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Community Eye Health Journal

Celebrating 30 years and 100 issues

Four editions • 23,000 readers • 136 countries worldwide

1988–2018

How far have we come?

Contents

EDITORIAL

Our centenary issue

The *Community Eye Health Journal* was created in 1988 to meet the needs of eye care workers worldwide. Thirty years and 100 issues later, our readers remain at the centre of all we do.

Blindness, visual impairment and eye disease affect people everywhere. However, not everyone is equally at risk; even in wealthier countries it is always the poor who suffer the most.

The history of the *Community Eye Health Journal* is deeply entwined with that of global eye health. We are the only publication specifically for eye care workers in low- and middle-income countries, and we have been here since 1988.

At this significant milestone, it seems appropriate to pause and reflect on the global story of eye health. In the pages that follow, our contributors examine what has been achieved over the last 30 years and the many challenges that still lie ahead.

But first I would like to put the spotlight on you: our readers. Your daily work is an essential part of the global effort to reduce avoidable blindness and visual impairment and to care for those whose vision cannot be improved. Everything you do is helping to end the needless suffering of those who cannot see well, who are in pain, or who feel that no-one cares.

And you are not alone. Thousands, if not millions, of people worldwide are also helping to improve the eye health of others. They may be treating patients, conducting research, maintaining equipment, balancing the books, working for the World Health Organization, fundraising or scrubbing the operating theatre. Everyone is part of this team.

It is a privilege to share our 100th issue with all of you. Thank you for everything you are doing, and long may you continue!

Elmien Wolvaardt Ellison (Editor)

Community Eye Health *Journal*
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World blindness and visual impairment: despite many successes, the problem is growing

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Over the last 30 years, there has been a reduction in the proportion of people with visual impairment and blindness worldwide. However, growing and ageing populations mean that the challenge of eliminating avoidable blindness is now bigger than ever before.

We have come a long way on the journey towards the global elimination of avoidable blindness and visual impairment over the last three decades. Thanks to the work of the Vision Loss Expert Group, it is now possible to say what has been achieved and what remains to be done.

The group has very recently published detailed estimates of the prevalence of global blindness and visual impairment – for the past, present and future – at global, regional and country level.[1] These estimates were derived from a detailed analysis of 288 population surveys conducted in 98 countries from 1980 to mid-2014. Although the estimates mainly concentrate on distance vision loss, data regarding near vision loss (presbyopia) are also included.

The wealth of information the group has produced has been summarised in the International Agency for the Prevention of Blindness (IAPB) Vision Atlas. The Vision Atlas includes a series of maps where you can find the latest estimates for your country at the click of a mouse **http://atlas.iapb.org/gvd-maps**

Overall trends and patterns

The headline figures from the group's latest global estimates are summarised in Figure 1.

In 2015, there were an estimated 253 million people with visual impairment worldwide. Of these, 36 million were blind and

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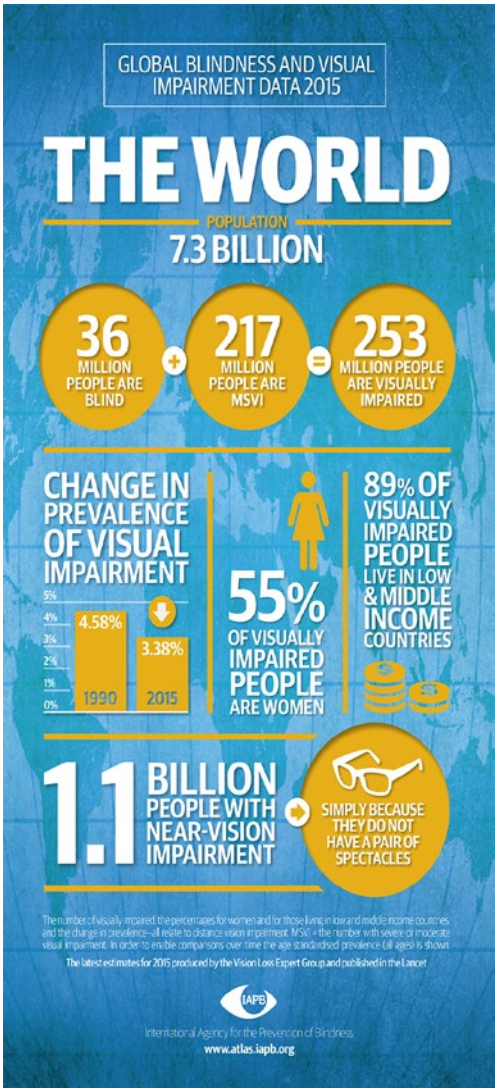

IAPB

Figure 1 Headline figures from the Vision Loss Expert Group's latest data

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100th issue front cover
Top row, left to right: Dieter Telemans/CCBRT; International Trachoma Initiative; Suzanne Porter/ Sightsavers.
Middle row: WaterAid/Dean Sewell; Ronnie Photography; International Trachoma Initiative.
Bottom row: IAPB; Geoff Oliver Bugbee; Henry Nkumbe.

It is important that women are able to access eye care services.
INDIA

D SUBRAMANYAM

a further 217 million had moderate to severe visual impairment (MSVI). The prevalence of people that have distance visual impairment is 3.44%, of whom 0.49% are blind and 2.95% have MSVI. A further 1.1 billion people are estimated to have functional presbyopia.

Age

The risk of most eye conditions increases with age; consequently, the prevalence of blindness and MSVI is much greater in older age groups. Figure 2 shows this for women (a very similar result is seen for men). Of the 253 million visually impaired people worldwide, 80% are aged 50 years or older.

Figure 2 The global prevalence of blindness and moderate to severe visual impairment (MSVI) in women*

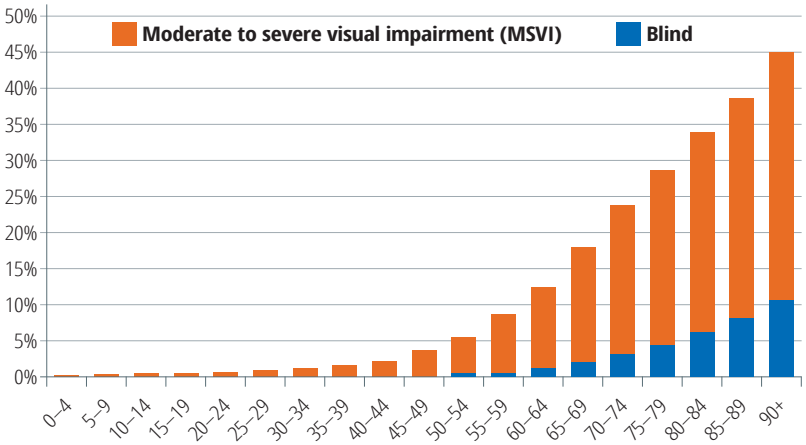
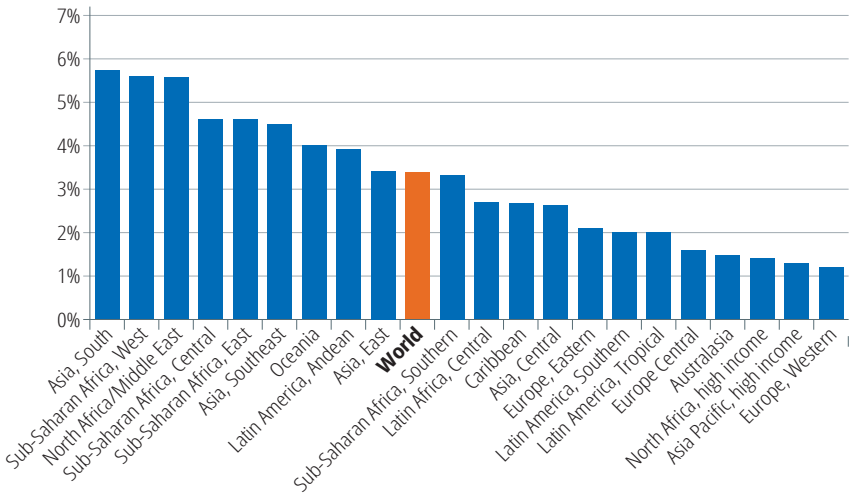


Figure 3 Age-standardised prevalence of visual impairment across the 21 regions*



*Based on data from the Vision Loss Expert Group

Gender

Of the 253 million people in the world who are visually impaired, 55% are women (139 million). A number of factors contribute to this gender imbalance, including the longer life expectancy of women compared with that of men, which means that there are more women in those age groups associated with a higher risk of developing a sight-threatening eye condition (Figure 2). In addition, women are at greater risk of developing certain eye conditions. In some countries, women suffer disadvantages in terms of access to eye health services. This is due to multiple socio-economic and cultural factors.

Regional data

The group used the 21 regions demarcated by the Global Burden of Disease study (**www.thelancet.com/gbd**) to disaggregate the global data and prepare regional estimates. These 21 regions cluster countries according to their physical location but also other factors, including their socio-economic status.

Socio-economic status

89% of visually impaired people live in low- and middle-income countries. Three Asian regions are home to 62% of the people in the world with visual impairment, even though they are home to only 51% of the world's population: South Asia (73 million), East Asia (59 million) and South East Asia (24 million). At the other end of the scale, the five high-income regions account for 14% of the world's population but only 11% of people with visual impairment.

Age profile

Comparing regions is not straightforward if one just looks at the overall numbers or prevalence; this is due to the differences in the age profile in each region; i.e. some populations may have a larger proportion of older people and fewer children compared to others. A technique called 'age standardisation' makes it possible to compare populations with different age profiles to each other and look at changes over time.

The age-standardised prevalence of visual impairment across the 21 regions is shown in Figure 3. The prevalence in poorer regions of the world is more than four times that seen in the high-income regions.

The group has also published a second paper[2] that looks at the causes of visual impairment. Table 1 summarises the estimates of the causes of blindness, moderate to severe visual impairment, and for blindness and visual impairment combined. The data are for 2015 and are given both in terms of absolute numbers and as a percentage.

Changes over time

The group has produced global estimates stretching back to 1990 and have also looked into the future to produce estimates for 2020 to 2050; the results are summarised in Table 2 (opposite). At first glance, the gradual increase in the absolute number of people who are blind or have MSVI from 1990 to 2015 may seem disappointing. However, over this 25-year period, two very important demographic changes have occurred, both of which would have been

Table 1 Vision Loss Expert Group estimates of the causes of visual impairment in 2015

Cause	Blind		Moderate to severe visual impairment		All visual impairment	
	<3/60 to no light perception (NLP)		<6/18-3/60		<6/18-NLP	
	No. millions	%	No. millions	%	No. millions	%
Cataract	12.6	35	52.6	24	65.2	26
Uncorrected refractive error	7.4	21	116.3	54	123.7	49
Glaucomas	3	8	4	2	7	3
Age-related macular degeneration	2	5	8.4	4	10.4	4
Corneal opacity	1.3	4	2.9	1	4.2	2
Trachoma	0.4	1	1.6	1	2	1
Diabetic retinopathy	0.4	1	2.6	1	3	1
All other causes	8.9	25	28.2	13	37.1	14
Total	**36**	**100**	**216.6**	**100**	**252.6**	**100**

expected to give rise to a much greater increase in the absolute number of visually impaired people:

1 The global population increased by 38%: from 5.3 billion in 1990 to 7.3 billion in 2015.
2 The world population aged and the total population over 50 years old almost doubled: from 878 million in 1990 to 1,640 million in 2015.

Allowing for these two major changes, there is in fact an underlying decline in the global age-standardised prevalence of blindness (all ages): it has reduced from 4.58% in 1990 to 3.38% in 2015. A number of factors – including a decline in poverty levels, a reduction of the incidence of certain conditions or a later onset of these conditions, improved public health measures and eye health service development – have all contributed to this encouraging progress.

Table 2 Vision Loss Expert Group estimates of the global number of people who are blind or have moderate to severe visual impairment, 1990 to 2050

Year	Global number affected, all ages (millions)	
	Blindness	Moderate to severe visual impairment
1990	31	160
2000	32	176
2010	34	199
2015	36	217
2020	39	237
2030	55	330
2040	80	451
2050	115	588

Table 3 Vision Loss Expert Group estimates for future population growth and ageing[3]

	2015	2050
Global population	7.3bn	9.7bn
> 60 years old	0.9bn	2.1bn
> 80 years old	125m	434m

The future

But what is likely to happen in future? United Nations data[3], summarised in Table 3, informs us that the global population was 7.3 billion in 2015. This is predicted to rise to 7.8 billion by 2020 and to 9.7 billion by 2050.

The growing population is also going to age at a much faster rate than seen in previous years. In 2015, there were 901 million people over the age of 60 (12% of the global population). By 2050, the number of people over the age of 60 is predicted to increase to 2.1 billion (22% of the population).

An even greater relative increase in the numbers of people aged ≥80 is expected; the current estimate of 125 million in 2015 is expected to increase more than threefold by 2050: to 434 million. As observed in Figure 2, the prevalence of visual impairment increases rapidly with age. By age 60, around 1 in 9 people will be either blind or have MSVI. By age 80, the ratio increases considerably: around 1 in 3 people will be either blind or have MSVI.

The combination of a growing and an ageing population will result in a massive increase in the number of people who are blind or have MSVI. Two other factors that also present a major risk for the future are the dramatic increase currently being seen in all parts of the world in the number of people with diabetes (which can cause diabetic retinopathy, a potentially blinding condition) and those with high myopia.

Overall, there may be some 703 million people who are blind or have MSVI by the year 2050 (as shown in Table 2). A massive investment in eye health services, along with protection from out-of-pocket payments for the poorest sectors of society, is needed to ensure universal access to eye health for all and avert a future human and societal catastrophe.

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3 United Nations, Department of Economic and Social Affairs, Population Division (2015). World Population Prospects: The 2015 revision, key findings and advance tables. Working Paper No. ESA/P/WP.241.

The epidemiology of blindness in children: changing priorities

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The number of children who are blind from eye conditions (excluding refractive error) is falling in all regions. To continue this encouraging trend, comprehensive eye care needs to be strengthened by improving referral mechanisms and counselling parents at every step.

TIM FRANSHAM/SIGHTSAVERS

A young girl after cataract surgery. Cataract is now the main cause of avoidable blindness in many low-income countries. INDIA

Nearly a third of the very first issue of the *Community Eye Health Journal* was about blinding eye diseases in children. One article described an Indian study about improving mothers' knowledge so that they could prevent eye conditions in their children. The other article also focused on the major causes of corneal scarring in children: vitamin A deficiency (VAD) and measles infection.

The issue was published two years before the first workshop on childhood blindness, which was initiated by the World Health Organization (WHO) and held in London in 1990. The workshop report reviewed what was then known about the prevalence and causes of blindness in children and estimated that there were 1.5 million blind children worldwide.[1] At that time, corneal scarring – principally from VAD – was estimated to be responsible for 50–70% of blindness among children in low-income settings. Every year, there were 350,000 new cases of xerophthalmia; an estimated 60% of these children would die within a year of becoming blind. Measles infection was recognised as an important cause of vitamin A deficiency.

Measles and vitamin A deficiency

Much has happened since then. Measles immunisation coverage (the proportion of children who have been immunised, expressed as a percentage) has increased in many countries to over 80% (Figure 1), with a marked reduction in the number of measles cases. In 2015, however, there were still estimated to be over 134,000 deaths from measles.[2] As can be seen in Figure 1, most countries in sub-Saharan still have immunisation coverage below the target of 80%.

Figure 1 Measles immunisation coverage: first dose, 2015[2]

HDPTCAR

Measles vaccination.
CENTRAL AFRICAN REPUBLIC

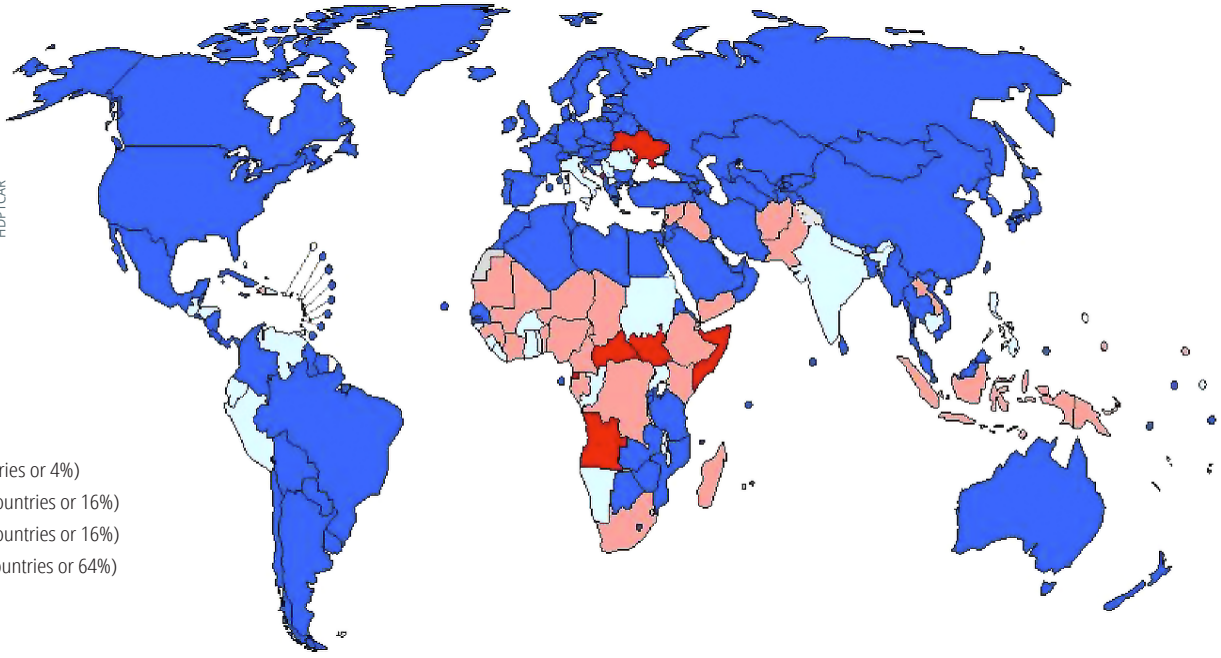
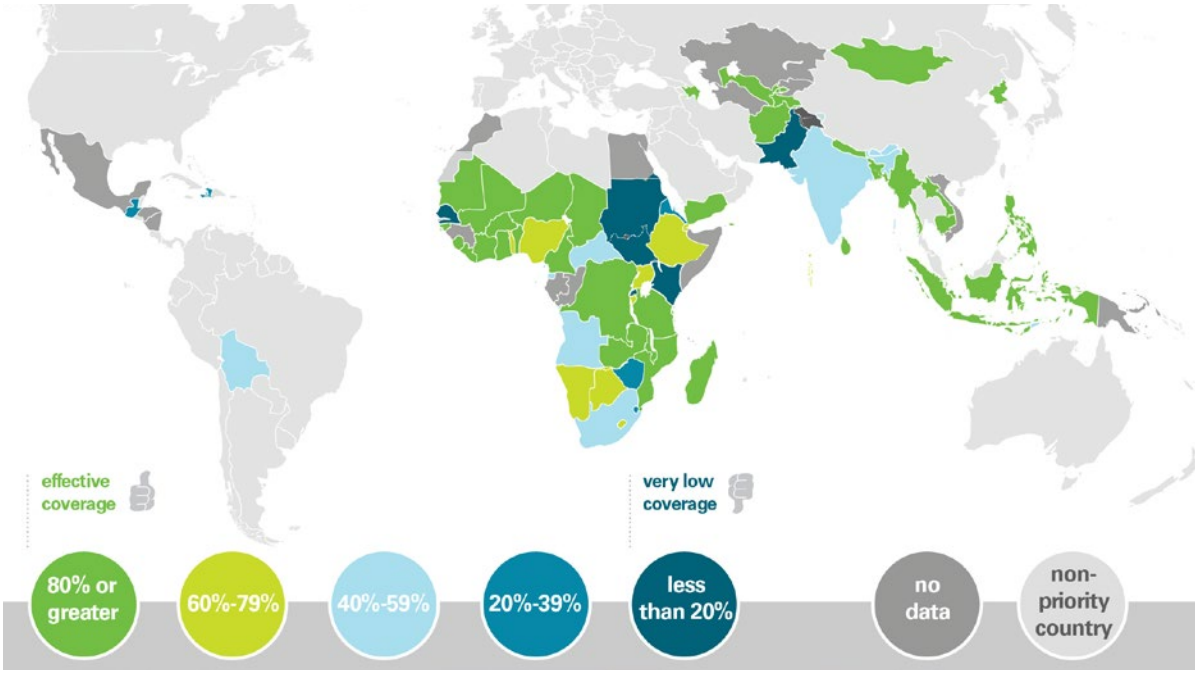


Figure 2 Vitamin A supplementation coverage, 2014



Adapted from Unicef, 2015 **https://data.unicef.org/wp-content/uploads/2015/12/Nut_VitA_300dpi-white-background-01_171.png**

RIC FRANCIS

A four-month-old baby receives a dose of vitamin A.
KENYA

In the late 1980s it became clear that children with xerophthalmia had a higher mortality rate than children without the condition. This important finding led to many clinical trials of vitamin A supplementation. Trials have shown that, in communities with less than adequate nutrition, supplementation of children aged 6–59 months reduces child mortality and morbidity, and also reduces the ocular signs of vitamin A deficiency.[3] Today, vitamin A supplementation (two doses per year for children aged 6–59 months) is being implemented in child health programmes in low-income countries. However, as with measles, vitamin A supplementation coverage is below 80% in many countries (Figure 2).[4] It is important to note that other approaches to improve the nutritional status of children, including their vitamin A intake, should go hand-in-hand with supplementation. These approaches include supplemental feeding, fortification of commonly consumed foods such as oil and sugar, and breeding crops so they have a higher vitamin A content (known as biofortification).

