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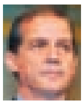
Changing patterns in global blindness: 1988–2008



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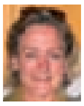

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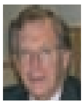

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Prevalence of visual impairment

Changing demography

When the *Community Eye Health Journal* was launched in 1988, the world population was approximately 5.1 billion. Over the last 20 years, it has increased by approximately 30%, reaching 6.7 billion in 2008. During the same period, the world population has also become proportionally older, as the number of people aged 65 years and over has increased by approximately 55%, from 320 million in 1988 to 500 million in 2008. Since the prevalence of visual impairment becomes higher as people age, this combination of an increasing population and an ageing population is expected to cause a significant increase in the total number of blind people.[1]

Estimates of the number of people with visual impairment worldwide

In 1988, the number of people who were blind (visual acuity (VA) <3/60 in the better eye) was estimated to be 37 million worldwide. By 2002–04, the latest period for which we have data (see Table 1), it was estimated to be 45 million: 8 million blind due to uncorrected refractive error and 37 million blind due to other causes.[2,3] It is thought that at least 60% of blind people are women.

Little was known in 1988 about the prevalence of low vision (VA <6/18 to 3/60). In 2002, the number of people with low vision was estimated to be 124 million worldwide, but this excluded low vision due to refractive error.[2] Owing to a lack of data from surveys, it has only very recently become possible to estimate that there are 145 million people with low vision due to refractive error.[3] This figure brings the overall number of people with low vision to 269 million.

In total, the number of people with visual impairment (which includes both low vision and blindness) is therefore estimated to be 314 million worldwide.

MM Farrahmand. AFGHANISTAN

Cataract has remained the major cause of blindness worldwide for the past 20 years

Causes of blindness

Over the last twenty years, the causes of blindness have changed in proportion and actual number. Cataract has remained the major cause of blindness globally. It is particularly important in Asia. The numbers of people

Continues overleaf ➤

Table 1. Most recent estimates of the number of people with visual impairment (blindness and low vision) worldwide[2,3,4]

Definition		Number of people (millions)
Blindness (eye disease)	<3/60 to no light perception	37
Blindness (refractive error)	<3/60 to light perception	8
Blindness (all causes)		**45**
Low vision (eye disease)	<6/18 to 3/60	124
Low vision (refractive error)	<6/18 to 3/60	145
Low vision (all causes)		**269**
Total: Visual impairment (all causes)		**314**

IN THIS ISSUE

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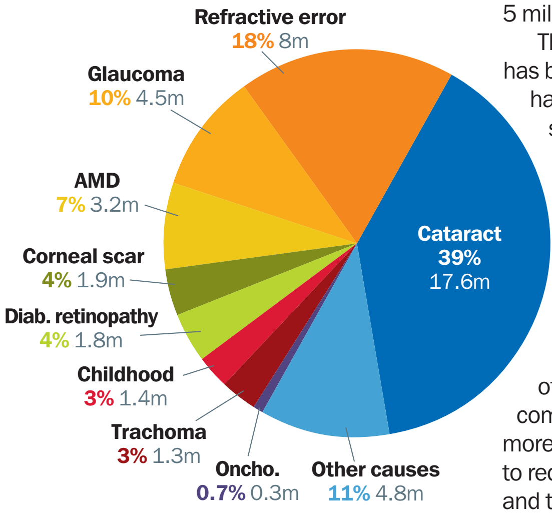
Figure 1. Proportion of cases of blindness due to each major cause*



*Global numbers shown in millions (m)

blinded by trachoma, onchocerciasis, and vitamin A deficiency have tended to decrease over the last twenty years. This is due to improvements in nutrition, water supplies, sanitation, and measles immunisation coverage, as well as to the provision of certain therapeutic medicines: ivermectin (Mectizan®), vitamin A, and antibiotics. Figure 1 shows the proportion of cases of blindness due to each major cause, according to the most recent estimates.

Cataract

Over the past twenty years, the major advance in the treatment of cataract has been the worldwide availability of low-cost, good-quality intraocular lenses (IOLs) since the early 1990s. Their routine use has resulted in an increase in both the quality of visual outcome for patients (as shown by population-based rapid assessment of cataract surgical services)[5] and the willingness of surgeons to perform cataract surgery at an earlier time, before blindness has developed. This is detailed in the article on page 40. There is evidence that, since the introduction of IOLs, there has been an increase in cataract surgical rates around the world, and particularly in low-income countries.[4]

Two other important developments in the past twenty years have been the popularisation of phacoemulsification and the introduction of small incision cataract surgery (SICS). Both have resulted in a faster and better restoration of visual acuity. With SICS, in addition, the cost per operation is also lower.

Although it is difficult to obtain accurate figures, it is likely that the global number of cataract operations has increased from about 5 million per year in 1988 to around 15 million per year now.

Despite these overall positive developments, we should not be complacent: 17 million people are blind today because they have not yet received cataract surgery.

Trachoma

In 1988, it was estimated that 150 million children were infected; this number had fallen to approximately 84 million by 2004.[6] Similarly, the number of people blind from trachoma decreased from approximately 5 million in 1988 to 1.3 million in 2002.

The SAFE strategy for trachoma control has become widely accepted, tarsal rotation has been shown to be the preferred surgical procedure for trichiasis, and oral azithromycin has become the first-choice antibiotic for mass treatment of communities with endemic trachoma infection (as shown in the article on page 43). It is also highly likely that improvements in water supply and sanitation have significantly reduced the transmission of trachoma infection in poor rural communities in Africa and Asia. However, more investigative work is required in order to reduce recurrence after trichiasis surgery and to identify the most cost-effective strategies for the distribution of azithromycin.

Onchocerciasis

In 1988, onchocerciasis was a significant cause of blindness in many countries in Africa. This same year, however, saw important developments in the treatment of the disease: Merck & Co. had registered the microfilaricide ivermectin (Mectizan®) a year earlier and its Mectizan® Donation Programme came into effect, providing Mectizan® free of charge to individuals and communities with onchocerciasis, as shown in the article on page 43. Twenty years on, the severity of onchocerciasis infection is decreasing and the number of people developing vision loss has markedly decreased. The figures for 2007 indicate that over 50 million people are now receiving Mectizan® on an annual basis through community-directed treatment programmes.

Childhood blindness

Although vitamin A deficiency was a well-recognised cause of blindness in children twenty years ago, little work had been done up to that time on the magnitude and causes of childhood blindness. The article on page 46 presents an overview of the data collected and the lessons learnt over the past twenty years.

These data show marked variations according to the socio-economic status of the community. For example, vitamin A deficiency still occurs in children under five years old living in very poor families and, today, rising food prices worldwide may aggravate this situation further. Similarly, retinopathy of prematurity has emerged as a significant problem in middle-income countries and in urban centres of the developing world. The most important treatable cause of childhood blindness, however, remains untreated or poorly treated cataract, which is responsible for 5–20% of all cases.

Refractive error

Little was known in 1988 about the magnitude of visual loss due to refractive error. This was due to the fact that the World Health Organization's (WHO) definition of blindness

Anita Shah

A patient collects her spectacles. INDIA

excluded correctable refractive error, which was therefore not recorded in surveys. Since then, some population-based blindness surveys have included people who cannot see because they have no spectacles and specific surveys have been done to assess refractive error in school children. Figures published in 2008 indicate that, due to uncorrected refractive error, there are 145 million people with VA ranging from <6/18 to 3/60 and 8 million people who are blind (VA <3/60) (see Table 1).[3] Spectacles have generally become more available and more affordable, but in many countries there is still a need for good refraction services and for appropriate dispensing of low-cost but good-quality spectacles.

Glaucoma

During the last twenty years, work has been undertaken to develop improved definitions and classifications of glaucoma. This has allowed for better estimates to be made of the number of people with this condition.[7] It is likely that the current global estimate of 4.5 million people blind due to glaucoma actually falls short of the true figure, as many surveys do not include an assessment of visual field loss and are limited to a definition of blindness based only on visual acuity. Globally, 60 million people are likely to have one of the glaucomas and up to 8 million may be blind because of this disease.

Because no simple, specific, and sensitive test exists for this condition, population-based screening cannot at present be advocated; opportunistic case detection should, however, be encouraged. Unfortunately, in many low- and middle-income countries, effective treatment for glaucoma is still out of reach: medical treatment requires the availability of affordable drugs and long-term patient compliance; surgical treatment requires patient acceptance, as well as surgical skill, experience, and the capacity for long-term follow-up. This is difficult to achieve in some settings.

