This report contains the collective views of an international group of experts and does not necessarily represent the decisions or the stated policy of the World Health Organization.

WORLD HEALTH ORGANIZATION

TECHNICAL REPORT SERIES

No. 518

THE PREVENTION OF BLINDNESS

Report of a WHO Study Group

WORLD HEALTH ORGANIZATION

GENEVA

1973

PRINTED IN FRANCE

CONTENTS

WHO STUDY GROUP ON THE PREVENTION OF BLINDNESS

Geneva, 6–10 November 1972

Members:

Professor G. B. Bietti, Director, Ophthalmological Clinic, University of Rome, Italy; President, International Organization against Trachoma, Rome, Italy (*Chairman*)

Mr F. H. Budden, Consultant Ophthalmologist, 21 Cloister Crofts, Leamington Spa, Warwicks., England (*Rapporteur*)

Dr H. Escapini, Head, Department of Ophthalmology, Rosales General Hospital, and Bloom Pediatric Hospital, San Salvador, El Salvador

Dr A. E. Maumenee, Director, The Wilmer Institute, Johns Hopkins Hospital, Baltimore, Md., USA

Professor A. Nakajima, Chairman, Department of Ophthalmology, Juntendo University School of Medicine, Hongo, Tokyo, Japan

Dr Oyinade Olurin, Senior Lecturer and Acting Head, Department of Ophthalmology, University College Hospital, Ibadan, Nigeria (*Vice-Chairman*)

Professor M. Radnót, Director, Department of Ophthalmology No. 1, University Medical School, Budapest, Hungary

Professor Mohyi-Eldin Said, Professor of Ophthalmology, Faculty of Medicine, University of Alexandria, Egypt

Dr G. Venkataswamy, Professor of Ophthalmology, Madurai Medical College, Madurai, Tamil Nadu, India

Representatives of other organizations:

United Nations

Mr Eyvind Hytten, Chief, European Social Development Programme Unit, United Nations Office at Geneva, Switzerland

United Nations Children's Fund

Mr Edward B. Marks, Special Assistant to Director, UNICEF, Office for Europe and North Africa, Geneva, Switzerland

Mr Lester J. Teply, Senior Nutritionist, Food Conservation Division, UNICEF, New York, USA

International Labour Organisation

Dr A. Annoni, Occupational Safety and Health Branch, International Labour Office, Geneva, Switzerland

International Association for Prevention of Blindness

Dr W. J. Holmes, Secretary-General, International Association for Prevention of Blindness, Honolulu, Hawaii, USA

International Federation of Ophthalmological Societies

Dr A. Dubois-Poulsen, Secretary, International Federation of Ophthalmological Societies, Paris, France

Secretariat:

Dr J. Bengoa, Chief, Nutrition, WHO, Geneva, Switzerland (*Co-Secretary*)

Dr A. Buck, Parasitic Diseases, WHO, Geneva, Switzerland (*Co-Secretary*)

Dr W. Chas. Cockburn, Chief, Virus Diseases, WHO, Geneva, Switzerland

Dr C. R. Dawson, Co-Director, WHO International Reference Centre for Trachoma and other Chlamydial Infections, Francis I. Proctor Foundation, University of California, San Francisco, Calif. USA (*Temporary Adviser*)

Dr B. Nizetic, Regional Adviser for Public Health Ophthalmology, WHO Regional Office for Europe, Copenhagen, Denmark

Dr H. A. P. C. Oomen, Professor of Tropical Nutrition, Royal Tropical Institute, Amsterdam, Netherlands (*Temporary Adviser*)

Professor B. Streiff, Lausanne, Switzerland (*Temporary Adviser*)

Dr M. L. Tarizzo, Virus Diseases, WHO, Geneva, Switzerland (*Co-Secretary*)

Mr J. F. Wilson, Director, Royal Commonwealth Society for the Blind and Chairman, Prevention of Blindness Committee and Overseas Aid Committee of the World Council for the Welfare of the Blind, Haywards Heath, Sussex, England (*Temporary Adviser*)

PREVENTION OF BLINDNESS

Report of a WHO Study Group

A WHO Study Group on the Prevention of Blindness met in Geneva from 6 to 10 November 1972. Dr P. Dorolle, Deputy Director-General, opened the meeting on behalf of the Director-General and welcomed the members and the representatives of other international organizations and of nongovernmental organizations in official relations with WHO. In his introductory remarks he pointed out that this was the first WHO Study Group on the subject and that it reflected the growing recognition of blindness as an international problem.

