

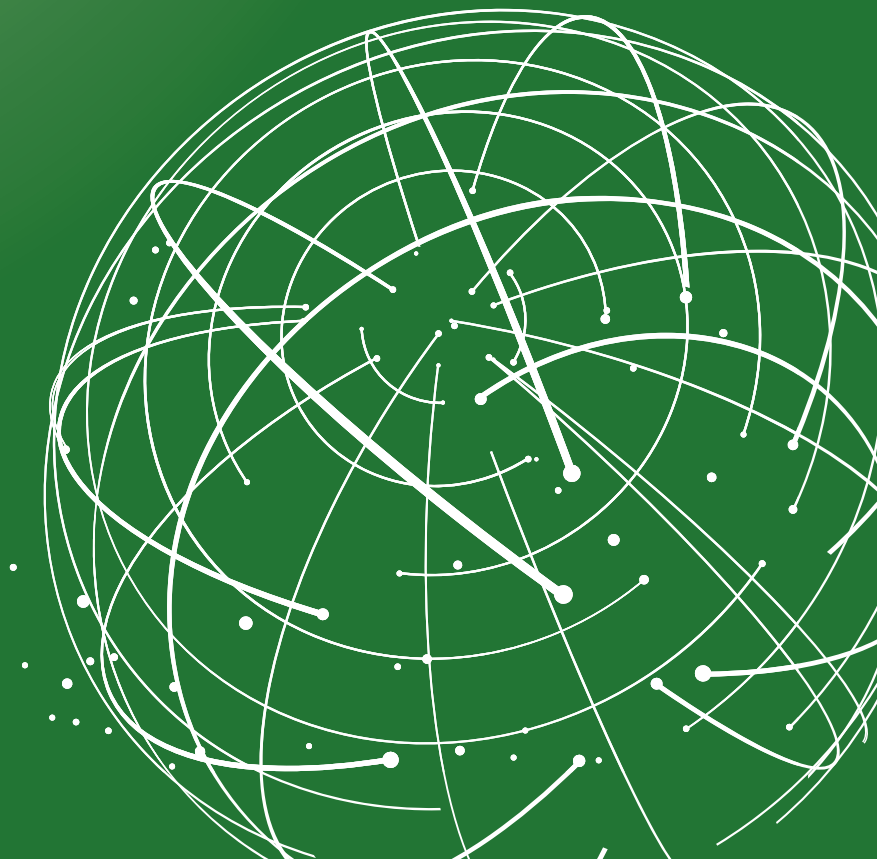


BRIGHT FUTURE

A NEW VISION FOR EYE HEALTH

Report of the WISH Eye Health Forum 2018

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FOREWORD

Vision is by far our most precious sense. Good eye health is an important part of wellbeing and a significant factor in economic and social prosperity. Good vision contributes to improved mobility, learning and comprehension. However, vision can deteriorate for many reasons and dramatically impact people's lives.

In the past, infectious diseases and nutrient deficiencies caused visual impairment in millions of people. In response, national and international prevention and treatment programs have provided millions of doses of antibiotics and other treatments to vulnerable populations over the last few decades. These programs have helped to reduce, and in some countries, eradicate causes of visual impairment.

Despite these efforts and successes, the World Health Organization estimates that more than 80 percent of blindness and serious visual loss around the world is avoidable. People are living longer, and as they age, their healthcare needs increase. Many eye diseases are directly linked to aging, including cataracts, glaucoma, age-related macular degeneration and diabetic retinopathy. Non-communicable diseases, such as diabetes – arguably the biggest health challenge in much of the world – can have a major impact on eye health. If left unchecked, it is predicted that these challenges will lead to a staggering increase in global visual impairment.

However, innovations in eye health treatments and services are providing an increasing number of solutions to these challenges. Implementing solutions such as those highlighted in this report could help bridge the divide between what is predicted and what is possible.

With the right investments, strategies and interventions, we can ensure a bright future in which all preventable visual impairment is avoided, those who are already visually impaired are fully supported and can achieve their full potential, and universal access to eye care services is a reality.



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EXECUTIVE SUMMARY

Extent and scale of global eye health challenges

Sight is our dominant sensory input. In a global YouGov survey commissioned by the World Innovation Summit for Health (WISH) in 2018, 74 percent of respondents identified sight as the most precious of the five senses. Our vision dramatically affects our awareness and perception of the world around us. Lost or impaired vision has an enormous impact on quality of life and economic productivity, as well as potentially reducing life span due to lifestyle and related health factors.^{1,2} In 2015, 36 million people worldwide were blind, and 217 million people had moderate to severe visual impairment (MSVI). Yet the World Health Organization (WHO) estimates that more than 80 percent of global visual impairment is avoidable or curable.

Health systems around the world are facing increasing pressures due to the growth and aging of their populations and a shift in the global burden of disease to age-related and largely non-communicable diseases. While the overall prevalence of blindness and MSVI reduced between 1990 and 2015, the total number of people affected by loss or deterioration of vision is increasing. The number of people in the world who are blind is expected to reach 38.5 million in 2020 and 115 million in 2050. Similarly, the number of people suffering from MSVI is expected to reach 237.1 million in 2020 and 587.6 million in 2050.

The effects of visual impairment can be devastating for individuals and their communities, particularly those in low-income countries. However, an increasing body of research shows that eye health interventions can lead to large financial returns on investment. Prevention and treatment of avoidable visual impairment can also improve overall health, wellbeing and economic and social prosperity, and help people retain their independence and quality of life.

Sustainable solutions to today's most prevalent challenges

National and international programs to eliminate trachoma, onchocerciasis and vitamin A deficiency have been highly successful over the past few decades. However, further action is required to fully eliminate the loss of vision due to these diseases. Also, much more specialized and co-ordinated care is required for age-related diseases that are growing in prevalence.

Without suitable interventions over the next few decades, there will be a dramatic increase in the number of people with visual impairment caused by uncorrected refractive error (URE) and non-communicable diseases. However, new screening and treatment programs, surgical techniques and drugs, if applied at a larger scale, could alleviate some of the significant burden of eye diseases.

Health system challenges and evidence-based solutions

In 1999, WHO and the International Agency for the Prevention of Blindness (IAPB) launched a global initiative, VISION 2020: The Right to Sight. The goal was to eliminate the main causes of all preventable and treatable blindness by the year 2020 through disease control, training programs for healthcare personnel, and developing infrastructure and appropriate technology. The VISION 2020 initiative has created an unprecedented level of international awareness around eye health. As a result, many countries have made significant improvements in their provision of eye care.

Some countries have developed innovative funding and financing models. However, as the growing and aging population begins to impact the eye health landscape, funding for preventive services or long-term treatments will need to be prioritized. Universal eye health coverage should be included as part of a broader shift toward full universal health coverage. Similarly, access to services will need to improve, especially in rural or remote areas where it is currently limited or non-existent. Also, more extensive education and training programs will be needed to improve the skills and talent of the current and future healthcare workforce.

Transforming eye health today and tomorrow

New models of care are needed to keep pace with future challenges, such as workforce shortages and the increase in the world population aged 60 years and over. These models are likely to involve new or hybrid roles for eye health professionals and promote collaboration across different levels of care. Other innovative strategies, such as mobile eye health clinics, virtual clinics and teleophthalmology services, will play a prominent role in improving access to and quality of care. Technological advances in cellular-level digital imaging and screening, enabled by new applications of artificial intelligence (AI), should help reduce time to diagnosis and treatment, reduce cost and eliminate human

error. Meanwhile, new drugs and delivery systems, including the use of stem cells, nanomedicine, gene therapy and microdevices have the potential to reverse the effects of some eye health conditions.