Diabetic retinopathy

In 1988, there were no data on the global prevalence of diabetic retinopathy or of blindness resulting from this condition. It is now estimated that there are approximately 171 million people with diabetes worldwide. Of these people, probably 10–20% have some form of retinopathy and around 1.78 million are blind. There are now better-defined screening procedures and agreed treatment protocols based upon evidence from clinical trials. In appropriate settings, therefore, there can now be a public health approach to the control of visual loss from diabetes.[8]

Age-related macular degeneration (AMD)

As life expectancy increases, AMD is becoming a more important problem, not only in high-income, but also in middle-income countries (see article on page 48). In 2002, it was estimated that 3.2 million people were blind from AMD. As yet, there is no proven prevention for AMD although smoking has been shown to be an important risk factor. Various surgical procedures are being tried in selected cases and recent studies indicate that vascular endothelial growth factor (VEGF) blockers can delay or stop progression of vascular AMD (see article on page 50). In spite of promising recent developments, there is, however, no proven therapy to reverse the degenerative process in all cases and current therapies remain expensive.[9]

Making a difference with VISION 2020: The Right to Sight

In 1988, the WHO Prevention of Blindness (PBL) programme and the International Agency for the Prevention of Blindness (IAPB) had been in existence for ten years. Over the next decade, several important developments made it possible to conceive of a global initiative to eliminate avoidable blindness: the Mectizan® Donation Programme was established in 1987, low-cost IOLs became available in the early 1990s, and the SAFE strategy was launched in 1996. In addition, the relationship between vitamin A deficiency and childhood mortality had already been documented.

Drawing on their experiences of cost-effective eye care delivery systems in several countries in the 1980s and 1990s, including in India and The Gambia, a group of non-governmental development organisations (NGDOs), together with the WHO, launched VISION 2020: The Right to Sight in 1999. This is a global initiative to eliminate avoidable blindness from cataract, trachoma, onchocerciasis, refractive error, vitamin A deficiency, and other causes of blindness in children by the year 2020.

The World Health Assembly has since adopted resolutions urging its member states to adopt the VISION 2020 principles. More than 90 NGDOs, agencies, and institutions, together with a number of major corporations, are now working together in this global partnership.

There is little doubt that the VISION 2020 initiative has raised awareness concerning blindness and the cost-effectiveness of available interventions. It has mobilised both government and private funding for eye care and it has generated a global public-private partnership working with a clearly defined focus and strategy.

Estimates of global blindness made in 2002 were 15 million lower than the projections made for this same year when VISION 2020 was launched. There is also evidence that the number of people who are blind due to onchocerciasis and trachoma has decreased, as well as evidence of increasing cataract surgical rates in many countries. Our challenge now is to build on what has been achieved and to focus resources on the poorest communities in the world. The goal of VISION 2020 is to enable all persons to receive eye care and have the right to sight – which is one of their fundamental human rights.

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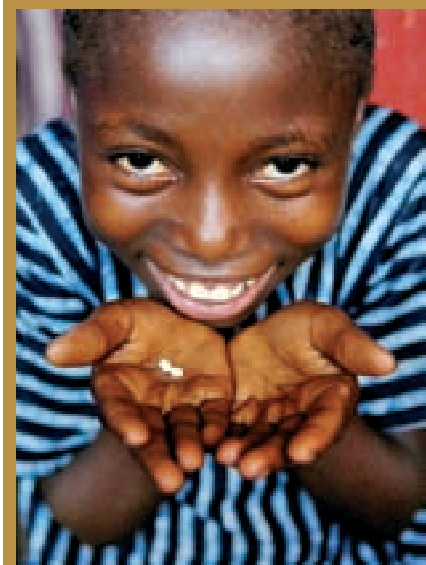
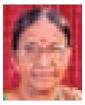


Phil Wilkinson/Scotland on Sunday/Sightsavers

Cataract surgery at Aravind Eye Hospitals: 1988–2008



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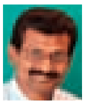

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In the 1980s, cataract was the major cause of blindness in India and was responsible for 80% of all blindness.[1,2] This prompted the Indian government to launch a national cataract control programme, which succeeded in lowering the prevalence of blindness from 1.49% to 1.1%.[2,3] In addition, by 2000, this programme had reduced the proportion of people blind due to cataract from 80% to 62%.[4]

Aravind Eye Hospitals contributed to a third of all cataract operations in the state of Tamil Nadu during the last two decades and played a major part in lowering the rate of blindness in that state. By 2000, the prevalence level of blindness was just 0.78%, compared to the national level of 1.11%.[3]

The first Aravind Eye Hospital was founded in 1976 and contained just 11 beds. There are now five Aravind Eye Hospitals, located up to 500 km apart, which form part of Aravind Eye Care System (AECS). Over the last two decades, the organisation has increased six-fold the number of cataract operations it performs annually: from a total of 29,928 in 1988 to 180,991 operations in 2007, performed at the five centres.

During the last two decades, over 70% of the cataract operations on poor patients have been performed free of charge or at a heavily subsidised rate; the other 30% have been conducted in the separate paying section, on patients who could afford the regular fee.

Anita Shah

The Aravind Eye Hospital in Madurai. INDIA

Transition in cataract services: 1988–2008

Community outreach

From the day the hospital opened its doors in 1976, Aravind has been organising community outreach, always with the involvement of the local community. This partnership has led to widespread awareness of cataract services across the state of Tamil Nadu. Today, the same strategy is being used successfully to create awareness about other conditions, such as diabetic retinopathy, refractive error, and childhood blindness, and to address them.

In the late 1970s, surgical eye camps were in vogue in India. During this era, in addition to the hundreds of screening camps it held, Aravind Eye Hospital organised a few surgical eye camps, which proved to be very resource intensive. In these surgical camps, operations were performed at the site, which could be a school, a college, a community hall, or a local hospital. At that time, intracapsular cataract extraction (ICCE) was the chosen surgical procedure. The postoperative stay

Anita Shah

Older patients are welcomed at a screening camp. INDIA

at the camp site ranged from four to seven days. Patients had to lie down with their eyes bandaged in a complete resting position to avoid wound leak or iris prolapse, and they were given soft food to eat. The operated patients were issued standard +10 D aphakic spectacles at the time of discharge and were advised to come for follow-up at the base hospital or camp site a month later.

We reduced the number of surgical eye camps over the years and, in 2002, we completely stopped organising them, as the growing network of Aravind Eye Hospitals provided easy access for the community in each service area. Screening eye camps, however, continue to this day; the patients brought in from these camps account for over 50% of the cataract operations performed in the five Aravind Eye Hospitals.

Indications for cataract surgery

In 1988, the selection criteria for cataract surgery was best corrected visual acuity (VA) of <6/60. In the 1990s, as new surgical techniques started to result in better visual rehabilitation, the criteria changed to include patients who, due to cataract, found it difficult to perform their daily tasks. This marked a shift away from clinical criteria and towards more patient-centred criteria. In addition, more and more patients are spontaneously coming for early surgery before they become blind, since cataract operations now have very good outcomes.

Quality assurance

In the 1980s, since only patients with a preoperative vision ranging from light perception to VA <6/60 were selected, patients were very happy with their postoperative vision, in spite of the limitations of the aphakic spectacles they were given. Nowadays, as patients with much better preoperative vision are being admitted, it has become essential to assess the quality of postoperative vision as well. In addition to quantitative visual acuity assessment, patients are also asked how satisfied they are with their vision. Amongst other things, this helps to refine postoperative refractive error correction by getting a better sense of the patients' expectations; it also helps in explaining to patients about the vision recovery process and what to expect. This improved vision assessment is a reflection of the modern lifestyle in India, which demands a much better quality of vision.[5]

At Aravind, surgical complications and the outcomes of every operation have been monitored since 1991, using continually evolving software, to enhance quality by analysing visual outcomes, infections, complications, and the number of patients needing a second operation on the same eye. This has helped put in place a system of continuous improvement.[6] For example, out of 73,323 cataract operations performed in 2007 at the Aravind Eye Hospital in Madurai, the rate of surgical complication was 1.6%, the rate of postoperative infection was 0.05%, and corrective surgery was needed on the operated eye in 0.4% of cases.

Jenny Matthews/Sightsavers. INDIA

The decision, in 1992, to locally produce high-quality IOLs and the introduction of manual SICS techniques in 1998 have contributed to much greater satisfaction amongst patients, both paying and non-paying

High-volume cataract surgery

Aravind's success at performing a large number of cataract operations per year and per surgeon (known as high-volume cataract surgery) is based on three main pillars:

- making intraocular lenses more affordable
- training cataract surgeons
- developing good systems of service delivery (as described above), as well as innovative operating practices (the 'assembly line' system, described below).

Making intraocular lenses more affordable

Although ICCE was the standard procedure at Aravind at the time, some surgeons had started to use 'iris clip' intraocular lenses (IOLs) in the paying section as early as 1979; a total of 20 such lenses were used in that year. A switch to anterior chamber IOLs was made in 1981 and, by the mid-1980s, surgeons started to use posterior chamber lenses regularly.

IOLs were however very expensive (imported at US $100 each in the mid-1980s) and these operations could only be offered in the paying section. The hospital therefore could not afford to give them away free or at low cost to poorer patients. For the same financial reasons, international non-governmental development organisations (NGDOs), as well as the Indian government, did not support IOL surgery at the time.