What impact have these large-scale public health initiatives had on the causes of blindness in children in low income countries? The simple answer is that they have had a major impact, with a marked decline in the proportion of blindness due to corneal scarring in many countries. However, we must not become complacent. In some countries, such as Ethiopia, corneal scarring remains the commonest cause of blindness[5], and sub-clinical vitamin A deficiency in children remains endemic in many countries. Indeed, UNICEF estimates that 33% of preschool-age children and 15% of pregnant women in low income countries do not have enough vitamin A in their daily diet, and that 5.2 million preschool-age children have clinical vitamin A deficiency. More needs to be done to increase awareness in communities about the need for a vitamin A-rich diet, and to improve the coverage of vitamin A supplementation.

Changes in demography and under-five mortality rates

What else has changed since 1988? The number of children in the world aged 0–15 years has increased from around 930 million in 1950 to 2 billion today. But the rate of increase is slowing, largely as a result of socio-economic development. The number of children has declined in upper-middle-income countries (UMIC) but is projected to continue to increase in low-income countries (LIC).[6] See Figure 3.

In the mid-1990s, it became clear that the prevalence of blindness in children is associated with under-five mortality rates: it is higher in countries with high under-five mortality rates, and low in countries with

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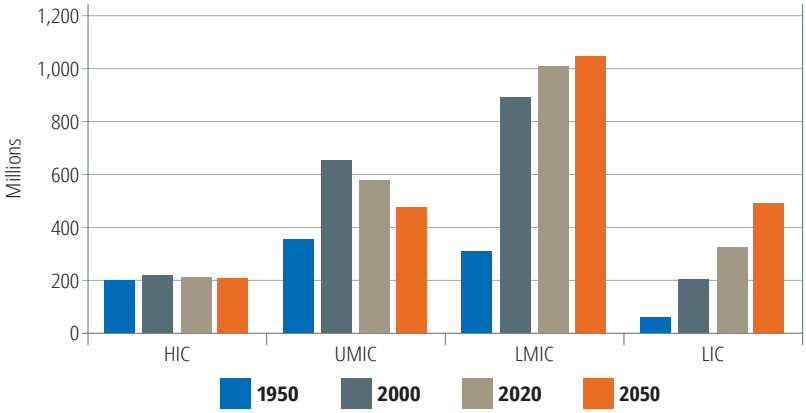
Figure 3 Child population (millions) aged 0–15 years, from 1950 to 2050, by region



Region	(all figures in millions)			
	1950	2000	2020	2050
High-income countries (HIC)	200	221	212	209
Upper-middle-income countries (UMIC)	357	658	578	477
Lower-middle-income countries (LMIC)	315	898	1,014	1,052
Low-income countries (LIC)	58	204	326	492
World	**930**	**1,980**	**2,129**	**2,230**

Data adapted to 0–15 year age group from
https://esa.un.org/unpd/wpp/Download/Standard/Population/

low under-five mortality rates. As can be seen in Figure 4, under-five mortality rates are declining in all regions. In 2005, sub-Saharan Africa had the highest under-five mortality rate compared with other regions.

The association between the prevalence of blindness in children and under-five mortality rates has been used to update the estimate of the number of blind children in the world.[7] The estimates are as follows:

- 1.5 million in 1990
- 1.4 million in 1999
- 1.26 million in 2010
- 1.14 million in 2015.

There has been a reduction of 24% in the number of blind children since 1990, despite the overall increase in the child population. Why is this happening? Better control of measles and vitamin A deficiency, which are both important causes of blindness, are contributing to declining under-five morality rates (Figure 4).[8] However, the overall decline in the number of blind children globally hides regional differences in the change (Figure 5). In sub-Saharan Africa, the estimated number increased between 1999 and 2010, but is now declining.

Childhood cataract

In many low-income countries where corneal scarring has declined, cataract has become the commonest cause of avoidable blindness in children. Much has been done to establish tertiary eye care centres with a well trained and equipped team, and many of the larger countries now have several such child eye care centres. One of the main challenges is that affected children often present very late for surgery due to lack of awareness and cultural, social and economic barriers, which compromises the visual outcomes. There is also some evidence that, in Asian countries, girls with bilateral cataract do not access services at the same rate as boys.[9] Another study from Bangladesh showed that children with better visual outcomes after cataract surgery were more likely to be in school, so cataract surgery contributes towards the Sustainable Development Goals regarding gender and education.[10] More needs to be done to improve access, to ensure that children attend for follow-up after surgery, and to provide low vision services for the children who do not have good visual outcomes.

Figure 4 Under-five mortality rates globally and by region*

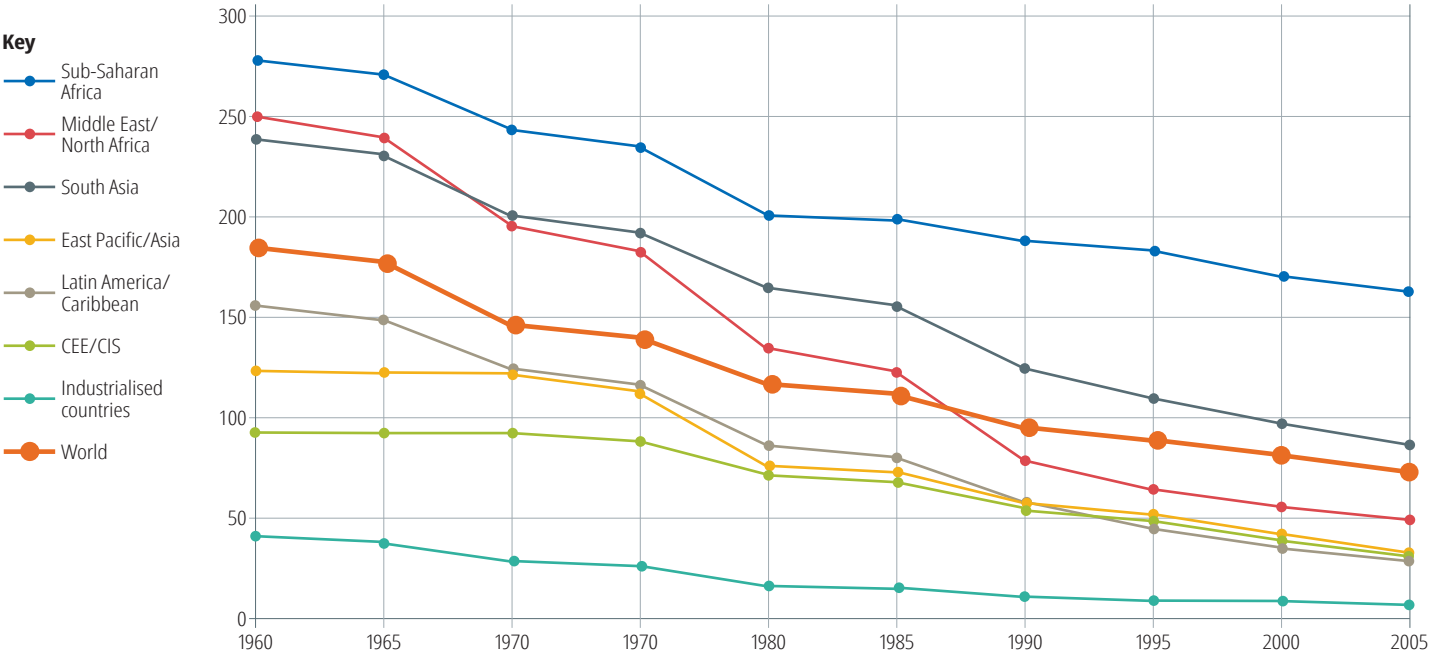
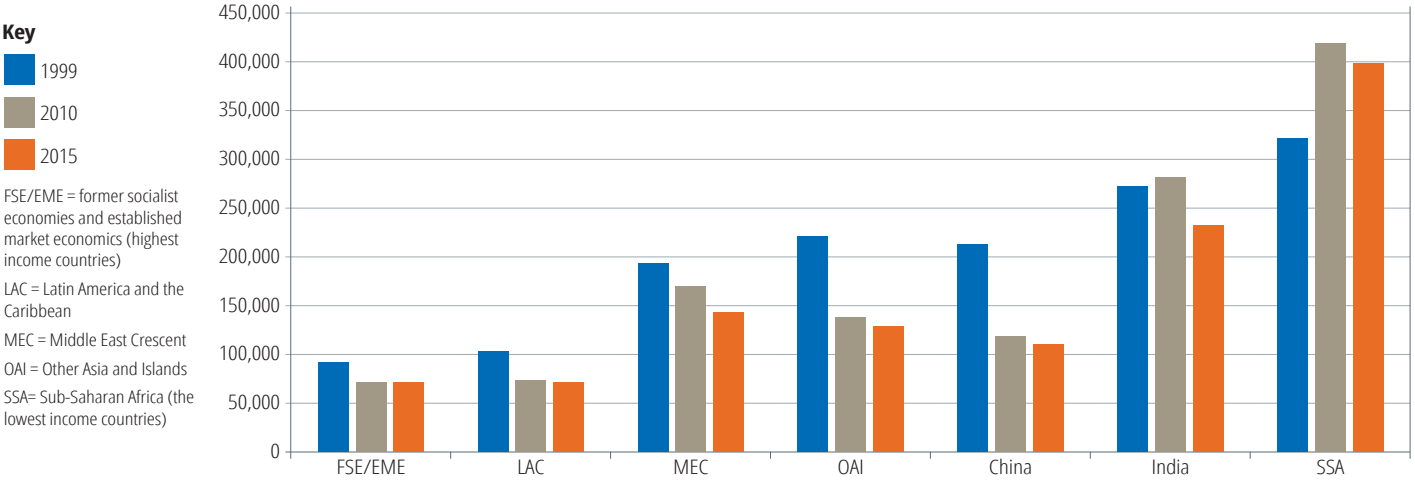
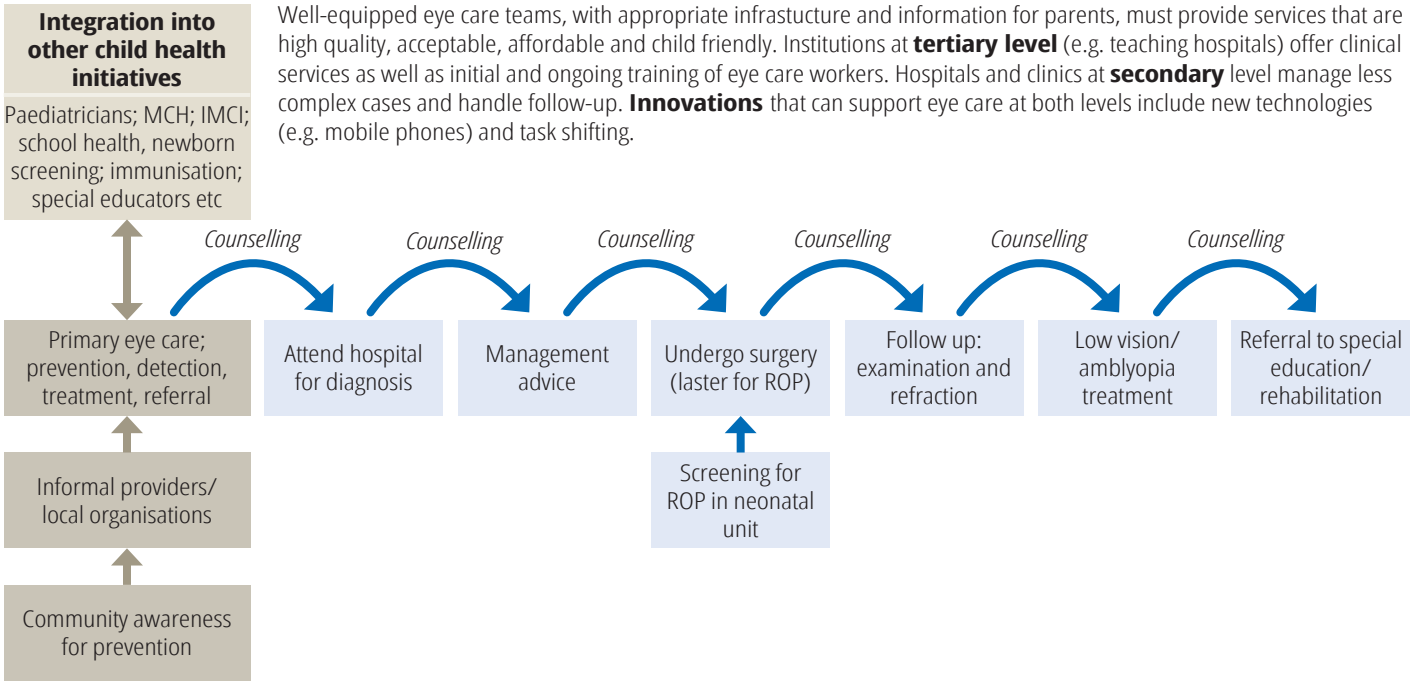


Figure 5 Regional variation in the estimates of blind children between 1990 and 2015*



*Source: **www.unicef.org/progressforchildren/2007n6/index_41802.htm***

Figure 6 Comprehensive clinical care for children at secondary and tertiary level (adapted from Aravind Eye Care System)



Prematurity and retinopathy

Another major change over the last 20 years is that services for preterm infants have expanded dramatically, as governments realise that Under-five mortality rates will remain high unless neonatal and infant mortality rates are brought down. Neonatal care initially expanded in upper-middle income countries, particularly in Latin America and the Caribbean, in the former socialist economies, and subsequently in many Asian countries. Neonatal care has just begun to expand in Africa. However, in most countries, policies and resources were not put in place to control retinopathy of prematurity, which has led to the 'third epidemic' of blindness due to retinopathy of prematurity.[11] A recent estimate of the annual number of infants becoming blind or visually impaired from retinopathy of prematurity shows that every region is affected, with 32,300 new cases every year.[12] In middle-income countries, retinopathy of prematurity is often the commonest cause of avoidable blindness. Many of these countries have or are responding by establishing screening and treatment programmes. However, more needs to be done to increase the coverage and quality of screening and treatment and to improve the quality of neonatal care, as this will reduce the incidence of retinopathy of prematurity needing treatment. Advocacy is needed to raise awareness among ministries of health and other agencies engaged in child health. The goal is to ensure that policies and programmes, with guidelines and resources, are put in place to reduce this potentially avoidable cause of blindness.

Cerebral visual impairment

Cerebral visual impairment (due to damage to the visual pathways in the brain) is the leading cause of severe visual impairment and blindness in children in high-income countries. It is also an emerging cause in low-income countries, where a relatively high proportion is attributable to perinatal factors and so potentially avoidable through better perinatal care.[13] Cerebral visual impairment may be missed because it usually affects children who also have other disabilities such as cerebral palsy or learning difficulties. A community-based study of cerebral palsy in Bangladesh showed that a third of children had reduced visual acuity and over half had visual perception problems which adversely affected their quality of life.[14]

Going forward

To improve child eye health and reduce disability, comprehensive services are needed at community, primary, secondary, and tertiary level, working alongside low vision, special education and rehabilitation services. Good referral mechanisms are needed to provide a continuum of care between all services (Figure 6).

Raising awareness in the community about eye diseases, and how they can be prevented, is very important, as was described in the first edition of the *Community Eye Health Journal*. At the primary level, staff providing services for mothers and young children need to know what they can do to prevent, detect and treat and eye diseases (pp. 78-79).[15] Eye care at secondary level needs to be strengthened to manage less complex cases and to follow children up after surgery. Screening and treatment of ROP can be undertaken by ophthalmologists at secondary or tertiary levels. Counselling parents at every step is of vital importance as it will help them to understand what to do and the important role they play.

Much is being done to improve tertiary eye care for children, but more tertiary centres are needed; ideally one per ten million population.[16] Greater emphasis is also needed on the other levels of service delivery, special education and rehabilitation; and the referral networks between them.

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References for this article are available as an online supplement to Issue 100. Visit **www.cehjournal.org**

Integrating child eye health within primary health care: a case study

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Few children have access to specialised eye care in Tanzania. However, ten simple activities have been shown to reduce the risk of childhood blindness and eye disease dramatically. By teaching these to primary health workers in Tanzania, thousands of babies now have a better chance of having healthy eyes.

TOMMY TRENCHARD/SIGHTSAVERS

A baby with healthy eyes. ZANZIBAR

The control of blindness in children is a priority of VISION 2020, a global initiative with the goal of eliminating avoidable blindness by the year 2020. Many of the causes of visual loss in children in low- and middle-income countries are preventable; the most common of which are vitamin A deficiency, measles, conjunctivitis of the newborn and the use of harmful traditional remedies. Other causes of blindness, such as cataract, are treatable.[1]

Primary eye care has the potential to play a major role in reducing blindness in children by carrying out specific preventive measures and identifying and referring children with treatable conditions.[2]

The preventive measures include:

- Maintaining high coverage with measles immunisation and vitamin A supplementation
- Credé's prophylaxis to prevent ophthalmia neonatorum
- Health education regarding a good diet and breastfeeding
- Avoidance of traditional eye remedies

Early identification and referral of children is needed because, in many low- and middle-income countries (including Tanzania), children with cataract frequently present for surgery very late – often years after the parents first noticed the problem.[3–5] Late presentation limits children's lifelong visual potential because seeing images clearly is important for their visual and general development when they are young.[6] Some of the barriers to early presentation are beliefs that congenital blindness cannot be treated; being given the wrong advice by health workers; not knowing where to go; believing that the condition would resolve on its own and a preference for local remedies. Lack of education among mothers is a risk factor for late presentation.[4]

Ten key activities to promote healthy eyes in children

In 2002, The World Health Organization (WHO) identified 'Ten key activities for healthy eyes' that would improve the eye health of children in Sub-Saharan Africa and South East

Table 1 Ten key activities to promote healthy eyes in children

Control of general health conditions which can also lead to visual loss	
Vitamin A deficiency	1. Give vitamin A supplements to children routinely
	2. Give vitamin A supplements to mothers after delivery
	3. Promote breastfeeding and good nutrition
Measles	4. Give vitamin A supplements to children with measles or malnutrition
	5. Immunise children against measles
Control of eye conditions	
Conjunctivitis of the newborn (ophthalmia neonatorum)	6. Clean the eyes of all babies at delivery and apply antibiotic eye drops or tetracycline eye ointment
Trachoma	7. Keep children's faces clean
Cataract	8. Refer children with poor vision or white pupils to an eye worker
Traditional eye remedies	9. Avoid the use of traditional eye medicines
Trauma	10. Refer children with history of injury to an eye worker

Asia (Table 1).[7] WHO recommended that these activities be implemented by primary health workers in reproductive and child health (RCH) clinics, the WHO's Expanded Programme of Immunization, and the WHO's Integrated Management of Childhood Illnesses programme.[8]

Pilot study

In Tanzania, late presentation occurs despite the fact that most young children (up to 5 years of age) have frequent contact with trained health personnel in RCH clinics for growth monitoring, immunisation, treatment of different diseases and health education. These appointments were a missed opportunity to identify children with eye problems.

This prompted us to conduct a pilot study in 2010 in RCH clinics in urban Dar es Salaam. We were interested to find out if there were any changes in workers' knowledge, attitudes and practices before, and 12 months after, a one-day training session on the ten key activities for healthy eyes.

