

Prevention

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Much blindness is avoidable

The main strategy of the World Health Organization's Programme for the Prevention of Blindness is to make simple eye care available to all populations. In many countries, national committees are responsible for the optimal utilization of resources and the coordination of work in this field. Several major international nongovernmental organizations provide support. Factors limiting the effectiveness of national programmes are being addressed in WHO collaborating centres.

More than 90% of blind people live in developing countries, where blindness rates are often 10 to 20 times higher than in the developed world. Up to 80% of the blindness encountered in developing countries could be prevented or cured if resources were mobilized and systematic action undertaken. Major blinding diseases, such as trachoma, can be prevented by relatively simple measures; in the case of cataract, vision can be restored by surgery. The WHO Programme for the Prevention of Blindness aims at controlling the major causes of avoidable blindness and making basic eye care available to all.

Epidemiology

The WHO Programme has developed a useful epidemiological model for blindness estimates, based on the following three settings.

- Developing countries, including many of the least developed ones, with endemic trachoma, foci of xerophthalmia due to vitamin A deficiency, or onchocerciasis, and insufficient eye care facilities, in particular for cataract surgery. The average blindness rate is around 1%.
- Countries at an intermediate stage of development, where communicable and nutritional eye diseases have been brought under control; the principal remaining problem is the lack of adequate eye care services, particularly cataract surgery. The average blindness rate is around 0.5%.
- Developed countries, where the pattern of blinding disorders is different and the average blindness rate is about 0.2%.

In 1978 it was estimated that there were 28 million blind people in the world. A recent updating of statistics on blindness led to an estimate of 27–35 million blind people, defined as having vision less than

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Table 1. Estimated global distribution of blindness, 1984^a

Region	Population in 1984 (x 10 ⁶)	Number of blind people (x 10 ³) (vision <3/60) ^b	Percentage
Africa	539	6030.0	19.4
America			
North	260	520.0	1.7
Latin	397	2037.5	6.5
Asia	2777	20 705.0	66.4
Europe (excluding USSR)	490	1107.5	3.6
Oceania	25	65.5	0.2
USSR	276	687.5	2.2
Total	4764	31 153.0	100.0

^a Data from unpublished document WHO/PBL/87.14.

^b Expressed as midpoints of confidence intervals.

3/60 with best possible correction. Globally, cataract is responsible for approximately 50% of all cases of blindness; trachoma and associated corneal disorders account for some 25% of cases, while probably only 5–10% are caused by onchocerciasis and xerophthalmia, given their limited geographical distribution and the mortality associated with vitamin A deficiency. Of course, the precise relative importance of these disorders varies between countries. It should be noted that glaucoma and phthisis bulbi are often difficult to diagnose or classify etiologically, and consequently there may be a tendency for certain diseases to be underrepresented in the global estimates. Glaucoma is probably responsible for around 10% of cases of blindness, corresponding to some 3 million people. Other important causes of visual loss are diabetic retinopathy and macular degeneration, both of which are rapidly increasing in certain areas as a result of life-style changes and aging. The estimated global distribution of blindness in 1984 is indicated in Table 1.

Public health and prevention strategies

In developing countries blindness is mainly found in rural communities, often in remote areas where economic development tends to be relatively poor and where, to a considerable extent, prevention requires behavioural changes. Thus personal or environmental hygiene may have to be improved, new nutritional habits adopted, and professional care sought rapidly in the event of injuries. At community level, simple but adequate eye care and guidance on eye health should be available within the context of primary health care.

Primary eye care involves simple promotional and clinical activities for the prevention or curing of eye disease. Improved living conditions, changes in behaviour, and timely attention to eye disease can reduce the risk of blindness. Community health workers should explain such matters as the importance of personal hygiene in the control of trachoma and the need for correct feeding of infants to avoid xerophthalmia, and should refer cataract patients for surgery. After training, personnel at this level can usually deal with

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the most common eye diseases, recognize and treat certain disorders, and decide when to refer patients for further examination or treatment (Table 2).

