice/clinical-guidelines/clinical-practice-guidelines?sso=y, accessed 17 March 2022). 10. Wallace DK, Morse CL, Melia M, Sprunger DT, Repka MX, Lee KA, et al. Pediatric eye evaluations PPP – 2017. American Academy of Ophthalmology; 2017 (https://www.aao.org/preferred-practice-pattern/pediatric-eye-evaluations-ppp-2017, accessed 17 March 2022). **Systematic reviews** 1. Barsam A, Allan BD. Excimer laser refractive surgery versus phakic intraocular lenses for the correction of moderate to high myopia. Cochrane Database Syst Rev. 2014(6). 2. Shortt AJ, Allan BD, Evans JR. Laser-assisted in-situ keratomileusis (LASIK) versus photorefractive keratectomy (PRK) for myopia. Cochrane Database Syst Rev. 2013(1). 3. Kuryan J, Cheema A, Chuck RS. Laser-assisted subepithelial keratectomy (LASEK) versus laser-assisted in-situ keratomileusis (LASIK) for correcting myopia. Cochrane Database Syst Rev. 2017(2). 4. Li SM, Zhan S, Li SY, Peng XX, Hu J, Law HA, Wang NL. Laser-assisted subepithelial keratectomy (LASEK) versus photorefractive keratectomy (PRK) for correction of myopia. Cochrane Database Syst Rev. 2016(2).

Eye condition	Guidelines and Systematic Reviews identified
	5. Settas G, Settas C, Minos E, Yeung IY. Photorefractive keratectomy (PRK) versus laser assisted in situ keratomileusis (LASIK) for hyperopia correction. Cochrane Database Syst Rev. 2012(6). 6. Wei ML, Liu JP, Li N, Liu M. Acupuncture for slowing the progression of myopia in children and adolescents. Cochrane Database Syst Rev. 2011(9). 7. Walline JJ, Lindsley KB, Vedula SS, Cotter SA, Mutti DO, Ng SM, et al. Interventions to slow progression of myopia in children. Cochrane Database Syst Rev. 2020(1). 8. Heus P, Verbeek JH, Tikka C. Optical correction of refractive error for preventing and treating eye symptoms in computer users. Cochrane Database Syst Rev. 2018(4). 9. Clarke EL, Evans JR, Smeeth L. Community screening for visual impairment in older people. Cochrane Database Syst Rev. 2018(2). 10. Evans JR, Morjaria P, Powell C. Vision screening for correctable visual acuity deficits in school-age children and adolescents. Cochrane Database Syst Rev. 2018(2).
Amblyopia and Strabismus	**Clinical Practice Guidelines** 1. Wallace DK, Repka MX, Lee KA, Melia M, Christiansen SP, Morse CL, et al. Amblyopia PPP – 2017. American Academy of Ophthalmology; 2017 (https://www.aao.org/preferred-practice-pattern/amblyopia-ppp-2017, accessed 17 March 2022). 2. Wallace DK, Morse CL, Melia M, Sprunger DT, Repka MX, Lee KA, et al. Pediatric eye evaluations PPP – 2017. American Academy of Ophthalmology; 2017 (https://www.aao.org/preferred-practice-pattern/pediatric-eye-evaluations-ppp-2017, accessed 17 March 2022). 3. Comprehensive pediatric eye and vision examination. American Optometric Association; 2017 (https://www.aoa.org/practice/clinical-guidelines/clinical-practice-guidelines?sso=y, accessed 17 March 2022). 4. Delpero WT, Robinson BE, Gardiner JA, Nasmith L, Rowan-Legg A, Tousignant B. Evidence-based clinical practice guidelines for the periodic eye examination in children aged 0–5 years in Canada. Can J Ophthalmol. 2019 Dec 1;54(6):751–9. 5. Grossman DC, Curry SJ, Owens DK, Barry MJ, Davidson KW, Doubeni CA, et al. Vision screening in children aged 6 months to 5 years: US Preventive Services Task Force recommendation statement. JAMA. 2017 Sep 5;318(9):836–44. 6. Yang MB, Melia M, Lambert SYSTEMATIC REVIEWS, Chiang MF, Simpson JL, Buffenn AN. Fibrin glue for closure of conjunctival incision in strabismus surgery: a report by the American Academy of Ophthalmology. Ophthalmology. 2013 Sep 1;120(9):1935–41. 7. Bartalena L, Macchia PE, Marcocci C, Salvi M, Vermiglio F. Effects of treatment modalities for Graves' hyperthyroidism on Graves' orbitopathy: a 2015 Italian Society of Endocrinology Consensus Statement. J Endocrinol Invest. 2015 Apr;38(4):481–7. 8. Squint in children. National Institute for Health and Care Excellence (NICE); 2016 (https://www.nice.org.uk/, accessed 17 March 2022). **Systematic reviews** 1. Rajendram R, Bunce C, Lee RW, Morley AM. Orbital radiotherapy for adult thyroid eye disease. Cochrane Database Syst Rev. 2012(7). 2. Haridas A, Sundaram V. Adjustable versus non- adjustable sutures for strabismus. Cochrane Database of Syst Rev. 2013(7).

Eye condition	Guidelines and Systematic Reviews identified
	3. Rowe FJ, Noonan CP. Botulinum toxin for the treatment of strabismus. Cochrane Database Syst Rev. 2017(3). 4. Jones- Jordan L, Wang X, Scherer RW, Mutti DO. Spectacle correction versus no spectacles for prevention of strabismus in hyperopic children. Cochrane Database Syst Rev. 2020(4). 5. Chang MY, Coleman AL, Tseng VL, Demer JL. Surgical interventions for vertical strabismus in superior oblique palsy. Cochrane Database Syst Rev. 2017(11). 6. Hatt SR, Gnanaraj L. Interventions for intermittent exotropia. Cochrane Database Syst Rev. 2013(5). 7. Hatt SR, Wang X, Holmes JM. Interventions for dissociated vertical deviation. Cochrane Database Syst Rev. 2015(11).
Vision rehabilitation	**Clinical Practice Guidelines** 1. Vreeken HR, van Nispen RM, van Rens GH. Visual disorders, rehabilitation and referral. 2012. Dutch Ophthalmic Society (Nederlands Oogheelkundig Gezelschap). 2. International standards for vision rehabilitation: report of the international consensus conference. World Health Organization, 2015 (https://www.iapb.org/learn/resources/who-international-consensus-conference-on-vision-rehabilitation-standards, accessed 17 March 2022). **Systematic Reviews** 1. van Nispen RM, Virgili G, Hoeben M, Langelaan M, Klevering J, Keunen JE, et al. Low vision rehabilitation for better quality of life in visually impaired adults. Cochrane Database Syst Rev. 2020(1). 2. Virgili G, Acosta R, Bentley SA, Giacomelli G, Allcock C, Evans JR. Reading aids for adults with low vision. Cochrane Database Syst Rev. 2018(4).
Cataract	**Clinical Practice Guidelines** 1. Cataract in adults: management. National Institute for Health and Care Excellence (NICE); 2017 (https://www.nice.org.uk/guidance/ng77, accessed 17 March 2022). 2. Olson RJ, Braga-Mele R, Chen SH, Miller KM, Pineda R, Tweeten JP, et al. Cataract in the adult eye PPP – 2016. American Academy of Ophthalmology; 2016 (https://www.aaojournal.org/article/S0161-6420(16)31418-X/fulltext, accessed 17 March 2022). 3. Rajavi Z, Javadi MA, Daftarian N, Safi S, Nejat F, Shirvani A, et al. Customized clinical practice guidelines for management of adult cataract in Iran. J Ophthalmic Vis Res. 2015 Oct;10(4):445–60. 4. Commissioning guide: adult cataract surgery. Royal College of Ophthalmologists; 2018 (https://www.locsu.co.uk/wp-content/uploads/Files/Members_Area/Clinical_Pathways/Cataract/Cataract-Commissioning-Guide-January-2018.pdf, accessed 17 March 2022).

Eye condition	Guidelines and Systematic Reviews identified
Glaucoma	**Clinical Practice Guidelines** 1. Gedde SJ, Chen PP, Muir KW, Vinod K, Lind JT, Wright MM, et al. Primary angle-closure disease PPP – 2020. American Academy of Ophthalmology; 2020 (https://www.aao.org/preferred-practice-pattern/primary-angle-closure-disease-ppp, accessed 17 March 2022). 2. Gedde SJ, Vinod K, Wright MM, Muir KW, Lind JT, Chen PP, et al. Primary open-angle glaucoma PPP – 2020. American Academy of Ophthalmology; 2020 (https://www.aao.org/preferred-practice-pattern/primary-open-angle-glaucoma-ppp, accessed 17 March 2022). 3. Gedde SJ, Lind JT, Wright MM, Chen PP, Muir KW, Vinod K, et al. Primary open-angle glaucoma suspect PPP – 2020. American Academy of Ophthalmology; 2020 (https://www.aao.org/preferred-practice-pattern/primary-open-angle-glaucoma-suspect-ppp, accessed 17 March 2022). 4. Glaucoma: diagnosis and management. National Institute for Health and Care Excellence (NICE); 2017 (https://www.nice.org.uk/guidance/ng81, accessed 17 March 2022). 5. Adgwe CJ, Agrawal B, Azuara-Blanco A, Cobb C, Daly R, Datta A. SIGN144 Glaucoma referral and safe discharge A national clinical guideline. Scottish Intercollegiate Guidelines Network, 2015 (https://www.sign.ac.uk/assets/sign144.pdf, accessed 17 March 2022). 6. Powell J. Ab externo canaloplasty for primary open-angle glaucoma. National Institute for Health and Care Excellence (NICE); 2017 (https://www.nice.org.uk/guidance/ipg591, accessed 17 March 2022). 7. Powell J. High-intensity focused ultrasound for glaucoma. National Institute for Health and Care Excellence (NICE); 2019 (https://www.nice.org.uk/guidance/ipg661, accessed 11 September 2021). 8. Powell J. Microinvasive subconjunctival insertion of a trans-scleral gelatin stent for primary open-angle glaucoma. National Institute for Health and Care Excellence (NICE); 2018 (https://www.nice.org.uk/guidance/ipg612, accessed 17 March 2022). 9. Trabecular stent bypass microsurgery for open-angle glaucoma. National Institute for Health and Care Excellence (NICE); 2017 (https://www.nice.org.uk/guidance/ipg575, accessed 17 March 2022). 10. Trabeculotomy ab interno for open angle glaucoma. National Institute for Health and Care Excellence (NICE); 2011 (https://www.nice.org.uk/guidance/ipg397, accessed 17 March 2022). 11. Azuara-Blanco A, Traverso CE. Terminology and guidelines for glaucoma. European Glaucoma Society, 2020 (https://www.eugs.org/eng/guidelines.asp, accessed 17 March 2022). 12. Khawaja AP, Sherratt MA, Sparrow JM. The Royal College of Ophthalmologists' glaucoma commissioning guidance: executive summary. Eye. 2017 May;31(5):818–22. 13. Zhou D, Chen W, Li X, Deng B, Xu W, Qu J, Zhang G, Zhang C, Sun L, Jiang C, Xu J. Evidence-based practice guideline of Chinese herbal medicine for psoriasis vulgaris (Bai Bi). Eur J Integr Med. 2014 Apr 1;6(2):135–46. 14. Commissioning guide: glaucoma (long version). The Royal College of Ophthalmologists; 2015 (https://www.rcophth.ac.uk/wp-content/uploads/2020/08/Glaucoma-Commissioning-Guide-Long-June-2016-Final.pdf, accessed 17 March 2022).