However, Dr G Venkataswamy, the founder of Aravind Eye Hospitals and AECS, felt strongly that every villager undergoing cataract surgery should get an IOL implant. He understood how difficult it was for these people to carry out farm work with aphakic spectacles. The major obstacles to offering IOL implantation to everyone were the high cost of IOLs and the fact that there were not enough ophthalmologists trained to perform this type of surgery. In addition, traditional operating practices needed to be assessed and improved, if necessary.

In 1992, AECS established Aurolab, a local non-profit trust, with the support of the Seva Foundation, Combat Blindness Foundation, and Sightsavers International. Aurolab undertook the task of producing low-cost IOLs. These were initially sold for US $10 each. The price of the IOLs produced by Aurolab steadily declined as efficiency and demand increased; at present, the cost of rigid polymethyl methacrylate (PMMA) IOLs stands at around US $2. These have been made available in over 120 developing countries. The trust also started to produce sutures, pharmaceuticals, and other surgical supplies locally. This has helped to bring down the cost of cataract operations further in India and elsewhere.

In 1994, Aravind introduced phacoemulsification. Considering the very good outcome of this new, sutureless IOL technique, Aravind promoted it very intensively amongst the paying patients who could afford the additional cost.

The development of the manual, sutureless, small incision cataract surgery (SICS) represented another great stride towards offering IOL cataract surgery to more patients. SICS is cheaper, quicker, and easier to perform, and its outcomes compare very well with that of phacoemulsification. In 1998–1999, we introduced this technique at Aravind in both the 'free or subsidised' and paying sections (see Table 1).

Continues overleaf ➤

Table 1. Surgical techniques used for cataract operations over the last two decades at Aravind Hospitals

Year	Patient category	Total no. of cataract operations	Surgical technique		
			Cataract surgery with IOL (% in each section)	Cataract surgery without IOL (% in each section)	
1988	Paying section	8,763	41%	59%	
	Free or subsidised section	21,193	4%	96%	
	All patients	**29,956**	**15%**	**85%**	
1998	Paying section	30,696	96%	4%	
	Free or subsidised section	100,480	88%	12%	
	All patients	**131,176**	**90%**	**10%**	
2007			ECCE with IOL*	SICS with IOL	Phaco with IOL
	Paying section	53,107	4%	23%	73%
	Free or subsidised section	127,884	15%	82%	3%
	All patients	**180,991**	**12%**	**65%**	**23%**

*Less than 1% of cataract operations are performed without IOL

Table 2. Worldwide distribution of Aravind trainees by World Health Organization Regions

	Europe	Americas	South East Asia	Africa	Western Pacific	Eastern Mediterranean
Candidates trained at Aravind in IOL surgery	91	10	1,353	38	101	29

Table 3. The impact of operating equipment and support staff on the number of cataract operations a single surgeon can perform in one hour at Aravind Eye Hospitals

Operating tables	Scrub nurses	Running nurses	Instrument sets	Operations per hour
1	1	1	1	1
1	1	1	2	2
2	2	1	6	6–8

Training cataract surgeons

To address the challenge of developing the skills required for microsurgery with IOL implants, AECS designed and started the Micro Surgery Training Programme in 1993, with support from Sightsavers International.

To promote high-quality and high-volume cataract surgery, Aravind also published a series of manuals, such as the *Quality Cataract Series* in 2001, the *Manual on SICS technique* in 2000, and the *Manual for IOL trainees* in 2001.

As of August 2008, a total of 1,622 trainees from 44 countries have been trained at Aravind: 1,132 in ECCE, 310 in SICS, and 180 in phacoemulsification (see Table 2).

Developing innovative operating practices

In order to ensure a high volume of cataract operations, while keeping the quality of surgery high, it is vital to use the time of the ophthalmologist as effectively as possible. Indeed, ophthalmologists are probably the most expensive and scarce resource needed to perform a cataract operation.

Aravind developed specific practices to increase the volume of cataract operations. These are known as the 'assembly line' system and consist of the following three elements:

- setting up an efficient patient flow
- organising the operating equipment and support staff to match the output capacity of the surgeons
- ensuring that all surgical supplies are available and that equipment is in good working condition.

Each day of surgery is planned meticulously in advance. This includes planning the number of surgeons and nurses needed, as well as the number of IOLs and other surgical supplies required. On the day of his/her operation, the patient receives the prescribed local anaesthesia and is then led to the operating room, where each surgeon has two operating tables. The patient is draped and prepared on one table, while the surgeon is operating on the other table, on a patient admitted earlier. On completing the operation, the surgeon swings the arm of the microscope over the next table, follows the prescribed asepsis protocol, and then begins surgery on the new patient. Table 3 illustrates how the productivity of a single surgeon increases according to the availability of operating equipment and support staff.

Patients discharged from a surgical camp are given food before they return home. INDIA

Aravind Eye Care System

Conclusion: the impact of the Aravind model

The developments described in this article have all played a major role in increasing the cataract surgery rate in Tamil Nadu (from 2,039 in 1988–9 to 7,633 in 2005–06), and in India as a whole.

The production of cheaper intraocular lenses by AECS and the establishment of a training programme for ophthalmologists have also increased the number of high-quality cataract operations performed worldwide. This is particularly true in developing countries, where costs were prohibitive before the introduction of low-cost IOLs.

Aravind has shown that cataract operations can be done on a massive scale, while still providing quality care. Previously, there was one kind of surgery for the upper classes and another for the masses. History has shown that, with appropriate technology and processes (the assembly line system, locally made IOLs and consumables, and locally trained surgeons), it is possible to duplicate developed world results at an affordable cost.

Current practice at Aravind

In the paying section:

- Around 75% of cataract operations are performed using phacoemulsification, mostly with foldable lenses. Many of the patients go home within two hours of surgery. A total of 80% of operations are performed under topical anaesthesia.
- Around 25% of operations are done using manual, sutureless small incision cataract surgery (SICS) techniques (usually when the nucleus is very hard).
- Less than 5% of operations are done using extracapsular cataract extraction (ECCE) when phacoemulsification or SICS are contraindicated.

In the 'free or subsidised' section:

- 80% of walk-in patients and those referred from eye camps are operated using manual, sutureless SICS techniques. Patients go home either on the same day or the next day, depending on the distance they need to travel. These operations are done under peribulbar or retrobulbar anaesthesia. This has increased the productivity of surgeons and brought down the cost of surgery.
- In cases where SICS is not possible, ECCE with IOL is performed.
- Almost 99% of cataract operations are performed with IOL.

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Onchocerciasis and trachoma control: what has changed in the past two decades?

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Trachoma and onchocerciasis are the two major infectious causes of blindness worldwide. Twenty years ago, the possibility of achieving worldwide and long-term control of these ancient scourges seemed remote and existing control programmes were deemed to have limited prospects. The picture is very different today: large-scale interventions to control both diseases are not only expanding, but control and even elimination are now being discussed as real achievable goals in a growing number of countries. As we will show in this mainly programmatic review, this is a remarkable achievement over only two decades!

Suzanne Porter/Sightsavers. CAMEROON

The donation of Mectizan® by Merck & Co from 1987 has had a unique impact on the worldwide fight against onchocerciasis

From slow and uncertain beginnings to large-scale efforts

Onchocerciasis

Up until the late 1980s (see Table 1), the only established disease control activity was the Onchocerciasis Control Programme (OCP), a World Health Organization (WHO) programme jointly sponsored by the World Bank, the United Nations, and a coalition of over 20 donor countries and agencies. Set up in 1974 in seven, then 11, countries in West Africa, OCP was the first programme to demonstrate that control of onchocerciasis as a public health problem was indeed possible. However, many thought this concerned only 11 countries. Moreover, neither the strategy (vector control), nor the tools developed by, and for, OCP operations (weekly aerial applications of larvicide, ongoing monitoring of community microfilarial loads and flies' infectivity, etc.), nor the financial support available at the time, would lend themselves to further extension of control activities to the other endemic countries (19 in Africa and six in Central and Latin America).[1]

All this changed in 1987 with a first and historic donation of ivermectin (Mectizan®) by Merck & Co.[2] For the first time, a safe and effective microfilaricide was not only available, but, as subsequent studies quickly established, could lend itself to mass treatments in high-risk, endemic communities. The wide and generous availability of Mectizan® also accelerated operational research activities and the development of new tools – for example Rapid Epidemiological Mapping of Onchocerciasis (REMO) was developed to precisely map all priority areas in each endemic country[3] and it emerged that Community-Directed Treatment with Ivermectin (CDTI) was the most appropriate and cost-effective method for community-wide delivery of the new drug. CDTI was advocated when the African Programme for Onchocerciasis Control (APOC) was launched in 1995, and it remains the current strategy of all programmes today. In addition, CDTI is now being used to distribute other public health interventions such as vitamin A and bednets to prevent malaria.