Policy recommendations

Without appropriate and effective intervention in global eye health, visual impairment is predicted to increase to unprecedented levels in the next few decades. To address this challenge, we have developed five evidence-based policy recommendations for policymakers in all countries to improve equity of access to good eye health. These are supported by evidence-based case studies throughout this report.

1. Prioritize the most precious sense

Raise the priority of eye health, and adopt policies that address inequalities by promoting early, equitable access to prevention, diagnosis and treatment services. Support these policies with evidence of the very high socioeconomic return on investment that can be achieved through improving eye health.

2. Invest in sustainable, universal eye health

Ensure that all people have access to information on maintaining good eye health, and provide preventive, curative and rehabilitative eye health services. Monitor performance through agreed key activity and outcome indicators, while also ensuring that service users are not exposed to financial hardship.

3. Embrace the power of partnership and collaboration

Utilize the skills and knowledge of key public, private and not-for-profit stakeholders in eye health through partnerships and collaborations to combine talent, expertise, technology and purpose to solve complex problems and work toward common goals.

4. Promote excellence in education and training

Develop and deliver effective education programs for the healthcare workforce, and support new ways of working, including task-shifting (moving appropriate tasks to less specialized health workers). Develop self-management educational tools to enable people to understand the risk factors and become co-creators in managing their own eye health.

5. Utilize technology and innovation

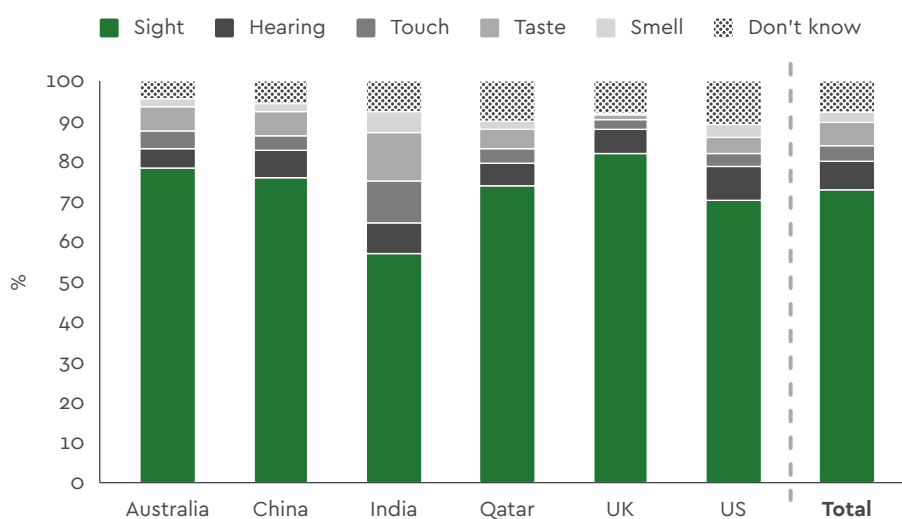
Invest in collaborative research and development, and use incentives and financial models to encourage the adoption of new technologies that can impact eye health worldwide.

SECTION 1. EXTENT AND SCALE OF GLOBAL EYE HEALTH CHALLENGES

Magnitude and causes of visual impairment today

Lost or impaired vision has an enormous impact on quality of life, economic productivity and life span. For this report, we commissioned a survey from YouGov that asked 6,496 people across six countries (UK, Australia, US, China, India and Qatar) which of their five senses is most precious to them. More than 74 percent of respondents (4,821 people) answered "sight" (see Figure 1a). These findings correlate with a 2016 study, which found that sight is the sense many people fear losing most – as much as or more so than losing memory, speech or a limb. When considering the possible consequences of vision loss, quality of life ranked as the top concern, followed by loss of independence.³ Other studies have found that the impact vision loss can have on quality of life can be similar to that experienced by people suffering from cancer, intractable pain and stroke.⁴

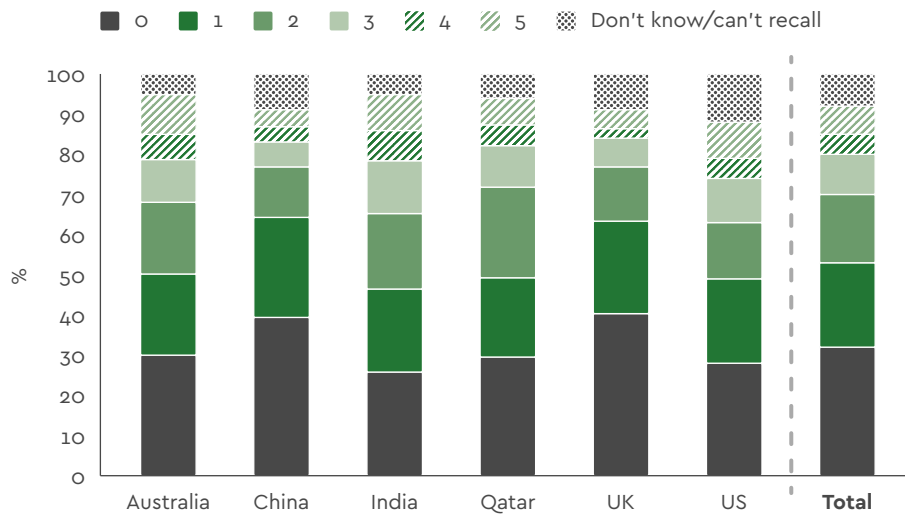
Figure 1a. Results from the WISH YouGov survey, "Which ONE of your five senses is the most precious to you?"



Source: YouGov, 2018

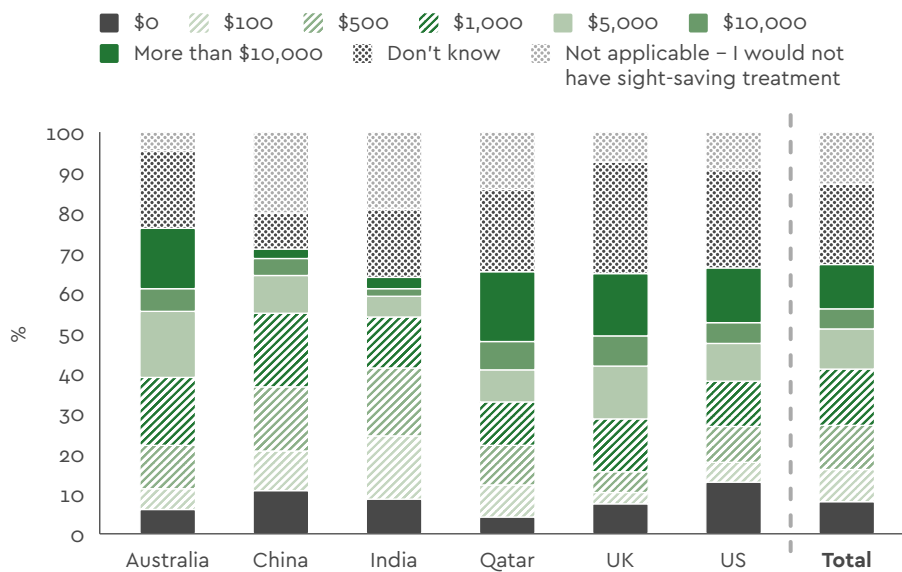
Eye problems are common around the world. Our survey found that more than 58 percent of our respondents (3,763) have at least one person in their immediate family who currently suffers or previously suffered from an eye problem more severe than needing to wear spectacles for long- or shortsightedness (see Figure 1b). Also, 28 percent would be prepared to spend \$5,000 or more for sight-saving treatment, and only 9 percent would not be prepared to spend anything (see Figure 1c).