Eye condition	Guidelines and Systematic Reviews identified
Retinopathy of prematurity	**Clinical Practice Guidelines** 1. Clinical practice guidelines for the management of retinopathy of prematurity. Pan American Health Organization, 2017 (https://iris.paho.org/handle/10665.2/51089, accessed 17 March 2022). 2. Pirelli A, Savant Levet P, Garetti E, Ancora G, Merazzi D, Bellieni CV, et al. Pain Study Group of the Italian Society of Neonatology. Literature review informs clinical guidelines for pain management during screening and laser photocoagulation for retinopathy of prematurity. Acta Paediatr. 2019 Apr;108(4):593–9. 3. VanderVeen DK, Melia M, Yang MB, Hutchinson AK, Wilson LB, Lambert SR. Anti-vascular endothelial growth factor therapy for primary treatment of type 1 retinopathy of prematurity: a report by the American Academy of Ophthalmology. Ophthalmology. 2017 May 1;124(5):619–33. 4. Simpson JL, Melia M, Yang MB, Buffenn AN, Chiang MF, Lambert SR. Current role of cryotherapy in retinopathy of prematurity: a report by the American Academy of Ophthalmology. Ophthalmology. 2012 Apr 1;119(4):873–7. **Systematic reviews** 1. Dempsey E, McCreery K. Local anaesthetic eye drops for prevention of pain in preterm infants undergoing screening for retinopathy of prematurity. Cochrane Database Syst Rev. 2011(9). 2. Jorge EC, Jorge EN, El Dib RP. Early light reduction for preventing retinopathy of prematurity in very low birth weight infants. Cochrane Database Syst Rev. 2013(8). 3. Kaempfen S, Neumann RP, Jost K, Schulzke SM. Beta- blockers for prevention and treatment of retinopathy of prematurity in preterm infants. Cochrane Database Syst Rev. 2018(3). 4. Qureshi MJ, Kumar M. D- Penicillamine for preventing retinopathy of prematurity in preterm infants. Cochrane Database Syst Rev. 2013(9). 5. Sankar MJ, Sankar J, Chandra P. Anti- vascular endothelial growth factor (VEGF) drugs for treatment of retinopathy of prematurity. Cochrane Database Syst Rev. 2018(1).
Congenital cataract	**Clinical Practice Guidelines** 1. Cotter SA, Cyert LA, Miller JM, Quinn GE. Vision screening for children 36 to <72 months: recommended practices. Optom Vis Sci. 2015 Jan;92(1):6. 2. Cataracts. National Institute for Health and Care Excellence (NICE); 2020 (https://www.nice.org.uk/cks-uk-only, accessed 17 March 2022). 3. Day AC, Wormald R, Coronini-Cronberg S, Smith R. The Royal College of Ophthalmologists' Cataract Surgery Commissioning Guidance: executive summary. The Royal College of Ophthalmologists; 2016 (https://www.rcophth.ac.uk/2016/03/the-royal-college-of-ophthalmologists-cataract-surgery-commissioning-guidance-executive-summary-eye-30-498-march-2016/, accessed 17 March 2022).

Eye condition	Guidelines and Systematic Reviews identified
Congenital glaucoma	**Clinical Practice Guideline** 1. Wallace DK, Morse CL, Melia M, Sprunger DT, Repka MX, Lee KA, et al. Pediatric eye evaluations PPP – 2017. American Academy of Ophthalmology; 2017 (https://www.aao.org/preferred-practice-pattern/pediatric-eye-evaluations-ppp-2017, accessed 17 March 2022). 2. Comprehensive pediatric eye and vision examination. American Optometric Association, 2017 (https://www.aoa.org/practice/clinical-guidelines/clinical-practice-guidelines?sso=y, accessed 17 March 2022). 3. NHMRC guidelines for the screening, prognosis, diagnosis, management and prevention of glaucoma 2010. National Health and Medical Research Council, Australian Government; 2010 (https://www.nhmrc.gov.au/sites/default/files/2018-10/cp113_glaucoma_120404.pdf, accessed 17 March 2022). **Systematic reviews** 1. Smith SD, Singh K, Lin SC, Chen PP, Chen TC, Francis BA, et al. Evaluation of the anterior chamber angle in glaucoma: a report by the American Academy of Ophthalmology. Ophthalmology. 2013 Oct 1;120(10):1985–97. 2. Chen TC, Chen PP, Francis BA, Junk AK, Smith SD, Singh K, et al. Pediatric glaucoma surgery: a report by the American Academy Of Ophthalmology. Ophthalmology. 2014 Nov 1;121(11):2107–15.
Age-related macular degeneration	**Clinical Practice Guidelines** 1. Age-related macular degeneration. National Institute for Health and Care Excellence (NICE); 2018 (https://www.nice.org.uk/guidance/ng82, accessed 17 March 2022). 2. Miniature lens system implantation for advanced age-related macular degeneration. National Institute for Health and Care Excellence (NICE); 2016 (https://www.nice.org.uk/guidance/ipg565, accessed 17 March 2022). 3. Epiretinal brachytherapy for wet age-related macular degeneration. National Institute for Health and Care Excellence (NICE); 2011 (https://www.nice.org.uk/guidance/ipg415, accessed 17 March 2022). 4. Limited macular translocation for wet age-related macular degeneration. National Institute for Health and Care Excellence (NICE); 2010 (https://www.nice.org.uk/guidance/ipg339, accessed 17 March 2022). 5. Macular translocation with 360° retinotomy for wet age-related macular degeneration. National Institute for Health and Care Excellence (NICE); 2010 (https://www.nice.org.uk/guidance/ipg340, accessed 17 March 2022). **Systematic reviews** 1. Evans JR, Lawrenson JG. Antioxidant vitamin and mineral supplements for preventing age- related macular degeneration. Cochrane Database Syst Rev. 2017(7). 2. Evans JR. Ginkgo biloba extract for age- related macular degeneration. Cochrane Database Syst Rev. 1999(3). 3. Lawrenson JG, Evans JR. Omega 3 fatty acids for preventing or slowing the progression of age- related macular degeneration. Cochrane Database Syst Rev. 2015(4). 4. Evans JR, Igwe C, Jackson TL, Chong V. Radiotherapy for neovascular age- related macular degeneration. Cochrane Database Syst Rev. 2020(8). 5. Gehlbach P, Li T, Hatef E. Statins for age- related macular degeneration. Cochrane Database Syst Rev. 2016(8).

Eye condition	Guidelines and Systematic Reviews identified
Diabetic retinopathy	**Clinical Practice Guidelines** 1. Flaxel CJ, Adelman RA, Bailey ST, Fawzi A, Lim JI, Vemulakonda GA, et al. Diabetic retinopathy PPP – 2019. American Academy of Ophthalmology; 2019 (https://www.aao.org/preferred-practice-pattern/diabetic-retinopathy-ppp, accessed 17 March 2022). 2. Nikkhah H, Karimi S, Ahmadieh H, Azarmina M, Abrishami M, Ahoor H, et al. Intravitreal injection of anti-vascular endothelial growth factor agents for ocular vascular diseases: clinical practice guideline. J Ophthalmic Vis Res. 2018 Apr;13(2):158. 3. Rajavi Z, Safi S, Javadi MA, Azarmina M, Moradian S, Entezari M, et al. Diabetic retinopathy clinical practice guidelines: customized for Iranian population. J Ophthalmic Vis Res. 2016 Oct;11(4):394. 4. Diabetes Canada clinical practice guidelines: 2018 Guidelines. Diabetes Canada; 2018 (http://guidelines.diabetes.ca/Clinical Practice Guidelines, accessed 17 March 2022). 5. Type 1 diabetes in children and adolescents. Diabetes in Canada; 2018 (https://guidelines.diabetes.ca/docs/Clinical Practice Guidelines/Ch34-Type-1-Diabetes-in-Children-and-Adolescents.pdf, accessed 17 March 2022). 6. Type 2 diabetes in children and adolescents. Diabetes Canada; 2018 (https://www.diabetes.ca/DiabetesCanadaWebsite/media/Health-care-providers/2018%20Clinical%20Practice%20Guidelines/Ch35-Type-2-Diabetes-in-Children-and-Adolescents.pdf, accessed 17 March 2022). 7. Schorr SG, Hammes HP, Müller UA, Abholz HH, Landgraf R, Bertram B. The prevention and treatment of retinal complications in diabetes. Dtsch Ärztebl Int. 2016 Dec;113(48):816. 8. Altomare F, Kherani A, Lovshin J. Retinopathy. Can J Diabetes. 2018 Apr 1;42:S210–6. 9. Aflibercept for treating visual impairment caused by macular oedema secondary to central retinal vein occlusion. National Institute for Health and Care Excellence (NICE); 2014 (https://www.nice.org.uk/guidance/ta305, accessed 17 March 2022). 10. Dexamethasone intravitreal implant for treating diabetic macular oedema. National Institute for Health and Care Excellence (NICE); 2015 (https://www.nice.org.uk/guidance/ta349, accessed 12 September 2021). 11. Ranibizumab for treating diabetic macular oedema. National Institute for Health and Care Excellence (NICE); 2013 (https://www.nice.org.uk/guidance/ta274, accessed 17 March 2021). 12. Ranibizumab for treating visual impairment caused by macular oedema secondary to retinal vein occlusion. National Institute for Health and Care Excellence (NICE); 2013 (https://www.nice.org.uk/guidance/ta283, accessed 17 March 2022). 13. Fluocinolone acetonide intravitreal implant for treating chronic diabetic macular oedema after an inadequate response to prior therapy. National Institute for Health and Care Excellence (NICE); 2013 (https://www.nice.org.uk/guidance/ta301, accessed 17 March 2022). 14. Fluocinolone acetonide intravitreal implant for treating chronic diabetic macular oedema in phakic eyes after an inadequate response to previous therapy. National Institute for Health and Care Excellence (NICE); 2019 (https://www.nice.org.uk/guidance/ta613, accessed 17 March 2022). 15. Mitchell P, Wong TY, Diabetic Macular Edema Treatment Guideline Working Group. Management paradigms for diabetic macular edema. Am J Ophthalmol. 2014 Mar 1;157(3):505–13.