Before the training session, the key activities for healthy eyes which relate to general care (i.e. vitamin A supplementation and measles immunisation) were being routinely implemented in RCH clinics included in the study. However, the key activities which specifically relate to eye health (e.g. application of tetracycline after birth to prevent ophthalmia neonatorum) were not being implemented. After the training session, the RCH workers had better knowledge of eye conditions and changed some practices, such as cleaning the eyes of newborn babies at delivery and instilling an antibiotic or antiseptic, and referring children with trauma, a white pupil, or red eyes. Lack of knowledge, skills and supervision were the reasons given that staff members had failed to implement all of the eye-specific activities.[2] It became clear that full and effective implementation of the ten key activities would not only control blindness, but also contribute towards reduction of under-five mortality rates.[9]

Following the study in Dar es Salaam, we worked with a steering committee to conduct further mixed methods research in RCH clinics and communities in the Singida region. Singida region is mainly rural and so more typical of Tanzania, compared to Dar es Salaam. The study, conducted in 2014, included facility surveys, observational checklists, interviews with staff, the assessment of case management of eye conditions using images, and interviews with key informants. A sample of mothers of children aged up to 24 months were as also interviewed to assess their knowledge, awareness and health-seeking behaviour and to assess coverage of measles immunisation and vitamin A supplementation. The results were similar to those of the pilot study: most RCH workers had little knowledge of eye conditions, management of eye conditions was poor and ocular prophylaxis had been stopped or was inadequately implemented. Measles vaccines and vitamin A supplements were sometimes out of stock and health education sessions very rarely included eye conditions. Mothers did not know that measles immunisation and vitamin A can prevent blindness, and only a quarter of children aged 9–24 months had documented evidence of having received a vitamin A supplement on their 'Road to Health' charts. Measles immunisation coverage was good (84.7%).

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Having enough nutrient-rich food to eat prevents stunting, blindness, and death in young children.

Integrated Management of Childhood Illness programme (IMCI)

When we explored a sustainable way to integrate primary eye care for children into primary health services, we considered the Integrated Management of Childhood Illness programme (IMCI). IMCI was developed by UNICEF and WHO to reduce morbidity and mortality in children aged 0–5 years. The programme has three elements:

1 Improving partnerships between health facilities or services and the communities they serve
2 Increasing appropriate and accessible care and information from community-based providers
3 Integrating promotion of key family practices critical for child health and nutrition.

IMCI has been adopted and implemented with varying degrees of success in low- and middle-income countries, including Tanzania.[10] Although it was developed as a comprehensive approach, the focus has been on treatment within health facilities. Tanzania is among the countries that have embraced IMCI and the programme is being implemented through the RCH services. In Tanzania, IMCI training is delivered in two ways: pre-service training and in-service training involving ten modules covering different conditions. Notably, IMCI has a section on ear health but there is no section dedicated to eye health.

Eye health module in IMCI

In April 2017, findings from both studies were presented to the steering committee in Tanzania, which included ministry of health officials responsible for IMCI. The committee agreed that an eye module should be added to the national IMCI in-service training package. The eye module has since been developed in collaboration with the ministry of health. A poster has been designed and DVD clips are being prepared on topics such as how to examine the eyes of a young child. All these materials will be tested and then they will be ready for use in the national IMCI programme. As training is being rolled out, we plan to undertake an evaluation to assess the effectiveness of this training on how RCH staff manage eye conditions in children and to assess whether it has improved other aspects of control, such as vitamin A supplementation coverage.

Conclusion

Inclusion of the eye module in IMCI in Tanzania is a significant step forward and has the potential to substantially reduce blindness in children. Findings from the planned evaluation will be used in advocacy so that other countries in Africa may include eye conditions in their IMCI training package.

Acknowledgements

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Changing techniques in cataract surgery: how have patients benefited?

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Cataract surgery is one of the most frequently performed operations in the world. Recent advances in techniques and instrumentation have resulted in earlier intervention, improved surgical outcomes, and reduced dependence on spectacles.

ICEH/LANCE BELLERS

Cataract surgery is essential in order to address avoidable blindness. ETHIOPIA

The first record of cataract being surgically treated is by Susruta, who carried out the procedure in 600 BC. Cataracts were treated using a technique known as couching, in which the opaque lens is pushed into the vitreous cavity to remove it from the visual axis. Couching is still performed in some parts of Africa and the Middle East. In 1753, Samuel Sharp performed the first **intracapsular cataract extraction** (ICCE) through a limbal incision. He used pressure from his thumb to extract the lens. In 1961, Polish surgeon Tadeusz Krwawicz developed a cryoprobe which could be used to grasp and extract cataracts during ICCE surgery. However, an aphakic spectacle correction was still required. When the first edition of the *Community Eye Health Journal* was published, ICCE was still the most widely practised method of cataract extraction in low- and middle-income countries. However, in high-income countries, ICCE had been superseded by extracapsular surgery with an IOL implant.

Modern **extracapsular cataract extraction** (ECCE) gained acceptance in high-income countries after the introduction of operating microscopes during the 1970s and 1980s made it possible to perform microsurgery. The microscopes offered better intraocular visibility and the ability to safely place multiple corneal sutures. ECCE has the advantage of leaving the posterior capsule intact; this reduces the risk of potentially blinding complications and makes it possible to implant a lens in the posterior chamber.

Phacoemulsification was introduced in 1967 by Dr Charles Kelman. Since then, there have been significant improvements in the fluidics, energy delivery, efficiency and safety of this procedure. Advantages include small incision size, faster recovery and a reduced risk of complications.[2]

Manual small-incision cataract surgery (MSICS) is a small-incision form of ECCE with a self-sealing wound which is mainly used in low-resource settings. MSICS has several advantages over phacoemulsification, including shorter operative time, less need for technology and a lower cost.[1,2] It is also very effective in dealing with advanced and hard cataracts. As with modern ECCE techniques, MSICS also allows for a lens to be implanted.

A recent introduction is **femtosecond laser-assisted cataract surgery**, during which a laser is used to dissect tissue at a microscopic level. Initial results from the recent FEMCAT trial suggest little or no improvement in safety and accuracy compared to standard phacoemulsification, and the procedure brings with it new clinical and financial challenges.

Today, although phacoemulsification is considered the gold standard for cataract removal in high-income countries, MSICS is hugely popular and practised widely in many countries of the world because of its universal applicability, efficiency and low cost.[3]

Improvements in ophthalmic equipment and intraocular lenses

Over the three decades since the first issue of the *Community Eye Health Journal* was published, the availability of microsurgery and high-quality intraocular lenses (IOLs), at an acceptable cost, have made a positive global impact on visual results after cataract surgery.

IOLs can be placed in the anterior chamber or posterior chamber, or be supported by the iris. The preferred location is the posterior chamber, where the posterior chamber IOL (or PCIOL) is supported by the residual lens capsule.

Sir Harold Ridley is credited with the first intraocular lens implantation in 1949, using a material known as PMMA. Since then, numerous design and material modifications have been developed to make IOLs safer

Table 1 Guidelines for the choice of formula based on axial length and specific circumstances

Circumstance		Recommended fomulae
Axial length	<22mm	Haigis / Hoffer-Q
	22–26mm	SRK-T
	>26mm	Haigis / SRK-T
Myopic LASIK		Haigis-L, ASCRS online calculator
Following radial keratotomy		ASCRS online calculator
Use of a piggyback IOL		Holladay's refractive formula

Adapted from **www.nice.org.uk/guidance/ng77/chapter/Recommendations#preoperative-assessment-and-biometry** (Oct 2017)

and more effective, and they have been in routine use in high-income countries since the 1980s. However, when the first edition of the CEHJ was published in 1988, an IOL cost approximately $200 and was far too expensive for widespread use in low- and middle-income countries. Thankfully, owing to the foresight and innovation of organisations such as the Fred Hollows Foundation and Aravind Eye Hospitals, IOLs are now produced at low cost in low- and middle-income countries and have become available to even the most disadvantaged patients.

With the introduction of the first **multifocal and toric IOLs**, the focus of IOL development has shifted toward improving refractive outcomes and reducing spectacle dependence. Toric lenses correct postoperative astigmatism, and multifocal lenses reduce dependency on spectacles for near vision. However, multifocal lenses may cause glare and reduced contrast sensitivity after surgery and should only be used in carefully selected patients. The **accommodating lenses** that are in current use are limited by their low and varied amplitude of accommodation.

The **light-adjustable lens** is made of a photosensitive silicone material. Within two weeks of surgery, the residual refractive error (sphero-cylindrical errors as well as presbyopia) can be corrected by shining an ultraviolet light on the IOL through a dilated pupil to change the shape of the lens. Development of an **intraocular lens (IOL) as a drug delivery device** has been pursued for many years. Common postoperative conditions such as posterior capsular opacification (PCO), intraocular inflammation or endophthalmitis are potential therapeutic targets for a drug-eluting IOL.

Choosing the best IOL

Although inserting a standard power IOL in all eyes is an improvement over standard power aphakic spectacles, the best results are obtained by calculating the correct power of lens implant for each eye. Many formulae have been developed over the last three decades to calculate the IOL power; however, no single formula works well in all circumstances. Table 1 provides guidelines for the choice of formula based on axial length and specific circumstances.

Changing trends in anaesthesia techniques

Ocular anaesthesia has evolved tremendously since Einhorn synthesised procaine in 1905, which led to its acceptance in retrobulbar anaesthesia. Drs David and Mandal introduced peribulbar anaesthesia in 1980. However, in the last two decades, sub-Tenon's anaesthesia has become a common technique for ocular anaesthesia. By using a blunt cannula to deliver the local anaesthetic, it avoids the risk of accidental perforation of the globe, which is a serious complication of retrobulbar and peribulbar anaesthetic techniques. There is a trend towards non-needle local anaesthesia techniques[4], which have the advantage of avoiding completely the complications related to orbital injections. The drawbacks include reliance on patient cooperation.

Adjuncts in cataract surgery

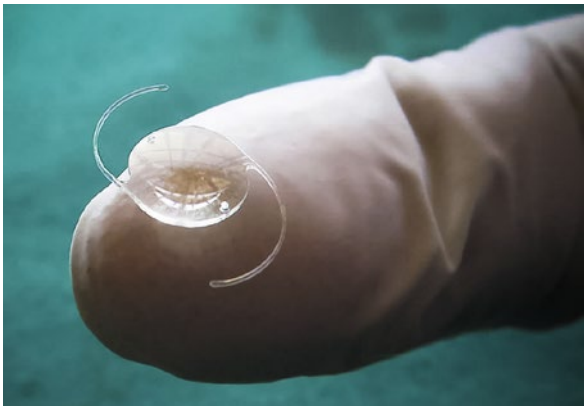
Over the last two to three decades, numerous adjuncts have been developed to improve outcomes in routine and complex cataract surgery. Use of dispersive and cohesive **ophthalmic visco-surgical devices** (OVDs) have led to a dramatic improvement in the safety of cataract surgery.[5] In addition, capsular tension rings, iris retractors and pupil expansion devices have made cataract surgery safer in eyes compromised by weak zonules, small pupils or a floppy iris.

A public health triumph

Clinical advances have led to significant improvements in cataract outcomes. Similarly, low-cost IOLs, surgical skill development and community-oriented programmes, together with government funding and enabling policies, have also dramatically increased the number of people who are able to benefit from cataract surgery.

Future outlook

The future of cataract treatment promises to be exciting. Surgery may not be the only treatment option if research can identify an agent to either slow or reverse lens opacification. For the immediate future, however, lens surgery will remain relevant for the world's ageing population.



BOATENG WIAFE

The arrival of affordable IOLs has radically improved visual outcome after cataract surgery.
GHANA

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Cataract indicators: their development and use over the last 30 years

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How do we know if our cataract service is reaching enough (and the right) people? How can we tell whether the quality of surgery is good enough? Understanding cataract indicators, and how to use them, can help us to meet the community's needs.

HANS LIMBURG

Visual acuity is tested during a RAAB survey. CAMBODIA

For the last four to five decades, cataract has been the most common cause of blindness worldwide; it is also a leading cause of visual impairment. Before this, fewer people grew old enough to develop cataract and infectious diseases (trachoma, onchocerciasis, measles) were thought to cause most blindness. Thanks to improved hygiene, antibiotics, ivermectin, vaccinations and vitamin A distribution, eye infections and xerophthalmia have become less common. At the same time, life expectancy increased, leading to a rapid increase in the incidence (i.e. new cases) of cataract. Because the incidence of cataract increases exponentially with increasing age, the age composition of the population determines the number of new cases of cataract; i.e., countries with older populations tend to have more people with cataract.

Several important advances in cataract surgery took place over the past 30 years, including the advent of microsurgery, the introduction of IOLs, and the transition from intra-capsular to extra-capsular and then small incision surgery. These advances allowed surgery to be undertaken earlier and vastly improved postoperative visual outcomes, which led to an increased demand for services. In parallel with these improvements, the indicators for monitoring services – and the tools to collect monitoring data – have also developed. In this article we describe these developments, and also discuss how to interpret and use indicators to improve cataract services.

Quantity of cataract surgery

When addressing cataract blindness became a priority, the focus was on increasing the number of cataract operations. **Cataract surgical rate (CSR)** was the first cataract indicator commonly reported. By recording all cataract operations, the total output of cataract operations in a year in a defined population (hospital catchment, district, province or country) can be determined, and trends over time followed. CSR is obtained when the cataract output in a given year is divided by the number of people (in millions) in the defined area.

Cataract surgical rate (CSR) = number of cataract operations per million population per year

It is important to monitor CSR for a whole year rather than part of a year, so any seasonal variations in demand for services are accounted for.

The CSR can be as high as 10,000 in some developed market economies, and less than 1,000 in some countries with a young population and/or inadequate eye care services.

A **target CSR** can be established based on the desired output of the available cataract surgeons in the area, or on the estimated incidence of operable cataract.

Because the incidence of cataract is lower in countries with a younger population and a lower life expectancy, the target CSR will be lower there as well.

The **number of operations** can be used to set and monitor output targets and compare the efficiency of cataract services and surgeons in different hospitals or geographic areas. For example:

- **Average weekly output per cataract surgeon:** the total number of cataract operations divided by the total number of cataract surgeons in the same area, divided by the number of weeks in a working year.
- **Annual output per cataract surgeon:** the total number of cataract operations per individual cataract surgeon within a 12-month period.

Quality of cataract surgery

As surgical techniques have advanced, publications from leading eye hospitals reported ever-improving outcomes. However, many eye surgeons worldwide currently work under less favourable conditions and

Table 1 WHO guidelines on visual outcome of cataract surgery 6–12 weeks post-operatively[4]

Postoperative visual acuity (VA) threshold		Target for the proportion of operated eyes achieving VA thresholds	
		Presenting visual acuity (PVA) or VA with available correction	Best corrected visual acuity (BCVA) or VA with pinhole
Good	6/18 or better	>80%	>90%
Borderline	<6/18 – 6/60	<15%	<5%
Poor	Worse than 6/60	<5%	<5%

their results are seldom published. In the late 1990s, some population-based surveys showed that up to 40% of operated patients could not see 6/60 after cataract surgery. In response, the World Health Organization (WHO) published recommendations on the outcome of cataract surgery in 1998 (Table 1). According to the WHO, fewer than 5% of cataract patients should be unable to see 6/60 (best corrected or presenting).

The indicator for the quality of cataract surgery is **cataract surgical outcome (CSO)**, which is the visual outcome in the operated eye.

Cataract surgical outcome (CSO) = visual acuity in the operated eye

Paper-based and computerised software tools were subsequently developed to monitor cataract surgical outcome on a routine basis.[5] The following information is recorded for each operation:

- Visual acuity (VA) before surgery
- Surgical technique used
- Whether the outcome is good, borderline or poor, both after surgery and at follow-up
- The type of complication, if any
- The major cause of each poor outcome.

The proportion of good, borderline or poor outcomes and the proportion of complications can be calculated. In the software tools, filters can be applied to the dates, surgeon, clinic and other parameters to make more detailed analysis possible. The software is intended to provide insight as to where and how modifications in the service can be made to improve visual outcome further.

The system is definitely not intended to compare individual eye surgeons or clinics, but to monitor improvement in outcome over time for the same surgeon or clinic. Unfortunately, many ophthalmologists have been reluctant to use the monitoring tools available, and we must identify and overcome the barriers to incorporating monitoring of outcomes into routine practice.

Population-based indicators

As cataract services continued to develop, it became clear that population-based information was needed that could capture local variations in disease pattern, environment and available resources. It was equally important to gather information on the population, rather than only those who were accessing services. Cross-sectional surveys can provide this information on the eye care situation within a defined area, such as a district, province or country. The information can then be used to plan and monitor services.

The rapid assessment of avoidable blindness (RAAB) methodology was specifically developed to collect data that would make it possible to plan eye care services for a population of between 0.5 and 5 million people. RAAB surveys are restricted to those aged 50 years and above, where the prevalence of blindness and visual impairment is highest. As a result, the sample size can be smaller and the survey is faster and less expensive to carry out than traditional full-population surveys. RAAB software includes standardised and automatic data analysis and reporting. It generates four important cataract indicators (see panel below).

Cataract indicators generated by RAAB software

Prevalence of blindness and visual impairment due to cataract and **estimated number of cases**. The sample prevalence and age- and sex-adjusted estimates of the cataract burden in the survey area are given.

Cataract surgical coverage (CSC). This is the proportion of people with bilateral cataract who have been operated upon in one or both eyes. Results are given separately to show coverage among people with best corrected visual acuity (BCVA) of <3/60, <6/60 and <6/18. It is written as either $CSC_{<3/60}$, $CSC_{<6/60}$ or $CSC_{<6/18}$ and expressed as a percentage. E.g., '$CSC_{3/60}$ 85%' means that 85% of people with BCVA of 3/60 have had surgery in one or both eyes.

Cataract surgical outcome (CSO). The proportion of operated eyes with a good visual outcome (6/18 or better) after cataract surgery, written as CSO_{good}. The causes of poor outcome are also given.

Effective cataract surgical coverage (eCSC) is the proportion of people with bilateral cataract and BCVA of <3/60, <6/60 or <6/18 who have received cataract surgery in one or both eyes *and* have postoperative presenting VA of 6/18 or better in at least one operated eye.

Other indicators reported by RAAB include **barriers to surgery** and **details of surgery** (location, type, cost). RAAB also generates information on the **main causes of blindness and VI** which identifies where cataract is positioned in terms of priority for intervention.

Equity of cataract services: disaggregating indicators

Cataract services are not used equally by people within countries. For example, in many settings high quality cataract surgery is provided to wealthy urban people, often before visual impairment occurs. In contrast, similar services are scarce or absent for the rural poor. If only wealthy urban people receive surgery, a high cataract surgical rate would not automatically mean

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that the coverage will be high or that the prevalence of cataract blindness will be low.

All cataract indicators can be disaggregated (reported separately) by gender, location (urban or rural), socio-economic status, or disability, etc. When this is done, inequity is often identified. For example, women and rural dwellers tend to have lower cataract surgical coverage, a higher burden of cataract blindness, and worse postoperative visual outcomes than men and urban dwellers.[11]

Disaggregated cataract indicators are essential in order to understand the nature and extent of inequality in the population, to inform appropriate strategies to reduce inequality, and to monitor whether improvements in services (e.g. quality and access) are experienced by the groups who need them most. Cataract surgical outcome monitoring and RAAB software already present results separately for women and men. In future, disaggregation for other factors (e.g. socio-economic status) should become possible.

Interpreting cataract indicators

The current global action plan has chosen cataract surgical rate (CSR) and cataract surgical coverage (CSC) as its service delivery indicators, but a clearer picture of cataract services emerges when data are available for a broad range of indicators from both facility-based and population-based sources. Also, rather than considering just CSR and CSC in isolation, they should be considered in combination with other cataract and eye health indicators. For example, a high CSR alone may not reflect 'good' cataract services, without also considering the cataract surgical outcomes (CSO) of the operations, who was operated on (to ensure equity), and whether coverage (CSC and effective cataract surgical coverage, or eCSC) is improving. We have provided three scenarios in Table 2 below to demonstrate how helpful it can be to use a range of indicators to identify the specific aspect(s) of the service that require improvement.

Conclusion

Cataract indicators and monitoring processes have evolved alongside cataract services over the past 30 years and will continue to do so in future. To be useful, indicators require good quality data and careful interpretation by clinicians and programme managers in order to identify which aspects of cataract services are most in need of being strengthened.

Useful resources

Road Map for Scaling up Human Resources for Health: 2012–2025, WHO African Regional Office, 2013

Vision for Africa: Human Resources for Eye Health Strategic Plan: 2014–2023, IAPB Africa, 2014

WHO Global Health Workforce Alliance **www.who.int/workforcealliance/en/**

WHO, 2010. Increasing Access to Health Workers in Remote and Rural Areas Through Improved Retention: Global Policy Recommendations,

WHO, 2016. Public Financing for Health in Africa: from Abuja to the SDGs.

