

Prevention of blindness and priorities for the future

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The impact of visual loss has profound implications for the person affected and society as a whole. The majority of blind people live in developing countries, and generally, their blindness could have been avoided or cured. Given the current predictions that the number of blind people worldwide will roughly double by the year 2020, it is clear that there is no room for complacency.

As the world's population increases and as a greater proportion survives into late adulthood, so the number of people with visual loss will inexorably rise. Given the success of programmes in combating the most common causes of blindness (infectious diseases and malnutrition) which generally affect the young, and the projected demographic shift, age-related eye disease will become increasingly prevalent. Effective preventive measures for these diseases can only be established as more is known about their etiology.

As the longevity of the world's population increases, the visual requirements at the workplace are also changing. People with low vision may be at a disadvantage in many common activities, and may face unemployment — particularly in technological societies. The definition of blindness needs to be rethought, to ensure that people with "economic" blindness are not forgotten. Efforts should be made to recognize and treat those affected at an early stage, for the benefit of the individual and society.

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Mots clés: Cécité/prévention et contrôle; Cécité/étiologie; Cécité/épidémiologie; Vieillesse; Dynamique population; Préviation (*source: INSERM*).

Palabras clave: Ceguera/prevenición y control; Ceguera/etiología; Ceguera/epidemiología; Envejecimiento; Dinámica de población; Predicción (*fuentes: BIREME*).

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Introduction

The impact of visual loss on the personal, economic, and social life of an individual is profound, and when the prevalence of blindness in communities is high, the consequences become a significant public issue. Currently, there are an estimated 45 million blind people worldwide, with an increase of 1–2 million each year — i.e. 0.85% of the world's population have a corrected visual acuity in the better eye of less than 3/60 (1). An additional 135 million people have low vision. The majority of people with visual loss live in the developing world, partly due to higher rates of blindness in these countries compared to those in industrialized countries, but also due to the sheer size

of the population in developing countries. In 1998, an estimated 90% of blind people lived in the developing world, and most of the blindness was largely either avoidable or curable. While much has been accomplished in blindness prevention in the last 30 years, even more effort will be required in the future, as current predictions suggest that the number of cases of blindness will roughly double worldwide by the year 2020 (2).

The most significant factors related to this rise are both the increase in the world's population, and the even greater rate of increase in the proportion of the population aged 65 and over. The world's population is estimated to grow from 6 to 7.9 billion by the year 2020, with 6 billion people in Africa and Asia alone. The decline in mortality rates in older age groups have resulted in a population with more and more people aged 65 and over; the decline in fertility rates contributes to an even greater increase in the proportion of the population who are elderly. In the United States of America, the projected increase in the proportion of those aged 65 and over during the next 25 years is from 13% to 19% (3), while in

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China, the growth is estimated to almost double, from 7% to 13%. Rates of visual impairment increase with increasing age, so with a larger proportion of the population surviving into late adulthood, the number of people with visual loss will inevitably rise.

With this demographic shift towards an older population will come a concomitant shift in the burden of diseases toward the chronic, age-related morbidities now seen in industrialized countries. Age-related cataract will become an even larger percentage of the causes of blindness worldwide, and glaucoma and age-related macular degeneration will emerge as public health issues. However, the rise in age-related eye diseases is due not only to the demographic transition, but also to the successes of programmes to combat the most common causes of blindness, infectious diseases and malnutrition, which typically affect younger people. These successes — initially in combating xerophthalmia, onchocerciasis, and trachoma — are a testimony to the power of adopting research and public health approaches to solve the problem of avoidable blindness. They can also provide a framework for future approaches which will be needed to control the causes of blindness associated with ageing.

Seeing off old enemies

The last 30 years have seen remarkable success in the battle to prevent blindness resulting from xerophthalmia, onchocerciasis, and trachoma. These diseases have in common an etiology that is largely external (infectious diseases or malnutrition) and that lends itself to a public health approach to control. In fact, the public health approaches to the elimination of blindness from these diseases have advanced rapidly, largely as the result of research into the identification and continuing refinement of effective strategies for control, coupled with political will and perseverance in their implementation.

Data linking xerophthalmia to vitamin A deficiency existed in the early 1900s, but the extent of the problem of blindness and recognition of its public health significance did not receive attention until the early 1970s, when the World Health Assembly focused on blindness prevention as a global issue. Even then, it took the establishment of the link between low levels of vitamin A and childhood morbidity and mortality (4) to propel the vitamin A deficiency into a major public health issue. National programmes to tackle vitamin A deficiency moved to the forefront of child-survival initiatives. Currently, an estimated 70 countries have active vitamin A control programmes. As a result of these initiatives, vitamin A deficiency is not expected to be a major cause of blindness in the future (1).