Figure 1b. Results from the WISH YouGov survey, "Including yourself, how many people in your family, if any, currently have or have ever had an eye problem?*"



* By "eye problem", we mean anything more severe than common eye problems like needing to wear glasses for long- or shortsightedness (eg conjunctivitis, pink eye, eye allergies, etc.). By 'family', we mean your immediate family such as parents, brother, sister, child(ren) as well as your extended family (eg aunt, uncle, cousin, brother/sister-in-law, etc.).
Source: YouGov, 2018

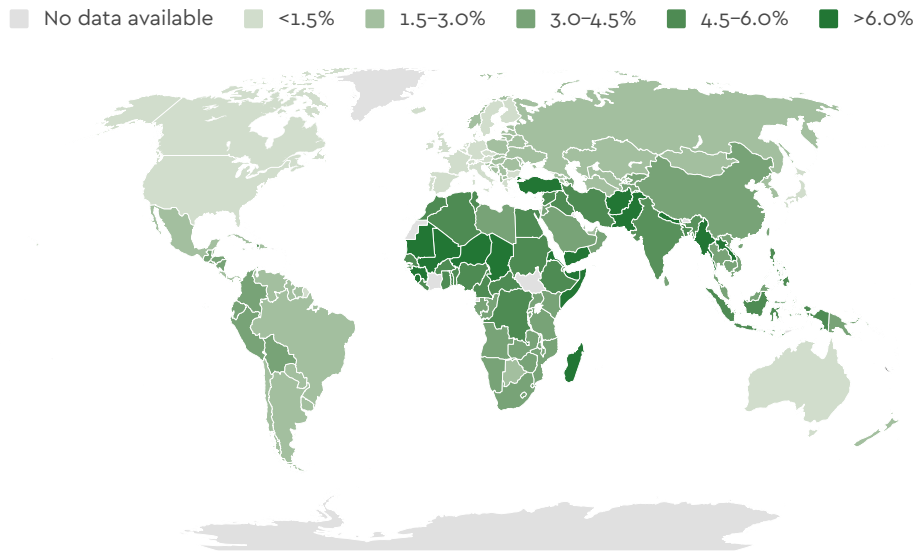
Figure 1c. Results from the WISH YouGov survey, "Please imagine you needed sight-saving eye treatment... Approximately how much, if anything, would you be prepared to spend on sight-saving eye treatment for yourself? (Please select the option that comes closest. If you would not have sight-saving treatment please select the 'Not applicable' option).*"



* By "sight-saving treatment", we mean surgery to correct blindness or treat visually impairing diseases, rather than laser eye surgery to correct imperfect vision.
Source: YouGov, 2018

In 2015, an estimated 36 million people worldwide were blind, and 217 million people had MSVI. Prevalence of visual impairment (blindness and MSVI) varies around the globe, and 89 percent of visually impaired people live in low- and middle-income countries (see Figure 2). However, over 80 percent of visual impairment is avoidable or curable.⁵

Figure 2. Global prevalence of visual impairment (blindness and MSVI)

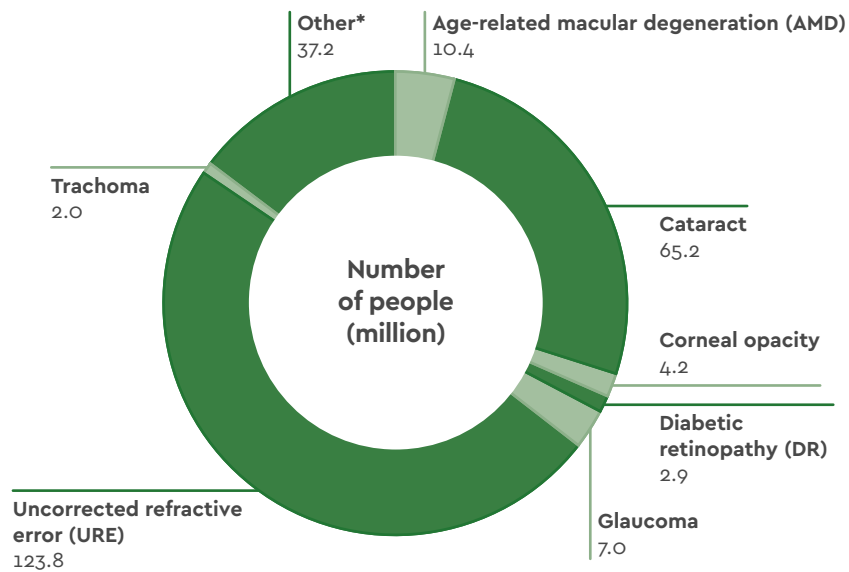


Source: IAPB Vision Atlas, 2018

The leading causes of visual impairment globally are shown in Figure 3. Uncorrected refractive error and cataracts are the two leading causes, accounting for 189 million people – nearly 75 percent of all cases. Diseases such as age-related macular degeneration (AMD), glaucoma, corneal opacity, diabetic retinopathy, and trachoma also cause high levels of visual impairment. 'Other' causes, which are less common and are often not identified or disaggregated in population studies, include rarer forms of macular degenerative conditions, retinopathies, optic neuropathies, and amblyopia. Some of these are genetic or the result of cancers, or they can be brought on by factors such as infectious disease during pregnancy, premature birth, and poor nutrition in mothers and children.

The overall prevalence of visual impairment reduced between 1990 and 2015. However, the growth and aging of the global population mean that the number of people affected by many eye diseases is increasing. Projections to 2020, an important milestone for WHO's Universal Eye Health: A global action plan 2014–2019, show that the prevalence of avoidable visual impairment is not decreasing fast enough to keep pace with the rapid demographic changes in the world's population.

Figure 3. Causes of visual impairment worldwide

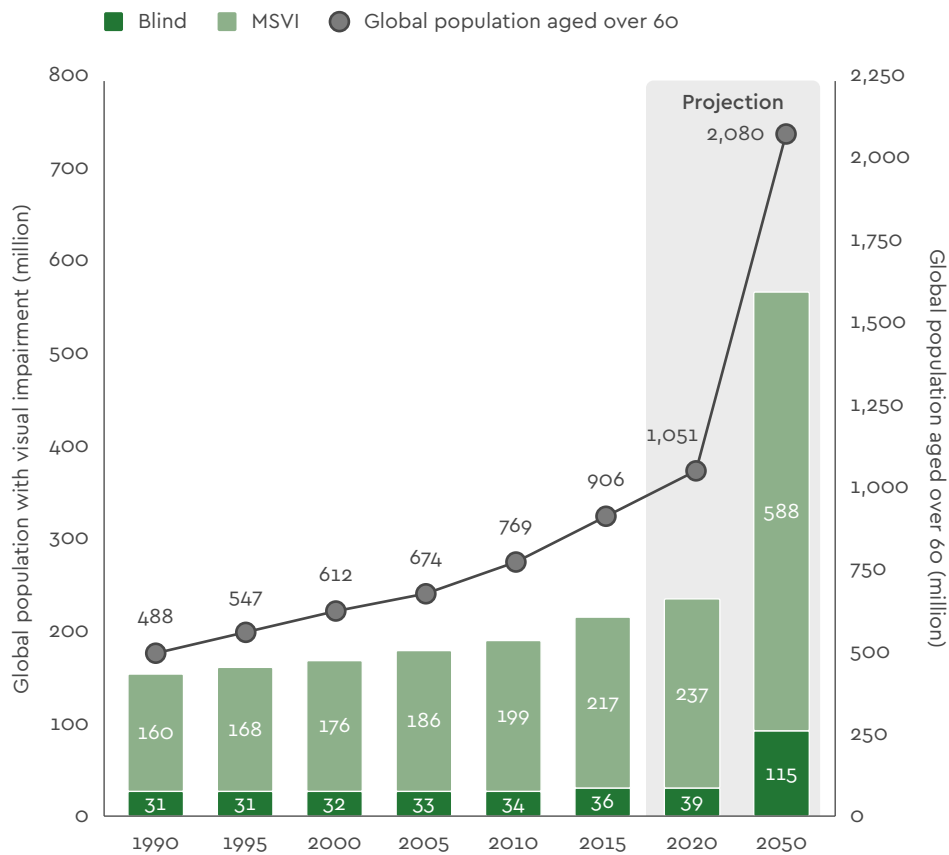


* Includes rarer forms of macular degenerative conditions, retinopathies, optic neuropathies, and amblyopia.
Source: IAPB Vision Atlas, 2018