References for this article, and a summary of cataract indicators, are available as an online supplement to Issue 100. Visit **www.cehjournal.org**

Table 2 Three scenarios to illustrate the interpretation of various RAAB cataract indicators (for people aged 50 and over)

RAAB indicators	Interpretation
Scenario 1	
All blindness: 2.7%; Cataract blindness: 1.2%	The prevalence of blindness due to cataract is moderate/high.
CSR 1,200	CSR is low/moderate.
CSO_{Good} PVA 58% (58% of patients had 'good' presenting visual acuity, i.e. 6/18 or better. See Table 1.)	The outcomes of surgery can be improved.
$CSC_{<3/60}$ 54%; $CSC_{<3/60}$ men 68%; $CSC_{<3/60}$ women 45%	CSC and eCSC are moderate/low, and men have considerably better results compared to women.
$eCSC_{<3/60}$ 39%; $eCSC_{<3/60}$ men 53%; $eCSC_{<3/60}$ women 27%	
Barriers 'Not aware' 32%; 'Cannot afford' 25%; 'Fear' 25%	
Possible response: This service needs to understand why those who are blind and vision impaired are not undergoing surgery i.e. who they are, where they are and how to deliver services in a more appropriate and accessible way. Health education, improvement of cataract surgical outcomes and more affordable services may increase CSR and CSC.	
Scenario 2	
All blindness: 1.8%; Cataract blindness: 0.9%	Cataract blindness is moderate.
CSR 4,000	CSR is moderate/good.
CSO_{Good} PVA: 65%;	The proportion of operations resulting in a good visual outcome (CSO_{Good}) is only 65%, compared to a target of 80%. Among women, it is only 47%, compared to 77% among men.
CSO_{Good} PVA women: 47%; CSO_{Good} PVA men: 77%	
$CSC_{<3/60}$ 82%; $CSC_{<6/60}$ 51%; $CSC_{<6/18}$ 29%	Cataract surgical coverage is acceptable at BCVA <3/60. Not much surgery is done at BCVA<6/60 and BCVA <6/18.
Possible response: Implement strategies to improve the quality of post-operative vision, particularly among women.	
Scenario 3	
All blindness: 0.9%; Cataract blindness: 0.2%	CSR is high, prevalence of blindness is low and cataract blindness <25% of all blindness.
CSR 8,000	
CSO_{Good} PVA 80%	Surgical outcomes are good and overall coverage is high. Cataract seems well under control.
$CSC_{<3/60}$ 96%; $CSC_{<6/60}$ 94%; $CSC_{<6/18}$ 81%	
$CSC_{<3/60}$ richest quintile 99%; poorest quintile 84%	However, when CSC is disaggregated by socio-economic status, domicile and gender, inequality exists with poorer people, rural dwellers and women experiencing lower coverage compared to richer people, urban dwellers and men.
$CSC_{<3/60}$ urban 98%; rural 86%	
$CSC_{<3/60}$ men 99%; women 85%	
Possible response: Maintain output and quality while implementing strategies to make services more accessible for poorer people, rural dwellers and women.	

Facing the crisis in human resources for eye health in sub-Saharan Africa

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Sub-Saharan Africa does not yet have enough eye health workers to help the millions of people suffering from eye disease in this region. This article explains the challenges in sub-Saharan Africa and the efforts underway to train and empower more eye health workers.

Supplied by Orbis Africa

Ophthalmic nurses attend World Sight Day celebrations. SOUTH AFRICA

Eye disease in sub-Saharan Africa is now estimated to affect 18–25% of the population. This includes blindness (0.6%–1% of the population), moderate to severe visual impairment (3.6%–4%), presbyopia (7%–8%) and 'all other ocular morbidities', an overarching term that describes any significant eye condition which may or may not cause sight loss (8%–10%).

To deal with this total burden of eye disease, sub-Saharan Africa must establish comprehensive eye health services, available to all. This requires an eye health workforce capable of working as a team at community, primary, secondary and tertiary levels. Without such a workforce, it will not be possible to meet the need for eye care in sub-Saharan Africa.

Whereas some countries (e.g. Ghana and Kenya) are approaching the World Health Organization's (WHO's) minimum requirements for eye health workers (Table 1), the majority of countries in sub-Saharan Africa remain under-resourced, particularly French and Portuguese speaking and conflict states (Table 2). The fact is that an insufficient number of new eye health workers are being trained for the needs of a growing and ageing population. Without government commitment to establish and fund professional pathways for eye care workers, the crisis is set to worsen.

Table 1 Minimum eye care team for 1 million population

Cadre	Key activities	Minimum per million population
Ophthalmologist	• Diagnosis/treatment • Eye surgery • Training	4
Eye nurse / allied health personnel	• Varies depending on training • May work alone or with an ophthalmologist	10
Optometrist	• Refraction, spectacles • Screening for eye disease • Low vision	10
Primary health care worker	• Screens visual acuity • Treats conjunctivitis • Dispenses reading spectacles for people aged 50 and over	200

International involvement

The importance of human resources for eye health (HReH) was first highlighted in 1999 with the launch of VISION 2020: The Right to Sight.[1] The 2006 World Health Report, 'Working Together for Health,' renewed the emphasis on human resources.[2]

In 2016, the World Health Organization (WHO) launched Workforce 2030[4], a new global strategy for human resources for health. It noted the need to increase the eye health workforce and urged member states to plan for the longer term. Workforce 2030 is a valuable resource for everyone involved in the health workforce arena.

There is a growing recognition that delivering comprehensive eye health, in a way that strengthens the health system[5], will require sufficient people to fill each role within the eye health sector, and that they must have the training they need to do their job effectively.[6] The WHO Global Action Plan for Universal Eye Health 2014-2019 echoed this prioritisation with 3 out of 5 global indicators relating to the eye health workforce.

However, population growth, combined with an ageing population (who have a greater need for eye care) and the emerging problems of diabetes and myopia, means that the overall need for eye care is increasing.[7]

Achievements

Much has been achieved over the last two decades. The eye health sector has developed large HR projects:

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- The Health for Peace initiative in West Africa (2006), a programme of training eye health workers for six small-population countries in West Africa
- DESSO, a francophone Diploma in Ophthalmology training programme set up in Guinea in 2006
- The East African College of Ophthalmology (EACO) was formed in 2010 and became the College of Ophthalmology of Eastern, Central and Southern Africa (COECSA)
- Ten new schools of optometry opened in Eritrea, Mali, Cameroon, Malawi, Zambia, Mozambique, Kenya, Uganda, and Zimbabwe (2008 onwards).
- Training for AOPs in Mozambique, Malawi and Zimbabwe was launched in 2009.

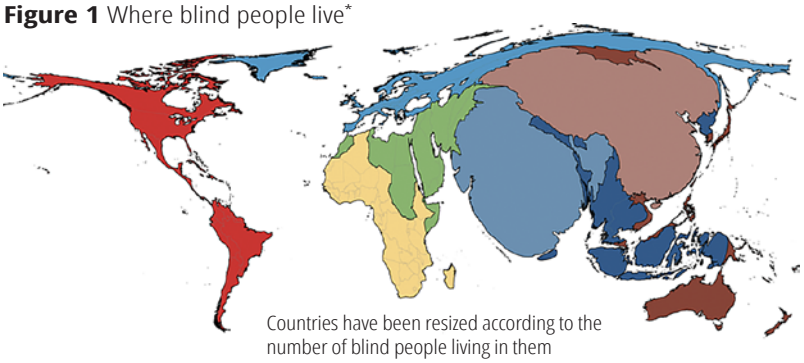
Additional activity by a number of international organisations, including members of the International Association for the Prevention of Blindness (IAPB), the Queen Elizabeth Diamond Jubilee Trust and the UK VISION 2020 LINKS Health Partnerships, have been of considerable benefit to individual training institutions and individual eye care workers.

Advocacy and integrated planning

International non-governmental organisations (INGOs) have and can play a significant role in supporting the development of HReH, in particular by influencing governments to take more responsibility in line with the recommendations of Workforce 2030 and the African Platform for Human Resources for Health.

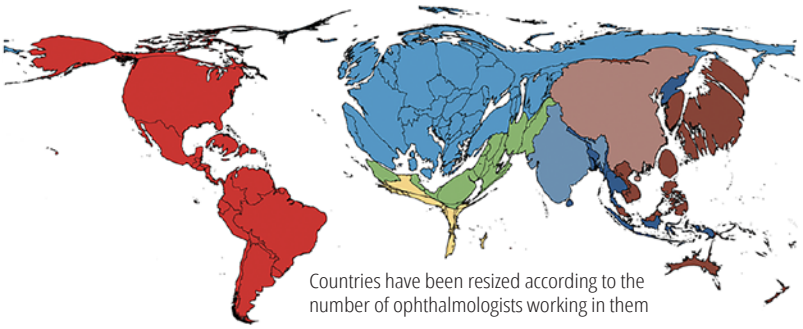
Integrated health workforce planning using the Workload Indicators of Staffing Needs (WISN) planning tool has now been implemented in Kenya, Malawi, Mozambique, Zambia, Cameroon and Ethiopia. WISN, which comes with its own computer software, is the workforce planning tool of choice. In Africa, the WHO Human Resources for Health Unit has introduced WISN to over 25 countries.

Figure 1 Where blind people live*



Countries have been resized according to the number of blind people living in them

Figure 2 Where ophthalmologists work*



Countries have been resized according to the number of ophthalmologists working in them

**Source:* Bastawrous A, Hennig BD. Br J Ophtalmol 2012.

Governments have not historically prioritised eye health. However, they invest heavily in the health workforce (40% of health budgets), thereby providing an opportunity to integrate eye health into workforce planning.

Ophthalmology

In 2016 and 2017, two expert meetings of the six colleges of ophthalmology in Africa, plus the Francophone Society, were convened with the objective of developing a harmonised, competency-based curriculum by 2020 and strengthening sub-specialty training in Africa.

Optometry

Since 2006 ten new schools of optometry have been opened in Africa, but more remains to be done, particularly in Francophone Africa. Optometrists have a critical role to play given the magnitude of presbyopia and myopia.[12]

Ophthalmic nurses and allied ophthalmic personnel

Ophthalmic nurses and allied ophthalmic personnel (ophthalmic clinical officers, ophthalmic assistants, etc.) are critical for eye care as the mid-level workforce. Their job titles, roles and responsibilities vary between countries, and issues of accreditation can limit personal and professional development. However, given the low number of eye specialists available, the mid-level workforce have an essential role in the eye care team. This must be recognised so that the best use can be made of their skills and availability.

The eye health component of primary health care

The new WHO-AFRO Primary Eye Care training package (with algorithms) is in the process of being finalised and published. Its development was informed by various workshops, expert meetings and rigorous field testing in Rwanda and Kenya. Arguably, in terms of patients treated, this will do more to strengthen eye health systems and enhance coverage than any other development.

Strengthening community health workers was the key recommendation of WHO's third global forum in 2013. This was echoed by the Policy Brief from WHO-AFRO (2017) and the survey of eye health and community health workers published by IAPB in 2015. The key challenge is to ensure that a comprehensive module for eye health is available at the country level so that the 'bottom of the eye health pyramid of care' is fully developed and available everywhere.

Core competencies

Despite an increase in the different types of allied health personnel, only ophthalmologists, ophthalmic nurses, optometrists, opticians and orthoptists are specifically recognised in the current International Standard Classification of Occupations (ISCO-08). The core competencies of three key professionals in the eye health team (ophthalmologists, optometrists and allied ophthalmic personnel) are currently being validated by WHO-AFRO to provide technical guidance to training institutions and ministries of health and as the basis for curriculum review and the expansion of competency-

Table 2 Distribution of eye health workers in by country language in sub-Saharan Africa

	Minimum required per million population (see Table 1)	Actual number per million population			
		Anglophone (English speaking)	Francophone	Lusophone	Total for sub-Saharan Africa
Population		574 million	281 million	53 million	908 million
Ophthalmologists (per million)	**4**	2.4	2.1	0.9	2,038
Optometrists (per million)	**10**	12.7	0.5	1.1	7,529
Ophthalmic nurses and Allied ophthalmic personnel (minimum 10 per million)	**10**	7.1	4.6	3.8	5,561

Derived from Resnikoff, BJO, 2012, Palmer J., ICEH, 2014 and the IAPB Africa data base, January 2016.

based education. Recognition of new kinds of eye care personnel is necessary to ensure that the eye health workforce is recognised, rewarded and supported to address the crisis in service delivery.

Priorities

Strategic advocacy

In order to address the current crisis in service delivery, and ensure sustainable eye health provision, governments must be willing to recognise the different types of workers needed (e.g. ophthalmic nurses, allied health personnel or optometrists). Advocacy is needed to persuade governments to set up training programmes, professional standards, career paths and salary structures for these workers – all of which are needed to retain workers and ensure they are deployed where they are needed.

Distribution

Alongside an overall shortage of eye health workers, there are large inequalities in their distribution which lead to inequalities in access to services within countries.[14] Of particular concern is the distribution and retention of eye health workers in rural areas.[15]

In Africa, inequalities in the distribution of eye health workers between countries is most marked with respect to differences between Anglophone, Francophone and Lusophone Africa (Table 2). WHO's recommended minimum ratio of ophthalmologist per population is 1 ophthalmologist per 250,000 population by 2020. In sub-Saharan Africa, there is now 1 ophthalmologist per 446,000 population on average; however, the ophthalmologists are unevenly distributed.

Data

Better data on HReH are needed for advocacy, policy and planning at national level. Eye health workforce data must be integrated into existing health management information systems.

The Universal Eye Health Global Action Plan currently contains three HReH indicators. The WHO-AFRO catalogue has 27 indicators, of which five relate to the workforce. However, important information on retention, distribution by sector and location, continued professional development, competency, primary eye care and community health workers, sub-specialties, training capacity, task sharing and productivity is not collected systematically. This highlights the pressing need to move towards a standardised data collection tool. One attempt to achieve this important objective is the IAPB Africa database (IADb), which has now been introduced in a number of countries in the region.

Future challenges

Achieving Universal Eye Health will require an efficient and well-run eye health system which ensures that people can obtain the eye health services they need without suffering financial hardship. It also requires access to essential eye medicines and technologies, and enough well-trained and motivated eye health workers.

To achieve these long-term objectives, the eye health sector in sub-Saharan Africa must change the way it works. Instead of focusing just on blindness and disease control, the emphasis should be on meeting national needs by establishing a comprehensive health service that offers universal access to eye health. We must also develop and support people who are willing to challenge barriers to improvement in a strategic manner.

HReH in sub-Saharan Africa is an ongoing crisis. Action is needed urgently to close the gap between the need for eye care and what is available. Where appropriate, organisations and individuals involved in addressing this crisis must:

- Work collaboratively in multi-agency consortia
- Develop teaching faculty to enhance the quality of training
- Provide essential equipment to ensure that graduates become productive and efficient as quickly as possible
- Offer regular continued professional development to enhance skills and improve job satisfaction
- Establish new partnerships with a range of stakeholders such as training institutions, regional health authorities, professional bodies and ministries of health and education
- Carry out strategic advocacy that encourages integrated planning of the health and eye health workforce.
- Collect, and provide access to, reliable and timely data that can be used for evidence-based planning.

Summary

Resolving the human resources crisis in Africa requires a range of interventions. We must accelerate efforts to train eye health workers to a high standard. Addressing other challenges, such as distribution, remuneration, recognition and retention require the involvement of governments; they cannot be resolved by international non-governmental organisations working on their own.

Useful resources

Road Map for Scaling up Human Resources for Health: 2012–2025, WHO African Regional Office, 2013

Vision for Africa: Human Resources for Eye Health Strategic Plan: 2014–2023, IAPB Africa, 2014

WHO Global Health Workforce Alliance **www.who.int/workforcealliance/en/**

WHO, 2010. Increasing Access to Health Workers in Remote and Rural Areas Through Improved Retention: Global Policy Recommendations,

WHO, 2016. Public Financing for Health in Africa: from Abuja to the SDGs.

References for this article are available as an online supplement to Issue 100. Visit **www.cehjournal.org**

Cataract surgical rates

Cataract remains the largest cause of blindness worldwide. Cataract surgical rate, or CSR, measures how many cataract operations are performed per million population in a given year. The map shows the latest available data taken from the IAPB atlas.

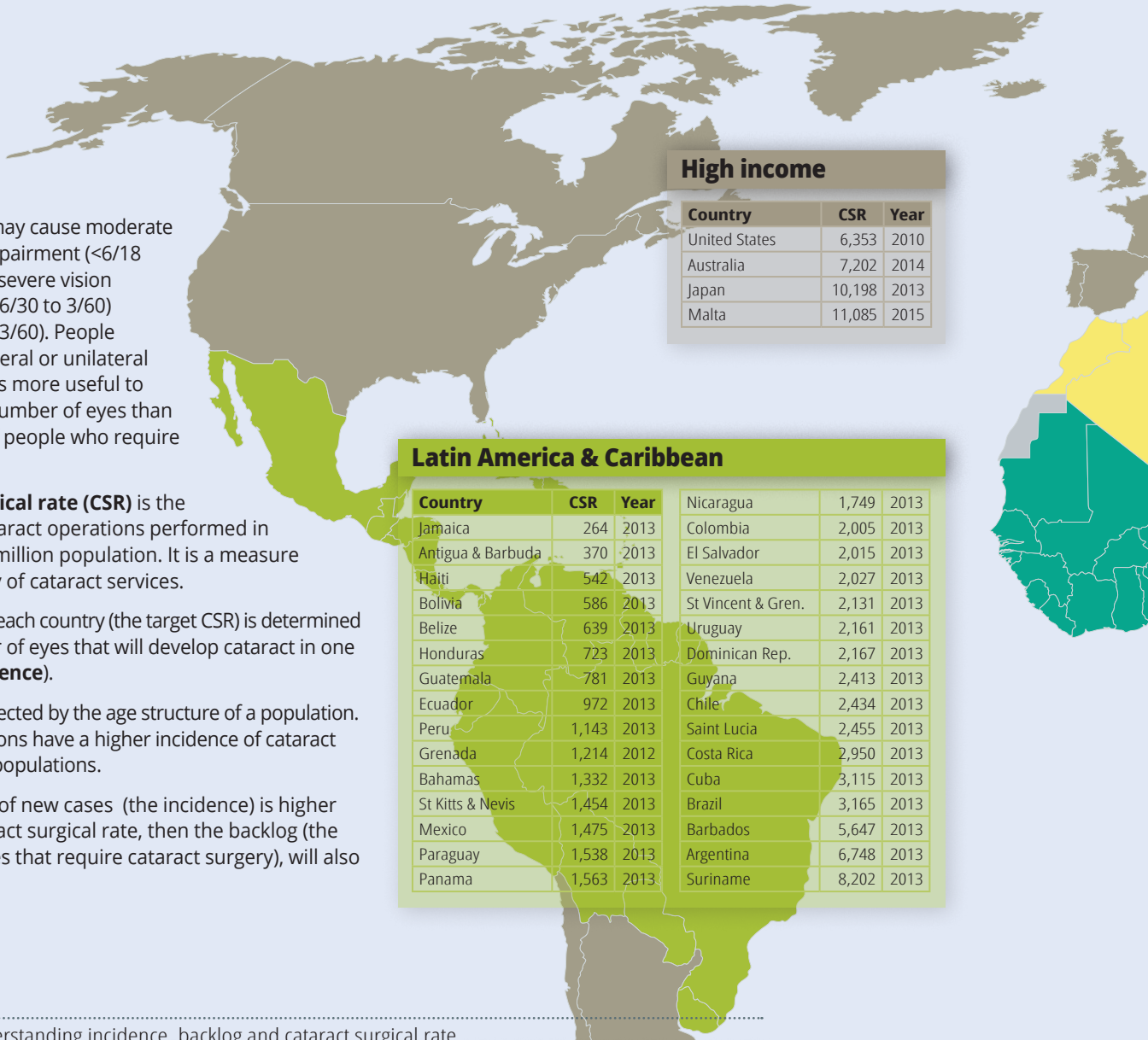
Cataract may cause moderate vision impairment (<6/18 to 6/60), severe vision impairment, (<6/30 to 3/60) or blindness (<3/60). People may have bilateral or unilateral cataract, so it is more useful to consider the number of eyes than the number of people who require surgery.

Cataract surgical rate (CSR) is the number of cataract operations performed in one year, per million population. It is a measure of the quantity of cataract services.

CSR needed in each country (the target CSR) is determined by the number of eyes that will develop cataract in one year (the **incidence**).

Incidence is affected by the age structure of a population. Older populations have a higher incidence of cataract than younger populations.

If the number of new cases (the incidence) is higher than the cataract surgical rate, then the backlog (the number of eyes that require cataract surgery), will also be high.