1. INTRODUCTION

The case for the elimination of unnecessary blindness is justified not only on humanitarian grounds but also by its social and economic consequences. In terms of economic loss, blindness is the most expensive of all causes of serious disablement. The magnitude of this problem is only now being fully appreciated and constitutes a compelling justification for more practical action both by international agencies and by national governments.

Several ophthalmological problems have been considered in the past by WHO, through expert committees, scientific groups, and seminars. In particular, WHO has been involved in problems of trachoma,[1] onchocerciasis,[2] and xerophthalmia,[3] and in some respects in the ophthalmological aspects of other diseases, such as leprosy and venereal diseases.

The Twenty-second World Health Assembly in 1969 adopted a resolution[4] requesting the Director-General " to undertake a study on the information which is at present available on the extent and all the causes of preventable and curable blindness ".

In pursuance of this request, the Director-General submitted to the Twenty-fifth World Health Assembly in May 1972 a report[5] that included

---

[1] *Wld Hlth Org. techn. Rep. Ser.*, 1962, No. 234; 1966, No. 330.

[2] *Wld Hlth Org. techn. Rep. Ser.*, 1966, No. 335.

[3] *Wld Hlth Org. techn. Rep. Ser.*, 1967, No. 377.

[4] World Health Organization (1971) Handbook of resolutions and decisions of the World Health Assembly and the Executive Board, 11th ed., 87 (WHA22.29).

[5] *WHO Chronicle*, 1973, 27, 21.

an analysis of the replies to a questionnaire that had been sent to governments on the prevalence and causes of blindness.

As a result of the discussions, the Health Assembly adopted a new resolution[1] in which the Director-General was requested to obtain additional data on visual impairment and blindness, to promote further studies on the most efficient and economical means of preventing blindness, to assist Member States in educational programmes related to blindness, and to intensify technical assistance to national programmes, particularly those against trachoma, onchocerciasis, and xerophthalmia.

As a first step in the development of a coordinated programme against blindness, an intersecretariat working group was established at WHO headquarters, in which several technical units participated. The present Study Group was convened to provide further guidance for the development of the WHO programme in the field of preventable blindness and to recommend measures for further action.

The Group understood that WHO should be involved, as implied in the resolution adopted by the Twenty-second World Health Assembly (1969), not only in measures related to the primary prevention of blindness, but also in the early detection and treatment of potentially blinding conditions.

2. THE EXTENT OF THE PROBLEMS OF VISUAL IMPAIRMENT AND BLINDNESS AND THEIR PREVENTION

According to the report of the Director-General to the Twenty-fifth World Health Assembly (1972), the number of blind persons in the whole world has been estimated at 10 – 15 million. This figure is based on fragmentary data and is believed to be an underestimate. Because of increases in population and life expectancy, the number of blind will be even greater in the future, and unless active measures are taken to prevent blindness it is expected that by the year 2000 the number of the blind will rise to over 30 000 000. This figure does not include persons with severe visual impairment.

In order to establish appropriate priorities for prevention and treatment at the national and international level, it is essential that reliable up-to-date statistical data on prevalence, age of onset, and causes of blindness be obtained.[2]

---

[1] *Off. Rec. Wld Hlth Org.*, 1972, No. 201 (Resolution WHA25.55).