Eye condition	Guidelines and Systematic Reviews identified
	16. Aflibercept for treating diabetic macular oedema. National Institute for Health and Care Excellence (NICE); 2015 (https://www.nice.org.uk/guidance/ta346, accessed 17 March 2022). **Systematic reviews** 1. Virgili G, Menchini F, Casazza G, Hogg R, Das RR, Wang X, et al. Optical coherence tomography (OCT) for detection of macular oedema in patients with diabetic retinopathy. Cochrane Database Syst Rev. 2015(1). 2. Moutray T, Evans JR, Lois N, Armstrong DJ, Peto T, Azuara- Blanco A. Different lasers and techniques for proliferative diabetic retinopathy. Cochrane Database Syst Rev. 2018(3). 3. Zhang HW, Zhang H, Grant SJ, Wan X, Li G. Single herbal medicine for diabetic retinopathy. Cochrane Database Syst Rev. 2018(12). 4. Lawrenson JG, Graham- Rowe E, Lorencatto F, Burr J, Bunce C, Francis JJ, Aluko P, et al. Interventions to increase attendance for diabetic retinopathy screening. Cochrane Database Syst Rev. 2018(1). 5. Sahoo S, Barua A, Myint KT, Haq A, Abas AB, Nair NS. Topical non- steroidal anti-inflammatory agents for diabetic cystoid macular oedema. Cochrane Database Syst Rev. 2015(2).
Myopic macular degeneration	**Clinical Practice Guidelines** 1. Nikkhah H, Karimi S, Ahmadieh H, Azarmina M, Abrishami M, Ahoor H, et al. Intravitreal injection of anti-vascular endothelial growth factor agents for ocular vascular diseases: clinical practice guideline. J Ophthalmic Vis Res. 2018 Apr;13(2):158. 2. Ranibizumab for treating choroidal neovascularisation associated with pathological myopia. National Institute for Health and Care Excellence (NICE); 2015 (https://www.nice.org.uk/guidance/ta298, accessed 17 March 2022).
Uveitis	**Clinical Practice Guidelines** 1. Adalimumab and dexamethasone for treating non-infectious uveitis. National Institute for Health and Care Excellence (NICE); 2017 (https://www.nice.org.uk/guidance/ta460, accessed 17 March 2022). 2. Uveitis clinical knowledge summary. National Institute for Health and Care Excellence (NICE); 2019 (https://cks.nice.org.uk/topics/uveitis/, accessed 17 March 2022). 3. Angeles-Han ST, Ringold S, Beukelman T, Lovell D, Cuello CA, Becker ML, et al. American College of Rheumatology/Arthritis Foundation guideline for the screening, monitoring, and treatment of juvenile idiopathic arthritis–associated uveitis. Arthritis Care Re. 2019 Jun;71(6):864–77. **Systematic reviews** 1. Brady CJ, Villanti AC, Law HA, Rahimy E, Reddy R, Sieving PC, et al. Corticosteroid implants for chronic non-infectious uveitis. Cochrane Database Syst Rev. 2016(2).

Eye condition	Guidelines and Systematic Reviews identified
Chalazion and Hordeola	**Clinical Practice Guidelines** 1. The College of Optometrists. Clinical management guidelines – Chalazion (Meibomian cyst); 2018 (https://www.college-optometrists.org/guidance/clinical-management-guidelines/chalazion-meibomian-cyst-.html, accessed 17 March 2022). 2. Meibomian cyst (Chalazion). National Institute for Health and Care Excellence (NICE); 2019 (https://www.nice.org.uk/, accessed 17 March 2022). 3. The College of Optometrists. Clinical management guidelines – Hordeolum; 2018 (https://www.college-optometrists.org/guidance/clinical-management-guidelines/hordeolum.html, accessed 17 March 2022). 4. Styes (hordeola). National Institute for Health and Care Excellence (NICE); 2019 (https://www.nice.org.uk/, accessed 17 March 2022).
Blepharitis	**Clinical Practice Guidelines** 1. The College of Optometrists. Clinical management guidelines – Blepharitis (Lid margin disease); 2018 (https://www.college-optometrists.org/guidance/clinical-management-guidelines/blepharitis-lid-margin-disease.html, accessed 17 March 2022). 2. Amescua G, Akpek EK, Farid M, Garcia-Ferrer FJ, Lin A, Rhee MK, et al. Blepharitis PPP – 2018. American Academy of Ophthalmology; 2018 (https://www.aao.org/preferred-practice-pattern/blepharitis-ppp-2018, accessed 17 March 2022). 3. Blepharitis. National Institute for Health and Care Excellence (NICE); 2019 (https://www.nice.org.uk, accessed 17 March 2022).
Lid and lacrimal system	**Clinical Practice Guidelines** 1. Wallace DK, Morse CL, Melia M, Sprunger DT, Repka MX, Lee KA, et al. Pediatric eye evaluations PPP – 2017. American Academy of Ophthalmology; 2017 (https://www.aao.org/preferred-practice-pattern/pediatric-eye-evaluations-ppp-2017, accessed 17 March 2022). 2. Cahill KV, Bradley EA, Meyer DR, Custer PL, Holck DE, Marcet MM, et al. Functional indications for upper eyelid ptosis and blepharoplasty surgery OTA. American Academy of Ophthalmology; 2011 (https://www.aao.org/ophthalmic-technology-assessment/functional-indications-upper-eyelid-ptosis-blephar, accessed 17 March 2022). **Systematic reviews** 1. Petris C, Liu D. Probing for congenital nasolacrimal duct obstruction. Cochrane Database Syst Rev. 2017(7). 2. Boboridis KG, Bunce C. Interventions for involutional lower lid entropion. Cochrane Database Syst Rev. 2011(12). 3. Rosenberg JB, Andersen J, Barmettler A. Types of materials for frontalis sling surgery for congenital ptosis. Cochrane Database Syst Rev. 2019(4).

Eye condition	Guidelines and Systematic Reviews identified
Conjunctivitis	**Clinical Practice Guidelines** 1. Sánchez-Hernández MC, Montero J, Rondon C, Benitez del Castillo JM, Velázquez E, Herreras JM, et al. Consensus document on allergic conjunctivitis (DECA). J Investig Allergol Clin Immunol. 2015 Jan 1;25(2):94–106. 2. The College of Optometrists. Clinical management guidelines – Atopic keratoconjunctivitis (AKC); 2019 (https://www.college-optometrists.org/guidance/clinical-management-guidelines/atopic-keratoconjunctivitis-akc-.html, accessed 16 March 2022). 3. The College of Optometrists. Clinical management guidelines – Seasonal allergic conjunctivitis (Hay fever conjunctivitis); Perennial allergic conjunctivitis; 2019 (https://www.college-optometrists.org/guidance/clinical-management-guidelines/seasonal-allergic-conjunctivitis.html, accessed 16 March 2022). 4. The College of Optometrists. Clinical management guidelines – CL-associated papillary conjunctivitis (CLAPC), Giant papillary conjunctivitis (GPC); 2019 (https://www.college-optometrists.org/guidance/clinical-management-guidelines/cl-associated-papillary-conjunctivitis-.html, accessed 16 March 2022). 5. The College of Optometrists. Clinical management guidelines – Conjunctivitis medicamentosa (also Dermatoconjunctivitis medicamentosa); 2019 (https://www.college-optometrists.org/guidance/clinical-management-guidelines/conjunctivitis-medicamentosa.html, accessed 16 March 2022). 6. Conjunctivitis – allergic. National Institute for Health and Care Excellence (NICE); 2019 (https://www.nice.org.uk, accessed 16 March 2022). 7. The College of Optometrists. Clinical management guidelines – Conjunctivitis (Acute allergic), 2019 (https://www.college-optometrists.org/guidance/clinical-management-guidelines/conjunctivitis-acute-allergic-.html, accessed 16 March 2022). 8. The College of Optometrists. Clinical management guidelines – Vernal keratoconjunctivitis (Spring catarrh), 2019 (https://www.college-optometrists.org/guidance/clinical-management-guidelines/vernal-keratoconjunctivitis-spring-catarrh-.html, accessed 16 March 2022). 9. Varu DM, Rhee MK, Akpek EK, Amescua G, Farid M, Garcia-Ferrer FJ, et al. Conjunctivitis – PPP 2018. American Academy of Ophthalmology, 2018 (https://www.aao.org/preferred-practice-pattern/conjunctivitis-ppp-2018, accessed 16 March 2022). 10. Curry SJ, Krist AH, Owens DK, Barry MJ, Caughey AB, Davidson KW, et al. Ocular prophylaxis for gonococcal ophthalmia neonatorum: US Preventive Services Task Force reaffirmation recommendation statement. JAMA. 2019 Jan 29;321(4):394–8. 11. The College of Optometrists. Clinical management guidelines – Conjunctivitis, chlamydial (adult inclusion conjunctivitis); 2019 (https://www.college-optometrists.org/guidance/clinical-management-guidelines/conjunctivitis-chlamydial.html, accessed 16 March 2022). 12. Conjunctivitis – infective. National Institute for Health and Care Excellence (NICE); 2019 (https://www.nice.org.uk, accessed 16 March 2022). 13. The College of Optometrists. Clinical management guidelines – Conjunctivitis (bacterial); 2019 (https://www.college-optometrists.org/guidance/clinical-management-guidelines/conjunctivitis-bacterial-.html, accessed 16 March 2022). 14. The College of Optometrists. Clinical management guidelines – Conjunctivitis (viral, non-herpetic); 2019 (https://www.college-optometrists.org/guidance/clinical-management-guidelines/conjunctivitis-viral-non-herpetic-.html, accessed 16 March 2022).