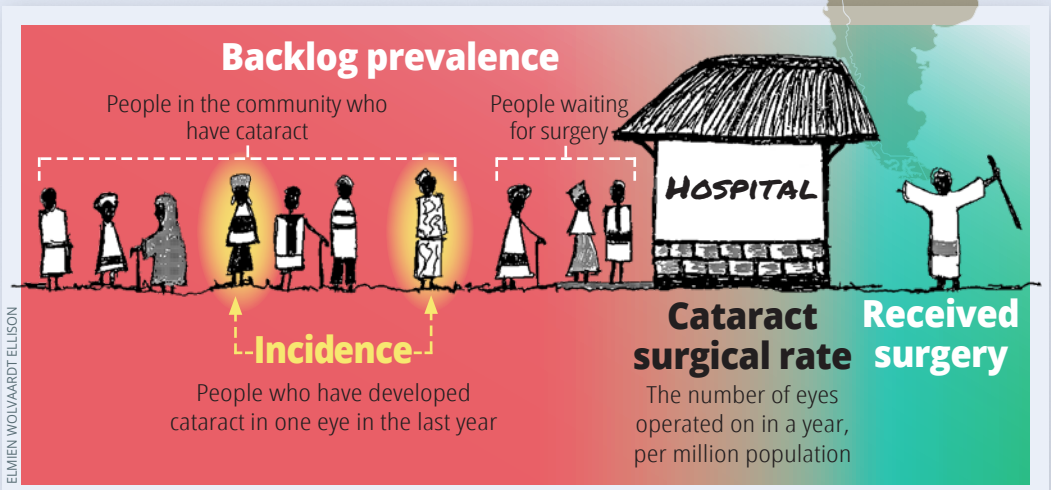
High income

Country	CSR	Year
United States	6,353	2010
Australia	7,202	2014
Japan	10,198	2013
Malta	11,085	2015

Latin America & Caribbean

Country	CSR	Year	Country	CSR	Year
Jamaica	264	2013	Nicaragua	1,749	2013
Antigua & Barbuda	370	2013	Colombia	2,005	2013
Haiti	542	2013	El Salvador	2,015	2013
Bolivia	586	2013	Venezuela	2,027	2013
Belize	639	2013	St Vincent & Gren.	2,131	2013
Honduras	723	2013	Uruguay	2,161	2013
Guatemala	781	2013	Dominican Rep.	2,167	2013
Ecuador	972	2013	Guyana	2,413	2013
Peru	1,143	2013	Chile	2,434	2013
Grenada	1,214	2012	Saint Lucia	2,455	2013
Bahamas	1,332	2013	Costa Rica	2,950	2013
St Kitts & Nevis	1,454	2013	Cuba	3,115	2013
Mexico	1,475	2013	Brazil	3,165	2013
Paraguay	1,538	2013	Barbados	5,647	2013
Panama	1,563	2013	Argentina	6,748	2013
			Suriname	8,202	2013

Figure 1 Understanding incidence, backlog and cataract surgical rate



SUZANNE PORTER/SIGHTSAVERS

A woman sees for the first time after cataract surgery. TANZANIA

Central Europe, Eastern Europe & Central Asia

Country	CSR	Year
Moldova	977	2014
Romania	1,361	2009
Serbia	2,478	2009
Bulgaria	4,616	2009
Lithuania	4,670	2009
Latvia	5,673	2009
Czechia	7,800	2009
Hungary	8,372	2014

North Africa & Middle East

Country	CSR	Year
Afghanistan	717	2014
Oman	969	2014
Saudi Arabia	1,187	2014
Kuwait	1,462	2014
Sudan	2,121	2014
Egypt	2,761	2014
Pakistan	2,819	2014
Morocco	2,924	2014

South Asia

Country	CSR	Year
Bangladesh	1,193	2014
Maldives	1,441	2014
Bhutan	1,533	2015
Myanmar	1,978	2015
Nepal	4,364	2015
India	4,830	2014
Sri Lanka	5,386	2015

South-East Asia, East Asia & Oceania

Country	CSR	Year
Papua New Guinea	196	2014
Micronesia	531	2014
Timor-Leste	784	2014
Laos	888	2014
Mongolia	1,068	2014
Malaysia	1,397	2014
China	1,402	2015
Indonesia	1,411	2014
Philippines	1,485	2014
Solomon Islands	1,601	2012
Cambodia	1,844	2015
Kiribati	2,185	2014
Vietnam	2,435	2014
Singapore	2,627	2014
Thailand	3,102	2015

Sub-Saharan Africa

Country	CSR	Year
Cote D'Ivoire	150	2014
DR Congo	157	2010
Liberia	157	2014
Uganda	192	2010
South Sudan	240	2010
Burundi	247	2014
Nigeria	317	2015
Mozambique	333	2015
Madagascar	368	2014
Sierra Leone	409	2015
Togo	429	2014
Ethiopia	434	2010
Senegal	472	2014
Rwanda	483	2015
Kenya	494	2014
Tanzania	518	2010
Malawi	523	2010
Guinea	535	2014
Benin	578	2014
Zimbabwe	631	2014
Cameroon	686	2014
Zambia	690	2014
Niger	708	2014
Ghana	710	2014
Mali	807	2015
South Africa	847	2015
Lesotho	937	2014
Botswana	1,490	2015
Mauritius	4,604	2016

KEY

For data analysis, the world is divided into seven regions, based on geographic location and country GDP.

- High income
- Latin America & Caribbean
- Central Europe, Eastern Europe & Central Asia
- North Africa & Middle East
- Sub-Saharan Africa
- South Asia
- South-East Asia, East Asia & Oceania

Trachoma then and now: update on mapping and control

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In the last 30 years, there has been rapid progress towards ending the suffering and blindness caused by trachoma, with five countries being validated as having achieved elimination. However, many challenges remain.

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Facial cleanliness is an important part of the trachoma elimination strategy. MALAWI

When the first issue of the *Community Eye Health Journal* was being sent to readers around the world in 1988, trachoma was at a turning point. One of the two foundational clinical trials establishing the effectiveness of the bilamellar tarsal rotation procedure for trachomatous trichiasis had just been completed; the other was about to start.[1,2] The pharmacokinetics and antimicrobial spectrum of azithromycin, a recently discovered macrolide antibiotic, were in the process of being defined.[3,4] The epidemiological association between a lack of facial cleanliness and the presence of active trachoma was becoming clearly established[5,6] and the World Health Organization's (WHO's) simplified grading system had just been published,[7] providing non-specialist health personnel working in endemic communities with a means to clearly and quickly identify and record the burden of disease. Additionally, the first national survey of the prevalence and causes of blindness in a country in Africa had just finished; it was conducted in The Gambia and suggested that 17% of all blindness there was due to trachoma.[8]

ROBERT ESSEL / INTERNATIONAL TRACHOMA INITIATIVE

Mass distribution of antibiotics. ETHIOPIA

These developments led, in the subsequent decade, to:

- Demonstration of the effectiveness of single-dose oral azithromycin against active trachoma,[9] successful trials of azithromycin mass drug administration,[10] and the initiation of a donation scheme by Pfizer, Inc., the manufacturer of azithromycin[11]
- Landmark community randomised trials investigating intensive facial cleanliness campaigns and fly control for reducing the prevalence of active disease[12,13]
- The 1993 WHO endorsement of the "SAFE strategy" (surgery, antibiotics, facial cleanliness and environmental improvement) for trachoma elimination[14]
- Establishment, at the end of 1996, of the WHO Alliance for the Global Elimination of Trachoma by 2020 (GET2020)[15]
- The 1998 World Health Assembly resolution 51.11, which called on endemic countries and WHO to take all actions necessary to achieve the GET2020 goal.[16]

The current landscape

As a consequence of the above, the landscape for trachoma now looks very different.The SAFE strategy is being implemented, partially or at scale, in at least 31 countries. In 2016, the year for which the most recent global data are available, more than 260,000 people had their trachomatous trichiasis managed, while more than 85 million people received antibiotics for trachoma.[17] Pfizer's azithromycin (Zithromax®) donation scheme has ramped up from one hundred thousand doses shipped in 1999, to more than one hundred and twenty million doses shipped in 2016.[18] As a result, global antibiotic coverage is expected to increase again from 2016 to 2017.[17]

Much of these recent increases in output of the SAFE strategy's surgery and antibiotic components rely

on data from the Global Trachoma Mapping Project (GTMP),[19] which from 2012–2016 completed population-based prevalence surveys in 1546 districts of 29 countries, adding to the 1,115 districts for which data had previously been amassed.[20] By working with health ministries to generate gold-standard data on trachoma prevalence within a culture of collaboration, openness and commitment to quality,[21,22] the GTMP helped foster a spirit of genuine collaboration within the trachoma elimination community, shone a light that has helped the rest of the world to see the ongoing public health tragedy of trachoma, and provided the district-by-district justification required to initiate interventions.

Financial resources to complement the continuing azithromycin donation have followed, with new or renewed contributions from a committed group of bilateral agencies, private foundations, non-governmental development organisations, service organisations and individual donors

Concrete proof of progress against disease is now available. The number of people worldwide who need operations for trichiasis is thought to have decreased from 8.2 million in 2007[23] to 2.8 million in 2016. Similarly, the number of people worldwide living in districts where the A, F and E components of SAFE need to be implemented for trachoma elimination purposes is thought to have decreased from 1,244 million in 2007 to 190 million in 2016.[17,23] Oman, Morocco, Mexico, Lao People's Democratic Republic and Cambodia have now all been officially validated as having eliminated trachoma as a public health problem, while a further six countries (China, Ghana, Iraq, Islamic Republic of Iran, Myanmar and The Gambia) have reported achieving elimination prevalence targets.[24]

The *Community Eye Health Journal* has been a part of this journey. In its first 100 issues, it has published more than 50 excellent articles about trachoma (**www.cehjournal.org/category/trachoma/**), providing a critical forum for education, information, debate and reflection. We congratulate the *Journal* on its century, and thank the editors, donors and readers who have contributed so much to international efforts against trachoma to date.

It would be wrong, however, to imply through these notes of congratulation that the race against trachoma has now been successfully run, or even that we could coast in from here to the finish line. Significant challenges remain.

1 There is an urgent need to address the remaining gap between the resources that have been committed and those that will be required.
2 Important work is also needed on a number of technical issues, including:
   a. How best to manage post-operative trachomatous trichiasis
   b. How to most efficiently deliver water, hygiene and sanitation interventions to cut transmission of ocular *Chlamydia trachomatis*
   c. How to undertake post-validation surveillance of previously-endemic districts, in order to guard against recrudescence of infection and disease.

It is our hope that with the ongoing political support of endemic country governments, current programmatic momentum, the continuing commitment of our many partners, and the relevance of our work to a multitude of cross-cutting targets within the Sustainable Development Goals,[25] the end of trachoma can be achieved.

Figure 1 The SAFE strategy for trachoma control

INTERNATIONAL TRACHOMA INITIATIVE

References for this article are available as an online supplement to Issue 100. Visit **www.cehjournal.org**

The authors alone are responsible for the views expressed in this article and they do not necessarily represent the views, decisions or policies of the institutions with which they are affiliated.

Onchocerciasis then and now: achievements, priorities and challenges

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Although river blindness is still endemic in many African countries, it is still possible that it will be eliminated by 2025. Doing so will require political stability and an unwavering focus on the goal.

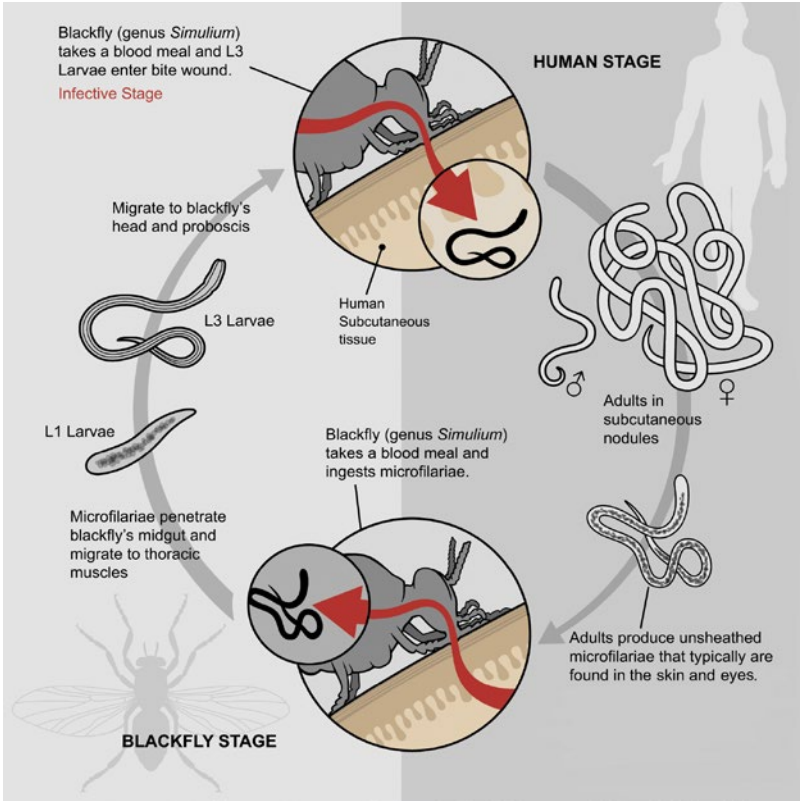
KATE HOLT/SIGHTSAVERS

The black fly, responsible for onchocerciasis transmission, breeds along rivers such as these. NIGERIA

Onchocerciasis is an eye and skin disease caused by a worm known as *Onchocerca volvulus*. It is transmitted from one human to another by black flies of the genus *Simulium*. It causes an itchy skin rash, eye disease (often blinding) and nodules under the skin. More than 99% of the people with this infection live in Africa.

In 1987, just before first issue of the *Community Eye Health Journal* was published, the pharmaceutical Company MSD (known as Merck & Co. Inc. in the USA and Canada) made an unprecedented commitment to donate Mectizan® (ivermectin MSD), for as long as was needed, to control onchocerciasis (river blindness).[1] Mass distribution of Mectizan revolutionised the approach to onchocerciasis control at the time, and has since led to mass drug administration for some of the other neglected tropical diseases (NTDs). It had become possible to imagine that onchocerciasis would one day be eliminated.

Figure 1 Life cycle of *Onchocerca volvulus*



GIOVANNI MAKI. DERIVED FROM BASÁÑEZ M-G, PION SDS, CHURCHER TS ET AL., 2006

The Onchocerciasis Control Programme

The first very successful, but very costly, control efforts had begun more than a decade earlier, in West Africa. These efforts were led by the Onchocerciasis Control Programme (OCP) in West Africa. The only tool available at the time was vector control: limiting or eradicating the insect responsible for spreading onchocerciasis.[2]

The principle was that, by controlling breeding sites of the flies for long enough, transmission could be interrupted while waiting for the adult parasites of *Onchocerca volvulus* to die (in infected individuals). Then, even if the flies returned, there would be no further larvae to transmit. This required the regular spraying of larvicide along thousands of kilometres of rivers in West Africa at very regular intervals during the peak breeding season, often using helicopters to treat inaccessible areas. Although transmission was in fact halted in many areas, nothing could be done for those patients already suffering from the effects of the disease which – as well as visual loss – included skin disease with severe itching.

Natural history

The adult stage of *Onchocerca volvulus* is a worm. In the bodies of humans, the worms are found intertwined in nodules, most of which are found on bony prominences just under the skin. These, however, cause few problems. However, each female adult worm produces thousands of larvae (microfilaria) which create the major problems of the disease.

The microfilariae migrate around the body, with most going to the skin where they are ingested with the blood meal during a black fly bite (and passed on to others when the same black fly bites them later). Microfilariae also find their way to other parts of the body, including the eye.

When the microfilariae in the tissues are alive, they cause few problems. Those which are not ingested by a black fly within six months or more will die, which causes a localised inflammatory response. In the skin this provokes itching which can be very severe.

The inflammatory response can also occur in any structure of the eye or optic nerve. Inflammatory reactions around an individual microfilaria are usually insignificant, but repeated sites of inflammation around many dying microfilaria eventually create irreversible changes. In the eyes, the most significant lesions causing visual impairment and blindness are sclerosing keratitis, anterior uveitis, chorioretinitis and optic atrophy.

Treatment

Diethylcarbamazine (DEC), known under various trade names in Africa, has been around for many years. It kills microfilaria but may lead to severe reactions in heavily infected patients. These reactions are called Mazzoti reactions and are due to dying microfilariae. In the eye, the inflammation is often so intense that it actually creates further visual loss and so use of DEC is contraindicated. Ivermectin may also lead to Mazzoti reactions, but these are much less severe and only occur in heavily infected individuals.

Ivermectin was shown to have no effect in the eye. The microfilariae are killed in the skin. Those in the eye either die naturally in the eye, or migrate out of the eye. There is therefore no detriment to vision when using ivermectin, although most changes that are already present are irreversible.

Ivermectin and onchocerciasis control

With the availability of ivermectin, a new era of safe, effective treatment for patients and disease control began. Ivermectin was first introduced in West Africa, where the Onchocerciasis Control Programme had been active. The donation also presented an opportunity to treat other areas.
Eye care nongovernmental development organisations (NGDOs), which had established blindness rehabilitation programmes in onchocerciasis endemic areas, were among the first to start distribution programmes in highly endemic areas. These NGDOs met together with the World Health Organization (WHO) to select priorities and coordinate programmes and develop common approaches to treatment.

Ivermectin kills microfilariae but not the adult worm. It does have a temporary sterilising effect on the adult females, thereby delaying by several months the re-invasion of the skin and other tissues. Early studies showed that an annual dose of ivermectin would control the symptoms of the disease and would prevent the development of further vision loss. Endemic areas were classified as hyperendemic, mesoendemic and hypoendemic. There were very few cases of blindness (or skin disease) in hypoendemic areas and these were not considered priority areas for control programmes. Endemicity was initially measured by skin snip studies where live microfilariae were visible in small pieces of skin.

As experience grew with the use of ivermectin, it was found possible to simplify the community diagnostic process using a nodule survey. If the prevalence of nodules was 20% or more, a community was considered meso- or hyper-endemic and received ivermectin. In these communities, all eligible people were treated thanks to mass drug administration (MDA) projects. Certain groups were excluded: children younger than five, pregnant women, lactating women during the first week post-partum, and those with a chronic disease, particularly diseases of the central nervous system. Although ivermectin was donated and imported to the government stores free of charge, there were still considerable costs and logical challenges. The costs related to training staff for ivermectin distribution and there were logistical challenges to get the medicines to the most remote areas, where most of the patients were found.

The African Programme for Onchocerciasis Control

The biggest problem was in Africa, which had over 99% of the global burden. It soon became clear that NGDOs working with national ministries of health would be unable to scale up as required. Negotiations with all the partners involved led to the creation of the African Programme for Onchocerciasis Control (APOC) in 1995. The programme was largely financed by donors to a World Bank Trust Fund, with the WHO as the implementing agency, supported by governments and NGDOs.

Operational research

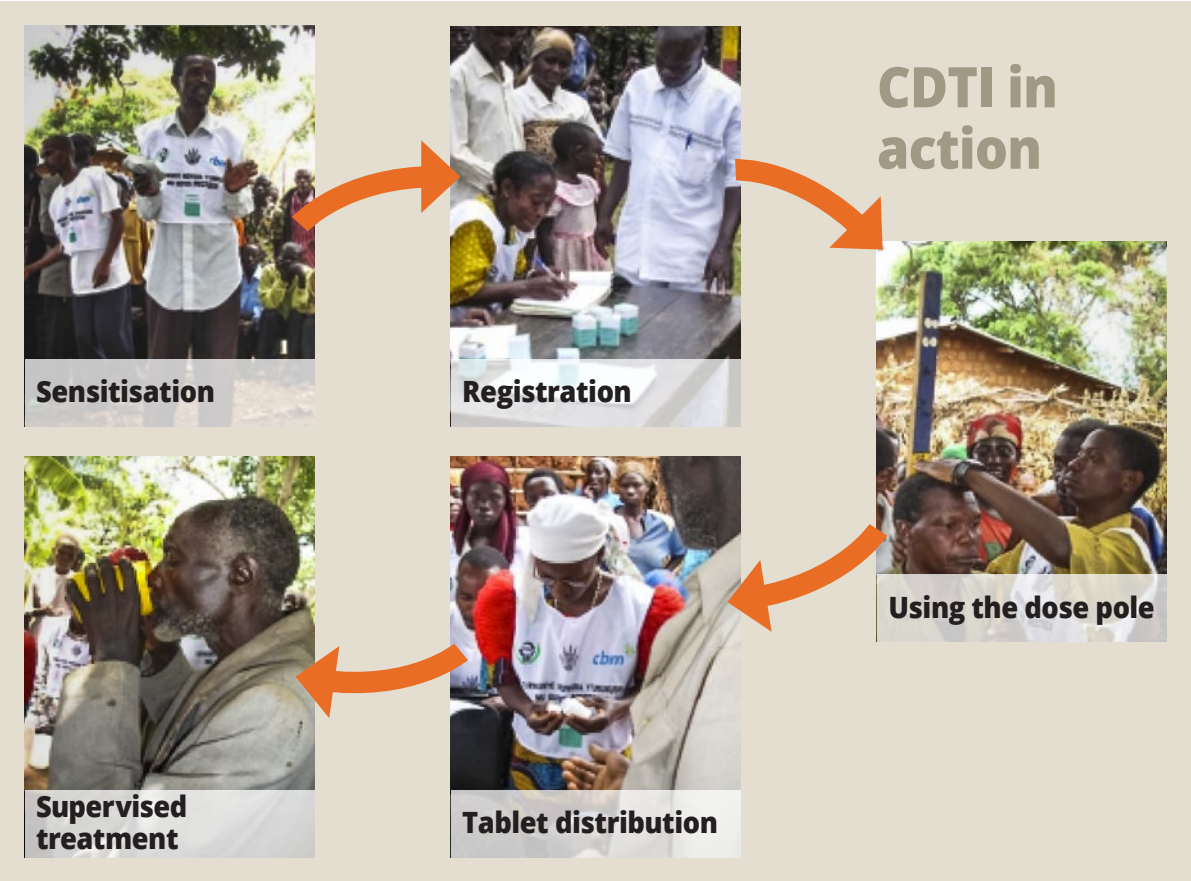
Research by the WHO's Special Programme for Research and Training in Tropical Diseases (TDR) brought about some major developments for onchocerciasis control. These included mapping and the involvement of communities in managing their own programmes of community-directed treatment with ivermectin (CDTI). The social consequences of severe skin disease were also identified as a problem of serious public health importance.