[2] See, for example: Said, M.-E., Goldstein, H., Korra, A. & El-Kashlan, K. (1972) Blindness prevalence rates in Egypt: a comparison of random and self-selected samples of urban and rural residents, by age and sex, *Health Services Reports*, **87**, 177.

The principal causes of preventable visual impairment vary from one region to another and are intimately related to ecological, socio-economic, and cultural factors. In developing countries, visual impairment associated with infections, nutritional deficiencies, and trauma is much more common than it is in developed countries and affects all age groups. The burden on society is thus proportionately higher.

2.1 Trachoma

Trachoma and associated infections are estimated to affect 400 – 500 million people in the world, of whom approximately 2 million are blind. It is still endemic in most of North Africa and the Eastern Mediterranean and in parts of Asia, East and West Africa, and Latin America. Within the areas of endemicity, however, there are striking differences in the prevalence and severity of the disease, and these differences correlate with ecological and socioeconomic factors.

Trachoma control activities assisted by WHO and UNICEF have contributed significantly to the reduction of complications leading to loss of vision,[1] but much remains to be done in many countries, as was stressed in the resolution of the Twenty-fifth World Health Assembly. It is strongly urged that similar actions be considered wherever trachoma and associated infections are an important cause of visual impairment.[2]

2.2 Xerophthalmia [3]

Xerophthalmia [4] is the major cause of blindness in children of preschool age in many developing countries, and it is estimated that tens

---

[1] Assaad, F. A., Sundaresan, T. K., Yang, C. Y. & Yeh, L. J. (1971) Clinical evaluation of the Taiwan trachoma control programme. *Bull. Wld Hlth Org.*, **45**, 491; Kupka, K., Nizetic, B. & Reinhards, J. (1968) Sampling studies on the epidemiology and control of trachoma in Southern Morocco, *Bull. Wld Hlth Org.*, **39**, 547; Majčuk, Ju. F. (1966) A study of trachoma and associated infections in the Sudan, *Bull. Wld Hlth Org.*, **35**, 262; Reinhards, J., Weber, A., Nizetic, B., Kupka, K. & Maxwell-Lyons, F. (1968) Studies in the epidemiology and control of seasonal conjunctivitis and trachoma in Southern Morocco, *Bull. Wld Hlth Org.*, **39**, 497.

[2] A suitable methodology is given in the WHO document "Methodology of trachoma control" (VIR/70.3), copies of which are available to persons officially or professionally interested in the subject from Virus Diseases, World Health Organization, 1211 Geneva, Switzerland.

[3] For practical purposes, the term xerophthalmia is considered to embrace all forms of eye lesions or changes due to vitamin A deficiency.

[4] Oomen, H. A. P. C., McLaren, D. S. & Escapini, H. (1964) Epidemiology and public health aspects of hypovitaminosis A. A global survey on xerophthalmia, *Trop. geogr. Med.*, **16**, 271; McLaren, D. S., Oomen, H. A. P. C. & Escapini, H. (1966) Ocular manifestations of vitamin-A deficiency in man, *Bull. Wld Hlth Org.*, **34**, 357; Jelliffe, D. B. (1966) *The assessment of the nutritional status of the community*, Geneva (*World Health Organization: Monograph Series*, No. 53).

of thousands of new cases of blindness from this cause occur every year. The condition is frequently associated with severe protein-calorie malnutrition and is often undetected. The areas most affected are the overpopulated regions of south and east Asia, e.g., Bangladesh, southern India, Indonesia, and the Philippines. Other areas where the disease is known to occur are tropical Africa and, to a less significant degree, North Africa, the Eastern Mediterranean, and certain parts of Latin America.

In the past the prevention of xerophthalmia was based mainly on an increased production of food rich in vitamin A and on the nutritional education of the public, but recently more immediate measures have been introduced to overcome the problem. Mention may be made of the oral administration of large doses of vitamin A to preschool children and of the possible fortification of food with vitamin A.[1] The Group strongly recommended that, among other measures, all skim-milk to be used in developing countries should be fortified with vitamin A. These approaches seem to be promising.