Eye condition	Guidelines and Systematic Reviews identified
	15. The College of Optometrists. Clinical management guidelines – Ophthalmia neonatorum; 2020 (https://www.college-optometrists.org/guidance/clinical-management-guidelines/ophthalmia-neonatorum.html, accessed 16 March 2022).
Dry eye	**Clinical Practice Guidelines** 1. Akpek EK, Amescua G, Farid M, Garcia-Ferrer FJ, Lin A, Rhee MK, et al. Dry eye syndrome – PPP 2018. American Academy of Ophthalmology, 2018 (https://www.aao.org/preferred-practice-pattern/dry-eye-syndrome-ppp-2018, accessed 16 March 2022). 2. Comprehensive adult medical eye evaluation – PPP 2020. American Academy of Ophthalmology, 2020 (https://www.aao.org/preferred-practice-pattern/comprehensive-adult-medical-eye-evaluation-ppp, accessed 16 March 2022). 3. Comprehensive adult eye and vision examination. American Optometric Association, 2015 (https://www.aoa.org/practice/clinical-guidelines/clinical-practice-guidelines?sso=y, accessed 16 March 2022). 4. Rauz S, Koay SY, Foot B, Kaye SB, Figueiredo F, Burdon MA, et al. The Royal College of Ophthalmologists guidelines on serum eye drops for the treatment of severe ocular surface disease: full report. Eye. 2017 Nov 17:1–6. **Systematic reviews** 1. Downie LE, Ng SM, Lindsley KB, Akpek EK. Omega-3 and omega-6 polyunsaturated fatty acids for dry eye disease. Cochrane Database Syst Rev. 2019(12). 2. Cote S, Zhang AC, Ahmadzai V, Maleken A, Li C, Oppedisano J, Nair K, Busija L, Downie LE. Intense pulsed light (IPL) therapy for the treatment of meibomian gland dysfunction. Cochrane Database Syst Rev. 2020(3).
Keratitis and corneal ulcer	**Clinical Practice Guidelines** 1. Lin A, Rhee MK, Akpek EK, Amescua G, Farid M, Garcia-Ferrer FJ, et al. Bacterial keratitis: PPP – 2018. American Academy of Ophthalmology, 2018 (https://www.aao.org/preferred-practice-pattern/bacterial-keratitis-ppp-2018, accessed 12 March 2022). 2. Farid M, Rhee MK, Akpek EK, Amescua G, Garcia-Ferrer FJ, Lin A, et al. Corneal edema and opacification: PPP – 2018. American Academy of Ophthalmology, 2018 (https://www.aao.org/preferred-practice-pattern/corneal-edema-and-opacification-ppp-2018, accessed 12 March 2022). 3. Curry SJ, Krist AH, Owens DK, Barry MJ, Caughey AB, Davidson KW, et al. Ocular prophylaxis for gonococcal ophthalmia neonatorum: US Preventive Services Task Force reaffirmation recommendation statement. JAMA. 2019 Jan 29;321(4):394–8. 4. White ML, Chodosh J. Herpes simplex virus keratitis: a treatment guideline. American Academy of Ophthalmology, 2014 (https://www.aao.org/clinical-statement/herpes-simplex-virus-keratitis-treatment-guideline, accessed 12 March 2022). 5. Herpes simplex – ocular. National Institute for Health and Care Excellence (NICE), 2016 (https://www.nice.org.uk, accessed 17 March 2022. **Systematic reviews** 1. Alkharashi M, Lindsley K, Law HA, Sikder S. Medical interventions for acanthamoeba keratitis. Cochrane Database Syst Rev. 2015(2). 2. FlorCruz NV, Evans JR. Medical interventions for fungal keratitis. Cochrane Database Syst Rev. 2015(4).

Eye condition	Guidelines and Systematic Reviews identified
Keratoconus	**Clinical Practice Guidelines** 1. Garcia-Ferrer FJ, Akpek EK, Amescua G, Farid M, Lin A, Rhee MK, et al. Corneal ectasia: PPP – 2018. American Academy of Ophthalmology, 2018 (https://www.aao.org/preferred-practice-pattern/corneal-ectasia-ppp-2018, accessed 12 March 2022).
Ocular trauma	**Clinical Practice Guidelines** 1. Holoclar for treating limbal stem cell deficiency after eye burns. National Institute for Health and Care Excellence (NICE), 2017 (https://www.nice.org.uk/guidance/ta467, accessed 17 March 2021). 2. Corneal superficial injury. National Institute for Health and Care Excellence (NICE), 2017 (https://www.nice.org.uk, accessed 17 March 2022). 3. Rajavi Z, Safi S, Javadi MA, Jafarinasab MR, Feizi S, Moghadam MS, et al. Clinical practice guidelines for prevention, diagnosis and management of early and delayed-onset ocular injuries due to mustard gas exposure. J Ophthalmic Vis Res. 2017 Jan;12(1):65. **Systematic reviews** 1. Clare G, Suleman H, Bunce C, Dua H. Amniotic membrane transplantation for acute ocular burns. Cochrane Database Syst Rev. 2012(9). 2. Gharaibeh A, Savage HI, Scherer RW, Goldberg MF, Lindsley K. Medical interventions for traumatic hyphema. Cochrane Database Syst Rev. 2019(1). 3. Lim CH, Turner A, Lim BX. Patching for corneal abrasion. Cochrane Database Syst Rev. 2016(7). 4. Wakai A, Lawrenson JG, Lawrenson AL, Wang Y, Brown MD, Quirke M, et al. Topical non- steroidal anti- inflammatory drugs for analgesia in traumatic corneal abrasions. Cochrane Database Syst Rev. 2017(5).
Pterygium	**Systematic reviews** 1. Clearfield E, Muthappan V, Wang X, Kuo IC. Conjunctival autograft for pterygium. Cochrane Database Syst Rev. 2016(2). 2. Romano V, Cruciani M, Conti L, Fontana L. Fibrin glue versus sutures for conjunctival autografting in primary pterygium surgery. Cochrane Database Syst Rev 2016(12). 3. Kaufman SC, Jacobs DS, Lee WB, Deng SX, Rosenblatt MI, Shtein RM. Options and adjuvants in surgery for pterygium: a report by the American Academy of Ophthalmology. Ophthalmology. 2013 Jan 1;120(1):201–8.

Eye condition	Guidelines and Systematic Reviews identified
Others	**Clinical Practice Guidelines** 1. Xerophthalmia and night blindness for the assessment of clinical vitamin A deficiency in individuals and populations. Geneva: World Health Organization; 2014 (https://apps.who.int/iris/bitstream/handle/10665/133705/WHO_NMH_NHD_EPG_14.4_eng.pdf?ua=1, accessed 12 March 2022). 2. WHO guideline on school health services. Geneva: World Health Organization; 2021 (https://www.who.int/publications/i/item/9789240029392, accessed 12 March 2022). 3. Integrated care for older people: guidelines on community-level interventions to manage declines in intrinsic capacity. Geneva: World Health Organization; 2017 (https://www.who.int/publications/i/item/9789241550109, accessed 12 March 2022). 4. Retinoblastoma. Best practice guidelines 2019. The Kenya National Retinoblastoma Strategy, 2019 (https://www.health.go.ke/wp-content/uploads/2021/02/RETINOBLASTOMA-Best-Practice-Guidelines-2019.pdf, accessed 12 March 2022). 5. Nathan P, Cohen V, Coupland S, Curtis K, Damato B, Evans J, et al. Uveal melanoma UK national guidelines. Eur J Cancer. 2015 Nov 1;51(16):2404–12.

Annex 3. Equipment and consumable requirements for eye care examinations, by level of care

Clinical examination	Equipment and consumables requirements at different levels of care[1]		
	Community and Primary	Primary plus	Secondary and Tertiary[2]
Visual acuity (distance, near and pinhole)	Snellen charts with letters, pictures, numbers and tumbling E's; Pinhole; Measuring tape/rope; Patch/ occluder.		LogMAR charts; LEA Symbols; Sloan letters; HOTV charts; Kay's pictures.
Preferential looking visual acuity testing (for infants and toddlers)			Toys with detail for fixation (illuminated and non-illuminated); Teller acuity cards; Cardiff acuity test; LEA Gratings.
Torchlight exam (external eye assessment)	Torch/transilluminator/Phone flashlight; Fixation object.		
Slit lamp exam			Slit Lamp Biomicroscope; 60D, 78D lens or 90D lens; Stand and Table top for slit lamp.
Automated refraction			Autorefractor; Photoscreener; Software.
Subjective refraction		Universal trial frame; Trial lens set (full diameter with minimum number of trial lenses); Lens bars; Cross cylinder; Light box.	Full aperture trial lens set; Pediatric trial frame
Retinoscopy			Retinoscope; Retinoscopy lens rack
Visual field testing			Standard automated perimeter with progression software; Amsler grid chart; Pencil.
Contrast sensitivity			Pelli-robson chart; Bailey Lovie chart.
Colour vision			Ishihara plates; HRR plates
Tonometry			Applanation tonometer; Non-contact tonometer; Fluorescein strips.
Keratometry			Keratometer; Hand held keratometer.
Biometry (optical and/or ultrasound)			Optical and/or ultrasound biometer

Clinical examination	Equipment and consumables requirements at different levels of care[1]		
	Community and Primary	Primary plus	Secondary and Tertiary[2]
Direct ophthalmoscopy		Direct Ophthalmoscope	
Indirect ophthalmoscopy			Indirect ophthalmoscope; 20D lens, 28D lens; Pan retinal lens.
Gonioscopy			Direct gonioscopy lenses; Coupling agent; Indirect gonioscopy lenses (adult and child sizes).
Ultrasonography			Ultrasound scanner Mode A and B; Coupling agent; Computer and monitor for viewing images; Software.
Pachymetry			Ultrasound/optical pachymeter; Computer and monitor; Software.
Fundus photography		Non-Mydriatic fundus camera; Computer and monitor for viewing retinal images; Cards for diagnosis of fundus; Fundus charts, Colour pens; Software.	
Binocular vision assessment – Stereoacuity test			Random dot and Lateral disparity; Stereo Smile design for young children; TNO test; Titmus fly test.
Binocular vision assessment – Fusion test			Worth 4 dot test equipment with red- green glasses or bagolini glasses.
Binocular vision assessment – Prism test			Prism bar (horizontal and vertical); Loose prisms.
Duochrome			Duochrome test chart.
Optical coherence tomography (OCT)[3]			OCT; Computer and monitor for viewing images; Software.
Dry eye assessment			Schirmer's strips, Sodium fluorescein dye; Fluorescein strips.
Corneal topography			Tertiary (only): Corneal topography machine; Computer and monitor for viewing images; Software

Clinical examination	Equipment and consumables requirements at different levels of care[1]		
	Community and Primary	Primary plus	Secondary and Tertiary[2]
Functional vision assessment			Visual functioning questionnaire (including assessment of vision for learning, parent input, and activities of daily living)
Others	Personal protective equipment; Equipment for laboratory testing; Referral slips.		

[1] For some clinical examinations, the equipment and consumables listed are interchangeable, representing different options depending on preferences, resources available and/or geographical availability.