As a rule primary eye care should tackle only the most common eye disorders. Activities at community level should include the promotion of eye health through, for

Table 2. Preventive measures for some common blinding disorders and management at the primary health care level^a

Disorder	Primary prevention	Secondary prevention			Tertiary prevention
		Recognition	Initial treatment	Referral	
Trachoma	Education Hygiene Conjunctivitis treatment	Conjunctival signs of trachoma	Topical treatment (tetracycline eye ointment)	Systemic treatment of severe cases Trichiasis	Possible measures include corneal transplantation (often bad results in these circumstances) or optical iridectomy, or low vision care for optimal use of residual vision
Xerophthalmia	Breast-feeding Nutrition education Measles vaccination Vitamin A prophylaxis	Night blindness Ocular signs	High dose of vitamin A	Cases of corneal involvement	
Conjunctivitis in the newborn	Education of mother Antenatal care Prophylaxis in newborn (Credé or similar)	Acute purulent conjunctivitis	Cleansing plus topical antibiotics	Urgent referral for definitive treatment	
Corneal ulcers	Hygiene Treatment of minor trauma Awareness	Creamy spot on cornea in painful red eye	Initiate topical treatment	Urgent referral for definitive treatment	
Superficial trauma	Education and awareness Protective measures and devices	Foreign body on cornea or conjunctiva Superficial scratch on cornea	Remove foreign body Topical antibiotic treatment	Referral if severe corneal involvement (painful red eye)	

^aAdapted from unpublished document WHO/PBL/89.16.

example, encouraging breast-feeding, the vaccination of infants, and personal and environmental hygiene, and there should be clinical measures related to the provision of basic eye care services. From the management point of view, eye disorders fall into the following categories.

- Disorders which should be recognized and treated locally. Examples include superficial foreign bodies, purulent conjunctivitis and trachoma, and xerophthalmia without corneal involvement.
- Disorders which should be recognized and given initial treatment before referral. These include injury to the eye and/or eyelids with laceration or

perforation, ophthalmia neonatorum due to *Neisseria gonorrhoeae*, corneal ulcers, and redness of the eye with pain and gross visual loss.

- Disorders which should be recognized by the community health worker and immediately referred for further action, such as cataract and trichiasis in need of surgery.

The personnel responsible for the provision of primary eye care should have simple, standardized equipment at their disposal, such as visual acuity charts, loupes, torches, bandages and plaster. The main ophthalmic drugs at this level include tetracycline 1% eye ointment, antibiotic eye drops (e.g., gentamicin), vitamin A capsules, and

astriquent drops for the treatment of chronic conjunctivitis. Silver nitrate 1% drops should also be available for Credé's prophylaxis or, alternatively, a single application of tetracycline 1% eye ointment may be used.

Manpower

The training of manpower for the prevention of blindness in developing countries is often a complex issue as, in general, competent staff are not only scarce but also unevenly distributed. In Africa there is only one ophthalmologist per million people, and the few specialists are in major urban areas. This makes it very difficult to set up a proper referral system in support of a primary eye care scheme. In most developing countries it is necessary not only to increase the number of ophthalmologists but also to broaden their distribution. At the same time, assistant ophthalmic personnel should be trained to assume much of the responsibility for routine clinical work. The training of ophthalmic assistants, i.e., nurses who usually have a year of additional training in eye care, has proved very valuable in several countries. However, in many countries they are still in short supply, while in others they are not yet officially accepted as a specific category of eye care personnel. Elsewhere, a similar role may be filled by ophthalmic nurses who, in principle, can run small outpatient clinics in rural settings and participate in the screening, diagnosis and referral of cases in mobile units. Both ophthalmic assistants and nurses are usually entrusted to carry out trichiasis surgery, but have so far practised cataract surgery to only a very limited extent, albeit with good results. Another way of increasing the availability of cataract surgeons is to train general physicians or surgeons; this has proved very useful in some countries. Although the situation with regard to

available manpower, particularly ophthalmologists, is better in Latin America and most of Asia than in Africa, the need to delegate work for eye care and blindness prevention persists. This is because of the uneven distribution of and access to specialist services.