As late as the 1980s, there was no effective treatment for onchocerciasis that was safe for use on a mass scale. Control of blindness depended on mass use of insecticides to destroy the vector — the black

fly (*Simulium*) — responsible for transmission of *Onchocerca volvulus*. Communities afflicted with onchocerciasis lived close to rivers which were the breeding sites for the flies. A vector control programme was carried out with varying success in the countries enrolled in the Onchocerciasis Control Programme of the World Health Organization. Although spraying larvicide was effective in preventing future disease in those not already heavily infected, it did little for those who were. Spraying was also less effective in communities living in terrain that was unsuitable for aerial spraying. Demonstration of the safety and efficacy of ivermectin against the microfilariae of *O. volvulus* radically altered the approach to control (5). With a generous donation of ivermectin from the manufacturer for the duration of need, national distribution programmes are now aiming to dose high-risk populations once a year for an undetermined time, until the adult worms have died out. Since 1987, the prevalence of onchocerciasis and its effect on vision have steadily declined: 11 countries in West Africa have eliminated onchocerciasis as a public health problem and have prevented an estimated 600 000 cases of blindness (1).

Trachoma is still the second leading cause of blindness worldwide. Although once widespread in most continents, it has largely disappeared from industrialized countries. Currently, the highest rates of trachoma are found in communities with the poorest resources, affecting their most vulnerable members: women and children. Unlike control strategies for onchocerciasis and xerophthalmia, there is no “magic bullet” for trachoma. Demonstrations of the safety and efficacy of a single dose of azithromycin to eliminate ocular infection with *Chlamydia trachomatis* have led to community-based trials which have recently shown that once-a-year mass treatment campaigns significantly reduce the pool of infection (6). However, coverage of the population is never 100%, and the disease can quickly re-emerge. Thus, although use of azithromycin has greatly improved the ease of treatment for trachoma, when compared to use of topical antibiotics, the provision of antibiotics alone will not control this disease. Research investigating the impact of hygiene modifications in affected communities — improved face washing (7) and environmental fly control (8) — indicate that these could result in sustained reduction of active trachoma. Therefore, the multisectoral campaign for the elimination of blinding trachoma consists of several interrelated components: surgery to repair trichiasis (the complication causing blindness), antibiotics to reduce the pool of infection in the community, and promotion of face washing and environmental sanitation to interrupt transmission. National programmes against trachoma, including the use of azithromycin donated by the manufacturer, have been recently launched and have received extensive philanthropic support in several countries. This concerted approach generates cautious optimism that trachoma will continue to decline as a major cause of blindness.

Research is still needed to identify and test potential vaccines against the agents causing trachoma and onchocerciasis, to provide long-term solutions, but the blindness-prevention community can move forward now by putting into operation existing strategies that effectively combat visual loss from these diseases.

Age-related eye diseases

Unlike xerophthalmia, trachoma, and onchocerciasis, age-related eye diseases do not have known external factors as their primary etiology. Rather, genetic constitution — probably following interaction with environmental and other factors — is likely to determine the risk of developing visually disabling, age-related eye disease. There is no doubt, however, that with the projected demographic shift, age-related morbidities will increase globally, not just in the industrialized countries where they are already prevalent. The most significant cause of blindness will continue to be cataract, but the importance of glaucoma, age-related macular degeneration, and diabetic retinopathy as causes of visual loss will increase as longevity increases and other, preventable causes of blindness in developing countries decline.

Management of blindness

At present, management of blindness from these age-related diseases relies on treatment to either restore sight (for cataract) or prevent further visual loss (for glaucoma and diabetic retinopathy): ways to prevent the onset of these diseases do not yet exist. For age-related macular degeneration, the situation is even more grim, as few cases respond effectively to existing treatment methods. Clearly, the priority for control of these diseases lies in continuing research to discover their etiology as a basis for establishing effective preventive measures.

Visually impairing cataract, although not preventable, lends itself to a public health-based control strategy through the safe, effective, and efficient delivery of affordable cataract surgical services. Research has shown that outcome of cataract surgery, in terms of visual rehabilitation and patient satisfaction, can be very high (9). As recently as a decade ago, the blindness-prevention community was divided over the relative merits of intraocular lens (IOL) surgery in developing countries (10). The superiority in outcome and patient satisfaction with extracapsular cataract extraction (ECCE) and IOL surgery is leading to general acceptance of pseudophakia as the global standard of care. The major issues remaining are increasing the volume and affordability of surgery, while assuring high quality.

The issues involved in increasing the volume of surgery are complex. In sub-Saharan Africa, for example, there are few ophthalmologists: less than 1 per million people overall with probably a tenth of that in remote rural areas (11). Clearly, the training of cataract surgeons is a high priority. Other countries

appear to have adequate numbers of ophthalmologists, as in Bulgaria, for example, but few are actually trained to perform cataract surgery let alone high-quality extracapsular cataract extraction (ECCE) with IOL (12). Thus, training surgeons to carry out high-quality cataract surgery with good visual rehabilitation outcomes will continue to be a major priority.