[2] Represents additional equipment and consumables to that mentioned at lower levels of care

[3] While OCT is considered the gold standard in the diagnosis and monitoring of treatment regiments for a range retinal disorders, cost implications currently limit availability in many low- and middle-income countries. There are several promising developments in this area that offer great potential to reduce the costs of OCT devices in the future. At the tertiary level, additional OCT features and modules for glaucoma and anterior segment are desirable.

Annex 4. An overview of the equipment and consumable requirements for treatment interventions

The four levels of care in the table below are defined as: Community; Primary (1) (including Primary plus); Secondary (2); Tertiary (3).

Treatment interventions	Level of care				Equipment and consumables
	Community	1	2	3	
Non-surgical interventions					
Provision of spectacles in adults	–	x (plus)	x	x	Frames (including options for bifocals) for adults; Inventory of optical lenses; Auto-edger; Lensmeter; Manual edger; Frame heater; Pattern cutter; Centration device; Set of optical pliers.
Provision of spectacles in children	x[1]	–	x	x	Frames for children; Inventory of optical lenses; Auto-edger; Lensmeter; Manual edger; Frame heater; Pattern cutter; Centration device; Set of optical pliers.
Provision of readymade reading spectacles for the correction of presbyopia	x	x	–	–	Readymade reading spectacles (+1.50, +2.00, +2.50, +3.00).
Patching for amblyopia	–	–	x	x	Eye patch.
Management of posterior capsular opacification	–	–	x	x	Nd:YAG laser machine.
Laser peripheral iridotomy	–	–	x	x	YAG laser; Argon green laser; Iridotomy laser lens; Coupling agent.
Selective laser trabeculoplasty	–	–	x	x	Slit lamp; SLT laser; SLT laser lens; Combination machine: SLT laser with YAG laser (where there are cost constraints).
Irrigation of the eye in cases of chemical exposure and referral, where indicated	x	x	x	x	IV infusion set for irrigation; Normal saline; Ringer lactate solution.
Management of corneal abrasions, erosions, and/or small perforations	–	–	x	x	Bandage contact lens; Cyanoacrylate glue.
Contact lens for keratoconus	–	–	x	x	Contact lens (soft, gas-permeable lens, or other hybrid KC lens); Contact lens solution.
Punctal occlusion for dry eye	–	–	x	x	Lacrimal dilator; Silicone punctal plugs.
Antivascular endothelial growth factor (anti-VEGF) therapy	–	–	x	x	Speculum; Callipers; Tuberculin syringe; 30 or 32 gauge needle.

Treatment interventions	Level of care				Equipment and consumables
	Community	1	2	3	
Retinal laser photocoagulation	–	–	x	x	Slit lamp delivery system with a contact lens, Indirect ophthalmoscope system with a non-contact binocular indirect ophthalmoscope condensing lens 28D or 20D; Coupling agent; Laser protection goggles.
General consumables applicable to the above interventions					Personal protective equipment; Sterile gloves; Eye pads; Eye shields; Sterile cotton surgical swabs.
Surgical interventions					
Strabismus surgery	–	–	–	x	Refer to Anaesthesia equipment and consumables; Operating theatre equipment and consumables; Strabismus equipment and consumables.
Large-incision, manual, extracapsular cataract extraction with intraocular lense (ECCE-IOL)	–	–	x	x	Refer to Anaesthesia equipment and consumables; Operating theatre equipment and consumables; Cataract equipment (general) and consumables.
Small incision cataract surgery (SICS) with IOL implantation	–	–	x	x	Refer to Anaesthesia equipment and consumables; Operating theatre equipment and consumables; Cataract equipment (general) and consumables; Cataract equipment (SICS).
Sutureless, small incision phacoemulsification with IOL implantation	–	–	x	x	Refer to Anaesthesia equipment and consumables; Operating theatre equipment and consumables; Cataract equipment (general) and consumables; Cataract equipment (Phaco).
Pediatric cataract surgery	–	–	–	x	Refer to Anaesthesia equipment and consumables; Operating theatre equipment and consumables; Cataract equipment and consumables; Vitreoretinal equipment and consumables.
Cyclophotocoagulation	–	–	–	x	Refer to Anaesthesia equipment and consumables; Operating theatre equipment and consumables; Diode laser cyclophotocoagulation system with metal multiple use probes; Glaucoma equipment and consumables.
Filtration surgery (trabeculectomy) and iridectomy	–	–	x	x	Refer to Anaesthesia equipment and consumables; Operating theatre equipment and consumables; Glaucoma equipment and consumables.

Treatment interventions	Level of care				Equipment and consumables
	Community	1	2	3	
Angle surgery (goniotomy or trabeculotomy) for children	–	–	–	x	Refer to Anaesthesia equipment and consumables; Operating theatre equipment and consumables; Glaucoma equipment and consumables; Goniotomy knife; Surgical gonioscopic lens; Trabeculotome.
Glaucoma surgery – glaucoma drainage devices	–	–	–	x	Refer to Anaesthesia equipment and consumables; Operating theatre equipment and consumables; Glaucoma equipment and consumables; Glaucoma drainage devices/ implants/tube shunts.
Incision and drainage of hordeolum and chalazion	–	–	x	x	Refer to Anaesthesia equipment and consumables; Operating theatre equipment and consumables; Eyelid equipment; Chalazion Spoon 2.5mm, Chalazion Clamp 9cms.
Probing for congenital nasolacrimal duct obstruction	–	–	x	x	Refer to Anaesthesia equipment and consumables; Operating theatre equipment and consumables; Lacrimal equipment and consumables.
Pterygium surgery	–	–	x	x	Refer to Anaesthesia equipment and consumables; Operating theatre equipment and consumables; Corneal equipment and consumables; Hockey stick blade, Diamond burr or dental burr.
Corneal cross-linking for keratoconus	–	–	–	x	Refer to Anaesthesia equipment and consumables; Operating theatre equipment and consumables; Corneal equipment and consumables; Corneal cross-linking system, Riboflavin 5'-phosphate in 20% dextran ophthalmic solution; Bandage contact lens.
Corneal transplantation surgery – keratoplasty	–	–	–	x	Refer to Anaesthesia equipment and consumables; Operating theatre equipment and consumables; Corneal equipment; PK and DALK equipment; Corneal graft
Amniotic membrane graft	–	–	–	x	Refer to Anaesthesia equipment and consumables; Operating theatre equipment and consumables; Corneal equipment and consumables; Pterygium equipment; Amniotic membrane; Conformer, Fibrin glue.
Eyelid surgery	–	–	x	x	Refer to Anaesthesia equipment and consumables; Operating theatre equipment and consumables; Eyelid equipment; Fixation forceps; Muscle hook; Mosquito artery forceps; Bolsters, biomaterial (poly tetra fluoro ethylene); Ptosis suspension set.

Treatment interventions	Level of care				Equipment and consumables
	Community	1	2	3	
Vitreoretinal surgery	–	–	–	x	Refer to Anaesthesia equipment and consumables; Operating theatre equipment and consumables; Vitreoretinal equipment and consumables; Equipment for Retinal laser photocoagulation.
Transpupillary diode laser for the treatment of retinopathy of prematurity	–	–	–	x	Refer to Anaesthesia equipment and consumables; Eye speculum; Scleral indenter; Diode laser equipment; Scleral depressor; Wire vectis depressor.
Management for retinoblastoma[2]	–	–	–	x	Refer to Anaesthesia equipment and consumables; Operating theatre equipment and consumables; Enucleation equipment and consumables; Diode laser equipment; Ocular cryotherapy systems and probes.
Management of post-operative infection/inflammation	–	–	x	x	Refer to Anaesthesia equipment and consumables; Operating theatre equipment and consumables; Cataract equipment (general) and consumables; Vitrectomy equipment and consumables.
Evisceration and enucleation	–	–	x	x	Refer to Anaesthesia equipment and consumables; Operating theatre equipment and consumables; Eyelid equipment; Enucleation and evisceration equipment and consumables; Conformer.

[1] Refers to vision screening and the provision of spectacles in the context of school health programmes. This often involves coordination with trained eye care professionals at other levels of care for eye examinations (including refractions) and/or optical dispensing.

[2] Retinoblastoma care requires a multidisciplinary approach.

Linking with the above overview, the tables below list specific equipment and consumable requirements for the surgical interventions.

Note: Some of the equipment and consumables listed below are interchangeable, representing different options depending on preferences, resources available and/or geographical availability.

1. Anaesthesia equipment and consumables

1.	Essential equipment for all anaesthetic procedures	Resuscitator AMBU adult 2000 ml silicone bag, with single shutter patient valve, size 5 face mask and oxygen reservoir
		Intravenous flexible cannula
		Pulse-oximeter system
		Syringes (2 ml, 5 ml, 10 ml)
2.	Paediatric anaesthesia	Operating table with adjustable height and tilting mechanism with accessories
		Oxygen concentrator cannula, humidifier, adaptor kit, humidifier bottle, long-life intake filter
		Electric suction machine (with battery back-up) and accessories
		Anaesthesia system (complete system, including ventilator, concentrator, vaporizer, UPS, AGSS)
		Paediatric/adult face mask
		Paediatric/child airways (endotracheal tubes with white tape to secure tube, laryngoscope blades and handles, oral airway, eye tape)

2. Operating theatre equipment and consumables

1.	General	Personal protective equipment
		Surgical eye drapes (disposable or reusable)
		Sterile surgeon's gowns (for surgeons, assistants, and patients), reusable or disposable, where applicable
		Speculum
2.	Sutures	Nylon, spatulated 6 mm needle, double armed and single armed (10-0, 9-0)
		Vicryl spatulated and cutting 6 mm needle, single armed (10-0, 8-0, 7-0, 6-0)
		4-0 black braided silk on reel, superior rectus
		10- 0 prolene suture (spatulated side-cutting needle)
		6-0 plain gut suture
		5-0 polygalactin with 19 mm, 3/8th circle reverse-cutting needle, 45 cm length (for eyelid surgery)
		5-0 mersilene polyester suture (for scleral buckle)

3.	Gloves	Sterile pre-powdered or powder-free gloves (6.0, 6.5, 7.0, 7.5, 8.0)
4.	Needles and syringes	Hypodermic sterile needles
		Peribulbar needle, 25G
		Sub-Tenon anaesthesia cannula, 19G
		Syringes (2 ml, 5 ml, 10 ml)
		1 ml Tuberculin syringe
5.	Dressing	Cotton wool
		Crepe elastic bandage
		Gauze roll
		Eye pad
		Plastic eye shield
6.	Cautery machines	Sterilizable ophthalmic bipolar forceps and leads
		McPherson forceps
		Disposable/autoclavable cables for use with forceps
7.	Sterilizers and autoclave	Instrument sterilizers
		Autoclave machine
		Sterilizing drums or ETO machine
		Cheatle forceps
		Instrument soaking tray
		Distilled water unit
8.	Operating microscope, lights, and furniture	Static microscopes (for vitrectomy) with zoom magnification, foot-pedal controlled X/Y shift, non-contact wide-angle viewing system, and appropriate wavelength filter for laser)
		Zoom magnification microscope on table stand (for cataract surgery)
		Floor stand
		Spare bulbs and fuse pack for microscope
		Portable surgical light
		Spare bulb and fuse pack for portable surgical light
		Dressing trolley
		Surgeon's stool with cushion and adjustable height