Demographic changes and future projections of sight loss

Without significant investment and intervention, millions more people will suffer from preventable visual impairment in the future. Due largely to aging, the number of people who are blind is expected to increase from 36 million in 2015 to 38.5 million in 2020 and to 115 million in 2050. Similarly, the number with MSVI is expected to increase from 216.6 million in 2015 to 237.1 million in 2020 and 587.6 million in 2050, meaning that the total number of people with visual impairment will reach 703 million by 2050 (see Figure 4).⁶

Figure 4. Estimated number of people suffering from blindness or MSVI over time



Source: IAPB Vision Atlas and WHO, 2018

The economic and health impact of eye morbidity

The burden of eye disease in low-income countries can be devastating for the individual. Where it impacts on those of working age, it can also affect the prosperity, living conditions, health and wellbeing of whole families. However, many health systems, particularly in low-income settings, are chronically underfunded, and eye health is rarely a priority. Regardless of country income level, prevention and treatment of avoidable visual impairment can improve people's overall health and wellbeing and increase economic participation.

Eye health interventions often lead to large financial returns on investment (ROI) to societies. This is because the individuals who are treated can remain in or return to the workforce, and those in old age are able to live independently for longer. Open-angle glaucoma therapy can result in a 4,000 percent ROI, and cataract surgery can result in a 4,500 percent ROI. Both interventions would make a significant indirect contribution to gross domestic product.⁷

The World Bank included cataract and trichiasis surgery in its list of 44 essential surgeries that address substantial needs, are cost-effective, and can feasibly be implemented.⁸ Also, the *Investing in vision* study estimated that the additional income generated from investing in health systems and treating those with blindness or visual impairments would outweigh the costs by a factor of four to one in low-income settings.⁹

For many policymakers, competing social priorities require difficult decisions. Interventions must demonstrate clearly that they are cost-effective and result in positive health outcomes. Evidence has shown that eye health interventions can greatly reduce poverty and levels of ill-health, thereby justifying investment in accessible, quality eye health services for all.

SECTION 2. SUSTAINABLE SOLUTIONS TO TODAY'S MOST PREVALENT CHALLENGES

Eliminating communicable diseases and micronutrient deficiencies that lead to blindness

In the past few decades, national and international programs to improve the prevention and effective treatment of a number of communicable diseases and micronutrient deficiencies have led to considerable progress in limiting vision loss. This section briefly examines the causes of some of most debilitating and prominent eye diseases in recent history, and the progress that is being made.

Trachoma – the world's leading cause of infectious blindness

In April 2018, 157.7 million people lived in trachoma endemic areas and were at risk of irreversible blindness caused by the disease.¹⁰ Visual impairment from trachoma is entirely preventable, and many countries are attempting elimination programs using a strategy recommended by WHO known as SAFE (Surgery, Antibiotic treatment, Facial cleanliness, Environmental improvement), adopted in 1993. In 1996, WHO launched the Alliance for the Global Elimination of Trachoma by 2020 (GET2020), a partnership that supports implementation of the SAFE strategy.¹¹ In 2017, surgery was performed on 231,447 people, and 83.5 million people received antibiotics for the elimination of trachoma. To date, seven countries have been declared trachoma free (Cambodia, Ghana, Lao People's Democratic Republic, Mexico, Morocco, Nepal and Oman), and a further five (China, Gambia, Iraq, Islamic Republic of Iran and Myanmar) have achieved their prevalence targets.¹²

Onchocerciasis (river blindness) – the world's second highest cause of infectious blindness

Three WHO regions, covering 198 million people, are affected by transmission of the parasite *Onchocerca volvulus*, which can lead to onchocerciasis, also known as river blindness: the African Region, the Region of the Americas, and the Eastern Mediterranean Region. Current infection prevalence is estimated at 17 million people, with 1.1 million disability-adjusted life years lost in 2015 due to the disease. Previously, WHO created three targeted programs to combat onchocerciasis, based on treating infections with ivermectin to kill the microfilariae that cause the disease.¹³ The number of people treated at least once for onchocerciasis has increased dramatically, but challenges do still exist. In response, WHO created the Onchocerciasis Technical Advisory Subgroup (OTS) in March 2017, which is developing research strategies to help make evidence-based programmatic decisions.¹⁴

Vitamin A deficiency (VAD) – the leading cause of preventable blindness in children

VAD is a public health problem in more than half of all countries. It increases the risk of disease and death from severe infections, and is the leading cause of preventable blindness in children. About 250 million preschool-aged children are vitamin A deficient, and between 250,000 and 500,000 children become blind each year from VAD, half of whom die within 12 months of losing their sight.¹⁵ To combat VAD, more than 80 countries have implemented vitamin A supplementation (VAS) programs that deliver high doses of preformed vitamin A twice a year.¹⁶ These programs can reduce child blindness by up to 70 percent.¹⁷

Lessons from elimination programs

These and other national and international programs to eliminate trachoma, onchocerciasis and VAD have been highly successful in the past few decades. However, further action is required to eliminate vision loss caused by these diseases. With the exception of surgical treatment for trichiasis, prevention and treatment for these diseases is through a 'one size fits all' strategy, where a pill is given to all individuals in a large community once or twice a year. For many other eye diseases, especially those becoming more prevalent because of our aging population and the rise of non-communicable diseases, accurate diagnosis and more specialized and co-ordinated care is required. In the next section, we examine the increasing demand on healthcare systems, and the impact of a few selected interventions.

Non-communicable diseases and uncorrected refractive error

Uncorrected refractive error (URE) – the leading cause of visual impairment

Refractive errors occur when the eye cannot focus clearly, leading to blurred vision. The three most common refractive errors (not including presbyopia, which can be corrected with plus powered spectacles, more commonly known as reading glasses) are myopia (shortsightedness), hyperopia (longsightedness), and astigmatism (distorted vision resulting from an irregularly curved cornea).¹⁸

These refractive errors affect a large proportion of global populations regardless of age, gender or ethnic group, but can be easily diagnosed, measured and corrected with a pair of spectacles, contact lenses or refractive surgery.¹⁹

However, uncorrected refractive errors (UREs) can result in visual impairment, and result in blindness in an estimated 7.4 million people worldwide. UREs are the leading cause of MSVI, affecting an estimated 116.3 million people. Overall URE is the world's leading cause of visual impairment.²⁰

In much of the world, barriers to correcting refractive errors, such as accessibility of screening and affordability of spectacles, are compounded by the general public's poor understanding of the conditions. Children are especially vulnerable, as UREs can lead to developmental or educational challenges that affect future social or work prospects.²¹

Cataracts – the most common cause of blindness

An estimated 12.6 million people were blind due to cataracts in 2015, and a further 52.6 million people had MSVI due to cataracts.²² Overall, cataracts and URE account for 74.4 percent of all cases of distance visual impairment, all of which are avoidable. However, cataract surgery – the most commonly performed surgical procedure worldwide – can reverse the effects of cataract-induced visual impairment through a fast one-time procedure with an extremely high success rate and minimal follow-up.²³

There are two main forms of cataract surgery: manual small-incision cataract surgery (MSICS) and phacoemulsification (phaco). The lower costs of disposables and maintenance, wider applicability, time savings, shorter learning curve for healthcare workers, safety and efficacy make MSICS the method most commonly used in low- and middle-income countries (LMICs).²⁴

Glaucoma – the most common cause of irreversible blindness

In 2015, glaucoma caused blindness in an estimated 2.9 million people, and a further 4 million people had MSVI due to glaucoma.²⁵ In the most common form of glaucoma, known as primary open-angle glaucoma, drainage canals in the eye slowly clog over time. This leads to increased eye pressure and damage to the optic nerve and, if left untreated, blindness. However, numerous treatments are available, including eye drops, laser treatment, and surgery.²⁶

Although glaucoma is currently incurable, early diagnosis and treatment can help stop progression of the disease. In LMICs, the primary challenge is access to treatment. In high-income countries, patient adherence is the main challenge, because topical treatments such as eye drops often require multiple applications per day. In both situations, a one-time surgical therapy with a complication and success rate similar to cataracts would change the paradigm of management.