For other countries, such as China and India, the major issue is to increase the efficiency of delivery of services, by making better use of the large pool of existing ophthalmologists. There are an estimated 10 million people with severe visual loss from cataract in India, with an annual incidence of between 3 and 4 million, yet the annual cataract surgery rate is estimated to be only around 2 million operations (13). This is equivalent to approximately 1–2 cataract operations per surgeon per day. If efficiency improved to even one third of that of the surgeons at the Aravind Eye Hospital in Madurai, India (an average of eight operations per surgeon per day), for example, the backlog and the new cases could theoretically be dealt with in one year. In China, an estimated 250 000 cataract operations were performed in 1982, and the number has probably only roughly doubled since that time (11). While state-of-the-art surgery is available in the larger cities, many surgeons are now concentrating on more lucrative refractive surgery. For countries where distribution and efficiency of manpower are primary issues, ophthalmologists need to be trained not only in techniques, but equally importantly, in the efficient delivery of services.

However, maintaining the dual goal of increasing surgical coverage and assuring high-quality visual rehabilitation is of paramount importance, as reports from India and China raise concerns about expansion at the expense of the outcomes (14, 15). Continuous monitoring of the results of cataract surgery to assure high-quality outcomes is an important component of any programme.

Payment for treatment

In an era of movement towards free market economies and privatization of services, the question of sources of payment for ECCE with IOL must be addressed. Options range from payment entirely from charitable sources or public funds, to payment solely by the patient. There are successful models of cross-subsidizing provision of low-cost, high-volume, and high-quality cataract surgery, as in several institutions in India. But these models depend on there being a certain percentage of patients with the means to pay the full cost, as well as there being dedicated surgeons working for below-market wages. Other models include the sale of marketable commodities such as reading spectacles or ocular medication to generate income for subsidizing cataract services (11). Where new economies favour the privatization of eye care, the provision of more lucrative procedures for the wealthy, such as refractive surgery, becomes more attractive to surgeons than high-volume cataract surgery. In such situations, social inequity will

inevitably result unless the profits are used to cross-subsidize cataract surgery for those with more limited means. Otherwise, poorer patients will not receive services or receive less than ideal services, such as intracapsular surgery with aphakic correction. A survey of Indian ophthalmologists clearly illustrated this: it reported that patients whose costs were paid for by the government were far less likely to receive ECCE with IOL than were private patients (16). In addition to the promotion of training to improve the quality and efficiency of cataract surgery, the blindness-prevention community needs to develop imaginative models to make cataract surgical programmes self-reliant while covering all socioeconomic classes of patients.

Consideration of models in which patients might contribute to cost recovery for cataract surgery raises the important issue of using “blindness” as an indication for surgery. In locations where cataract surgical services are not offered to patients until they have accrued significant visual loss — often less than 3/60 — the practice condemns patients to lose employment, and hence economic productivity, while awaiting eligibility for surgery. This requirement is especially counterproductive in situations where the workplace demands a much higher level of visual function. In recognition of the importance of patient-reported disability in determining the need for cataract surgery, the American Academy of Ophthalmology has changed its practice pattern guidelines from solely a visual acuity cut-off criterion to reliance on patient-perceived functional limitations as well (17).

As the goal of VISION 2020 — a global initiative to eliminate avoidable blindness — focuses on the reduction in the burden of blindness, defined in terms of severe acuity loss, it is appropriate to revisit this concept of blindness.

“Blindness” revisited

About twenty years ago, the World Health Organization adopted categories 3–5 of visual impairment of the *International Classification of Diseases* (9th revision) as the designation of blindness (18). Blindness thus became a corrected acuity of less than 3/60 in the better eye. The justification was that such a handicap precluded a person from functioning effectively in the community. At that time, there was recognition that the burden of blindness fell disproportionately on developing countries, where “infections, malnutrition and cataract predominate” (18). Thus, the communities that formed the backdrop for this definition were the heavily agrarian, resource-poor communities in densely populated, rural Africa and Asia. Of the estimated 30–40 million blind people, 65% were located in Asia alone (19).

As infectious diseases and malnutrition wane in importance as causes of blindness, and age-related eye diseases increase, the burden of blindness will still be borne by countries such as China and India, due to

the sheer numbers of older people in their populations. This burden will only be exacerbated by rapid industrialization and the spread of information technology, which have changed the nature of the workplace for many people. Increasingly, functional limitations are defined by inability to perform visually intensive tasks. Driving, reading, sewing, interpersonal interactions, and computer skills are examples of visually demanding tasks that have assumed greater importance, particularly as more of the heavily populated countries in Asia experience economic development.