Looking back, this historic and still unsurpassed donation of Mectizan®, "to as many as need it, for as long as needed," is the one essential ingredient that has uniquely impacted nearly every major development in the worldwide fight against onchocerciasis since then. It has also inspired other major drug donation initiatives, such as that of albendazole by GlaxoSmithKline in 1998 for lymphatic filariasis, and that of azithromycin by Pfizer Inc. for trachoma the same year.

Table 1. A chronological outline of the development of onchocerciasis control programmes since 1974

Date	Key event
1974	• OCP is established in West Africa, using vector control as the sole strategy
1987	• Mectizan® Donation Programme is launched
1989–1990	• Large community-scale trials show the benefit of Mectizan® • First NGDO-supported Mectizan® distribution projects, using mobile strategies
1992	• The NGDO Group for Mectizan® distribution is established within the WHO Prevention of Blindness Programme • OEPA is launched
1994	• REMO is developed to define priority areas for disease control
1995	• CDTI is recommended as a safe and cost-effective strategy for onchocerciasis control • APOC is launched
1999	• VISION 2020 is launched
2002	• OCP winds down its activities

Trachoma

Modern efforts to control trachoma date back to the early 1950s, with the establishment, through WHO's support, of national programmes in endemic countries in the Western Pacific, Asia, and the Middle East (see Table 2). These activities also included the assessment of the magnitude of blinding trachoma in these regions and the institution, where feasible, of operational research on treatment options. However, these efforts were rarely sustained. This was due partly to the lack of a simple tool to assess and grade trachoma and to the nearly insurmountable challenge of

Continues overleaf ➤

Table 2. A chronological outline of the development of trachoma control programmes since the mid-twentieth century

Date	Key event
1950s and 1960s	• Establishment of National Trachoma Control Programmes, mainly in endemic Asian, Middle Eastern, and Western Pacific countries
1987	• Introduction of the simplified grading scheme for trachoma
1996	• Introduction of the SAFE strategy
1997	• Launch of GET 2020
1998	• First donation of azithromycin and establishment of the International Trachoma Initiative
1999	• Launch of VISION 2020

fostering community-wide compliance for a six-week treatment regimen of twice-daily application of a tetracycline ointment, in the absence of parallel measures to transform at the same time the environment in which trachoma thrives. As a result, trachoma attracted only marginal public interest until the mid-1990s.[4]

The introduction of the simplified grading scheme for trachoma in 1987 and of the SAFE strategy (Surgery, Antibiotics, Facial cleanliness and Environmental changes) in 1996 by WHO[5] represented crucial operational milestones in trachoma control. This led to three important developments, which provided the impetus needed to put this ancient disease back on the world map in the mid-1990s: (i) the establishment of the WHO GET 2020 alliance (Global Elimination of Blinding Trachoma by the Year 2020), providing the mandate and framework for trachoma control worldwide; (ii) the donation of azithromycin by Pfizer Inc. in 1997; and (iii) the subsequent establishment in 1998 of the International Trachoma Initiative (ITI), to manage this donation. This served as a catalyst to expand and accelerate ongoing control activities, a process further facilitated by the ease with which azithromycin can be administered even on a large scale (a single oral dose in most cases, as opposed to the six-week tetracycline regimen).

Some major achievements to date

Onchocerciasis

OCP wound down its activities in 2002, having achieved the prevention of 600,000 cases of blindness and protected a further 40 million people from ocular morbidity throughout large areas in West Africa. However, it was also agreed that in order to prevent recurrence of the disease and consolidate these important gains, distribution of Mectizan® must be continued, with high coverage, and robust surveillance systems established and maintained.

Elsewhere, control activities now cover nearly all known meso- and hyper-endemic areas around the world. APOC thus aims to protect some 92 million at-risk individuals from the deleterious effects of river blindness; currently more than half of them are under annual Mectizan® treatment.

Similarly, the Onchocerciasis Elimination Programme for the Americas (OEPA) has established, in all six endemic countries, effective national programmes in all 13 foci with a treatment coverage of at least 85% twice a year. Even more significantly in 2007, all eye lesions attributable to onchocerciasis had been eliminated in nine of these 13 foci.

Trachoma

An increasing number of endemic countries are now receiving support for baseline surveys, national plan development, the implementation of the SAFE strategy, and the development and use of appropriate indicators for monitoring and evaluation purposes. Others, like Morocco, the first country to have completed its campaign for trachoma control in 2006, are now awaiting WHO

Ten reasons for success

The rapid progress and success achieved so far by onchocerciasis and trachoma control programmes is due to a combination of many contributing factors. These include:

1. **Drug donations by pharmaceutical companies:** the historic, generous and timeless donation by Merck & Co. of Mectizan® for onchocerciasis control activities, and Pfizer Inc.'s donation of azithromycin for trachoma control in a number of affected countries.
2. **The development of cost-effective, rapid assessment methodologies** which facilitated the mapping of the disease, such as: REMO (Rapid Epidemiological Mapping of Onchocerciasis) and REA (Rapid Epidemiological Assessment) for onchocerciasis, or the simplified grading scheme for trachoma, which facilitated the identification of priority areas.
3. **Development of country databases for planning, monitoring and evaluation:** extensive, user-friendly, interactive databases, with detailed information on all endemic communities, target populations, nearby schools and health facilities, roads, etc.
4. **Regular maintenance and updating of these databases in each country** by well-trained and capable local teams.
5. **Secure and predictable financing over many years** ensuring that planned activities will indeed be implemented: 27 years for former OCP; ongoing since 1992 and 1995, respectively, for OEPA and APOC.
6. **The establishment of a solid public-private partnership and the meeting once a year of all stakeholders** to review past and future programme activities and more importantly, to agree on next year's budget for the programme.
7. **The existence in each endemic country of well-structured and truly functional National Onchocerciasis Task Forces** (NOTF), in which all stakeholders (programme managers, NGDOs, Ministry of Health officials, researchers) meet regularly to plan, implement, monitor, and evaluate together all ongoing control activities.
8. **The promotion, generous support and regular use of operational research** on all core aspects of programme implementation and its 'feedback' into ongoing operations.
9. **A flexible and adaptive approach to mass distribution:** e.g. mass distribution of Mectizan® has evolved from mobile strategies (very expensive and hardly sustainable) to community-directed treatment with ivermectin (high community ownership, very cost effective, and more likely to be sustainable).
10. **Active involvement of target communities:** the prime beneficiaries of the programme, i.e. affected communities, are actively involved at all stages of programme implementation (planning, community mobilisation, motivation of distributors, implementation, supervision, monitoring – including self-monitoring and supervision). A sharp contrast to what still prevails in many health intervention programmes, where targeted populations have no other role to play except that of passive but grateful participants of well-designed and scientifically sound programmes developed on their behalf and for their benefit.

certification for the elimination of blinding trachoma as a public health problem throughout the country. Other countries still (The Gambia, Ghana, Mauritania, and Viet Nam) are also well on track to completing their trachoma control campaigns by 2010.

Future prospects

There is little doubt that, because of ongoing activities and the remarkable achievements to date, onchocerciasis and blinding trachoma may become the first major causes of needless blindness to achieve VISION 2020 objectives within the year 2020 endpoint.

APOC's operations are now scheduled to end by 2015. Current thinking and consensus is that, by then, the primary objective of the Programme, i.e. to establish sustainable national onchocerciasis control activities in all endemic countries, may not be achieved everywhere. This is mainly because programme implementation has been significantly slowed down in war-torn countries, for obvious reasons, and in Central Africa where co-endemicity with Loa Loa and the risk of severe Central Nervous System complications has required extreme care and close medical supervision in the distribution of Mectizan®.

John Buchan. MALI

The SAFE strategy, introduced in 1996, was one of the events that put the fight against trachoma back on the map

It is therefore imperative to ensure that all residual activities, including post-treatment surveillance, will have the financial and other logistic support needed for their completion or, failing that, for their integration into viable national health care systems.

Regarding trachoma control, the coming years should see a further expansion of the SAFE strategy and an increasing number of endemic countries with fully developed national plans. Hopefully, both developments will be matched with a similar increase in financial resources available at country level.

Conclusion

Despite being two very different diseases, onchocerciasis and trachoma have a lot in common. Both are diseases of poverty, often affecting not just the poorest among the poor, but also the most difficult to reach in communities often described as "at the end of the road." The challenges that they pose for their control are also quite similar, in that successful control of both diseases requires far more than an effective strategy or a freely available drug. Just as essential is highly coordinated work between all players involved, from donors and researchers, to people working in the field, not forgetting affected communities themselves.

Trachoma control presents us with an additional (and major) operational challenge, in that the success of the SAFE strategy requires a close and essential collaboration with non-medical experts for the implementation of its 'F' and 'E' components. Failing to fully implement all of its four components will mean running the risk of reducing the SAFE strategy into a purely medical effort that, most agree, is not likely to achieve optimal success – if at all – in our fight against blinding trachoma.