Age-related macular degeneration (AMD) – a risk factor-related cause of blindness

AMD caused blindness in an estimated 2 million people worldwide and led to MSVI in 8.4 million people in 2015.²⁷ Degeneration of the macula – the small area in the centre of the retina that allows us to see fine details clearly – mainly affects central vision.

Dry AMD, the less severe form, currently has no treatment. However, a number of risk factors have been identified through research, including age, family history and genetics, race, smoking, obesity and cardiovascular disease. Some of these risk factors, such as smoking, can be modified to reduce risk.²⁸ There are treatments for wet AMD, the more severe form of which can lead to permanent loss of vision. Intravitreal (directly into the eye) injections of anti-vascular endothelial growth factor (anti-VEGF), given every one to two months to inhibit the growth of new blood vessels in the eye, are now the most common and effective treatment for wet AMD and can lead to slower progression of the disease and moderate gains in vision in some cases.²⁹

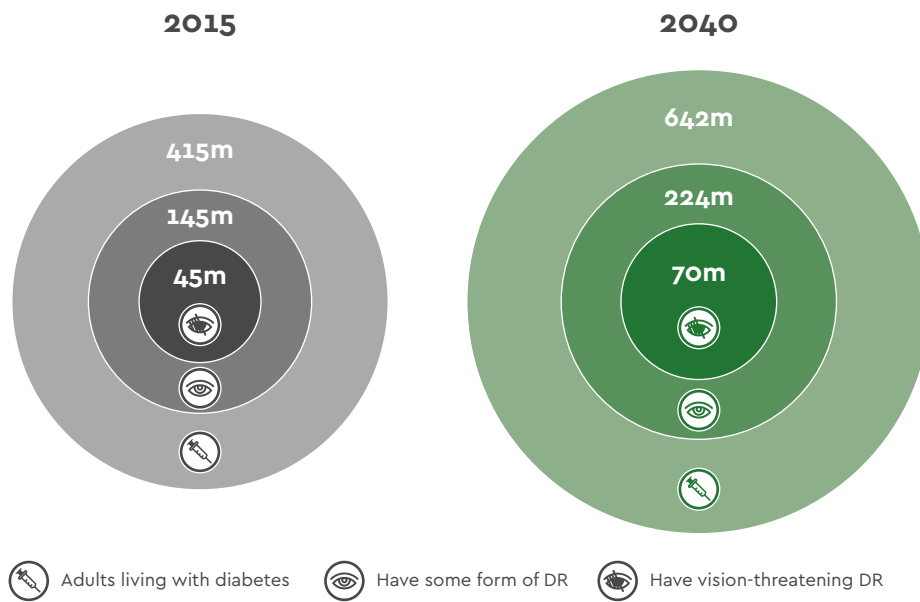
Diabetic retinopathy (DR) – a complication of diabetes mellitus

DR is a complication of diabetes mellitus, resulting in lesions on the retina. DR is usually found in patients who have had diabetes for several years. As the disease progresses, new blood vessels and scar tissue on the retina can develop, increasing the risk of retinal detachment and vision loss.³⁰

The main treatments for severe cases (stage 3) include anti-VEGF injections or surgery. About one in three people with diabetes have some degree of DR, while one in ten will eventually develop stage 3 DR, making it the leading cause of vision loss in adults aged 20 to 65 years.³¹ In 2017, an estimated 425 million people were living with diabetes,³² up from 422 million people in 2014 and 108 million in 1980.³³ By 2040, it is estimated that 642 million people will have diabetes, of which 70 million will have vision-threatening DR (see [Figure 5](#)).

In many LMICs, screening services are patchy or non-existent, and access to many treatments is severely limited. However, knowledge and understanding of the epidemiology of DR has grown in the past few decades, and screening, early detection, and prompt treatment of stage 3 DR can reduce visual impairment rates by 57 percent.³⁴ In England, the NHS Diabetic Eye Screening Programme provides annual screening for all diabetic patients over the age of 12 (see [Case study 1](#)).

Figure 5. Current and projected number of people with DR



Source: ©IAPB Vision Atlas

Case study 1. The NHS Diabetic Eye Screening Programme (NDESP)

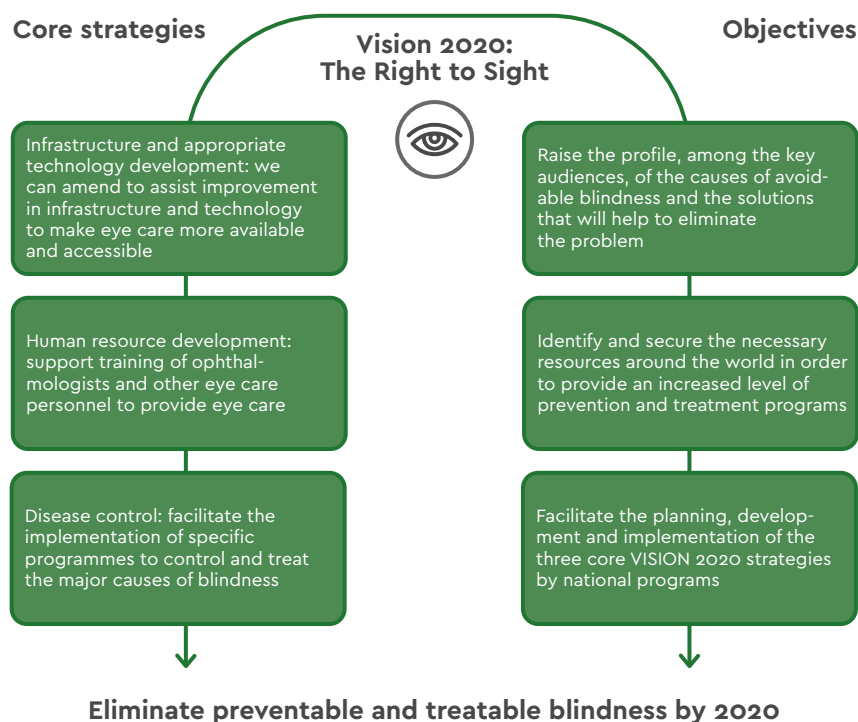
The NDESP was the first systemic national screening program for DR in the world. The program was first announced in England in 2003 and, by 2008, local retinal screening programs were available across all of the UK, allowing anyone aged 12 and older with diabetes to undergo annual screening for DR. In England, NDESP oversees more than 80 local screening programs covering the 2.5 million people over the age of 12 with diabetes – a population that grows by 5 percent (120,000) every year. From 2011 to 2012, more than 80 percent of the 2,362,000 people invited by NDESP attended the screening.³⁵ In 2014, a study found that, for the first time in more than five decades, DR was no longer the leading cause of blindness in working-age adults in England and Wales.³⁶

SECTION 3. HEALTH SYSTEM CHALLENGES AND EVIDENCE-BASED SOLUTIONS

Policy and planning priority afforded to eye health at the national and international level

Since VISION 2020: The Right to Sight launched in 1999 (see Figure 6),³⁷ several other complementary global policy initiatives have also launched, including the IAPB's VISION 2020 Action Plan 2006–2011 and WHO's Universal Eye Health: A global action plan 2014–2019, known as GAP. Supported by four World Health Assembly resolutions (2003, 2006, 2009, 2013), VISION 2020 has created unprecedented international awareness around eye health. Consequently, many countries have made improvements in provision of eye care, but the scale of the challenge remains enormous.