The visual requirements to function effectively in the marketplace are now far more stringent than they once were. Population-based research has shown that at a best corrected acuity of 6/18 or less, 85% of people aged 65 and over cannot read standard newsprint effectively (i.e. they read less than 80 words per minute) (S. West, unpublished data). Among people with a best corrected acuity less than 6/30, 87% have significant difficulty recognizing faces. At 6/60, over 50% of people have difficulty with mobility, and over 66% have difficulty with simple tasks such as dialling a phone number, or using a key or plug correctly. For the success of communities of the future, the goal must be prevention of avoidable visual loss at these lower acuity levels in order to maintain the functional capacity and employment of affected people. “Economic” blindness might be more appropriately set at a visual acuity of less than 6/18: this level should be used as the target for eliminating avoidable visual loss.

The implication of resetting the definition of blindness to this level — less than 6/18 — is the instant magnification of the global burden of blindness several fold. More importantly, it highlights the need to marshal resources for preventive activities and treatment to deal with visual problems at an earlier stage — prior to loss of economic productivity and subsequent dependency, at a stage when affected individuals can recognize the benefits of “investing” personal resources in their treatment.

Conclusion

The blindness-prevention community has a set a laudable goal in its new initiative, VISION 2020, designed to reduce the global burden of avoidable blindness. But there is an urgent need to recognize that the true burden of blindness has changed with the rapid pace of industrialization and technology, and that at least some of the costs of programmes will need to be born by patients themselves. By updating the criterion for blindness, and setting a target of reducing avoidable economic blindness, we highlight the true burden of blindness, as well as the need to recognize and treat those affected at a stage which permits them to maintain their independence and dignity. ■

Résumé

Prévention de la cécité et priorités pour l'avenir

La perte de vision a de profondes répercussions sur la personne atteinte et sur la société tout entière. La plupart des personnes aveugles vivent dans des pays en développement et, d'une façon générale, leur cécité aurait pu être évitée ou traitée. Etant donné les prévisions actuelles selon lesquelles le nombre de personnes aveugles devrait pratiquement doubler d'ici 2020, il est clair que ce problème ne doit pas être pris à la légère.

Comme la population mondiale s'accroît et qu'une plus grande proportion survit jusqu'à un âge avancé, le nombre de personnes présentant un déficit visuel ira inévitablement en augmentant. Etant donné le succès des programmes destinés à combattre les causes les plus courantes de cécité (maladies infectieuses et malnutrition) qui touchent en général les jeunes, et la tendance de

l'évolution démographique, les affections oculaires liées à l'âge auront une prévalence de plus en plus grande. Des mesures de prévention efficaces axées sur ces maladies ne pourront être prises que si on en connaît mieux l'étiologie.

A mesure que l'espérance de vie de la population mondiale augmente, les besoins visuels au travail évoluent eux aussi. Les personnes ayant une vue faible peuvent être désavantagées dans de nombreuses activités courantes, et peuvent se retrouver au chômage, en particulier dans les sociétés technologiquement avancées. La définition de la cécité doit être repensée afin d'assurer que les personnes atteintes de cécité « économique » ne sont pas oubliées. Des efforts devront être entrepris pour reconnaître et traiter les personnes atteintes à un stade précoce, dans l'intérêt de l'individu comme de la société.

Resumen

Prevención de la ceguera y prioridades para el futuro

La pérdida de visión tiene profundas repercusiones para la persona afectada y para el conjunto de la sociedad. La mayoría de las personas ciegas viven en países en desarrollo, y en general su ceguera podría haberse evitado o curado. Dadas las actuales predicciones de que la cifra mundial de personas ciegas se habrá duplicado para el año 2020, está claro que no hay lugar para la complacencia.

Paralelamente al aumento tanto de la población mundial como de la proporción de la misma que sobrevivirá hasta la edad adulta, aumentará también inexorablemente el número de personas con pérdida de visión. Teniendo en cuenta el éxito de los programas emprendidos para combatir las causas más frecuentes de ceguera (enfermedades infecciosas y malnutrición) que afectan generalmente a los jóvenes, así como las

proyecciones demográficas, cabe prever que las enfermedades oculares relacionadas con la edad serán cada día más frecuentes. Sólo conociendo mejor su etiología se podrán establecer medidas preventivas eficaces contra esas enfermedades.

Conforme crece la longevidad de la población mundial, cambian también las exigencias de los lugares de trabajo en cuanto a la función visual. Las personas con visión mermada se encuentran a menudo en una situación de desventaja en muchas actividades corrientes y pueden perder su trabajo, sobre todo en las sociedades tecnológicas. Es necesario reconsiderar la definición de ceguera, a fin de no ignorar a las personas con ceguera « económica ». Y hay que desplegar esfuerzos para reconocer y tratar a los afectados en una fase temprana, en beneficio del individuo y de la sociedad.

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