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A challenge for the future: moving out of our comfort zone

Past experience has consistently shown that medical personnel tend to implement only the S (Surgery) and A (Antibiotic) components of the SAFE strategy. Reasons for this include:

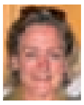
- The 'S' and 'A' components are the ones that health workers are most comfortable with or have skills for.
- The Ministry of Health rarely has the skills, expertise, and resources needed for the effective implementation of the 'F' and 'E' components.
- The 'F' and 'E' components require input from, and a close working relationship with, experts in the fields of education, community development, water, sanitation, and hygiene.
- To this date, in many endemic countries, trachoma and public health experts have shown limited willingness for, and experience with, such a close and synergistic collaboration with non-medical experts.

While there is no doubt that the 'S' and 'A' components remain important and urgent, the natural history of trachoma, in those parts of the world where it was once endemic, is also there to remind us that the disappearance of the disease had little to do with effective medical intervention (nonexistent at the time), but everything to do with improved socioeconomic living conditions, better sanitation, easy access to water, etc.

Seen in that light, trachoma control presents to medical professionals a far greater challenge than any other cause of avoidable blindness. The imperative to make it succeed leaves us with no other option but to move out of our comfort zone and to proactively seek and reach out to other players, whose contribution to our global success may turn out at the end to be the 'essential one'.

A humbling challenge indeed for some, but also a unique opportunity to develop tomorrow's leaders, many of whom will be operating more and more (and not less) in resource-constrained environments, involved in more and more complex interventions such as, the Millennium Development Goals or the co-implementation of Neglected Tropical Diseases.

Twenty years of childhood blindness: what have we learnt?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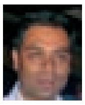

Mohammed Muhit
Clinical Research Fellow, International Centre for Eye Health, UK.

Over the last 20 years, much has been achieved in controlling blindness in children. Prior to the launch of VISION 2020, a number of international initiatives and programmes had raised the profile and increased interventions for child health and survival, which also had a positive impact on eye diseases and blindness in children, e.g. the Expanded Programme for Immunisation (EPI)(1974) and the Global School Health Initiative (1995). Since 2000, the United Nations' Millennium Development Goals have emphasised the need to promote child health and survival.

Since VISION 2020 was launched in 1999, controlling blindness in children has been a high priority. Child Eye Care Centres are being established with well-trained, well-equipped teams, particularly in Asia. Programmes for detecting babies with retinopathy of prematurity (ROP) are expanding in Latin America, India, China, and other countries in Asia. Many school-going children are having their visual acuity measured and those with refractive error are being provided with spectacles. Finally, there is improved availability of affordable consumables and equipment, such as paediatric low vision devices, small diameter intraocular lenses, and spectacles for children.

This article presents an overview of what we have learnt over the past twenty years and outlines some of the challenges we still have to face in order to control avoidable blindness in children and adequately support those with incurable visual loss.

1 Magnitude and causes

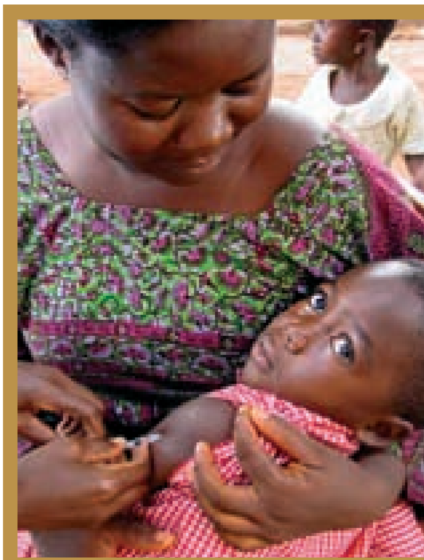
In 1988, there was little information on the magnitude and causes of blindness and visual impairment in children. At that time, most of the information on causes had come from examining children in schools for the blind and prevalence data were very limited. However, we have since made substantial progress, both in collecting data and in finding ways to estimate the magnitude and causes of childhood blindness.

In 1990, the World Health Organization (WHO) organised the first meeting of experts on the prevention of blindness in children; they estimated that there were 1.5 million blind children in the world.[1] In 1997 WHO held a second meeting, during which the estimate was revised to 1.4 million: a new method was used to estimate the magnitude for countries where these data were not available, which was based on the association between under-five mortality rates and the prevalence of blindness in children. This method is still being used, as data from more recent population-based surveys confirm that the prevalence of blindness in children and under-five mortality rates correlate reasonably well. Under-five mortality rates are also being used as a proxy indicator of vitamin A deficiency in children.[2]

In 1990, experts agreed that corneal scarring, mainly from vitamin A deficiency and measles, was the major cause of childhood blindness in most low-income countries.[1] However, as a simple classification of causes did not exist, the International Centre for Eye Health (ICEH) worked with WHO to develop a new system for classifying the causes of blindness in children, which was published in 1993.[3] Data collected using this system, which has clear definitions, a standard recording form, and a data analysis package, is being used to compile a global database of causes.[4] In 1997, it was estimated that 45% of blind children were blind from avoidable causes and that the pattern of causes varied widely between and even within countries.[4] The following conditions were prioritised for control: corneal scarring, cataract, retinopathy of prematurity, refractive error (mostly myopia), and low vision.[5] Other studies have shown that most blind children are either born blind or lose their sight before their sixth birthday. Novel methods have also been developed which can provide important information on the prevalence and causes of blindness in children, such as the use of local volunteers who act as key informants.[6]

2 Vitamin A deficiency and measles

During the 1980s, it was realised that vitamin A deficiency was an important cause of child mortality and that high-dose vitamin A supplementation significantly reduced child deaths, even in communities with low levels of clinical xerophthalmia. Intermittent high-dose vitamin A supplementation is an important public health intervention and approximately 500 million doses are given annually throughout the world at a cost of approximately US $1 per dose. As a result, the prevalence of vitamin A deficiency has declined in many regions of the world. There is also evidence that blindness in children due to corneal scarring has also declined. For example, in Uganda, 53% of all blind children born between 1951 and 1965 were blind from corneal scarring, compared with 14% for children born between 1980 and 1995.[7] However, some communities are still affected by vitamin A deficiency today, such as those living in urban slums and poor communities in rural areas.



As a result of intense efforts to reduce under-five mortality rates over the last 20 years, the prevalence of corneal blindness in children has declined

Measles immunisation is another large-scale public health intervention to reduce child morbidity and mortality. Since the launch of EPI in 1974, coverage with measles immunisation has increased to target levels in most regions. The numbers of measles cases and measles-related deaths have declined as a consequence. Measles epidemics are now relatively rare and measles-related corneal blindness has also declined. As with vitamin A deficiency, there are still communities of children at risk, particularly in sub-saharan Africa, where the majority of measles cases and measles-related deaths now occur.

There is no reason to be complacent, as there is evidence that under-five mortality rates are no longer declining at the same rate as in earlier decades in the poorest parts of the world. Our role as eye care professionals is to advocate for children – when we see a child with corneal ulceration from vitamin A deficiency or following measles, we should not only treat the child, but we should also inform the relevant authorities so that they can improve their programmes.

3 Cataract in children

Because corneal blindness is declining in many countries in Africa and Asia, cataract is becoming a relatively more important cause of avoidable blindness. The management of cataract in young children has changed dramatically over the last 20 years. When intraocular lenses (IOLs) were first used in the late 1970s, they were thought not to be suitable for children. Over the last decade, smaller, high-power IOLs, suitable for children, have become available; surgical techniques and equipment have also evolved. Many paediatric ophthalmologists now insert IOLs in children as young as 12 months of age. However, this technique requires considerable expertise and a vitrectomy machine, as the posterior capsule and anterior vitreous have to be removed in young children. Long-term follow-up is also crucial to manage visual axis opacities and to ensure the child is given optimal optical correction and low vision devices, if required.

4 Retinopathy of prematurity (ROP)

In the early 1990s, it became apparent that an epidemic of blindness due to ROP was occurring in middle-income countries.[8] There are three main reasons for this epidemic: neonatal care services have expanded and premature babies are surviving; levels of neonatal care are not always adequate to prevent ROP, particularly in larger, more mature babies; finally, not all babies at risk are being examined by an ophthalmologist and treated, if required. Recent evidence suggests that ROP is also emerging as a new cause of blindness in urban centres in India, China, and other countries in Asia. In these low- and middle-income regions, premature babies are also at risk of severe ROP with higher birth weights than is currently the case in industrialised countries. The implications of these findings are that neonatal care needs to be improved to prevent ROP and that examination of babies in neonatal units needs to include larger premature babies.