National programmes

As activities expand, overall coordination becomes necessary for planning and evaluation purposes. The establishment of national programmes for the prevention of blindness makes it possible to assess needs and resources and the inputs required from the many sectors that may contribute. Over 60 WHO Member States have so far developed such programmes. National committees for the prevention of blindness have been formed in most of these countries, usually under ministry of health leadership and including representatives of other sectors and nongovernmental organizations. A well-functioning national committee can be extremely valuable in making a country's programme effective and can serve as a forum for setting technical

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standards, coordinating activities, and mobilizing resources. Much support for national programmes is provided by major international nongovernmental organizations, which collaborate closely with the WHO Programme for the Prevention of Blindness. They do much to arouse the interest of countries by demonstrating what, often at modest cost, is feasible.

Programme for the Prevention of Blindness

In view of the global problem of some 30 million blind people, with ensuing disability and social and economic repercussions, the WHO Programme for the Prevention of Blindness was established in 1978 to take action against major blinding disorders, particularly in developing countries.

Up to 80% of blindness in developing countries is avoidable, i.e., either preventable or curable. The WHO Programme thus focuses mainly on cataract, trachoma, onchocerciasis, xerophthalmia (vitamin A deficiency) and ocular trauma. The aim is to make simple eye care available as part of primary health care to all populations, particularly in rural, underserved areas. However, such a "primary eye care" scheme depends on a good referral system, with eye care services being strengthened at the intermediary and sometimes also tertiary levels. National committees for the prevention of blindness, which have been established in 66 Member States under the aegis of the ministry of health and with the collaboration of several major international nongovernmental organizations, have proved very useful for the optimal use of resources and coordination of work. However, in spite of financial support amounting to some US\$ 30 million year provided by these organizations, there is still a great need for more resources.

Some of the constraints to more effective and widespread blindness prevention programmes are found in the insufficiency or irrational use of available human resources and in the need for further improvements in facilities and technology. These problems are being addressed through a network of WHO Collaborating Centres for the Prevention of Blindness, where several institutions are developing new approaches for training of manpower and for operations research.

Evaluation

Evaluation is essential for decision-makers and the managers responsible for allocating and utilizing resources, because it reveals the extent of progress and cost-effectiveness. The WHO Programme for the Prevention of Blindness has developed simple models for evaluation, focusing on changes in prevalence and incidence or on the intensity of disease. The approach selected depends on which disease is being considered. Thus a reduction in the prevalence and intensity of

trachomatous inflammation in children, following an intervention programme, would reflect an early change in the disease pattern, whereas a reduction in the incidence of trichiasis or blindness due to trachoma cannot be expected until after several years of intervention. However, the introduction of Credé's prophylaxis against ophthalmia neonatorum due to *N. gonorrhoeae* in the newborn would be expected to reduce the incidence of the condition, and the same may apply if vitamin A supplementation is used to protect children against

xerophthalmia. Cataract is common everywhere but the assessment of lens opacification and aphakia can be limited to people over 40 years of age. Evaluations of national programmes, which should be conducted every three to five years, are not very costly if attention is paid to the critical questions and the database needed and if use is made of information that is relatively easy to obtain. This is why targeted evaluation in relation to specific diseases is preferable to complicated assessment of blindness changes that can only be demonstrated over a long period.