		Operating table with adjustable height and tilting mechanism with accessories
9.	Cryotherapy	Cryosurgical machine
		Console with footswitch, high-pressure hose, exhaust hose and adjustable spanner with reliable supply of compressed gas
		Sterilizable cryoprobes (curved for retina)
		Standard retinal probe or disposable probes (2.5 mm standard retinal probe, 2.5 mm extended retinal probe)
		Trolley
		Pencil sterilization box

3. Cataract equipment (general) and consumables

1.	Forceps	Wet field electric cautery (unipolar and bipolar) forceps
		Superior rectus forceps
		Fixation forceps
		Toothed forceps
		Non-toothed forceps
		Mosquito, curved forceps
		Mosquito, straight forceps
		Corneal, 0.12 mm atraumatic tips, angled with tying platform forceps
		Corneal, 1x2 teeth, 0.12 mm, with 6 mm tying platform forceps
		Suture tying forceps
		Lens introducing, angle to tip 8–12 mm, smooth jaw forceps
		Capsulorhexis, angle to tip 11 mm, sharp tip to use as a cystotome, utrata forceps
2.	Needle holder	Straight needle holder for 4-0, 5-0, 6-0 or 7-0 suture for larger sutures
		Curved or straight needle holder, overall length 10–11 mm, jaws 8 mm, for 8-0 to 10-0 suture
3.	Knives, blades, and handles	Blade breaker and holder
		Blade handle for No. 15
		Surgical blades for blade handle
		Reusable knives
		15-degree stab knife

		Disposable crescent (bevel up) blade
		Disposable keratomes
		Razor fragments OR blade slit knife (disposable)
4.	Scissors	Conjunctival scissors
		Corneal section (corneoscleral) scissors, 10 mm blades
		Angled, 10 mm, extra thin blades, Barraquer scissors
		Iridectomy scissors
		Capsulotomy, fine scissors
		Iris, sharp pointed scissors
		Ordinary scissors (for cutting big sutures and threads)
5.	Cannulas	Anterior chamber (AC) infusion cannula (AC maintainer) 23G or 25G, infusion tube
		Hydrodissection cannula, 23G to 30G, 32 degrees angled shaft, 8 mm from bend to tip, with flattened smooth oval-shaped tip
		30-gauge cannula
		Air injection, 27G cannula
		Viscoelastic, 22G cannula
		Simcoe, irrigating/aspirating, 23G, angled cannula
		Irrigating vectis, three ports 23G cannula
6.	Intraocular lens	1 piece acrysof IOL (preferred for pediatric cases)
		PMMA posterior chamber IOLs 19–21D, 21–23D, 24–25D, single piece with dialling holes (0.50D and 1D increments for PCIOL)
		Square edge PMMA
		PMMA single piece or multipiece lens
		Hydrophobic acrylic IOL (if available)
		AC lenses 19D three or four point fixation
7.	Other	Desmarres infant retractor
		Speculum, 12 mm blade (adult and child); Speculum (newborn wire – 2 mm blades; child wire – 8 mm blades)
		Wire speculum, adjustable
		Towel clip, cross action
		Callipers (1–20 mm in 1 mm increments)

		Cautery ball or electric cautery
		Silicone tube (1 mm)
		Scleral fixation rings
		Capsular tension ring (11 mm)
		Kuglen iris hook and lens manipulator
		Sinskey hook straight or angled
		Lens expressor
		Iris spatula or repositor
		Vectis, lens loop or wire
		Muscle hook or squint hook
		Sterile cotton surgical swabs
		Triangular swabs (micro sponges)
		Ringers lactate solution, 1 litre bags with IVI set
		Methylcellulose HPMC in pre-filled syringes with cannula, 2 ml (glass syringes, where applicable)
		Trypan blue, 0.06% 1 ml injection
		Sodium hyaluronate, 1.4% 1 ml

4. Cataract equipment (SICS)

1.	Additional to cataract (general) equipment and consumables	Keratome (bevel up), 2.7–3.5mm
		Metal handle for single use knives
		Knife: slit/keratome, angled 3.2 mm (bevel up)
		Knife: MVR 19G

5. Cataract equipment (Phaco)

1.	Additional to cataract (general) equipment and consumables	Phacoemulsification machine with anterior vitrector
		Phaco hand piece, tip and accessory pack with silicone sleeve
		Irrigation-aspiration tip (co-axial)
		Bimanual irrigation hand pieces
		Keratome (bevel up) 2.7–3.5 mm
		MVR 19G knife
		Phaco chopper

		Fine iris spatula
		IOL folding and inserting forceps
		Blades (included in sets)
		Foldable (HEMA) hydrophilic lens, modified C loop with injectable cartridge and disposable plunger (dioptre 10.0D to 30.0D)

6. Vitreoretinal equipment and consumables

1.	General	Contact and/or non-contact viewing systems
2.	Vitrectomy	Pars Plana Vitrectomy Unit (vitrectomy machine with vitrectomy pack 23G and 25G), with vitrectomy probe, fibre-optic light source, controlled air and fluid infusion (including viscous fluid injection and removal), diathermy and fragmatome, endoilluminator probe, (sleeve) tubing, sterile disposable vitrectors, footswitch, and transport case
		Trochar/cannula (23G, 25G, 27G)
		Vitrectomy plugs and plug removal forceps
3.	Forceps	Moorfield forceps
		St Martins forceps
		Fine toothed forceps (Pierse Hoskin or Colibri)
		Fine block forceps (McPherson)
		Straight artery forceps
		Curved artery forceps
		Tying forceps
		Intraocular end-gripping forceps (Eckardt or ILM forceps – 20G, 23G or 25G), or intraocular magnet
4.	Needle holders	Fine needle holders (Troutman or Barraquer)
		Needle holders (Castroviejo)
5.	Scissors	Drape scissors
		Suture scissors (straight springs)
		Tenotomy scissors (Westcott)
		Vannas spring scissors
		Intraocular scissors (vertical, curved or horizontal – 20G, 23G, or 25G)

6.	Knives, blades, and handles	Keratome knife (2.4 mm)
		Crescent angled knife (2.5 mm)
		15-degree stab knife
		MVR knife (19G, 23G, 25G)
7.	Cannulas	Simcoe cannula
		Double-barreled cannula (PFCL injection cannula)
		Silicone tipped cannula
		Backflush cannula or flute handpiece (23G, 25G)
8.	Other	Self-retaining illuminating system (chandelier illuminating system)
		Pan fundus lens with inverter
		Large autoclavable protective instrument tray
		Bipolar diathermy
		Endolaser probes
		Direct or indirect surgical lens
		Calliper
		Scleral depressor
		Scleral marker
		Lid speculum
		Lid retractor (for RD surgery)
		Muscle hook or squint hook (Graffe squint hooks)
		Fisons retractor
		Schepens retractor
		Bulldog clip
		Loop or Tano diamond-dusted scraper
		Scleral plugs (20G, 18G)
9.	Other consumables	Silicone oil packs (syringes, cannulas, and tubing for injection or removal of silicone oil)
		Silicone sponges (5 mm, 7 mm, and 8 mm)
		Silicone band (240 and 260)
		Silicone groove (3.5 mm and 5 mm)

		Silicone tyre
		Silicone sleeve
		Medical grade gas or oil tamponade (SF6 gas, C3F8 gas, 1000cs silicone oil, 5000cs silicone oil, heavy silicone oil)
		Perfluorocarbon liquid
		BSS/Hartmanns
		Preservative-free triamcinolone
		Vitreoretinal surgical dye (Trypan blue, Brilliant blue G)

6.1 Laser equipment (pan retinal, photocoagulation, focal, grid)

1.	General	Laser photocoagulator system (portable if possible)
		Endo photocoagulation probe (20G, 23G, or 25G)
		Retinal photocoagulation laser 1) Green laser: -532 nm 2) The 810 nm infrared laser, or diode laser
		Vitrectomy lens

7. Glaucoma equipment and consumables

1.	General	Calliper
		Wire speculum
		Self-retaining speculum
		12 mm blade (adult) speculum
2.	Needle holders	Fine needle holder
		Curved or straight needle holder
3.	Scissors	Vannas scissors
		Spring scissors
4.	Forceps	Plain forceps
		McPherson forceps
		Jaffe suture tying forceps
		Hoskins forceps
		Corneoscleral forceps
		Corneal forceps (Colibri)
		Superior rectus holding forceps

5.	Cannulas	Air injection cannula, 27G or 30G, blunt tip, 45-degree angled tube, 5 mm from tip to bend, disposable
		Hydrodissection cannula, 23G to 30G, 32-degree angled shaft, 8 mm from bend to tip, with flattened smooth oval-shaped tip
		Viscoelastic cannula, 23G to 27G, 11 mm from bend to tip, blunt tip
		Simcoe irrigation-aspiration cannula, 21G to 23G
6.	Knives and blades	Bard Parker handle
		15-degree blade
		Surgical blade (67 blade)
		Crescent knife
		Tooke knife
		Slit/Keratome, angled knife
		Paracentesis blade
7.	Others	Diathermy
		Kelly punch, or alternative punch
		Trabeculotomy probe
		Trabeculotome pair (right and left)
		Stainless steel gallipots
		Bandage contact lens
		Glaucoma drainage devices/implants/tube shunts
		Sponges for antifibrotic agents
		Sterile fluids (BSS)

8. Corneal equipment and consumables

1.	Suture set	Corneoscleral forceps
		Castroviejo scissors
		Westcott tenotomy scissors
		Kelman-McPherson forceps
		Jaffe tying forceps