5 Refractive error in children

Little was known about the magnitude of vision loss due to refractive error in children until the late 1990s. Since 2000, WHO has worked with the National Eye Institute, USA, to undertake standard, population-based surveys of the prevalence of refractive error in all regions of the world among children aged five or seven up to 15 years. The findings show that refractive errors are more prevalent in children in Asian countries than in other regions, and that myopia, which increases with increasing age, is the commonest refractive error in older children. Myopia is also more common in children from urban areas than in those from rural areas. The current thinking is that myopia is caused by the influence of genes as well as environmental factors, and that outdoor activity may protect children from myopia. We also know from studies in Tanzania[9] and Mexico, that a high proportion of children with refractive error identified in school eye health programmes do not wear the spectacles provided. All these studies provide important information for those planning school screening for refractive error.

Clare Gilbert

Premature baby in a neonatal intensive care unit. VENEZUELA

6 Functional low vision in children

Recent data from the studies of refractive error mentioned above suggest that the prevalence of functional low vision (corrected visual acuity in the better eye ranging from <6/18 to, and including, light perception from untreatable causes) is approximately twice the prevalence of blindness: there are almost 3 million children worldwide who have the potential to benefit from low vision care.[10] It is, therefore, essential that low vision services be part of eye care services for children at all levels of service delivery.

7 Conclusion

The control of blindness in children is a VISION 2020 priority because the number of 'blind person years' resulting from blindness starting in childhood is second only to cataract. If VISION 2020 targets for children can be met, the global prevalence of blindness will have fallen from 7.5/10,000 children (in 1997) to 4/10,000 children by the year 2020. The number of children who are blind will decline to approximately 800,000.

Visual loss from refractive error and cataract is treatable, and blindness from vitamin A deficiency, measles, or ROP is potentially preventable. As eye care workers, we must provide the relevant information, services, and support to reduce blindness and visual impairment in children from these avoidable causes. We also need to ensure that children with incurable visual loss are not denied their equal right to education and to lives that are fulfilled and rewarding.

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Challenges for the future

1 Integrating eye health into broader child health initiatives

- International initiatives for the promotion of child health
- Primary health care (e.g. kindergartens, Maternal Child Health Clinics, or micro-credit schemes for women) for most of the preventable eye conditions.

2 Tailoring services specifically for children

- Not treating children like small adults
- Adopting a holistic, child-centred approach, which includes parents and carers
- Developing and emphasising the sub-specialty of paediatric ophthalmology, from residency programmes through to service delivery
- Planning services for a catchment population of 10 million people, rather than the 1 million used for adult blindness.

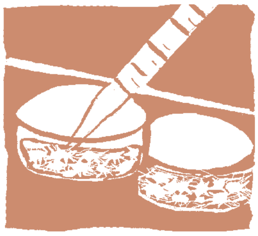
3 Increasing uptake of services

- We have to be much more proactive in finding children who need treatment, particularly girls (e.g. by using local key informants)
- We must try to make services affordable for children (free or greatly subsidised) and inform the community of how much is being charged
- Health education for mothers is crucial: they should know how to prevent potentially blinding conditions and where they should go if their child has a problem
- Health education for children, girls in particular, is equally important: they are the parents of the future
- The current focus of school programmes on refractive error alone means that opportunities for health promotion and education are being missed. School-going children have siblings and parents at home.

4 Recognising the importance of education and rehabilitation

- Many children attending eye care services have visual loss from untreatable conditions. It is our responsibility to ensure they are seen in low vision clinics and referred for education and rehabilitation
- As avoidable causes are declining, a greater emphasis needs to be placed on preventing disability through education and rehabilitation.

5 Ongoing research activities to improve programmes



LOOKING AHEAD

Eye health in the future: what are the challenges for the next twenty years?

Hugh R Taylor
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When looking ahead, it is really important to know where we have come from. This allows us to project identified trends and to reflect on the tremendous amount of change that can happen over a relatively short period.

Reflect for a moment on the intensity of the debate regarding the use of intraocular lenses (IOLs) in low-income settings in the 1990s. As they were still very expensive, some insisted that aphakic correction after surgery was the best approach for these countries. The subsequent availability of low-cost IOLs made the debate irrelevant. It dramatically changed our ability to provide modern IOL cataract surgery and control cataract blindness worldwide, and it laid the basis for VISION 2020. Other dramatic changes occurred with the introduction of ivermectin for onchocerciasis and azithromycin for trachoma, which gave us the ability to eliminate these two devastating and previously intractable causes of blindness. Our medical management of glaucoma or of age-related macular degeneration today is totally different from what it was 20 years ago, although there is still a long way to go. Our approach to refractive error has also altered dramatically, thanks to the recognition of its importance and the availability of high-quality, low-cost spectacles.

So, given what we know about the past, what are the challenges we face in the future?

Doing what we know

The gap between knowledge and practice

To my mind, the single biggest challenge we face – and the one which will offer by far the biggest pay-off – is the challenge of fully applying what we already know. We know how to cure cataract blindness, how to cure uncorrected refractive error, how to eliminate trachoma and onchocerciasis, and how to prevent most blindness from diabetic retinopathy. We do not need to wait for a new gene to be discovered or a new laser. Why, then, aren't we putting this knowledge into practice right now?

VISION 2020 recognises that three-quarters of all blindness worldwide is either avoidable or preventable with what we currently know and it aims to bridge the existing gap between knowledge and practice. The VISION 2020 initiative emphasises disease control, but it also recognises the need for eye care to be delivered through national programmes that are tailored to individual countries. The initiative also rightly emphasises human resource development and infrastructure.

However, none of this is possible without money! Non-governmental organisations and donor agencies can provide some level of ongoing funding, as well as flexible start-up money for new initiatives. Yet long-term funding for ongoing blindness prevention and eye care must eventually come from governments or their insurance programmes, although individuals themselves will continue to pay some costs.

The crucial importance of advocacy

What is really needed, therefore, is strong advocacy programmes to alert governments to the importance of eye care, the costs of not doing more, and the benefits of intervening to prevent avoidable blindness.

Evidence for advocacy. For effective advocacy, good data is essential.

- National, population-based prevalence data on blindness can be invaluable, but using data from similar countries, extrapolated with national demographic data, is almost as effective and far more cost-effective and timely.
- Exciting advances are being made in quantifying the 'burden of disease' or the 'loss of wellbeing' attributable to vision loss and translating it into monetary terms (such as US dollar per quality-adjusted life-year or QALY).
- Eye care interventions are amongst the most cost-effective of all health care interventions, in terms of reducing the number of years people would otherwise have lived with a disability (this is quantified as disability-adjusted life-years or DALYs).
- Economic arguments such as these are what governments and finance departments understand. For example, one can show that for each US dollar spent on eye care, there is a US $5 return to the community. Such an objective financial argument carries more weight than an emotional call for action to stop people losing their sight.

Hannah Kuper

Older woman with cataract. VIET NAM

- It is also important to monitor and evaluate our programmes to show their ongoing success, efficiency, and impact – and to add this to the case for eye care we are trying to build.

Developing advocacy skills. With solid evidence being available to support the establishment of eye care programmes, the focus moves to the need for strong advocacy skills.

- Key members of eye teams should receive specific training to enable them to succinctly state and present the case for eye health.
- Some work has already started on this – workshops run by the International Agency for the Prevention of Blindness and the International Centre for Eye Health, as well as various activities by the International Council for Ophthalmology – but much more will be needed in the coming years.
- There are a growing number of good examples of successful case development and advocacy at a national level, but these successes will need to be repeated many times, for each country and of course at the international level through the World Health Assembly.

Recognising the changing demography

The population is getting older worldwide

- Over the last 50 years, life expectancy has increased by about 20 years around the world, except in those countries most affected by HIV/AIDS. As a consequence, the world population is getting older, with the number of elderly people set to double in the next 20 years.
- Because the frequency of blindness and vision loss increases with age, the demand for eye services will increase exponentially as populations grow older – this will need to be taken into account when planning eye care services. For example, the cataract surgical rate a country will need to achieve in order to eliminate blindness may increase significantly if there are more older people with cataract.
- In addition, the indications for surgery may change over time, as countries grow and people need to be able to read or drive a car in order to remain economically active; this will further increase the need for cataract surgery.

New patterns of disease

The changing demographic structure, coupled with economic growth, has also led to dramatic changes in the patterns of disease. Diseases particular to older people, especially age-related macular degeneration (AMD) and glaucoma, have become increasingly important.

AMD and glaucoma

- AMD is now the leading cause of blindness in most developed countries; it was not even listed as an important cause 50 or 100 years ago! Glaucoma too will become increasingly important.
- However, for both AMD and glaucoma, prevention is tough, treatment long and expensive, and at present only partially effective.
- In addition, interventions are very costly, but relatively inefficient, and both diseases require good low vision services to help people make the most of their remaining vision.

Diabetes

- Vision loss from diabetes is another growing problem resulting from increased life expectancy and changing lifestyles. People who would ordinarily have died of old age now live long enough to experience the retinal complications of the disease (diabetic retinopathy).
- Whereas diabetes once only affected people in high-income countries, the number of people with type-2 diabetes and obesity in low- and middle-income countries is now rapidly growing.
- As ophthalmologists cannot screen every person with diabetes for diabetic retinopathy on an annual basis, there is a pressing need to develop effective screening strategies with teams working in primary care and diabetes clinics. These teams might include ophthalmic nurses, optometrists, or other suitably trained mid-level personnel.