Continues overleaf ➤

KATE HOLT/SIGHTSAVERS

Community distribution of ivermectin for onchocerciasis.
NIGERIA

Figure 2 Community-directed treatment with ivermectin



Mapping techniques started to develop rapidly when it was discovered that there was an approximate relationship between the onchocercal nodules under the skin and the prevalence of skin microfilaria. In Africa, mapping techniques evolved from nodule surveys in each village, to a system of rapid epidemiological mapping for onchocerciasis (REMO). After careful selection of a limited number of communities, their populations were assessed for nodules, and regions of meso and hyperendemic onchocerciasis defined. After the populations were made aware of onchocerciasis and its treatment, and chose people to train as distributors of ivermectin, they carried out their own MDA and reported the results. With the resources of APOC and support from NGDOs, governments were able to map onchocerciasis using this REMO technique. Efforts were scaled up the over a period of a few years so that most endemic areas were covered.

There were a few problem areas, notably in conflict or post-conflict areas, and in co-endemic areas with another filarial disease, Loa loa. APOC was however a major success as a control programme, as acknowledged in the final evaluation in 2015.[3] A total of 120 million people were treated. Communities were taking ownership of not only the onchocerciasis programme, but also mass drug administration for other neglected tropical diseases. Onchocerciasis had been largely eliminated as a public health problem. There are probably only a few new cases of blindness from onchocerciasis in Africa every year, mainly in areas of political instability where programmes have not been functioning well.

Onchocerciasis Elimination Programme for the Americas

In Latin America, the areas affected by onchocerciasis were small and well circumscribed, with an estimated half a million people infected. Here, the strategy was to treat everyone at risk and not to take into account the levels of endemicity.

The Onchocerciasis Elimination Programme for the Americas (OEPA) set out with the objective of eliminating the transmission of onchocerciasis. In 1995, some areas were put on twice yearly treatment with ivermectin. From 2000, there was a big effort to scale up treatment and achieve excellent coverage. The result has been that onchocerciasis has been eliminated in Colombia, Ecuador, Mexico and Guatemala. Only Venezuela and Brazil still have some cases, particularly deep in the Amazon forest, on their common border.[4]

Elimination of transmission in Africa: a paradigm shift

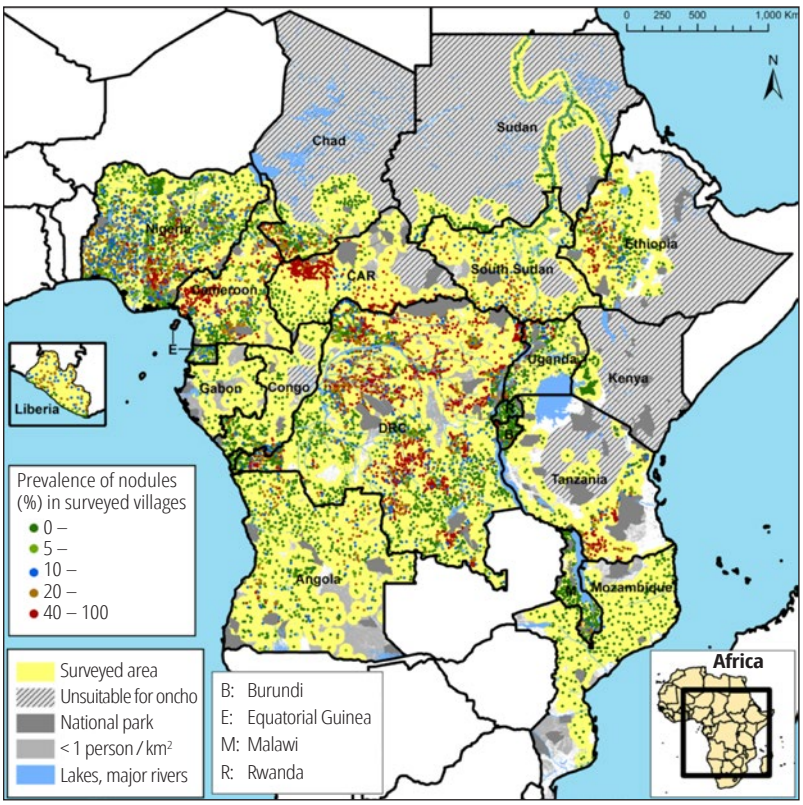
In Africa, where the epidemiology is completely different, with large foci often not well defined and treatment focused primarily on control of disease as a public health problem, the main question was if, and when, treatment with ivermectin could be stopped. Studies in Senegal and Mali (completed in 2009) showed that transmission of the disease had been interrupted by multiple rounds of annual ivermectin treatment. Elimination of transmission was now a possibility and on the agenda for Africa.

In 2009, the first consultation between partners took place to review the possibilities.[5] At the annual meeting

of APOC (the Joint Action Forum) it was agreed to change the focus of the control programmes to the elimination of transmission, where possible. This shift needed to be reflected in country programmes. WHO has now produced updated guidelines on criteria for elimination[6], but countries still need help to reach this goal; for example, there must be mapping for elimination that includes all potential hypoendemic regions.

Decisions must be made about alternative treatments for many of the affected areas. For example, whether treatment should be increased to twice or even four times a year in some areas, and whether short-term vector control should be added in some areas to break the transmission cycle. These decisions must be made at the national level, and many countries are now setting up 'elimination expert advisory committees.' For example, in Uganda, which has had a committee in place for 10 years, some areas are now clear of the disease and treatment has been stopped. However, due to conflict in the north of the country, the programme has only been carried out at full scale over the last two to three years. Cross-border areas continue to cause difficulties in Uganda, due to delayed programmes in the DRC and South Sudan.

Figure 3 The baseline endemicity of onchocerciasis in APOC countries.



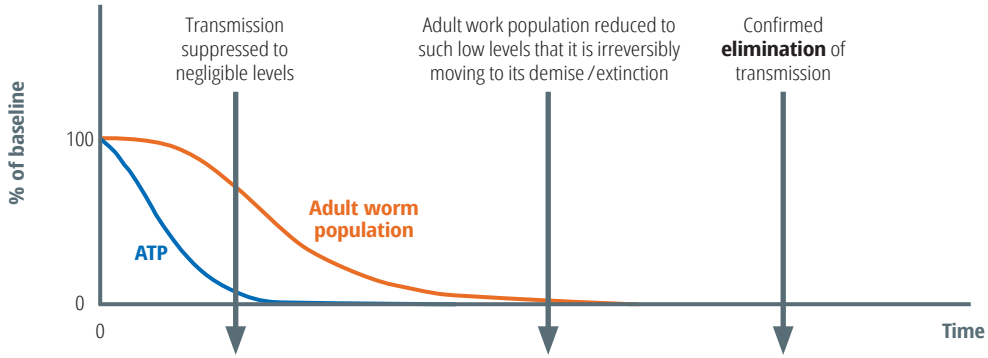
Future opportunities

Whereas much has been achieved using existing control strategies, more is needed to enhance diagnosis and treatment. For example:

- Developing on an easy-to-use macrofilaricide, which would kill the adult parasite, would have a major impact on speeding up the elimination process.
- Skin snips have started to be replaced by serological tests, using the OV-16 antibody test, and this could be implemented in more areas.
- Ongoing research about the best strategies to use in areas where loiasis is co-endemic has had some success, but further research is needed to see how to put the strategies into policy, particularly in Cameroon and the DRC where the problem is greatest.
- Ivermectin is also used for mass drug administration in the lymphatic filariasis (LF) elimination programme in Africa, where the two diseases co-exist. Strategies must be coordinated and a process for monitoring and evaluation needs to be established, especially where one disease may have already been eliminated but treatment needs to continue for the other.

The international community has set a target for elimination of onchocerciasis by 2025. This is ambitious but possible, provided there is commitment and political stability in Africa and Yemen, which is working on its own elimination programme. As endemic countries establish their health targets for the future, onchocerciasis elimination must be a priority.

Figure 4 Phases of elimination



Transmission	Ongoing	Negligible, conditional on continued intervention	(Irreversibly approaching) zero due to insufficient or absent adult worms	Zero
Intervention	Active intervention, aimed at reducing work burden or transmission (mass treatment and / or vector control)		None	None
Surveillance	Monitoring and evaluation of progress		Active surveillance to proof elimination	Surveillance for timely detection of a possible reintroduction of infection

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Open education in eye health: transforming access to learning

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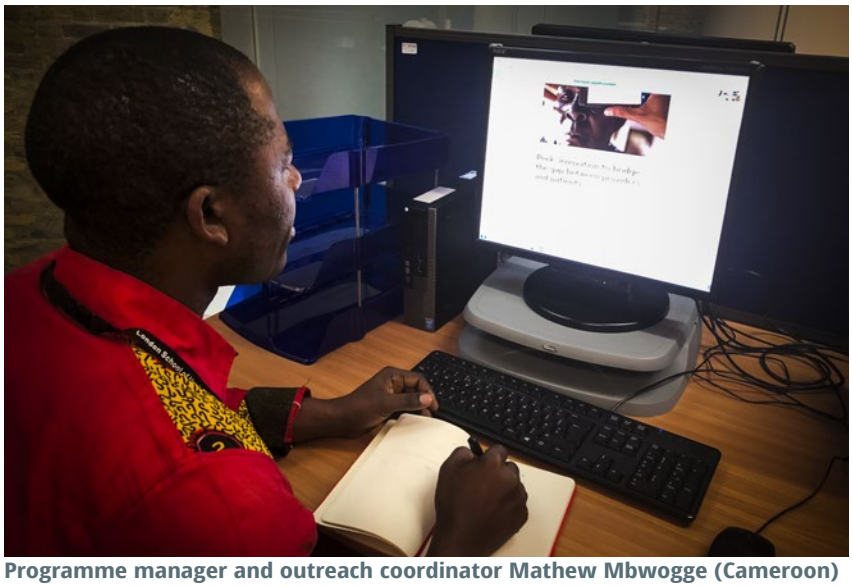
Remaining relevant and keeping up with medical advances is a challenge, as access to high-quality education is inequitable and costly. The open education approach is designed to reduce restrictions to learning.



ROMULO FABUNAN

Programme manager and outreach coordinator Mathew Mbwogge (Cameroon) uses ICEH's Global Blindness course, which is available free of charge on FutureLearn, to update his knowledge. UK

Over the years, improvements in medical education have been linked with improved clinical practice, which has in turn contributed to a doubling of life span in the 20th century.[1] However, we are still faced with inequities in health provision within and between countries. Health systems worldwide continue to place growing demands on health professionals to keep up with medical advances, manage challenges due to rapid demographic change and remain prepared to face new infections or environmental risks.

In eye health education, the situation is no different. Both practitioners and training programmes must review and update their resources to remain relevant by:

- Setting standards for clinical and surgical competencies
- Ensuring that training programmes are matched to the needs of the population, in the context of their health systems
- Improving teamwork across professional groups, such as ophthalmologists and optometrists.

Maintaining high standards for the quality of education in eye health is essential; these should be consistent from country to country. In theory, quality requirements for education in eye health can be aligned by creating international training curricula, practice guidelines and standardised competencies. in practice, however, it is difficult to standardise training due to cost, inequitable opportunities, a shortage of educators and limited access to updated resources. Inequities in education and training can result in low workforce motivation, low clinical and surgical outputs, poor quality of care and dissatisfied patients. In order to address this, medical education needs to keep pace not only with advancements in medicine but also with new educational methods and technologies.

Our everyday life has been transformed by the use of technology to connect with each other, gain access to information and conduct financial transactions. This offers an opportunity to broaden our approach to education and remain relevant to how learners' needs, behaviour and access to information are changing in the digital era. There is growing evidence that online learning (E-learning) can support knowledge and skill development and can also be used to support and strengthen training programmes.[2]

Continuing professional development requires that individuals adopt a purposeful, self-directed approach to find resources that are appropriate to them at that time. E-learning, together with guidance from professional societies, can support eye health workers and professionals to do so.

Open education is about broadening access to learning by removing barriers such as cost and distance. It is usually done by offering access to free open educational resources via the internet. Learning can be guided or self-directed.

The term 'open educational resources' first came into use in 2002, when participants at a UNESCO conference defined it as: "The open provision of educational resources, enabled by information and communication technologies, for consultation, use and adaptation by

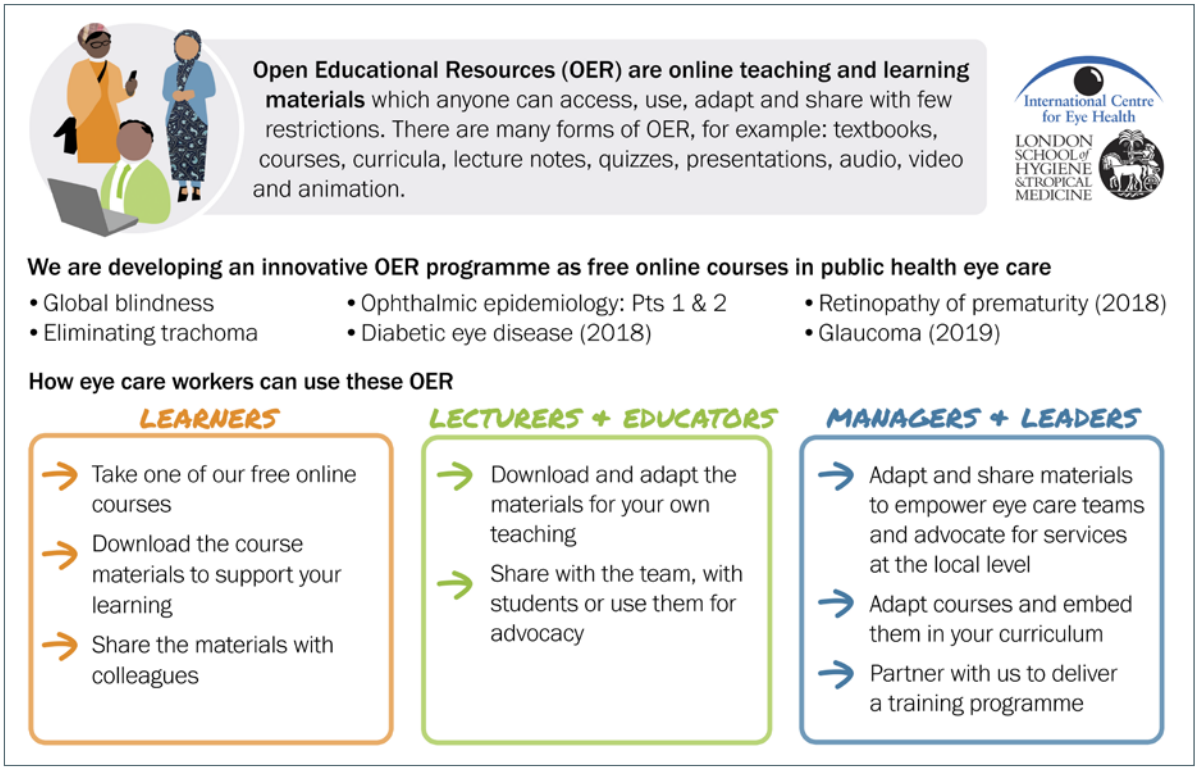
Inequalities

Inequalities in health exist for various reasons. If inequalities are avoidable (e.g. by making eye services more affordable, or making them available in rural areas) then they are better described as inequities, a word which highlights the unfairness of the situation.

Open education

The two most important aspects of openness have to do with free availability over the internet and as few restrictions as possible on the use of the resource. There should be no technical barriers (undisclosed source code), no price barriers (subscriptions, licensing fees, pay-per-view fees) and as few legal permission barriers as possible (copyright and licensing restrictions) for the end-user.

Figure 1 Different ways to use open education In eye health



a community of users for non-commercial purposes."[3] Not only can users of open educational resources use or read it, but they can also adapt it, build on it and reuse it.

Open does not mean totally unrestricted; rather it is guided by the Creative Commons licensing framework.[2] The key principle of this framework is that resources must be attributed to the original creator or source. It also states exactly how content may be used and adapted, provided that it has been attributed correctly:

1 **Retain.** The right to make, own and control copies of the content (e.g., download, duplicate, store, and manage)
2 **Reuse.** The right to use the content in a wide range of ways (e.g., in a class, in a study group, on a website, in a video)
3 **Revise.** The right to adapt, adjust, modify, or alter the content itself (e.g., translate the content into another language)
4 **Remix.** The right to combine the original or revised content with other material to create something new (e.g., incorporate the content into a mashup)
5 **Redistribute.** The right to share copies of the original content, your revisions and/or your remixes.

Open online education: our approach

In 2015, the International Centre for Eye Health (ICEH) started to develop open education courses in eye health, with the idea of exploring fresh opportunities in technology and addressing imbalances in opportunities for eye health education.

Each course was facilitated over several weeks and learners were able to participate actively in the online discussions. All of the course content was then made available as a range of open educational resources for online use, including videos, images and online articles.

The course structure allowed us to align all these resources into a learning framework (curriculum) with clearly structured learning outcomes and self-assessment tests. These became free-to-access, standalone courses on online learning platforms such as FutureLearn or Moodle.

The purpose behind this approach is to enable individuals to engage easily with the content, download and reuse it locally; and to adapt and introduce it into their own training programmes.

When courses are 'live' (facilitated), there are peer discussion forums, webinars with experts who answer learners' questions, and course mentors who guide a learner through the content. This helps to enhance learning and reflects how people share information in a conversational style, as adopted across many social media technologies such Facebook, WhatsApp or Twitter.

Finally, when a user completes the course requirements, they have the option to purchase a certificate as an acknowledgement of their achievement.

What are the available courses?

ICEH have made a range of courses available:

- **Global blindness: planning and managing eyecare services.** This course is structured to help the learner to understand the WHO classification of visual impairment, the magnitude and causes of blindness and the strategies and planning required to control cataract blindness and refractive errors. There are tools to support learners to begin to apply their learning at a local level.

  "This course is excellent in explaining how to set aims and objectives and the relevance of national and local planning for eye care." ***Denise***

Continues overleaf ➤

- **Ophthalmic Epidemiology 1: Basic principles and 2: Application to eye disease.** This is a specific subject area delivered as a two-part course structured to build an understanding of the basic principles of epidemiology as applied to ophthalmology. Participants are guided to critically appraise evidence essential to improve their practice. Quote from a previous participant:

  "This course made complex materials easy to understand and I could do it in my own time"

- **Eliminating Trachoma:** Trachoma remains endemic and a risk of blindness in 42 countries. This course is a practical induction into SAFE activities that need to be implemented towards the goal of eliminating trachoma.

  "I have been able to identify the causative agents, how to diagnose trachoma and strategic plans to eradicate trachoma. Global mapping cannot be over emphasised as it is the only way for us to identify or pinpoint areas that are trachoma endemic." ***Rotimi***

  "The course has given me a new perspective on trachoma. I think it should be recommended for all ophthalmologists, especially in areas at risk. I've learned a lot about mapping trachoma and I'm eager to learn even more." ***Eloisa***

Different ways to use open education in eye health

Open education promotes a sense of shared responsibility to ensure that good quality information, of relevance for practice at a local level as well as at the global level, is available. Strengthening an interconnected approach in the digital age has the potential to address inequity in eye health knowledge and encourage the practice of life-long learning for all health professionals.