2.	General	Wire speculum
		Self-retaining speculum
		Speculum, 12 mm blade (adult)
		Speculum, 8 mm blades (child)
3.	Needle holders	Castroviejo needle holder
		Barraquer needle holder
4.	Scissors	Conjunctival scissors
		Corneoscleral scissors (right and left)
		Vannas scissors
		Tenotomy scissors
5.	Forceps	Plain forceps
		McPherson forceps
		Jaffe suture tying forceps
		Hoskins forceps
		Corneoscleral forceps
		Colibri forceps
		Superior rectus holding forceps
6.	Cannulas	Air injection cannula, 27G or 30 G, blunt tip, 45-degree angled tube, 5 mm from tip to bend, disposable
		Hydrodissection cannula, 23G to 30G, 32 degrees angled shaft, 8 mm from bend to tip, flattened smooth oval-shaped tip
		Viscoelastic cannula, 23G to 27G, 11 mm from bend to tip, blunt tip
		Simcoe irrigation-aspiration cannula, 21G to 23G
7.	Knives and blades	Scalpel – Bard Parker handle
		Blade (no.11, no.15)
		Crescent knife
		Tooke knife
		Keratome
8.	Others	Castroviejo callipers
		Iris spatula

		Skin marker pen
		Symblepharon ring
		Ellis foreign body spud
		Epilation forceps
		Eye shield

8.1 Keratoplasty (penetrating and deep) equipment

1.	Penetrating keratoplasty	Teflon block
		Trephine (disposable corneal trephine; Castroviejo corneal trephine; suction trephine)
		Scleral fixation ring and blepharostat
		Endothelial punch
		Radial marker
		Paton spatula and spoon
		DeWecker scissors
		Bulldog forceps
		Tissue forceps
		Corneal fixation forceps
2.	Deep keratoplasty	Paufique sclerotomy knife
		Fogla pointed dissector
		Fogla air injection cannula
		Fogla trifacet spatula
		Fogla scissors (left and right)
		Corneal graft holding forceps
		Cellulose spears

9. Eyelid equipment

1.	General	Mosquito, curved forceps
		Mosquito, straight forceps
		Toothed forceps
		Non-toothed forceps

		Entropion (tarsal plate rotation) clamp (right and left, 10 cm)
		Lid plate (11 cm)
		Scissors (straight, sharp pointed)
		Desmarres lid retractor
		Lid plates: Trabut plate or TT or Waddell clamp

10. Strabismus equipment and consumables

1.	General	Open wire blade speculum
2.	Scissors	Westcott scissors
3.	Forceps	Moorfield forceps
		Tying forceps
		Hartman mosquito forceps (curved and straight)
4.	Sutures	Vicryl 1/4 spatulated 8 mm needle 6-0 for extraocular muscle surgery
		Vicryl spatulated and cutting 6 mm needle, single armed (10-0, 7-0, 8-0, 6-0)
5.	Others	Eyelid retractor (12 mm, 16 mm)
		Single small hook – Jameson hook (size 0, 1, 2)

11. Enucleation and evisceration equipment and consumables

1.	Additional to eyelid and cornea equipment	Muscle hook
		Enucleation spoon
		Fixation forceps
		Mosquito forceps (curved)
		Tenotomy scissors (curved)
		Enucleation scissors (straight)
		Eye scissors (straight)
		Evisceration scoop
		Orbital implants
		Conformer

12. Lacrimal equipment and consumables

1.	Additional to eyelid and cornea equipment	Syringe (disposable, plastic) 2cc, 5cc
		Castroviejo double ended lacrimal dilator (straight)
		Ziegler double-ended lacrimal dilator (curved)
		Bowman probes (sizes 0000-000, 00-0, 00)
		Lacrimal cannula (23G)

Annex 5. List of medicines for the Package of Eye Care Interventions

The medicines are listed for the following eye conditions: **A**: refractive error; **B**: vision rehabilitation; **C**: cataract; **D**: glaucoma; **E**: pediatrics; **F**: vitreoretina; **G**: anterior segment and adnexa.

No	PECI List of medicines	Included in the WHO EML*	Eye condition						
			A	B	C	D	E	F	G
1.	**Mydriatics/dilating drops/cycloplegics**								
	Adrenaline, 1 mg/ml injection	✓	–	x	x	x	x	x	x
	Atropine sulphate eye drops, 0.5–1%	✓	x	x	x	x	x	x	x
	Cyclopentolate hydrochloride, 0.5–1% eye drops	✓	x	x	x	x	x	x	x
	Tropicamide, 0.5–1% eye drops	✓	x	x	x	x	x	x	x
	Homatropine, 2% eye drops, 5 ml	✓	x	x	x	x	x	x	–
	Epinephrine (adrenaline), 2% eye drops	✓	x	x	x	x	x	x	x
2.	**Local anaesthetic preparations**								
2.1	*Topical*								
	Amethocaine (tetracaine) hydrochloride, 0.5% eye drops, 10 ml	✓	–	–	x	x	x	x	x
2.2	*Local preparations*								
	Bupivacaine hydrochloride, 0.5%, 20 ml injection	✓		–	x	x	x	x	x
	Lidocaine hydrochloride 2% 50ml Injection (without or with 1:100,000 epinephrine)	✓			x	x	x	x	x
3.	**General anaesthetic preparations**								
	Ketamine hydrochloride, 50 mg/ml injection, 10 ml	✓	–	–	–	x	–	–	–
	Propofol (Diprivan), 1% (10 mg/ml), 20 ml	✓	–	–	–	x	x	–	–
	Suxamethonium chloride, 50 mg/ml, 2 ml	✓	–	–	–	x	x	–	–
	Ibuprofen suspension, 100 mg/5 ml, 100 ml	✓	–	–	–	–	x	–	–
	Ibuprofen tablets, 200 mg	✓	–	–	–	–	x	–	–
	Morphine HCL, 10 mg/ml, 1 ml	✓	–	–	–	–	x	–	–
	Paracetamol, 120 mg/5 ml suspension, 100 ml	✓	–	–	–	–	x	–	–

No	PECI List of medicines	Included in the WHO EML*	Eye condition						
			A	B	C	D	E	F	G
4.	**Antibiotics**								
	Povidone-iodine 5%, 10% aqueous solution (200ml)	✓	–	–	x	x	x	x	x
4.1	*Topical antibiotics*								
	Ofloxacin eye drops, 0.3%	✓	–	–	x	x	x	x	x
	Ciprofloxacin eye drops, 0.3%	✓	–	–	x	x	x	x	x
	Gentamicin eye drops, 0.3%	✓	–	–	–	x	–	–	x
	Tobramycin eye drops, 0.3%	✓	–	–	x	x	x	x	x
	Erythromycin eye ointment, 0.5%	✓	–	–	x	x	x	x	x
	Tetracycline eye ointment, 1%, 5 gm	✓	–	–	x	x	–	–	x
4.2	*Oral antibiotics*								
	Ciprofloxacin, 500 mg	✓	–	–	x	x	–	x	–
	Trimethoprim-sulfamethoxazole, 160–800 mg P.O.	✓	–	–	x	–	–	x	x
	Pyrimethamine, 25–100 mg P.O.	✓	–	–	x	–	–	x	x
	Sulfadiazine, 2–4 g P.O.	✓	–	–	x	–	–	x	x
	Amoxicillin oral suspension	✓	–	–	–	–	x	–	–
	Amoxicillin and clavulanic acid oral suspension	✓	–	–	–	–	x	–	–
	Doxycycline, 50–100 mg P.O.	✓	–	–	–	–	–	–	x
	Azithromycin, 1–2 g P.O.	✓	–	–	–	–	–	–	x
4.3	*Parenteral antibiotics*								
	Vancomycin, 500 mg, 1 gm for injection	✓	–	–	x	–	x	x	x
	Ceftazidime, 1 gm powder for injection	✓	–	–	x	–	x	x	x
	Cefuroxime, 750 mg or 250 mg powder for injection	✓	–	–	x	–	x	x	–
	Ceftriaxone. 250 mg; 1 g for injection	✓	–	–	x	–	x	x	–
	Gentamicin injection, 40 mg/ml; 2 ml for subconjunctival use	✓	–	–	x	x	x	x	–
5.	**Antivirals**								
5.1	*Topical antivirals*								
	Topical acyclovir, 3% eye ointment	✓	–	–	–	–	–	–	x

No	PECI List of medicines	Included in the WHO EML*	Eye condition						
			A	B	C	D	E	F	G
5.2	*Oral antivirals*								
	Valacyclovir, 500–1000 µg	✓	–	–	–	–	–	–	x
6.	**Anti-fungals (topical)**								
	Natamycin eye drops, 5%	✓	–	–	–	–	–	–	x
7.	**Additional drugs – Acanthamoeba keratitis**								
	Topical chlorhexidine, 0.02–0.04%	–	–	–	–	–	–	–	x
8.	**Steroids**								
8.1	*Topical steroids*								
	Prednisolone sodium phosphate eye drops, 0.5%	✓	–	–	x	x	x	x	x
	Hydrocortisone, 1% eye ointment	✓	–	–	–	–	–	–	x
8.2	*Oral steroids*								
	Prednisolone, 0.5–1 mg/kg/day P.O.	✓	–	–	x	x	x	x	x
8.3	*Steroids for intravitreal and subconjunctival use*								
	Dexamethasone sodium phosphate 4 mg/ml, 1 ml injection for subconjunctival use	✓	–	–	x	–	x	x	x
8.4	*Parenteral steroids*								
	Methylprednisolone, 1 g IV	✓	–	–	–	–	–	x	x
9.	**Antibiotics and steroid combinations**	**–**	**–**	**–**	**x**	**x**	**x**	**x**	**x**
10.	**Topical lubricating drops/artificial tear substitutes (preservative-free where possible)**								
	Carboxymethylcellulose eye drops, 0.2–1%	–	–	–	x	x	x	x	x
	Hydroxyethyl cellulose, Hydroxypropyl methylcellulose eye drops, 0.2–2.5%	–	–	–	x	x	x	x	x
	Propylene glycol, polyethylene glycol, glycerin eye drops, 0.2–1%	–	–	–	x	x	x	x	x
11.	**Miotics and glaucoma preparations**								
	Pilocarpine eye drops, 1–2%	✓	–	–	x	x	x	–	–
11.1	*Prostaglandin analogues*								
	Latanaprost, 50 mcg/ml eye drops, 2.5 ml	✓	–	–	–	x	x	–	–
11.2	*Beta blockers*								