2.3 Onchocerciasis

Endemic onchocerciasis occurs in tropical Africa, Central America and in isolated foci of South America. It is a particularly serious problem in the savanna belt of West Africa, where it has been recognized by some governments as a leading public health problem in their countries.

It is estimated that more than 20 million people are infected and that some 500 000 of them have severely impaired vision. The impact of the disease is greatest on the adult male population, 30% or more of whom are visually incapacitated in certain villages. The consequent impoverishment has lead to the depopulation of fertile valleys in one savanna country.

2.4 Cataract and other causes of blindness

Cataract is a universal cause of blindness. Though the statistics of patients blinded by cataract may not be comprehensive, there is sufficient information to say with certainty that it is a major cause of curable blindness in the developing countries. Although as yet prevention is not possible, sight may be restored by cataract extraction.

---

[1] Pan American Health Organization (1970) *Hypovitaminosis A in the Americas. Report of a PAHO Technical Group Meeting*, Washington, D.C., (Scientific Publication No. 198); WHO Consultation on Prevention of Xerophthalmia in South-East Asia, Hyderabad, 27-29 March 1972 (a limited number of copies of this document, No. NUTR/72.3, are available from Nutrition, World Health Organization, 1211 Geneva, Switzerland).

Among other important causes of blindness are glaucoma, diabetic retinopathy, retinal detachment, retinal degeneration, ocular trauma, and congenital and hereditary diseases. These diseases assume greater relative importance in developed countries.

Some of these conditions (such as trauma) can, and should be, prevented. While visual impairment from conditions such as diabetic retinopathy, retinal degeneration and intraocular inflammation is difficult to prevent at the present time, it is hoped that methods resulting from the intensive research being carried out on these problems will alter the outcome.

2.5 Activities aimed at the preservation of sight

The preservation of sight involves: (1) preventing the occurrence of blinding eye diseases, e.g., nutritional improvement for xerophthalmia, chemoprophylaxis of the newborn to prevent gonorrhoeal ophthalmia; (2) limiting the progression of blinding eye diseases by appropriate treatment, e.g., treatment for trachoma and glaucoma; (3) restoring visual function, e.g., surgery for cataract and corneal opacity. It has been estimated that two-thirds of the world's blindness is preventable and that 20% of it (i.e., that due to cataract) is curable.

The Study Group called attention to the following important activities that WHO might undertake in addition to its activities against trachoma, onchocerciasis, and xerophthalmia:

(1) screening for glaucoma to control this important and universal cause of blindness

(2) conducting an international epidemiological investigation of cataract with particular reference to its earlier onset in countries such as India

(3) preventing and treating amblyopia and other conditions through school and preschool eye clinics

(4) supporting research directed towards the prevention or control of diabetic retinopathy, a steadily increasing cause of blindness in developed countries

(5) providing genetic counselling directed towards the prevention of many inherited blinding diseases affecting every structure of the eye

(6) supporting research into the possibility of controlling vascular and degenerative eye conditions, which are assuming greater importance as longevity increases

(7) supporting research into the causes and possible prevention of the many internal inflammations of the eye and affections of the optic

nerve, which to a large extent have so far resisted satisfactory etiological explanation

(8) promoting suitable public health education and legislation directed towards the prevention of loss of vision

(9) encouraging the application in developing countries of modern methods of controlling and preventing bacterial conjunctivitis and in particular gonorrhoeal ophthalmia neonatorum — methods that have virtually eliminated these causes of blindness in developed countries

(10) emphasizing the importance of measures for preventing needless eye injuries.