Challenges

The principal goal in developing countries is to provide cataract surgery for all who require it. In many countries there is an accumulating backlog of unoperated cases. The trend will be difficult to reverse because the increasing proportion of elderly people in all countries raises further the demand for cataract surgery. At present the lowest possible cost for such surgery, as carried out in eye camps in India, is around US\$ 25 per case for intracapsular cataract extraction and the provision of aphakic spectacles. This is expensive in relation to the annual total health expenditure per capita of around US\$ 5 in some of the least developed countries. A lack of financial resources is undoubtedly a major obstacle to progress in these countries, and is one of the reasons why extracapsular cataract extractions and the implantation of artificial intraocular lenses have rarely been performed there. The cost of such lenses and the technology required for optimal results still largely restrict this technique to people in wealthy countries.

There is a need to strengthen the eye care infrastructure with better facilities, more equipment, and improved staff training.

Certain obstacles in developed countries, such as the limited availability of hospital beds, have been overcome by introducing outpatient cataract surgery. This, however, would be difficult to do in many developing countries, where transport facilities and social factors may influence the length of the hospitalization period. Consequently, developing countries cannot simply imitate the developed ones in trying to provide cataract surgery. New approaches will have to be adopted which take account of local conditions.

As a result of efforts made since the 1960s and of improved living standards in many parts of developing countries, trachoma has gradually decreased in importance as a cause of blindness, particularly in urban and industrialized, or economically active, areas. It is important to maintain trachoma control measures in areas where the disease remains a threat. These areas are often remote, poor and underserved, and have little economic potential. Recent studies have demonstrated the link between the intensity of trachomatous inflammation and simple measures of hygiene, such as regular face-washing in children. These measures, together with large-scale intermittent topical treatment with tetracycline 1% eye ointment

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and the provision of trichiasis surgery, are still valuable in the control of trachoma. A simplified grading system for the assessment of trachoma and its complications, now being implemented in selected countries by the WHO Programme, should facilitate

monitoring and uniform reporting of the disease.

Ivermectin has opened up new possibilities for the control of onchocerciasis. This product kills the microfilariae in the body but does not cause many of the adverse side-effects associated with previously available drugs. Furthermore, a single dose is effective for 6–12 months, making it possible to prevent severe eye lesions and blindness from onchocerciasis by means of an annual dose. Several countries in Africa and Latin America have initiated control schemes on this basis, although as yet their scale is limited. In developing countries it is often difficult to reach everyone in need, as distribution costs may be high and trained staff lacking. This is why relatively few countries outside the project area of the Onchocerciasis Control Programme in West Africa have started ivermectin schemes. Substantial support from outside is needed if large-scale regular treatment programmes in all highly endemic foci are to be mounted. In the area of the Onchocerciasis Control Programme a marked regression of the disease has occurred thanks to several years of vector control. During the next few years an effort will have to be made to mobilize support to combat onchocerciasis in all those countries in Africa where the disease remains a significant problem and has not yet been tackled through vector control. The vast majority of African populations at risk of, or suffering from, onchocerciasis, still have to be brought within the ambit of control schemes.

Vitamin A deficiency causes xerophthalmia and is a significant factor in childhood blindness, morbidity and mortality. Capsules containing 200 000 I.U. vitamin A are given twice a year to children below the age of five years in some countries but the measure has not been entirely successful because coverage has been patchy. Other approaches

have proved successful in some settings, such as the fortification with vitamin A of selected food items. Regrettably, however, the manufacturing facilities which this requires are often unavailable. In several countries, attempts are being made to increase the daily consumption of vitamin A in locally grown foods. Another initiative, still at the pilot stage, consists in giving vitamin A to infants while vaccination schemes are being carried out. All possible approaches will need to be adopted if there is to be a realistic chance of controlling xerophthalmia. Systematic vaccination against measles will also have to be introduced universally in view of the link between measles and vitamin A deficiency in the pathogenesis of blinding malnutrition.