Changing interventions. These new patterns of disease will lead to changes in interventions. Ongoing, chronic conditions such as diabetic retinopathy, AMD, and glaucoma require a very different approach from the almost one-off contact required for cataract surgery. For example, persuading diabetes patients to change their behaviour may become an important way to prevent blindness from diabetic retinopathy.

Daisy Wilson. SWAZILAND

As the frequency of blindness and vision loss increases three times with each decade over 40, the demand for eye services will increase exponentially as the world population grows older

Therapeutic advances

AMD treatment

In the field of AMD, I feel sure there will be very exciting and rapid advances, particularly concerning drugs that inhibit or reverse the growth of new vessels; both better compounds and better delivery methods are being developed – specifically, vascular endothelial growth factor (VEGF) blockers or inhibitors (see article on page 50). The challenge will be to make these drugs available at prices both affordable and justifiable on a cost-effectiveness basis. The current drugs are often unaffordable by most (even in high-income countries) and not cost-effective. The biggest pay-off will be for drugs that slow or prevent the progression of the disease.

Glaucoma treatment

In the case of glaucoma treatment, we are also likely to witness the further development of drugs that are more convenient to administer and have fewer side effects. However, these new drugs will have to be far superior to justify prices that are higher than those of the present drugs.

It would be much better if we were able to diagnose the people with glaucoma who are currently undiagnosed (estimated at 50% of all cases). It would also be better if we were able to provide laser trabeculoplasty as the first-line therapy, rather than drugs that are expensive, have more side effects, and are plagued by poor compliance. However, the real breakthrough for glaucoma will be a safe and effective filtering procedure, such as a surgical drainage stent. Advances in our understanding of wound healing and nanofabrication should allow a simple-to-insert stent to give simple surgical control of pressure.

Gene chips

The ready availability of gene chips in the future could enable improved diagnosis and specifically tailored treatments for various eye diseases, including AMD and glaucoma. Gene chips are already available as prototypes, but there is likely to be much development as more and more genes are identified for various conditions and differential responses to treatment are determined.

Accommodating IOLs

All of ophthalmology and eye care would be revolutionised by the development of an effective and safe accommodating IOL. This would immediately replace all current IOLs and would further increase the demand for cataract surgery at earlier stages of vision loss. In addition, an accommodating IOL would also replace most refractive surgery and therefore affect both the Excimer laser surgery and the contact lens markets. Moreover, accommodating IOLs could well become the preferred option for the correction of presbyopia and make bifocal spectacles redundant. Wouldn't that be a revolution!

Bionic eye and stem cell biology

Another exciting possibility – although likely to be out of the financial reach of most people – is the 'bionic eye' for those with severe outer retinal damage. Such implants are likely to be extremely expensive and will be far more challenging to develop than the successful bionic ear, which has been in use for 20 years and still costs over US $20,000.

Stem cell biology also offers hope for those with conditions which are currently difficult to treat, such as some forms of corneal blindness.

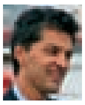
Childhood blindness

I hope it is only my ignorance, but I do not see any major breakthroughs in childhood blindness. Genetic identification may help to guide planned pregnancies in high-income countries and the first successful examples of gene transfer appear to offer exciting possibilities for treating inherited retinal degeneration. However, neither of these advances is likely to have a major impact in low- and middle-income countries in the foreseeable future. As far as I can see, the major advances will result from doing what we already know how to do, but doing it better: rubella and measles vaccination, clean faces, improving vitamin A intake, improving management of amblyopia (as it is needed after cataract, glaucoma, and squint treatment), monitoring of oxygen levels, early detection and low vision training, etc.

Conclusion

I will probably be embarrassed by some of these predictions by the time this is published and, surely, many of them will turn out to be foolish with hindsight. However, even if only one or two turn out to be correct, we will have a very exciting time over the next 20 years.

New developments in age-related macular degeneration



Lyndon da Cruz
Consultant Ophthalmic Surgeon, Moorfields Eye Hospital, 162 City Road, London EC1V 2PD, UK.

Epidemiology and Classification

The World Health Organization (WHO) estimates that over 3 million people (9% of global blindness) are blinded by age-related macular degeneration (AMD). AMD affects people over the age of 55. There are two main types of AMD, dry and wet. In dry AMD, patients slowly lose vision through progressive atrophy of the macular tissue. Wet, or exudative, AMD, is associated with new blood vessels called subretinal neovascular membranes (or SRNVM) and affected patients lose vision more rapidly due to fluid leakage and haemorrhage at the macula.

Recent developments in genetics

Originally, AMD was thought to be a degenerative disease with a genetic component, but strongly influenced by environmental factors, especially smoking. This changed in 2005, with the demonstration that a gene (complement factor H or CFH, a regulator of inflammation) is implicated in up to 50% of cases of AMD in some populations.[1] This suggests that AMD may be associated with inflammatory processes rather than primarily being an environmentally determined degenerative disease.

Since then, other genes, predominantly associated with inflammation, have been linked to AMD: some increase the risk of AMD and others protect against it. These genes are markers of risk for both wet and dry AMD. Their prevalence varies between different ethnic groups.[2]

It is still not understood why an individual at risk will manifest dry or wet AMD; at present, the only known trigger for wet AMD is smoking – an environmental factor.

New treatments for SRNVM in wet AMD

Although, there is still no effective therapy for dry AMD, new and more effective treatments for wet AMD have been developed.

Initial treatment protocols for SRNVM were restricted to thermal laser[3] and, subsequently, photodynamic therapy (PDT).[4] Though thermal laser was cheap to deliver, few patients were eligible for treatment and recurrence after laser was common. PDT allowed more patients to be treated, but the usual outcome was delayed vision loss rather than visual improvement.

The identification of the crucial role played by vascular endothelial growth factor (VEGF) in the pathogenesis of wet AMD has allowed the development of VEGF-blocking agents such as bevacizumab (Avastin), pegaptanib (Macugen) and ranibizumab (Lucentis).[5] This is the first generation of

Richard Leung/Kings College Hospital

Wet AMD

drugs which start to control the vision loss from late disease in all types of wet AMD and, in some cases, to produce improvement.[6]

Macugen was shown to be more effective than PDT in treating wet AMD and to reduce the probability of developing severe vision loss (by about 50% over one year). However, like PDT, it only delayed vision loss but did not prevent it.

Subsequently, it was shown that Lucentis was more effective than Macugen and could prevent further vision loss: about 95% of patients maintained their baseline vision whilst on treatment. Furthermore, one third of patients experienced a gain of vision (more than 15 letters of visual acuity).

In 2005, it was demonstrated that Avastin, the molecule from which Lucentis is derived, could also be used for the treatment of wet AMD,[7] although this was not its original use. Since then, the use of Avastin for the treatment of AMD has been widely reported; the literature suggests that its efficacy is similar to that of Lucentis, as well as its toxicity. The advantages of Avastin are a lower cost and longer half-life (allowing for six-weekly dosing, rather than four-weekly as for Lucentis).

Combination treatment protocols

Possibly the most important recent addition to treatment protocols for wet AMD is the combination of two, or even three, modalities delivered simultaneously to minimise re-treatments and optimise gain in visual acuity. Intravitreal anti-VEGF agents have been combined with intravitreal steroids (either dexamethasone or triamcinolone) and, in some cases, in combination with PDT. This is called 'triple therapy'. There are some reports suggesting that these triple treatments may reduce the need for re-treatment and may provide a 'one shot' treatment.

Polypoidal chorio-vasculopathy

Recently, a subset of wet AMD, termed polypoidal chorio-vasculopathy (PCV), has been identified as a clinical entity.[8] PCV is important, as it may be the main cause of vision loss from AMD in certain Asian and black populations.[8] It has a different natural history, treatment, and prognosis relative to traditional wet AMD.

PCV is best demonstrated by ICG (indocyanine green) angiography, while wet AMD is shown with fluorescein. The distinctive clinical features of PCV include one or more haemorrhagic pigment epithelial detachments (PEDs), extensive exudation, and disease outside of the macula including the periphery. There is a predilection for peripapillary 'polyps'. Patients are also characteristically younger.

Current treatments include: direct laser ablation of choroidal polyps[9] seen on ICG angiography, PDT, and intravitreal anti-VEGF drugs – or a combination of all of these. There is no consensus regarding treatment protocol, but there are series reporting each modality as being effective. For a clinician, it is critical to suspect PCV from the clinical picture and the ethnicity of the patient, and then to investigate appropriately with ICG and identify the polyps for treatment.