Cataract training using simulation

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Over the last 30 years, there have been significant changes in the way eye surgery is taught to trainee surgeons. A fairly recent development is that, instead of learning eye surgery in a live operating theatre, surgeons can practise surgical techniques by simulation: using another object with properties that are similar enough to those of a real human eye. The idea is to help eye surgeons to learn a new technique, such as cataract or glaucoma surgery, safely and effectively. Surgeons are expected to achieve a specified level of competence and confidence before they carry out supervised surgery on real patients.

Cataract training by simulation can be done using high-tech computerised simulators, for example the HelpMeSee simulator for small-incision cataract surgery (New York, USA), or the Eyesi Surgical Training simulator for phacoemulsification (VRmagic, Mannheim, Germany). However, these may be unaffordable in low- and middle-income countries.

Fortunately, low-cost simulation models are also available. For example, a tomato placed into boiled water for 30 seconds can be used to practise capsulotomy, an apple can be used to simulate scleral tunnelling and a banana or piece of foam is very good for practising suturing. The simulation does not need to be 'high-tech' or expensive, but it does need to have high fidelity – i.e., it should be very similar to the real thing. The website **www.simulatedocularsurgery.com** has a simulation gallery with interesting ideas from around the world.

WILL DEAN

Surgeons practise techniques again and again. SOUTH AFRICA

Simulation can be a powerful tool that allows sustained, deliberate practising of individual surgical steps again, and again, and again. Imagine the benefits of being able to practise a scleral tunnel incision or a capsulotomy 50 to 100 hundred times before operating (under supervision) on a patient. Simulation can help trainee surgeons to practise managing complications during surgery and experienced surgeons to learn new techniques.

Practice makes perfect, but the correct technique must be practised. Simulation training must be integrated into a curriculum. Trained surgical instructors must be present to offer instruction, guidance and feedback. Outcome measurements and assessments will help to ensure the quality of the training.

The International Agency for the Prevention of Blindness (IAPB) have developed a Standard List for the initial development of a surgical skills centre (or wet/dry-lab): **https://iapb.standardlist.org/knowledge/guide-establishing-surgical-skills-centre/**

Although it takes years of experience and practice in the operating theatre to become an expert cataract surgeon, learning cataract surgery to an acceptable level of competence can be achieved safely and efficiently thanks to cataract training by simulation.

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Eye care in South Asia, 1988–2018: developments, achievements and future challenges

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Despite South Asia's many challenges, including a rapid increase in non-communicable eye diseases such as glaucoma, diabetic retinopathy and retinopathy of prematurity, the many and varied successes of the last thirty years are a cause for celebration.

QUEEN ELIZABETH DIAMOND JUBILEE TRUST ROP INITIATIVE INDIA

Health must be at the centre of political debate in South Asia. INDIA

South Asia is a unique geopolitical region which covers 3.4% of the world's surface area and supports 25% of the world's population (1.749 billion). It hosts the second (India), sixth (Pakistan) and the eighth (Bangladesh) most populous countries in the world. The South Asia Association for Regional Cooperation (SAARC) was established in 1985 and currently has eight Member States. SAARC accounts for a tenth of the global economy and member countries span two World Health Organization (WHO) regions: Eastern Mediterranean (Afghanistan, Pakistan) and South East Asia (Bangladesh, Bhutan, India, Maldives, Nepal and Sri Lanka). Over the past three decades, South Asia has faced and withstood many human and natural disasters, including a tsunami, devastating cyclones, annual floods, earthquakes, landslides, riots, civil disturbances, wars and terrorist strikes.

Developments in eye health: 1988–2018

South Asia has witnessed a dramatic demographic transformation over the last three decades, with the population increasing by 162%. Life expectancy at birth across South Asia has increased by 11 years, from 57 years in 1988 to 68 years in 2015, with the increase ranging from 6 years in Pakistan to 19 years in Bhutan (Table 1). Infant and under-five mortality rates have decreased in all countries in South Asia from 1988 to 2016 and the population aged 50 years and older has increased significantly. This demographic transition has increased the 'at-risk' population for visual impairment and blindness as all the commonest causes are age-related. At the same time, with decreasing under-five mortality rates, the prevalence and causes of childhood blindness have decreased, particularly the nutritional and infective causes.

There are two main challenges facing South Asia. Visual impairment and blindness due to infectious conditions (such as leprosy and trachoma) still exist, and non-communicable blinding conditions such as cataract, glaucoma, diabetic retinopathy (DR) and retinopathy of prematurity (ROP) are increasing rapidly in magnitude. As a result of these challenges, and the failure of the health systems in the region to provide adequate services (due to logistical issues), conditions such as uncorrected refractive error still require urgent attention in South Asia – despite the fact that the technical know-how exists.

Eye health and prevention of blindness

South Asia is home to four WHO Collaborative Centres for Prevention of Blindness (one in Pakistan and three in India). Most countries in South Asia have a mixed health care system. There is significant participation from the private sector, including non-governmental organisations (NGOs), especially at the secondary and tertiary levels. At the primary level, the government is the principal service provider. In Sri Lanka, Bhutan and Maldives, eye care is predominantly managed by the government, whereas in Nepal and Bangladesh the NGO sector is the predominant service provider. On average, individuals have to pay 61% of the cost of health care out of their own pockets. It is lowest in the Maldives (18%) and highest Bangladesh (67%).

South Asia, along with neighbouring countries in South East Asia, has been the cradle of innovation in eye care since time immemorial, starting with outreach eye camps for cataract surgery and pilot programmes for trachoma control. India was the first country to establish a national programme for control of blindness (in 1976). It was declared a national priority by the then Prime Minister of India and later many countries in the region adopted it as an effective approach to addressing blindness.

The year 1988 began with the reaffirmation of the Alma-Ata 'Health for all' declaration in Riga, Latvia – ten years after it first identified primary health care as the key to the attainment of the goal of Health for All. Along with the emerging epidemic of HIV/AIDS, this led to

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increased emphasis on primary health care worldwide. Countries in South Asia initiated schemes such as Lady Health Workers in Pakistan and Community Health Workers (CHWs) and Accredited Social Health Activists in India. In countries where primary health care development has been strong and a functional system exists, eye care programmes have been more successful.

Many international non-governmental organisations support eye care work in South Asia. As a result, infrastructure has improved and human resources for eye health have been augmented.[1]

Blindness and visual impairment

The Global Burden of Disease study observed that South Asia is the region that is home to the greatest number of people who are blind (11.7 million), which accounts for 32.5% of the people who are blind worldwide. The prevalence of blindness in South Asia was 0.7%. Similarly, 61.2 million people in South Asia have moderate and severe visual impairment, which accounts for 28.2% of the global magnitude.[2]

Despite the challenges, much progress has been made in reducing avoidable blindness. From 1990 to 2015, the age-standardised prevalence rate of blindness is estimated to have reduced from 0.8% to 0.5% (all ages), and from 5.2% to 3.5% among people aged 50 years and older. Population-based surveys repeated in the same geographical areas in India, 10 years apart, have demonstrated this reduction very effectively.[3] Eye care indicators in South Asia reveal a significant decrease in the prevalence of blindness and a continuous increase of cataract surgical rates (CSR) and cataract surgical coverage (CSC).

VISION 2020

The regional launches of VISION 2020 in both the Eastern Mediterranean and South-East Asia regions took place in September 1999.[4] This added pace and energy to the eye care efforts in the regions and have resulted in programme advocacy with the political and administrative leadership in individual countries. A VISION 2020 action plan has been operational in all countries in South Asia since 2010.

Achievements in eye care (1988–2016)

South Asia has contributed success stories to augment the global initiative for the elimination of avoidable blindness over the past three decades. The following examples highlight this contribution.

Cataract surgery has restored this man's vision.
PAKISTAN

JAMSHYD MASUD/SIGHTSAVERS

Evidence for planning

1 Using evidence to plan eye care programmes has been the hallmark of the national programme for the control of blindness in India. Surveys have been conducted at periodic intervals and have guided the evolution of eye care programmes, especially over the last three decades. For example, the National Trachoma Control Program was later transformed into a more comprehensive National Program for Control of Blindness in order to address national eye health priorities.
2 Development and validation of the rapid assessment tools for blindness and cataract surgical services took place in India during the period 1992–1996. This was the precursor of the rapid assessment of avoidable blindness (RAAB) survey protocol (pp. 82–84).
3 Self-monitoring and institutional monitoring records for cataract surgery were first introduced in India in 1994.
4 Development and validation of the key informant method for childhood blindness was pioneered in Bangladesh in 1998.

Improved quality and efficiency of eye care programmes

1 The high-volume cataract surgery protocol was developed and promoted by the Aravind Eye Care System in India in the 1980s and 1990s.
2 Universal use of intraocular lenses (IOL) in cataract surgery and the promotion of manual small-incision cataract surgery (MSICS) revolutionised cataract surgery. It led to excellent visual outcomes after surgery and cost reduction, which has improved access to cataract surgery for the poor. From a low of less than 5% in 1988, today more than 95% of the cataracts operated in South Asia receive an IOL.
3 The past three decades have seen a shift away from outreach surgical eye camps to a 'source-and-serve' approach: diagnosis takes place at outreach camps, and surgery is carried out at a base hospital. This approach improves outcomes and reduces the risk of complications, and has become the standard across most low- and middle income countries.
4 Integrating eye care into primary health care has been carried out successfully in India and Pakistan, where Accredited Social Health Activists and Lady Health Workers (respectively) have been trained as front-line health workers with the capacity to identify and refer eye problems as needed.
5 Development of a cost-effective school eye screening protocol began in 1992. School vision screening programmes were part of school health examinations, but vision was not emphasised. The reach of school eye screening was increased by developing a single optotype screening card (6/9) and training school teachers to do the initial screening. This reduced the workload of the few ophthalmic assistants/optometrists available and increased awareness among the school teachers and parents.

Decentralised planning and service delivery

1 A comprehensive district eye care strategy – which invested in strengthening eye health infrastructure and human resource capacity for eye health at the district level – was the hallmark of the national plan in Pakistan in 1990. In 2008, a project was initiated to train 70,000 Lady Health Workers in primary eye care and provide them with appropriate skills and equipment.

2 In 1992, a pilot project was initiated in five districts in India to augment local planning capacity for eye care. District Blindness Control Societies were established and provided with partial financial and administrative autonomy to develop an annual programme implementation plan. This was then scaled up to the entire country from 1996 onwards and has found wide application as a planning template for eye care.

National initiatives to control specific causes of avoidable blindness

1 A soft loan was obtained by the Indian government from the World Bank in 1994 to augment infrastructure and human resource capacity to tackle the magnitude of cataract and improve outcomes after surgery.
2 Special task forces – with strong political buy-in – have been set up in India to control visual impairment and blindness due to diabetic retinopathy and retinopathy of prematurity.

Future challenges and way forward

Financing

The foremost challenge is to ensure universal access to quality health care, including eye care, at an affordable cost for the country and with manageable out-of-pocket expenses for families. The inadequate financing of eye care services needs urgent attention. Models of affordable health insurance packages need to be formulated as the increasing proportion of middle-income and affluent sections of society can afford to share the costs of care.

Non-communicable diseases

The epidemiologic transition is still continuing and the magnitude of non-communicable diseases is bound to increase further.[5] The number of people with diabetes worldwide has been steadily increasing from an estimated 41.7 million in 2000 to 69.2 million in 2015 and is expected to increase to 124 million by 2040.[6] The South Asia region is characterised by a high prevalence of type 2 diabetes, despite having a young population with relatively lower rates of obesity than that observed in high-income countries. This has been postulated to be the result of a 'South Asian' phenotype with higher waist circumference than in other countries, which has implications for diabetic retinopathy (DR): the risk of DR is almost twice as high among those who develop diabetes below 40 years of age.[4] Assuming that sight-threatening DR (STDR) affects 10% of people living with diabetes, the number of people with STDR would increase to 10 or 11 million by 2030. Effective screening programmes embedded in existing health systems at all levels, coupled with treatment facilities nearby, should be strongly emphasised over the next two decades. Task-shifting will need to be considered as screening such a large number of diabetes will be beyond the reach of ophthalmologists in South Asia. Countries should develop national policies on training, deployment and utilisation of the different types of eye care professionals supporting the health system.

Age-related macular degeneration will also increase in the next two decades, and there will be an increasing need to develop low vision centres to support people who suffer from the condition.

With an increasing incidence of premature babies who survive, there is now a greater risk of retinopathy of prematurity (ROP) across South Asia, especially in urban areas. Integrating screening for ROP in care units for sick and premature babies, and in child care centres or programmes, is of immediate importance.

Vision centres

Vision centres supported by tele-consultation or other forms of remote reporting must be developed as comprehensive eye care centres and not be limited to refractive services alone. Identifying refractive errors, and dispensing affordable corrective spectacles, should be a core function of vision centres, but not their only activity. There has to be regular monitoring of skills and outcomes in order to enhance the quality of the services offered at this level. Their work can be supported by non-communicable disease volunteers who can be trained to detect conditions and encourage compliance with treatment. Vision centres should be integrated or linked with the primary health care network so that resources can be optimised.

Gender

The South Asian community has a strong male preference. This gender disparity also affects service uptake by women. Therefore, sex-disaggregated data should become a norm when monitoring performance. Innovative initiatives and incentives may be required in order to bring about change. This is critical, as female life expectancies outstrip that of men by a large margin, and widowed, dependent women will require greater support from the health systems.

Training

With institutions of excellence in some of the countries in South Asia demonstrating their capacity to support eye care in other low- and middle-income countries, South-South collaboration needs to be augmented. This is not only cost-effective but there is better appreciation of the cultural needs of supported populations. Except for Nepal and Bhutan, all the other countries in South Asia were colonies of the United Kingdom and are therefore members of the Commonwealth. This platform can and should be used to strengthen transnational eye care services.

Inadequacies in training curricula for ophthalmology residents have been highlighted in the recent past. Deficiencies exist in exposure to diagnostic and surgical methods. Certification and validation procedures are rarely practiced in the region and clinical audits are not routinely conducted. These aspects need to be addressed to improve quality. With improved access to information technology platforms, the use of massive open online courses should be promoted within the region (see pp 93–95). Doing so not only reduces cost, but helps with the standardisation of service delivery norms, because people are exposed to best-practice models.

Health, including eye health, must be placed at the centre of the political debate and political agenda across South Asia. Even though families face catastrophic health expenditures, health is not a priority at the community level. This script needs to be changed by means of strong advocacy.

The issue today is not about technology. South Asia is the hub of global information technology and high quality service delivery protocols are available. The challenge confronting South Asia is how to use the available technology to achieve social transformation.

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"Without this journal, I am in utter darkness"

Elmien Wolvaardt Ellison
Editor: Community Eye Health Journal, International Centre for Eye Health, London School of Hygiene & Tropical Medicine, London, UK.

Thirty years and 100 issues call for celebration and reflection. In this article, the editors and the journal team do both, while the current editor considers the impact the *Community Eye Health Journal* has on its readers and the patients they serve.

ANDREW POTTER

Taking time to read the *Community Eye Health Journal*. NIGER

My interview for the position as editor of the *Community Eye Health Journal* (the *Journal*) is something I will never forget.

The International Centre for Eye Health (ICEH) had moved up in the world – away from the somewhat cramped quarters near Moorfields Hospital from which Dr Murray McGavin published the first issue in 1988, to the lofty heights of the London School of Hygiene and Tropical Medicine's Bedford Square offices, a beautiful three-storey house overlooking a city garden. Perhaps the *Journal* itself hadn't moved quite as far up in the world, however: my interview took place in the basement, headquarters of ICEH's education activities.

Having arrived from South Africa just one month earlier, I had no inkling that I would be spending the next eleven years of my life as editor of this hugely respected journal; working first in that basement and later at the School's Keppel Street building, just around the corner from the house where anaesthesia (chloroform) was first used.

At the interview, Clare Gilbert, Daksha Patel and Richard Wormald subjected me to very thorough but friendly grilling, and I was delighted when the phone call came to say the job was mine: not only would I be working with wonderful colleagues, but I would be contributing to eye health in my own country, even though I now lived so far away.

Of course, I had assumed that my years of experience in journalism, editing and science writing had impressed the panel – only to find out later that it was my enthusiasm for previous editor Victoria Francis's beautiful woodcut panels that had clinched the deal!

Personal view Dr Murray McGavin

Founding editor

It was while working in Afghanistan that thoughts of an Eye Journal to meet the needs of eye care workers in low-income countries first came to me. I recall a ward round in NOOR Eye Institute in Kabul, where patients with severe ocular injuries often came late for eye care. Landmines caused horrific injuries, including blindness. Little did I appreciate then that, 10 years later, Issue 24 would be the first publication worldwide to focus on the blinding effects of landmines.

After returning to Scotland in the mid-1980s, Dr Jock Anderson and Professor Barrie R Jones asked me to join them in the newly established International Centre for Eye Health, then based at Moorfields Eye Hospital in London. I shared my vision of a journal for eye workers in low-income countries with them, and later with Professor Gordon Johnson.

Together with Gordon, we secured funding from CBM, Sightsavers and Coca-Cola in London. CBM and Sightsavers have remained faithful supporters of the journal over the last 30 years and, without them, the Journal would not have been possible. Thank you.

It was my privilege to be the editor of the journal for 15 years, from Issue 1 to 47. When I stepped down, I handed over to the extremely capable health educator Victoria Francis. Our current editor, Elmien Wolvaardt Ellison, joined in 2007 and is continuing this important work.

I am extremely grateful to the many people who joined in the work: the Editorial Boards; the Regional Advisers; colleagues at the International Centre for Eye Health – Professors Gordon Johnson, Allen Foster, Clare Gilbert and Darwin Minassian – who provided advice and opinion. Particular mention is due to Sue Stevens, our Nurse Consultant, whose immense practical contribution and commitment over many years kept us on course as a primary health care publication. I also offer a special word of thanks to Anita Shah, our Editorial Assistant and Administrator. Anita has lasted the pace and coped with different bosses ... admirably! Well done, Anita. The emphasis has rightly been on teamwork. So many other names could and should have been mentioned. But, for all involved, 'Thank you!'

I'm so grateful to have been given the opportunity to start the journal and to see it continuing to support and inform eye care workers around the world. May the *Community Eye Health Journal* continue to fulfil its important function of informing eye care workers in low and middle income settings as they work to prevent and treat blindness worldwide!

Early days

Just three months later, I was sent back to my home town of Durban for the inaugural World Congress on Refractive Error; my task was to gather ideas and authors for our upcoming issue on that theme. There, for the first time, I discovered how lucky I was to see well despite having high myopia: there are millions of people worldwide cannot not work or read because they do not have a pair of spectacles. A real eye opener. I also started to meet, for the first but not the last time, the many leading lights in international eye health who would be encouraging and supporting me in this work for many years to come, whether by answering questions, writing or reviewing articles, or providing images. I am deeply indebted to all of you.

A happy challenge

When I started in 2007, the world of international eye health was completely unfamiliar. In fact, to my great embarassment, it was a month or two before I got the better of that pesky extra 'h' in ophthalmology! But this did have its advantages: every issue and topic was – and still often is – new to me. I have relished the challenge of learning more about eye health with every issue we produce. For me, the best part is discovering – and then sharing – the 'why', and the 'what needs to change': why should this issue or theme matter to our readers and their patients? What do we want readers to do about it? And what information do we need to provide to make this possible? In that sense, the *Journal* is an important tool for the improvement of global eye care.

Coming to each theme without specialist knowledge has also helped to ensure that everything we publish is clear to all our readers, many of whom have English as an additional language. It is hard work for everyone involved, and our authors, reviewers and consulting editors have been wonderfully patient with the endless rounds of revisions. We always get there in the end!

Our readers: my inspiration

What keeps me going is the appreciation I have for every single one of our readers who work, often in the most difficult of circumstances, to prevent blindness and improve the eye health of people in their communities. It is a joy to support them in this work.

Thanks to the excellent readership survey Victoria had conducted in 2005, it was clear to me how much the journal meant to our readers. We repeated her survey, with minor changes, in 2010. I was deeply touched by the lovely things readers said then too. However, it was this comment, from an optometrist in Nigeria, that made the biggest impact. He wrote: *"Without this journal, I am in utter darkness."* This image has stayed with me ever since, reminding me how much our readers rely on the *Journal* to support them and guide their way.

A few years later, Daniel Etya'ale, another leading light in international eye care, put it into context for me. "When you get to the end of the road somewhere in the middle of Africa," he said, "and then walk another few hours into the bush, there you will find a clinic with a single ophthalmic nurse who only had her study notes from 20 years ago – until she received the *Journal*."

Continues overleaf ➤

Personal view Victoria Francis

Editor 2004–2007

My first issue was SICS – Small Incision Cataract Surgery.

"Why start me off with such a technical topic?"

Allen Foster: "Because if it were too easy you would run away!"

I was the first non-ophthalmologist editor and I remember my gratitude to the editorial committee for their guidance during lively editorial meetings and email exchanges.