Little progress has been made on the control of visual loss from glaucoma in developing countries. No simple technology or procedure is available for the early diagnosis of the disease. Screening procedures for the assessment of intraocular pressure in the population over 40 years of age have not proved very cost-effective, and the follow-up of borderline cases makes a heavy demand on resources. Targeted screening of people at particular risk, such as individuals belonging to families in which there are known cases of glaucoma, may be more feasible but requires specialist manpower and resources for follow-up. Intraocular pressure alone is not a very reliable guide in the early stage of glaucoma, and the examination of the optic disc and visual fields should also be performed. The use of auxiliary or non-specialist staff for such screening procedures has still to be evaluated.

Ocular traumas are not usually a very prominent cause of blindness. However, they are the commonest cause of unilateral loss of vision in most developing countries, where domestic and road accidents are

generally increasing and eyes are often lost through perforation or chemical damage. Furthermore workplaces in developing countries may not be subject to adequate safety measures and personnel may lack proper training and instructions. In order to prevent ocular traumas it is particularly necessary to raise public awareness about dangerous situations in daily life and to explain how to protect the eyes. This may require legislation, as for compulsory use of car seat-belts, the maintenance of industrial safety standards, and control of the manufacture of fireworks. It is also important to promote the message that patients who suffer accidents resulting in ocular traumas should be urgently referred for treatment. Regular training and refresher courses should be organized for personnel involved in eye care.

Diabetic retinopathy is rapidly becoming a significant problem among urban populations in Africa, the Caribbean area, the South Pacific, and elsewhere in the developing world as a result of changes in life-style. Whereas great progress has been made in dealing with diabetic retinopathy in developed countries through regular check-ups, laser photocoagulation, vitrectomies, and so on, the developing countries are less fortunate. It can be expected that diabetes will become a significant cause of blindness in these countries, because the required technology and procedures are often unavailable. Low vision care should be provided, i.e., training

patients to use residual vision effectively and supplying optical aids. This is especially important for visually impaired children, since low vision care can have a great impact on their education and careers. Very little has been done along these lines in developing countries. An effort should be made to obtain the necessary resources and to initiate projects for the training of staff, the establishment of low vision centres, and the use of appropriate low-cost technology.

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The prospects for the prevention of blindness depend largely on the availability of resources, including trained manpower. Much more is feasible than is actually being done; this is largely attributable to the scarcity of resources or to their irrational utilization, as with the uneven distribution of specialist manpower. Some of the constraints encountered in national blindness prevention programmes could be overcome if more money were available. Progress is more difficult where the need is for changed life-styles, new professional roles, or more efficient project management. In most countries a greater political commitment to blindness prevention is required, so that awareness and support can be generated in all groups of society. Such a mobilization of forces is essential if a significant reduction in blindness is to be achieved. □

If you want to know more about the prevention of blinding disorders:

WHO publications

- Strategies for the prevention of blindness in national programmes (1984).
- Guide to trachoma control (1981).
- Conjunctivitis of the newborn (1986).
- Field guide to the detection and control of xerophthalmia, 2nd edition, by A. Sommer (1982).
- WHO Expert Committee on Onchocerciasis – Third report (1987, Technical Report Series No. 752).
- The provision of spectacles at low cost (1987).
- Cataract: strategies for management within primary health care (1990).

Unpublished reports

(available on request from the Programme for the Prevention of Blindness, World Health Organization, 1211 Geneva 27, Switzerland)

- Report of the Eighth Meeting of the WHO Programme Advisory Group on the Prevention of Blindness (WHO/PBL/89.17).
- Available data on blindness (update 1987) (WHO/PBL/87.14).
- Report of Interregional Meeting on the Management of Cataract within Primary Health Care Systems (WHO/PBL/87.13).
- Report of Interregional Meeting on Control of Corneal Blindness within Primary Health Care Systems (WHO/PBL/89.16).
- Report of a task force on evaluation mechanisms for programmes for the prevention of blindness (WHO/PBL/84.9).
- Formulation and management of national programmes for prevention of blindness – Suggested outlines (WHO/PBL/90.18).
- Prevention of blindness in leprosy, edited by Paul Courtright & Gordon J. Johnson, 1988.