Conclusion

Over the last four years, age-related macular degeneration has become better understood and treatments have become much more effective. The demonstration of high-risk genes associated with the inflammation process has changed the approach to this disease. Also, the identification of VEGF as central to the pathogenesis of wet AMD has allowed the development of the first generation of drugs that start to control the vision loss from late disease. In the future, we may be able to identify at-risk individuals and, as well as stopping smoking, suggest other changes in lifestyle and perhaps offer long-term medication that can prevent the disease.

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The *Community Eye Health Journal*: twenty years on

A word from former and present Editors

DD Murray McGavin
Editor 1988–2003

Many years ago, in Central Asia, the *Journal* was ‘given to me to do’ – and the first issue was published in 1988. In 2003, after reaching Issue 47, the fulfilling task of Editor was handed on to a very able and experienced colleague, Victoria Francis. In 2007, Elmien Wolvaardt Ellison became our third Editor, bringing a wealth of expertise to further enhance the original vision and purpose of the *Journal*.

Through the role of Editor, I have had the opportunity and privilege of meeting and working with many colleagues and friends, truly an international community of health professionals who have sufficient vision and selfless purpose to work together, seeking to eliminate avoidable blindness worldwide.

During the past twenty years, the *Community Eye Health Journal* has sought to provide a service to health workers – not only to specialists, but to those who are simply ‘faced with eye problems’ – ophthalmologists, doctors, ophthalmic nurses, general nurses, optometrists, refractionists, ophthalmic medical assistants, ophthalmic technicians, community health workers, and many others.

It has been the ethos and purpose of the *Journal* from the outset to bring health workers up to date with current thinking and practice – a process of continuing medical and health education. In 2004–2005, a survey found that the *Journal* was the only source of up-to-date information for 73% of our readers and 72% said that the *Journal* had changed or influenced their practice.

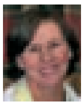
Perhaps appropriately, the last twenty years have seen a growth in the development of eye care services – policies for disease control, human resource development, and infrastructure and appropriate technology provision – all central to VISION 2020: The Right to Sight. It is an encouraging thought that the *Journal* has played some part in providing knowledge and disseminating information, interpreting views and policy in health care practice to its readers and, thereby, preventing blindness and visual impairment around the world.

Gordon Johnson. MONGOLIA

A reader survey conducted recently showed that, for 73% of our readers, this journal is their only source of up-to-date information

Henry Nkumbe

Two eye nurses browse a copy of the *Journal*. MADAGASCAR



Victoria Francis
Editor 2003–2007

My first encounter with the *Community Eye Health Journal* (*CEHJ*) was during its early beginnings as the ‘Bulletin of Community Eye Health’ – a simple biannual publication that aimed to extend the arm of a burgeoning training programme at the International Centre for Eye Health. The courses addressed the public health dimensions of ophthalmology and provided training relevant to resource-poor settings. As a postgraduate student at the Institute of Education, I was fascinated by the educational approach of both the courses and the extended learning materials, including the *Bulletin*. Twenty years on, the courses in community eye health and the *CEHJ*, now based at the London School of Hygiene and Tropical Medicine, continue to contribute to the global prevention of blindness. Two things strike me as remarkable about this. First, the contiguous development of the academic programme and the *Journal*, which ensures that content remains current and is continuously fed by international staff and students who contribute in many ways to its relevance. Second, the contrast in technological possibilities between ‘then’ and ‘now’. This has presented a great challenge in terms of maximising the potential of the digital revolution for those living comfortably on the digital highway, while at the same time not forsaking print as the only way to reach those without internet, who may in fact be working even beyond the end of a dirt track road. It has always been the purpose of the *CEHJ* to serve those who have limited access to information and I feel privileged to have been part of this during my period of Editorship. I wish the *CEHJ* continued success and growth in the coming 20 years!

Elmien Wolvaardt Ellison
Editor since 2007

What I wanted to say about the future of the *Journal* is that we hope to remain a reliable source of information and continued professional education for eye care workers who would otherwise not have access to such resources. Some news is that we will be adapting key parts of the curriculum of the MSc in Community Eye Health, which is taught at the London School of Hygiene and Tropical Medicine, as an educational series in the *Journal* (with some questions/tasks for Continuing Professional Development). This will be in the form of a four-page spread in the centre of the *Journal*, which readers can take out and keep. It will appear in every issue from 2010 until 2015. We will also keep striving to not just provide eye care information, but to provide information in a form that readers can immediately understand and use. Readers will have noticed an increase in the number of ‘boxes’ in the *Journal*, where we summarise key points and procedures as bulleted lists. We hope that some readers will cut these out and keep them handy, so they can refer to them during the course of their work – or use them to educate colleagues and students.

Henry Nkumbe

A refractionist reading a French edition of the *Journal*. MADAGASCAR

Meetings

Asia ARVO international meeting on research in vision and ophthalmology, 15–18 January 2009, Hyderabad, India. For information, visit: **www.asiaarvo2009.org**

Courses

Community Eye Health Institute, University of Cape Town, South Africa

Postgraduate diploma in community eye health NEW
Start date: January 2009
Target audience: National VISION 2020 coordinators and district VISION 2020 programme managers who wish to receive training in the management of district VISION 2020 programmes.
Course structure: One-year course, comprising an initial 10 weeks on campus, then 36 weeks off campus when the student is back working in his/her health district, and a final two weeks on campus. **Closing date:** 30 November 2008. **Course fee:** ZAR 47,040 (approximately €4,704). Recommended living expenses for 12 weeks in Cape Town ZAR 23,100 (approximately €2,310). Travel to and from Cape Town.
For more information: Contact Adri Winckler at **adri.winckler@uct.ac.za**

International Centre for Eye Health, London, UK

Diploma in Community Eye Health, 18 February – 23 May 2009
Target audience: Eye care professionals (including ophthalmologists, optometrists, and project managers) who want to receive training in community eye health, but cannot be away from their place of work for a longer training course. **Information and admission procedures:** Visit **www.Lshtm.ac.uk/prospectus/short/sdceh.html** or email **shortcourses@Lshtm.ac.uk**

Kilimanjaro Centre for Community Ophthalmology, Tanzania

All courses are held by the Kilimanjaro Centre for Community Ophthalmology (KCCO) in collaboration with the Fred Hollows Foundation. **Venue:** KCCO, Moshi, Tanzania. **Information:** Visit **www.kcco.net** or contact Genes Mng'anya at **genes@kcco.net**

Bridging communities and eye care providers to achieve VISION 2020 in Africa, 10–14 November 2008
Target audience: Eye care programme managers, trainers, and key decision makers of national prevention of blindness programmes.

Organisational and financial management to achieve VISION 2020 in Africa, 17–28 November 2008. **Target audience:** Heads and key decision makers of VISION 2020 planning areas.

Building research capacity in Africa for VISION 2020, 23–27 February 2009
Target audience: There will be no more than 6 to 8 students, budding researchers who are interested in learning to write a good-quality, fundable, research proposal. By the end of the course, each student will have a research proposal ready for submission for funding and ethical approval.

LAICO – Aravind Eye Care System, India

All courses are run by LAICO – Aravind Eye Care System, 1 Anna Nagar, Madurai 625 020, Tamil Nadu, India.
Tel: +91 452 4356500
+91 452 4356100
Fax: +91 452 2530984
Website: **www.aravind.org**

Management priorities in eye care delivery, 4–10 January 2009. **Target audience:** Heads of eye hospitals (ophthalmologist and management). **Application deadline:** 1 December 2008. **Information:** Mr Sanil Joseph at **Sanil@aravind.org**

Management training for eye care programme managers, 16–27 February 2009. **Target audience:** Professionals concerned with eye care programme development, monitoring evaluation and funding. **Application deadline:** 15 January 2009. **Information:** Ms Sasipriya at **Sashi@aravind.org**

Resources

Standard list for a VISION 2020 eye care service unit

The *Standard list* is produced under the guidance of the Technology Programme Committee of the Global Initiative for the Elimination of Avoidable Blindness. It aims to assist programme managers and medical personnel to set up and manage eye care services. It suggests the equipment, instruments, and supplies required to primary and secondary level (district) eye care units serving a population of 500,000 to 1 million.

The newly revised edition has additional sections on paediatric and general anaesthesia. Diagnostic and surgical equipment sections have been expanded to include the needs of units involved in the prevention and treatment of conditions associated with childhood blindness. The list gives the contact details of a range of suitable suppliers. Additionally the list can be used as a source of information where local purchasing is feasible or can be developed.

The list can be downloaded on **www.v20202.org** or a print version can be obtained by sending your name, occupation, and postal address to: Teaching Aids at Low Cost (TALC), PO Box 49, St Albans, Hertfordshire, AL1 5TX, UK **Email:** **info@talcuk.org** **Website:** **www.talc.org/featured-publishers/iceh.htm**
Cost is UK £3 plus post and packing (free to low- and middle-income countries).

Next issue

Lance Bellers/Sightsavers

The next issue of the *Community Eye Health Journal* will be on the theme **Improving eye care**