Figure 6. VISION 2020 – The Right to Sight



Source: WHO

Funding and financing models

In many countries, eye health funding is used primarily to treat or prevent visual impairment due to infectious diseases, with the goal of elimination. In most cases, elimination programs are making considerable progress, but the challenges facing these programs will pale in comparison to the growing aging population susceptible to numerous non-communicable diseases that affect sight. Funding for preventive services or long-term treatable conditions has been virtually non-existent in much of the world, but the main focus is now on developing universal eye health coverage. This will require maximising every funding opportunity available and removing separate funding sources. Universal eye health coverage will only become a reality if health systems are strengthened and affordable and accessible eye health services are provided as part of a broader shift toward full universal health coverage. A number of different innovative funding models in places such as Vietnam and Rwanda have led to advances in coverage and improved health outcomes.³⁸ The well-established Aravind Eye Care System in India is a leading example detailed in numerous publications,³⁹ as is the Ghana National Health Insurance Scheme (see [Case study 2](#)).

Case study 2. Ghana National Health Insurance Scheme (NHIS)

The Ghana NHIS was established in 2003 with the goal of providing universal health coverage. All residents of Ghana are eligible for NHIS coverage, including non-citizens. However, contributors to the Social Security and National Insurance Trust and those aged under 18 or over 70 do not pay premiums. This equates to about two-thirds of all NHIS members. As of 2014, the NHIS covered 10.5 million people, or 40 percent of Ghana's population, and the total annual number of inpatient and outpatient visits to health facilities had reached almost 3 per capita, up from 0.5 per capita in 2005. The NHIS is the only government health system in the world (as of 2017) that finances its health insurance scheme through value-added tax (VAT) revenue, ensuring that revenue keeps pace with economic growth. Other advantages of using VAT to finance healthcare include creating an implicit subsidy for basic care and avoiding scheme fragmentation by providing a basis for pooling risks and costs at the national level. However, the major disadvantage of the NHIS is that, as coverage expands, revenue does not increase. The NHIS covers 95 percent of all diagnosed conditions with no cost-sharing requirements, covering all outpatient, inpatient and emergency care, except for a list of excluded conditions.⁴⁰ For eye care, the NHIS covers services such as refraction, visual fields, scans, keratometry (measuring the curvature of the anterior surface of the cornea), cataract removal and eyelid surgery.⁴¹

Access to prevention and diagnostic services

Much of the world still lacks access to high-quality eye health services. These include: primary preventative services, including public education around diseases that affect vision and the effects of aging; diagnostic services, including child eye health services and screening programs; and secondary preventative and rehabilitation services. With healthcare budgets stretched even in high-income countries, innovative approaches to services are needed to improve availability of and access to high-quality services and to work toward universal eye health coverage. One such innovation, Peek Vision, focuses on building eye health capacity in LMICs through its smartphone-based technologies (see [Case study 3](#)).

Case study 3. Peek Vision



Peek Vision is a social enterprise that develops technology, health intelligence and partnerships to create sustainable, evidence-based solutions for improving access to eye care.

Specifically designed for remote and low-resource settings, Peek Vision solutions include:

- Smartphone-based vision screening
- Real-time data reporting
- Eye health service analytics.

Smartphone eye health screening and data reporting

Peek Vision smartphone screening tools enable non-specialists to conduct large-scale vision screening in schools and communities. Patients requiring specialist review are identified rapidly and reliably. Real-time data are provided to local healthcare services, joining up patient care across service providers.

Peek Acuity is a clinically validated vision check app, available for free, with more than 20,000 downloads in over 150 countries to date.⁴² Peek Vision is working with governments and non-governmental organizations to implement comprehensive eye health screening solutions at an increased scale to improve the efficiency, reach and quality of eye health services.

In Peek Vision eye health screening systems, the vision check app is embedded in a data capture and tracking system which allows health service providers to monitor patient referrals and attendance. Individuals and their carers, families or community leaders receive reminders about referral appointments, and the system generates an accurate simulation of the individual's visual acuity compared to clear vision, which reinforces the importance of attending follow-up appointments.

A recent study in Kenya showed that the Peek Vision school screening system more than doubled the proportion of school children who attended follow-up appointments, compared with conventional screening.⁴³ Since that trial, the program has expanded to cover the whole of Trans Nzoia county, and 300,000 children will have been screened by the end of 2018. The Government of Botswana have committed to using the technology to screen and treat every school child in the country, after a pilot in 2016 screened 13,000 children in three weeks.

Work is in progress in Kenya to validate the screening system's use in community settings. School and community screening programs using the technology are currently underway in six countries (Botswana, Indonesia, Kenya, Pakistan, Rwanda and Zimbabwe). Research is being done to integrate additional functions (for example, contrast sensitivity and retinal imaging) into the screening system over the next five years.

Eye health surveys for service planning

Rapid Assessment of Avoidable Blindness (RAAB) is the gold-standard public health population survey for eye disease prevalence. This information is essential for planning cost-effective and targeted eye health services and for providing baseline information to measure progress against. With the London School of Hygiene & Tropical Medicine, Peek has developed mRAAB, a mobile app that has enabled these surveys to become paperless. In addition to improved convenience and usability, the app enables immediate error checks and allows data to be stored and analysed remotely. This reduces costs and makes this world-leading survey methodology accessible to many more eye health services.

Peek Vision now plans to test the incorporation of its vision check apps into the survey. They will also add improved reporting functions and data visualization to inform better health service planning.

Effective education and training of the current and future workforce

Variation in capacity and capability limits the effectiveness of the eye health workforce around the world. Many regions or countries are woefully understaffed, particularly in rural or remote areas, where access to services is difficult or non-existent. To combat staff shortages, some countries have opted to train more ophthalmologists. However, many fully trained ophthalmologists still opt to build their practices in urban areas where patients are often willing and able to pay for services. Other strategies have included training more optometrists, expanding the roles of optometrists or other task-shifting strategies to cover the delivery of more services, or building multidisciplinary teams to reach more patients. A number of higher education institutions, consortiums and national programs have been effective in developing the skills and talent of the current and future workforce (see [Case study 4](#)).

Case study 4. Education and training programs

College of Ophthalmology of Eastern, Central and Southern Africa (COECSA)

COECSA is a specialized virtual college that was established in 2012. It aims to address the shortage of ophthalmologists in Eastern, Central, and Southern Africa and improve the quality of eye care services in the region. COECSA's mission is threefold:

- To improve the quality of eye care through training, research and advocacy
- To provide leadership in eye care
- To create a forum for exchange of ophthalmic skills, knowledge and resources in Eastern, Central and Southern Africa.