No	PECI List of medicines	Included in the WHO EML*	Eye condition						
			A	B	C	D	E	F	G
	Timolol maleate eye drops, 0.25–0.5%, 5 ml	✓	–	–	–	x	x	–	–
11.3	*Carbonic anhydrase inhibitors*								
	Oral acetazolamide, 250 mg	✓	–	–	x	x	x	x	–
11.4	**Others**								
	Intravenous mannitol, 10–20%	✓	–	–	x	x	x	x	–
	5-Fluorouracil, 250 mg/5 ml	✓	–	–	–	x	x	–	–
	Mitomycin C, 0.1–0.5 mg/ml	–	–	–	–	x	x	–	x
12.	**Chemotherapy agents for retinoblastoma (dose adjusted based on age)**								
	Vincristine IV infusion	✓	–	–	–	–	x	–	–
	Carboplatin IV infusion	✓	–	–	–	–	x	–	–
	Etoposide IV infusion	✓	–	–	–	–	x	–	–
13.	**Anti-VEGF drugs**								
	Bevacizumab, 1.25 mg/0.05 ml	✓	–	–	–	–	–	x	–
14.	**Immunosuppressive drugs**								
14.1	*Oral immunosuppressants*								
	Azathioprine, 2.0–2.25 mg/kg/day	✓	–	–	–	–	–	x	x
	Methotrexate, 15–20 mg/wk	✓	–	–	–	–	–	x	x
	Ciclosporine, 25 mg	✓	–	–	–	–	–	x	x
	Tacrolimus, 0.5–5.0 mg	✓	–	–	–	–	–	x	x
15.	**Systemic biological agents**								
	Adalimumab, 40 mg s/c	✓	–	–	–	–	–	x	x
	Infliximab	✓	–	–	–	–	–	x	x
16.	**Disinfectants**								
	Alcohol-based hand rub (isopropyl alcohol 75%)	✓	–	–	x	x	x	x	x
	Chlorhexidine aqueous, 0.5%	✓	–	–	x	x	x	x	x
17.	**Consumables**								
	Fluorescein strips	–	–	–	x	x	x	x	x

No	PECI List of medicines	Included in the WHO EML*	Eye condition						
			A	B	C	D	E	F	G
	Fluorescein eye drops, 1%	✓	–	–	x	x	x	x	x
	Balanced salt solution	–	–	–	x	x	x	x	x
	Methylcellulose or other coupling agents	–	–	–	x	x	x	x	x
	Fibrin glue	–	–	–	–	–	–	–	x
	Trypan blue, 0.06%, 1 ml	–	–	–	x	–	–	x	x
	Tamponade agents (SF6 and C3F8 gas)	–	–	–	–	–	–	x	–
	Perfluorocarbon liquid	–	–	–	–	–	–	x	–
	Scrubbing brush	–	–	–	x	x	x	x	x
	Antiseptic handwash solution (500 ml)	–	x	x	x	x	x	x	x

* This column showcases categories of medicines and lists drugs that are also included within the World Health Organization Model List of Essential Medicines – WHO EML (https://www.who.int/publications/i/item/WHO-MHP-HPS-EML-2021.02) in order to maintain homogeneity with existing and approved drugs.

Annex 6. Assistive product requirements for the vision rehabilitation interventions

Rehabilitation interventions	Equipment and consumables[1]	Included in WHO Priority Assistive Products List (WHO-APL)[2]
Use of optical assistive products	Magnifiers (spectacles, hand-held, stand, illuminated, dome)	✓
	Telescopes in different powers	–
	Spectacles: low vision, short distance, long distance, filters and protection	✓
Use of non-optical assistive products	Audiobooks (audio players with DAISY capability)	✓
	Braille books, Braille writers and paper	✓
	Communication boards/books/cards	✓
Use of electronic assistive products	Digital magnifiers	✓
	Screen readers	✓
	Simplified mobile phones	✓
	Video communication devices	✓
	Keyboard and mouse emulation software	✓
	Personal digital assistant	✓
	Recorders	✓
	Braille displays	✓
	Talking/tactile watches	✓
	Alarm signallers with light/sound/vibration	✓
	Personal emergency alarm systems	✓
	Closed captioning displays	✓
	Communication software	✓
	Deafblind communicators	✓
	Gesture to voice technology	✓
Activities of daily living and mobility devices	Filters	✓
	Fall detectors	✓
	Standing frames, adjustable	✓

Rehabilitation interventions	Equipment and consumables[1]	Included in WHO Priority Assistive Products List (WHO-APL)[2]
	Canes/sticks, various types	✓
	Modified walkers (walking frames, walkers)	✓
	Electronic navigation systems: global positioning system locators	✓
	Hand rails/grab bars	✓
	Resources on sighted guide techniques	–

[1] WHO specifications for several of the listed assistive products can be found in the document 'Assistive product specifications and how to use them' (https://apps.who.int/iris/rest/bitstreams/1333963/retrieve).

[2] This column showcases equipment and consumables that are also included within the World Health Organization Priority Assistive Products List (https://www.who.int/publications/i/item/priority-assistive-products-list).

Annex 7. Recommended eye care interventions/resources that can be easily, safely and effectively delivered at primary-level health facilities in low-resource settings

This section outlines recommendations on a set of low-cost, high-impact, evidence-based eye care interventions/resources that can be easily, safely and effectively delivered at primary-level health facilities in low-resource settings, and the minimum essential equipment and consumable requirements for their provision.

List of interventions for the Primary Eye Care Package, stratified by health service type and relevance to life-course.

Intervention[1]	Short description	Essential	Life-course
Health promotion, education and counselling			
Health education and counselling to promote good eye health practices and prevention strategies	Health education and counselling measures with the help of posters, promotion material, and mHealth tools to raise awareness on good eye health practices and prevention strategies. This may include education on: Nutrition and immunization (Early childhood) Myopia prevention and spectacle compliance (Early childhood to Later adulthood) Risk factors for diabetic retinopathy among people with diabetes (Early adulthood to Later adulthood) Lifestyle or behavioural risk factors for eye conditions (Later adolescence to Later adulthood) Importance of regular comprehensive eye examinations (All ages) Counselling on good eye health practices and prevention strategies for the spread of eye infections (All ages) Ocular injury prevention (All ages).	x	–
Screening and prevention			
Screening of infants to detect pediatric eye conditions	Screening of infants for the detection of congenital and/or acquired eye conditions including eye infections, and general eye health assessment[2] with timely referral to appropriate level of care, where indicated.	x	Neonatal (<1 month, preferably within 72 hrs of birth)
Vision testing and general eye health assessment	Relevant ocular medical history, vision testing and assessment of general eye health status with timely referral to appropriate level of care, where indicated.	x	Early childhood to Later adulthood (Pre-school: 3–5 years); School age (5–18 years); Older adults; Persons with diabetes of all ages

Intervention[1]	Short description	Essential	Life-course
Treatment			
Measuring near vision and provision of readymade spectacles for near vision correction	Measuring and recording near visual acuity of persons aged 40 years and over using standard near-reading chart with provision of readymade reading spectacles, where indicated.	x	Early adulthood to Later adulthood (adults aged 40 years and over)
Provision of first aid care and referral for ocular discomfort (red eye, vision loss, and/or external eye conditions)[3]	Provision of treatment and/or first aid care for persons presenting with red eye and/or abnormal lashes with advice on follow-up and timely referral to appropriate level of care if there is little or no improvement. Persons presenting with vision loss, swelling of the eye, and/or any growth on the eyeball should be counselled and referred immediately to appropriate level of care.	x	All ages
Provision of immediate first aid care and referral for eye injury[4]	Provision of immediate first aid care for persons presenting with eye injury that includes blunt injury, corneal abrasions, foreign body, sharp or penetrating injury, and burns with urgent referral to appropriate level of care.	x	All ages
Rehabilitation			
Provide advice to optimize the living environment for persons with vision impairment	Provide advice to optimize the living and working environment and minimize the risk of falls for persons with vision impairment. Recommendations can be offered on how to best manage daily activities; use of fall-detection devices; use of white canes; and modification of environments to facilitate accessibility and independence.	–	All ages
Provision of assistive products for persons with vision impairment or blindness	Provision of assistive products that include optical, non-optical, and electronic devices, where available.	–	All ages
Referral to group programmes and psychological support for persons with vision impairment or blindness	Referral and/or delivery of mental health support aimed at the prevention, treatment or counselling of depression, anxiety, fatigue or grief related to (progressive) vision loss, either individually or in groups, led by mental health-care professionals or peers.	x	All ages

[1] In line with the referral system in use in a country's health infrastructure, all cases which go beyond the scope of primary care require referral to the appropriate eye care and rehabilitation professionals.

[2] **General eye health assessment** includes assessment of the eye and its surrounding structures with respect to shape, colour, size, position, direction, and lid closure to be able to identify any abnormalities.

[3] **Ocular discomfort** includes red eye, with or without pain; discharge and/or itching; abnormal lashes; swelling of the eye; growth/lump on the eyeball; loss of vision; and other vision related complaints (double vision, night blindness, photophobia, constricted vision, colour blindness, etc.

[4] **Eye injury** includes blunt injury, corneal abrasions, foreign body, sharp or penetrating injury, and burns (including chemical burns).

Annex 8. Minimum essential equipment and consumables, medicines and deliverable health products for integration of eye care into primary care facilities

Equipment and Consumables (essential)			
1	Pen and record card	7	Eye shield (adhesive tape, eye pad, cotton wool, thin cardboard, scissors)
2	Vision screening charts for near and distance	8	Clean gauze
3	Measuring tape/string	9	Cotton bud
4	Pinhole	10	I.V. infusion set for irrigation
5	Torchlight with spare bulb and battery	11	Personal protective equipment (PPE)
Equipment and Consumables (desirable)			
1	Epilating forceps (in trachoma endemic areas)		
Medicines (essential)			
1	Irrigating fluid (saline/universal buffer solution and/or sterile/filter water)	4	Vitamin A tablet and syrup[1] 200 000 IU (as palmitate) capsule 100 000 IU per ml (as palmitate) oral oily solution in multidose dispenser
2	Antibiotics (topical) Ofloxacin eye drops, 0.3% (EML) Ciprofloxacin eye drops, 0.3% (EML) Erythromycin eye ointment, 0.5% (EML) Tetracycline eye ointment, 1% (EML)	5	Anaesthetic (topical) Amethocaine (tetracaine) hydrochloride 0.5% eye drops 10 ml (EML)
3	Lubricating/tear substitutes (topical) Carboxymethylcellulose eye drops, 0.2–1% Hydroxyethylcellulose; hydroxypropyl methylcellulose eye drops, 0.2–2.5%	6	Injection tetanus toxoid (EML) Intramuscular, 50 000 IU in vial
Deliverable health products (essential)			
1	Readymade reading spectacles (+1.50, +2.00, +2.50, +3.00)	3	WHO posters on ocular trauma and ocular hygiene
2	Referral form	4	Eye health promotion material (including posters, leaflets, and mHealth related tools)
Deliverable health products (desirable)			
1	Assistive products: Talking and touching watches, audio players, magnifiers and telescopes, white canes	2	Vision rehabilitation promotional material for primary health care and rehabilitation workers

[1] Further guidance can be found in the following WHO guideline: Vitamin A supplementation in infants and children 6–59 months of age 2011 *(46)*.

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https://www.who.int/health-topics/blindness-and-vision-loss

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