Coming from an education, social research and health communication background, I saw my role, at that point in the Journal's life, to review and enhance the way it communicated with its readers. It was important that we were reaching the right people with the right information presented in the clearest way possible. My first task was a content analysis of past issues to review topics and relevance to different levels of eye care workers in diverse geographical settings. We also conducted a reader survey to solicit reader views, particularly how CEHJ influenced attitudes and practice. This, along with dialogue with regional consultants, informed the changes.

The Journal's 'face lift' targeted content and design. The Cochrane Eyes and Vision Group contributed a section on "Evidence-based Ophthalmology" and a new "Exchange" section encouraged readers to share inspiring experiences. For the restyle, I worked with talented designer Lance Bellers to maximise space within the 16 pages and modernise layouts leading to the now familiar design starting with issue 51. We tried to make it more visual, using my illustrations as design elements and info-graphics and included ready-to-use education materials, as requested in the reader survey.

Revisiting the 14 issues I worked on, I am reminded of the facilitative relationships with authors – all of them practitioners who made time in very busy lives to share their knowledge and experience. I remember too the fruitful collaborations for the Indian edition and the French translation.

Around this time, the online version was gaining momentum with Sally Parsley delivering improvements in **www.cehjournal.org**. I remember with some shame my scepticism, sticking stubbornly to the argument that many readers would be hard pressed to have a working computer let alone internet access. Comparing Internet World Stats between 2004 and 2017 leads me to eat my hat; Sally's vision was well founded: Africa up from 1% - 31%, Asia up from 7% to 46%, Middle East 7% to 59%, Latin America and the Caribbean 9% up to 61%.

My least favorite aspect of the job was meticulous proofreading to ensure correctness and consistency. To make my life easier, and with a thought for my successor, a small team (kept in check by editorial administrator Anita Shah) made a tedious task fun as we created the Author Guidelines and Style Sheet.

Four years after taking on the editorship, it was time to hand over the baton. My last issue was Research and Training Programmes, a topic close to my heart, and I was delighted to include 20 summaries of Community Eye Health MSc dissertations, demonstrating the close relationship between training offered at the LSHTM and the Journal as a vehicle for providing distance learning to readers across over 180 countries.

Handing over to Elmien and the continuity of the Editorial Committee, I felt confident that the important role of the CEHJ was in safe hands.

Feedback and questions

Is there anything you would like us to cover in a future issue? Send questions and suggestions to **admin@cehjournal.org**

Teamwork for eye health

The *Journal* inspires and enables positive changes in readers' approach to patients and eye disease. We have encouraged readers to communicate better with patients and their families, to actively include women and people with disabilities in their services, and to collaborate with colleagues in other departments to address emerging diseases such as diabetic retinopathy, glaucoma and retinopathy of prematurity. More than anything else, we have promoted the importance of the eye health team: people with different skills and qualifications, working together to improve eye health.

Producing the *Journal* is very much a team effort too. I am very lucky to work with ICEH's inspirational co-directors, Allen Foster and Clare Gilbert; and with the wonderful Nick Astbury (advisor), Anita Shah (editorial administrator), Lance Bellers (designer), and online team Astrid Leck and Miyo Hanazawa. Thank you for everything you do, every day, to ensure that the journal is helpful, beautiful and reaches everyone who needs it.

I would also like to express my heartfelt thanks to our two previous editors, Murray McGavin and Victoria Francis. I am standing on the shoulders of giants.

It is an honour to be here at this important milestone. Here is to another 100 issues!

The four editions *(from left to right)*: International, Francophone Africa, South Asia and Latin America.

Reader survey: 2015/2016

Our readers are at the centre of all our editorial decisions about themes and articles. Readers send feedback throughout the year, and we actively invite readers' input regarding future themes and topics by conducting reader surveys every five years.

Our most recent survey was conducted by mobile phone. A total of 89 readers from 27 countries were interviewed by then intern Nnamdi Nwuba. Readers were selected to represent the different occupations in eye care: mid-level personnel (ophthalmic nurses, cataract surgeons and ophthalmic clinical officers), ophthalmologists, optometrists and managers/others. They worked in government (57%), the private sector (23%), and non-governmental organisations (17%).

How useful was the *Journal*?

Three-quarters reported reading either 'all of' or 'most of' the *Journal*, and nearly two-thirds shared their copy with colleagues. Exactly half of those interviewed used the pictures to explain eye conditions to patients, and 39% relied on the *Journal* when teaching eye health professionals, both formally and informally.

What did people like about it?

The appreciation for the journal was overwhelming. The following themes emerged very strongly:

- The *Journal* is a source of education and offers an opportunity to connect with the wider world, especially in remote areas
- The information is relevant and useful, particularly in low-income settings
- The *Journal* builds confidence and inspires readers to learn and do more; the international perspective is part of this.

Other comments focused on the format of the *Journal*, e.g. the fact that it covers a different theme in-depth in each issue and that it has regular sections such as the editorial article, the quizzes, the announcement section and so on. Readers felt the *Journal* was easy to understand and helpful for teaching others.

Personal view **Anita Shah**

Editorial administrator

Dr Murray McGavin, founded the *Community Eye Health Journal* in 1988. I was appointed as his secretary in 1997 and joined Ann Naughton and Sue Stevens to complete the small team responsible for the production of the Journal.

As Editorial Administrator, my overall purpose is to ensure the smooth running of the Journal's production, from planning meetings through to proof-reading, printing and distribution. The Journal has a circulation of about 20,000 (International and French CEHJ).

I manage the database and help to increase subscriptions through promotion of the Journal at external events and through correspondence with subscribers. Such direct contact with our readers and authors is a particularly enjoyable part of my role; I am also the first point of contact for many of them.

Coordination of the production schedule involves liaising with editors of other language editions, the designer, the printers, and the website manager. I also manage the article submission and review process of unsolicited research articles and correspond with authors, reviewers and the Editor. All unsolicited articles are sent to two reviewers who are experts in the relevant field of ophthalmology. All comments received are passed back to the authors for the necessary changes to be made. If the article is rejected, feedback is offered with encouragement for future submission, as appropriate.

It is a huge privilege to be part of ICEH, especially the *Community Eye Health Journal* production team and play a part in the promotion of eye health and prevention of blindness worldwide.

To subscribe, contact Anita on **admin@cehjournal.org**

The impact on readers and their patients

Readers were asked: "Has anything you've read or seen in the *Journal* changed the way you work or do your job?" 83% of the respondents said 'yes'. Change was experienced in many different areas, including clinical and patient care, in readers themselves, and in public health eye care and planning. Here are some examples.

I used the advice on the management of bacterial conjunctivitis and the management of corneal ulcers. I have since changed my choice of antibiotics. ***Cataract surgeon, Zambia***

It helps practically with going into the community. For example, I wasn't well practised with a Schiotz Tonometer, but I followed step-by-step what you mentioned and it helped me all the way! ***Optometrist, Nigeria***

We now have protocols in place for ophthalmic assistants. It has helped with human resource training. Also, the Journal *has been useful for the care of ophthalmic instruments.* ***Ophthalmologist, Kenya***

We used to focus only on cataracts and glaucoma. Now we can do refractive error and low vision during outreach in the community. We have improved our training programme. We get people from East Africa now, not just West Africa (as we did before). It is a very comprehensive journal! ***Eye care coordinator/manager,The Gambia***

I always wanted to go into the community. It informs me about things to do in the community. Gives me courage to do things. It enables me to assess myself and my ability. I find joy in reading things through and practically performing them. Makes me proud to be an ophthalmic nurse. Even when the doctor is not available, I can feel confident. ***Ophthalmic nurse, Nigeria***

It's had a complete effect on my work. I take ideas from the Journal and use it to revise my work. It directs me to do good things. When I read it, it makes me a better person - better in thinking, better in performing. ***Professor/educator, Bangladesh***

The thoroughness seen in the Journal motivates me to implement changes in my own practice. ***Ophthalmologist, Nigeria***

Internet access

According to the World Bank Development Indicators[1], internet access in sub-Saharan Africa is still low. Access is highest in Southern Africa (just below 25%) and lowest in Central Africa (just over 10%). The figures were higher among the mobile phone users we interviewed: 44% had access to our online journal and 22% were able to download PDFs to read later (Figure 1). A further 12% had a tablet device, and these higher-earning readers (professors and ophthalmologists) enjoyed being able to share content electronically with others. However, even in this group of readers, 81% said they preferred the paper copy. The majority (61%) reported having problems with internet access, mainly because it was too slow and because access was interrupted as a result of power failures (FIgure 2). Congratulations to Sally Parsley, who creating our hugely successful online issue (receiving around 20,000 unique page visits per month!) and to Astrid Leck, who is carrying on this important work. We plan to further develop our online and mobile content, while ensuring that those who need the printed issue receive their copies in the post.

Personal view Lance Bellers

Graphic designer

I think I may have said something like "I'll just help a bit on one or two," to Victoria when we first discussed how best to piece the *Journal* together. That was issue 51 and I'm still here – making it a round 50 issues for me and a perfect 100 for the *Journal* since its inception.

I was working as freelance graphic designer for Sightsavers at the time. When asked if I'd be interested in branching out to work on a project at the International Centre of Eye Health, of course I said yes.

My background is largely reports and magazines – including 20 years on Focus on Africa magazine at the BBC World Service – and so my role with the *Journal* is to lend my experience of presenting stories and information in an accessible way to a wide range of readers. The *Journal* is sometimes quite specialist and technical, so it is important that the design makes everything clear and easy to follow. Then everyone can get as much as possible from its pages; whether for their own education, to train others, or to explain eye conditions to patients.

The idea that it is used and appreciated by the readership is very important to me and and it has been a privilege to play a part in its evolution. Elmien has brought her keen journalistic approach to each of her issues since Victoria handed over the baton and it has also been a pleasure for me to design the French edition of the Journal with Paddy Ricard, who works tirelessly to reach the Francophone readership across the world.

In the most recent refresh of both the English and French editions, we have kept in mind the ever-more important online aspect and hopefully the structure lends itself to transferring to the web after each printed edition has come off the press.

The high point? In 2005, I was fortunate to travel in Africa and visit eye care projects in Tanzania and Ethiopia. The look of glee on an elderly woman's face as her bandage was removed after a cataract operation was priceless. The *Journal* helps make this happen – long may it continue.

Read the *Community Eye Health Journal* online. Visit **www.cehjournal.org**

Figure 1 How respondents accessed the *Journal* (%). Readers could select any that applied

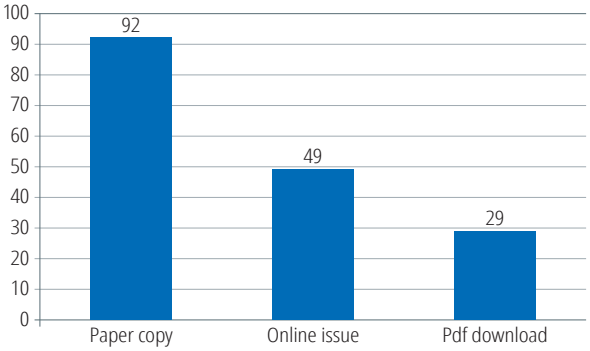
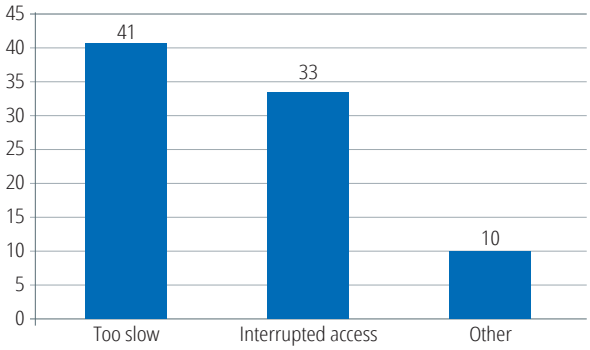


Figure 2 Problems accessing the internet (%)



Reference

1 Agyepong IA, Sewankambo N, Binagwaho A, Coll-Seck AM, Corrah T, Ezeh A et al. The path to longer and healthier lives for all Africans by 2030: the Lancet Commission on the future of health in sub-Saharan Africa. Lancet 2017. **http://wdi.worldbank.org/table**

Test your knowledge and understanding

This page is designed to help you to test your own understanding of the concepts covered in this issue, and to reflect on what you have learnt.

INTERNATIONAL TRACHOMA INITIATIVE

School children line up to receive Zithromax. UGANDA

We hope that you will also discuss the questions with your colleagues and other members of the eye care team, perhaps in a journal club. To complete the activities online – and get instant feedback – please visit **www.cehjournal.org**

Tick ALL that are TRUE

Question 1
Visual Impairment

- ☐ **a** Visual impairment is defined as <6/18 to 6/60 in the better eye at presentation.
- ☐ **b** The major cause of visual impairment in the world is uncorrected refractive error.
- ☐ **c** In 2015 there were an estimated 253 million visually impaired people in the world.
- ☐ **d** There are more visually impaired men than women, approximately 55% to 45%.
- ☐ **e** The prevalence of vision impairment increased in the world from 1990 to 2015.

Question 2
Cataract Indicators

- ☐ **a** Cataract Surgical Coverage (CSC) is a measure of the quality of a cataract operation.
- ☐ **b** The main risk factor for incidence of visually impairing cataract is age.
- ☐ **c** Cataract Surgical Rate (CSR) depends mainly on the number of ophthalmologists per million population.
- ☐ **d** A poor outcome after cataract surgery (defined as <6/60 vision at presentation 6 weeks after surgery) is nearly always due to surgical complications.
- ☐ **e** The useful indicators in monitoring a cataract service are cataract surgical rate, cataract surgical coverage and cataract outcome.

Question 3
Childhood eye disease

- ☐ **a** Vitamin A deficiency is no longer a public health problem in the world.
- ☐ **b** Retinopathy of prematurity occurs only in high-income countries.
- ☐ **c** Rubella is a preventable cause of congenital cataract.
- ☐ **d** Uncorrected hypermetropia is the commonest cause of visual acuity <6/12 in school children.
- ☐ **e** Low vision services and aids are often needed after surgery for cataract in children.

Question 4
Infectious eye diseases

- ☐ **a** The treatment for onchocerciasis is Mectizan (ivermectin) given annually to communities where onchocerciasis is endemic.
- ☐ **b** Trachoma is caused by *Chlamydia trachomatis* serotypes A, B and C.
- ☐ **c** In communities where the prevalence of TF in children aged 1–9 years is 15%, azithromycin treatment to the community is recommended annually for 3 years.
- ☐ **d** Trichiasis surgery for TT can be performed in health clinics by eye assistants trained in TT surgery.
- ☐ **e** The number of blind people from both onchocerciasis and trachoma has decreased between 1990 and 2015.

ANSWERS

1. b and c are TRUE. Visual impairment is defined as <6/18 to no light perception in the better eye at presentation; it includes moderate and severe VI and blindness. It is estimated that 55% of all visually impaired people in the world are women. The prevalence of VI is estimated to have decreased from 4.58% to 3.38% between 1990 and 2015.

2. b and e are TRUE. CSC is a measure of the coverage, that is quantity of cataract services. The CSR depends on a number of factors including barriers to access e.g. cost, distance; and the indication for surgery. If there are insufficient ophthalmologists then the CSR may be low, however the number of ophthalmologists is not the MAIN factor. Some countries in Latin America and Eastern Europe have many ophthalmologists but relatively low CSR. Poor outcome can be due to uncorrected refractive error; co-existing eye pathology e.g. glaucoma; or surgical complications. It is not true to say poor outcome is "nearly always due to surgical complications".

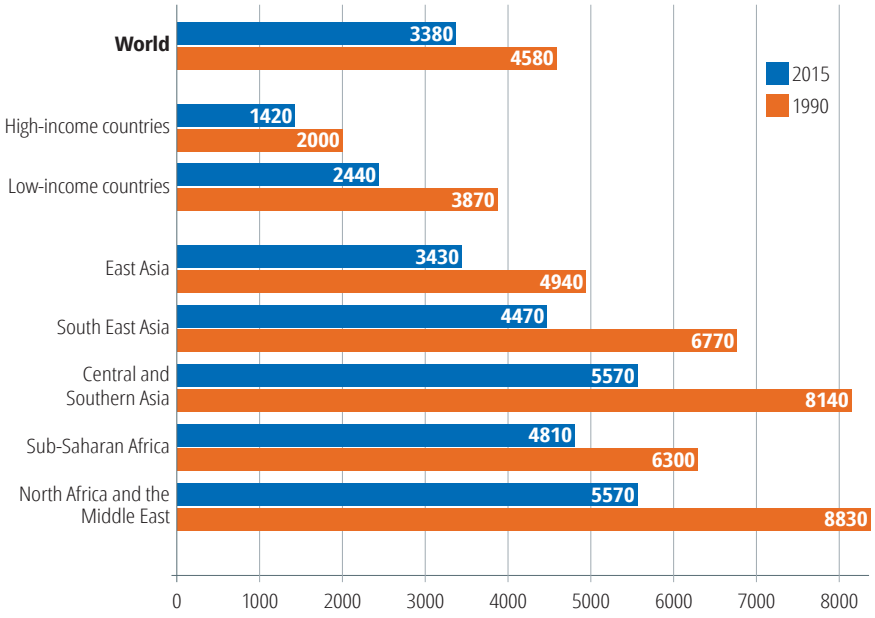
3. c and e are TRUE. Vitamin A deficiency remains a public health problem in some countries and is a preventable cause of childhood mortality and visual loss. ROP is seen in Latin America, Eastern Europe and urban centres of middle income countries in Asia and Africa being associated with increased survival of low birth weight babies in neonatal units. Uncorrected MYOPIA is the major cause of decreased acuity in school children.

4. All are TRUE.

Picture quiz

The chart below shows the number of blind people per million population for the world, and different regions, between 1990 and 2015.

Number of blind people per million population



Question 1

What two trends are shown in the figure?

Question 2

What is the ratio of blindness in 2015 between sub-Saharan African countries and high-income countries?

Question 3

Why do low-income countries have more blindness per million population than high-income countries?

Question 4

Why might you expect high-income countries to have more blindness per million population than low-income countries?

ANSWERS

1. Decrease in the number of blind/million population between 1990 and 2015 in all regions; and decrease in the number of blind in regions with better economies (High income countries, compared to Asia, compared to Africa).

2. 4810/1480 blind people per million pop; counties in SSA have 3.25 times more blind people than high income countries.

3. Low income countries have less resources for health care – health trained staff and facilities so less eye care services.
Also low income countries have greater levels of poverty, so fewer people can afford to pay for health services.
People living in low income countries have greater exposure to some risk factors that cause eye diseases e.g. poor diet; poor water and sanitation etc.

4. High income countries have older populations so there are more people over the age of 50 years in each million population. Because visual impairment and blindness are associated with aging one would therefore expect more blindness per million population in countries with older populations.

Courses

MSc Public Health for Eye Care, London School of Hygiene & Tropical Medicine

Fully funded scholarships are available for Commonwealth country nationals. The course aims to provide eye health professionals with the public health knowledge and skills required to reduce blindness and visual disability.

For more information visit **www.lshtm.ac.uk/study/masters/mscphec.html** or email **romulo.fabunan@lsthm.ac.uk**

Free online courses

ICEH Open Education for eye care programme offers a series of online courses in key topics in public health eye care. All the courses are free to access.

Courses:

Global Blindness, Eliminating Trachoma, Ophthalmic Epidemiology Basic Principles (1) and Application to Eye Disease (2).

More free courses coming! Certification also available.

For more information visit **http://iceh.lshtm.ac.uk/oer/**

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Next issue


ALLEN FOSTER

The next issue of the *Community Eye Health Journal* is on the theme **Retinoblastoma**

Key messages: global eye health

What progress has been made?

SUZANNE PORTER/SIGHTSAVERS

- The prevalence of blindness has decreased by 25%: from 4.6 per 1,000 people in 1990 to 3.4 per 1,000 people in 2015
- More people are receiving cataract surgery and implantation of an IOL is now routine, giving better post-operative vision
- Many people have received Mectizan for onchocerciasis, Zithromax for trachoma and Vitamin A supplementation for vitamin A deficiency, and blindness due to these infections and malnutrition has decreased

What about human resources in eye health?

Supplied by Orbis Africa

- There have been significant improvements worldwide in the training of ophthalmologists, optometrists and allied ophthalmic personnel (including ophthalmic nurses) around the world
- However, the number of eye health personnel in most African countries is well below the minimum recommended. There are insufficient training schools and graduates to meet the need for different types of eye health personnel

What are the emerging disease challenges?

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- Cataract is still the top cause of blindness
- Myopia is increasing among children and requires school screening programmes
- Glaucoma is the third cause of global blindness and cost-effective services are needed
- More people are developing diabetes and diabetic retinopathy, which requires treatment to prevent visual loss
- Retinopathy of prematurity is increasing among babies in middle-income countries