COECSA also has several strategic goals, including to:

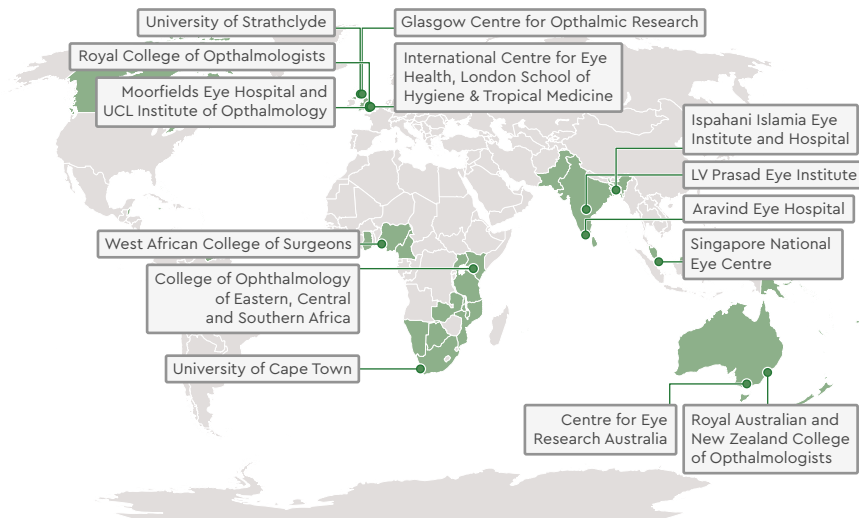
- Improve the number of skilled and motivated eye care workers
- Promote evidence-based standards and guidelines of practice in eye health
- Influence the inclusion of human resources for eye health in human resources for health policies and plans by providing leadership and relevant expertise
- Develop a strong and sustainable organization, able to efficiently and effectively deliver its programs.

As of 2017, COECSA had trained 87 delegates over four years through a Training the Trainers program, as part of the VISION 2020 Links Programme. It is estimated that nearly 1 million patients per year were being treated by eye care workers who had benefited from the program.⁴⁴ COECSA has also organized the Annual COECSA Congress since 2013 to exchange ideas, knowledge and information in the region.⁴⁵

Commonwealth Eye Health Consortium

The Commonwealth Eye Health Consortium is a group of eye health organizations from across the Commonwealth that have partnered to deliver a five-year program of fellowships, research and technology development (see Figure 7). Funded by the Queen Elizabeth Diamond Jubilee Trust and based at the London School of Hygiene & Tropical Medicine, the Consortium aims to help Commonwealth countries implement the global action plan for the prevention of avoidable blindness and visual impairment – Universal Eye Health: A global action plan 2014–2019.⁴⁶

Figure 7. Commonwealth Eye Health Consortium member organizations



Source: Commonwealth Eye Health Consortium

SECTION 4. TRANSFORMING EYE HEALTH TODAY AND TOMORROW

New models of primary and secondary services

Many countries, regardless of income level, will struggle to provide adequate eye care. Demand for services from an aging population is compounded by workforce shortages and economic challenges. Similarly, many eye care interventions place a significant burden on patients and their families, because effective treatments require visits to eye care centres and high levels of treatment and medication compliance. Therefore, new models of care need to keep pace with future needs.

These models may introduce new or hybrid roles, or change existing roles of eye health professionals. They also promote collaboration across different levels of care. Implementing any of these changes will require significant cultural and behavior change. Other adaptations may be more organizational in nature, and some countries are already embracing these new models. In the UK, NHS-funded ophthalmology services are increasingly becoming available through independent providers, such as Newmedica Ophthalmology, which delivers over 70,000 patient interactions each year through more than 20 services.⁴⁷

In low-resource settings, more comprehensive changes or capacity building will be required. In India, the LV Prasad Eye Institute (LVPEI) has created a 'Pyramid of Eye Care' model that has been adopted by India's Government and will be implemented in a number of other Indian states (see [Case study 5](#)). Principles from the Pyramid of Eye Care and the Aravind Eye Care System have influenced the founding of other low-cost, high-quality, high-volume eye care models, such as salaUno in Mexico.⁴⁸ However, the high volume of patients required to cover the fixed costs of eye surgery has meant that replicating these models in many locations has proved difficult.

Mobile eye health clinics – improving access to eye health services

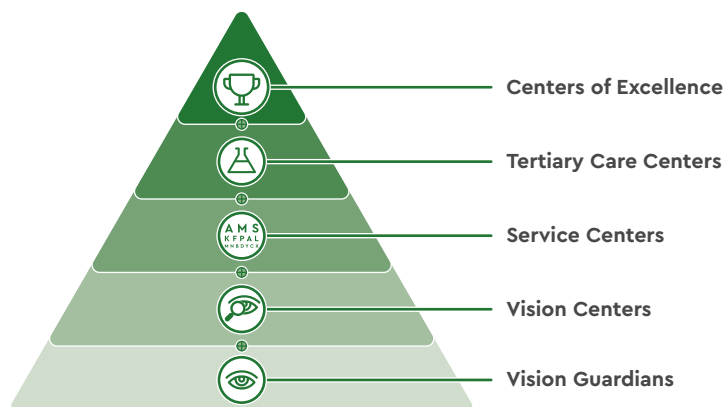
Providing access to specialist eye care to populations in remote regions can be especially difficult. These communities are often too small to support traditional models of healthcare delivery. Some communities and organizations have created innovative healthcare models to bring services to remote regions on a periodic basis, to improve access for hard-to-reach populations (see [Case study 6](#)).

Case study 5. The LVPEI Pyramid of Eye Care

The LVPEI created a Pyramid of Eye Care model that has been adopted by the Government of India and is expected to be implemented in multiple Indian states. The pyramid represents a 'bottom-up' model of holistic eye care, leading to universal eye health coverage. The model relies on the creation of permanent, sustainable facilities within local communities. These facilities are staffed and managed by a locally trained workforce and linked to successively higher levels of care:

- Vision Guardians sit at the bottom of the pyramid and represent community involvement.
- Vision Centers are the next level up and focus on the primary health needs of the community.
- Service (Secondary Eye Care) Centers form networks with the Vision Centers and cover populations of about 500,000 people.
- Tertiary Care (Hospitals and Training) Centers link to Service Centers and serve populations of about 5 million people, providing a comprehensive range of services and also serve as training centers for Service Centers.
- Centers of Excellence link to Tertiary Care Centers and serve 50 million people, treating complex diseases and training trainers in subspecialties and rehabilitation.

The pyramid model aims to be replicable and sustainable, requiring each center to generate income and also subsidize services without depending on long-term external funding or expertise. Since LVPEI's establishment in 1987, more than 23.8 million patients have been treated, over half receiving free services regardless of their complexity.⁴⁹



Case study 6. Bringing services to remote regions

Lions Outback Vision Van

Lions Outback Vision provides outreach services in Western Australia through the Lions Outback Vision Van, a mobile eye health clinic consisting of three consulting rooms and specialist equipment. The Vision Van completes two circuits per year through Western Australia and provides comprehensive ophthalmology care for cataracts, trachoma, glaucoma and diabetic retinopathy.⁵⁰

Orbis Flying Eye Hospital

The Orbis Flying Eye Hospital is a modified cargo plane containing an operating room, classroom and recovery room. The service has been in existence since 1982 and is now on its third generation plane. The plane brings a team of eye specialists to LMICs to share skills and techniques with local medical teams. The service is also an effective advocacy tool for raising awareness of the importance of eye health, getting the attention of local governments, global organizations, philanthropists and the public.⁵¹ Qatar Airways has supported Orbis since 2015, providing free flights for Orbis staff and volunteers. The Qatar Fund For Development has also partnered with Orbis UK to fund the Qatar Creating Vision initiative, dedicated to providing visual health services and training to locations most in need. The initiative aims to provide 5.5 million eye screenings and treatments to children in India and Bangladesh from 2016 to 2020.⁵²



Teleophthalmology services

Telemedicine, also known as telehealth, is a form of medicine in which technology is used to provide clinical care from a distance. Teleophthalmology services enable disease screening, diagnosis and monitoring to be done without needing the ophthalmologist and patient to be in the same location. This improves access to distance learning, which enables better training of eye health professionals in remote areas (see [Case study 7](#)). Telemedicine is also gaining popularity as a way to make access to care in urban areas more efficient.

Case study 7. Teleophthalmology services

cybersight

Cybersight – Orbis International

Cybersight is Orbis's award-winning telemedicine platform. Through Cybersight, Orbis expert volunteers teach and support eye care teams around the world using the latest advancements in internet and mobile technologies. Cybersight is equal parts library, school and remote-medicine platform. It allows Orbis to increase the intensity and types of training it does with partners, but equally important, it means having an impact in places that Orbis could not otherwise work on the ground for reasons of conflict and security. In 2017, Orbis trained eye health professionals in 125 countries through Cybersight, and to date has supported more than 16,000 patients through telemedicine consultations.⁵³

Technological advances in digital ophthalmic imaging and screening

Screening and diagnosis for many eye disease pathologies, particularly AMD and DR, often involve ophthalmic imaging, such as digital fundus (back of the eye) photography and optical coherence tomography (OCT). However, the processes used to diagnose eye diseases are often time-consuming, costly, and prone to human error. A number of universities, hospitals, charities and companies are trialling new technologies that rely on AI and machine learning to determine if this process can be optimized to reduce the amount of time and cost involved in analysing images, and also reduce the potential for human error (see [Case study 8](#)).

Case study 8. DeepMind and Moorfields Eye Hospital NHS Foundation Trust



More than 3,000 OCT scans are performed every week at Moorfields Eye Hospital NHS Foundation Trust. These scans require highly trained experts to analyse results, which can lead to delays in diagnosis and treatment. To help alleviate this burden, Moorfields partnered with DeepMind Health in 2016 to determine if AI and machine learning could identify patterns and categorize results in the images, reducing the time it takes for experts to diagnose eye diseases from the scans. The resulting study has shown that AI can achieve 96 percent accuracy in diagnosis of more than 50 conditions – equivalent to the best clinicians in the world – and can determine the urgency of the condition to a similar accuracy. No urgent patient was misdiagnosed. The AI algorithm can also adapt to different types of OCT imaging machines, which will allow the same level of performance, even with new machines. This technology has the potential to speed up diagnosis and management of common retinal diseases such as AMD and DR.⁵⁴ It also has the potential to direct the patient immediately for eyecare and treatment and also visually show the patient the detrimental impact of the disease on their eye and by implication their whole body, even while they are asymptomatic. 75 percent of patients fail to return upon recall from traditional 'screen-and-recall' systems (most current systems) in LMICs. The introduction of these systems has the potential to radically change this situation.

New approaches to monitoring and treatment of eye health conditions

Innovative technologies are driving radical changes in eye health, particularly around managing complex problems. Life science companies are developing innovative new drugs, devices and delivery systems to treat a myriad of eye diseases, including Bausch + Lomb's RETISERT,⁵⁵ Allergan's Ozurdex,⁵⁶ the CustomFlex Artificial Iris,⁵⁷ Genentech's investigational Port Delivery System with ranibizumab,⁵⁸ and the use of stem cells to treat AMD by the London Project to Cure Blindness.⁵⁹ In addition, new treatment approaches for glaucoma are being introduced, including the use of new rapidly implanted microdevices combined with anti-scarring therapies in glaucoma surgery (see Case study 9).

Case study 9. New treatment approaches for glaucoma

The 10:10:10 Challenge for fast and effective glaucoma surgery

Eye drops are the most common form of glaucoma treatment but often prove too impractical, costly, or burdensome to result in high patient compliance. Instead, a one-off surgical treatment may prove to be much more practical, particularly in LMICs. The Moorfields Safer Surgery System has improved the outcomes and consistency of glaucoma surgery throughout the world, but its current format requires a significant amount of training, and is dependent on the surgeon's skill level to be reliable and effective. To improve the system and provide access to glaucoma surgery in LMICs, researchers at Moorfields Eye Hospital have set an ambitious goal known as the 10:10:10 Challenge. The objective of this challenge is to be able to perform a 10-minute surgery on glaucoma patients that lowers their eye pressure to 10 mmHg (mm of mercury) for 10 years. In order to achieve this goal, surgeons need to be able to control wound healing and minimize scarring after the surgery. Current research efforts are focusing on the development and refinement of microdevices that control fluid drainage from the eye very precisely after surgery and the use of anti-scarring agents to avoid sealing any drainage pathway created during the surgery.⁶⁰

Use of emerging technology

A number of emerging technologies have great potential for improving treatments to numerous eye diseases. These include nanomedicine, implantable visual prosthetics and advances in gene therapy such as clustered regularly interspaced short palindromic repeats (CRISPR). These developments promise the prospect of a cure for some of the world's most intractable eye health problems.

SECTION 5. POLICY RECOMMENDATIONS

Without appropriate and effective intervention in global eye health, visual impairment is predicted to increase to unprecedented levels in the next few decades. To address these challenges, we have developed five policy recommendations – supported by the evidence-based case studies presented throughout this report – that policymakers can implement in their home countries.

1. Prioritize the most precious sense

Raise the priority of eye health, and adopt policies that address inequalities by promoting early, equitable access to prevention, diagnosis and treatment services. Support these policies with evidence of the very high socioeconomic return on investment that can be achieved through improving eye health.

2. Invest in sustainable, universal eye health

Ensure that all people have access to information on maintaining good eye health, and provide preventative, curative and rehabilitative eye health services. Monitor performance through agreed key activity and outcome indicators, while also ensuring that the users of these services are not exposed to financial hardship.

3. Embrace the power of partnership and collaboration

Utilize the skills and knowledge of key public, private and not-for-profit stakeholders in eye health through partnerships and collaborations to combine talent, expertise, technology and purpose to solve complex problems and work toward common goals.

4. Promote excellence in education and training

Develop and deliver effective education programs for the healthcare workforce, and support new ways of working, including task-shifting (moving appropriate tasks to less specialized health workers). Develop self-management educational tools to enable people to understand the risk factors and become co-creators in managing their own eye health.

5. Utilize technology and innovation

Invest in collaborative research and development, and use incentives and financial models to encourage the adoption of new technologies that can impact eye health worldwide.

ABBREVIATIONS

AI

artificial intelligence

AMD

age-related macular degeneration

anti-VEGF

anti-vascular
endothelial growth factor

COECSA

College of Ophthalmology
of Eastern, Central and
Southern Africa

CRISPR

clustered regularly interspaced
short palindromic repeats

DR

diabetic retinopathy

GAP

Universal Eye Health: A global
action plan 2014–2019

GET2020

WHO Alliance for the Global Elimination of Trachoma by 2020

IAPB

International Agency for the
Prevention of Blindness

LMICs

low- and middle-income countries

LVPEI

LV Prasad Eye Institute

MSICS

manual small-incision
cataract surgery

MSVI

moderate to severe
visual impairment

NDESP

NHS Diabetic Eye
Screening Programme

NHIS

National Health Insurance Scheme

OCT

optical coherence tomography

OTS

Onchocerciasis Technical
Advisory Subgroup

RAAB

Rapid Assessment of
Avoidable Blindness

ROI

return on investment

SAFE

Surgery, Antibiotic
treatment, Facial cleanliness,
Environmental improvement

UREs

uncorrected refractive errors

VAD

vitamin A deficiency

VAS

vitamin A supplementation

VAT

value-added tax

WHO

World Health Organization

WISH

World Innovation
Summit for Health

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