3. DEFINITION OF VISUAL IMPAIRMENT AND BLINDNESS

Bearing in mind the request of the World Health Assembly for " a generally accepted definition of blindness and visual impairment " (resolution WHA25.55), the Study Group felt it necessary to define categories of visual impairment as a first step to obtaining comparable

CATEGORIES OF VISUAL IMPAIRMENT AND BLINDNESS [a]

Category of visual impairment [b]	Visual acuity (with both eyes, using the best possible correction)	
	maximum less than	minimum equal to or better than
1	6/18 3/10 (0.3) 20/70	6/60 1/10 (0.1) 20/200
2	6/60 1/10 (0.1) 20/200	3/60 1/20 (0.05) 20/400
3	3/60 1/20 (0.05) 20/400	1/60 (Finger counting at 1 metre) 1/50 (0.02) 5/300 (20/1200)
4	1/60 (Finger counting at 1 metre) 1/50 (0.02) 5/300	Light perception
5	No light perception	
9	Undetermined or unspecified	

[a] If the extent of the visual field is to be considered also, patients with a field of less than 10° but more than 5° around central fixation should be placed in category 3 and patients with a field less than 5° around central fixation should be placed in category 4, even if the central acuity is not impaired.

[b] These categories are intended to correspond with the fourth digit of the numbering system used in the International Classification of Diseases. In this system, the digit 9 customarily signifies " unspecified ".

data. The categories are shown in the table. It will be noted that although visual loss is defined primarily in terms of distant visual acuity, account should also be taken where possible of visual field and near vision (for instance, when good near visual acuity exists together with decreased distant visual acuity).

While each country must define blindness in relation to its own social and economic conditions (preferably using the standard categories given in this report), there is need for an internationally accepted definition of blindness for the purposes of compiling international statistical data. The Group recommended that this definition of blindness should include categories 3, 4, and 5. It is hoped that eventually all nations will prepare statistics according to the categories defined in the table. Until this is done, countries using a different definition might submit their national statistics for the level of vision laid down by their own authorities, with adjustments where possible to conform to international practice.

4. METHOD OF RECORDING CAUSES OF VISUAL IMPAIRMENT AND BLINDNESS

Details for coding the causes of visual impairment and blindness are given in the WHO International Classification of Diseases.[1] It is felt, however, that for practical purposes a less detailed classification of the causes of blindness could be used. The Group considered that the scheme already adopted in the Director-General's report on the prevention of blindness might be modified as indicated in the following paragraphs.

The causes of blindness and visual impairment may be listed under the following headings, which are not meant to imply any order of priority:

1. Accidental
2. Hereditary
3. Congenital
4. Degenerative
5. Metabolic
6. Nutritional
7. Infectious
8. Neoplastic
9. Glaucomatous
10. Myopic
11. Amblyopic
12. Toxic
13. Other (specify)
14. Unknown

Infectious diseases should be further subdivided (again with no implication of priority) into the following categories:

[1] World Health Organization (1967) *Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death, 1965 Revision*, Geneva.

(*a*) Trachoma and superimposed infections
(*b*) Onchocerciasis
(*c*) Gonorrhoea
(*d*) Smallpox
(*e*) Syphilis
(*f*) Leprosy
(*g*) Other diseases (specify)
(*h*) Unknown diseases

The Group also recommended that the anatomical localization of the lesion be indicated as follows :

(*a*) Cornea
(*b*) Lens
(*c*) Uvea
(*d*) Central retina (macula)
(*e*) Retina as a whole
(*f*) Optic nerve
(*g*) Intracranial optic pathways and brain
(*h*) Bulbar atrophy (phthisis)
(*i*) Other location (specify)
(*j*) Unknown location

The results of examinations might be recorded on individual patient record cards, on which the categories would be printed, check marks being entered against the appropriate etiological and anatomical categories for each eye separately.

5. PROCEDURES FOR SURVEYS ON POPULATION SAMPLES

The application of various investigative techniques to large numbers of people (epidemiological surveys, disease surveillance, screening for disease) represents a powerful public health tool for discovering indicators of the eye health status of individuals and population groups, which is a step in a series of actions aimed at achieving improved eye health. Furthermore, it contributes to the provision of eye health services for new patients detected by screening and provides baseline data for the planning and evaluation of eye health care systems.

In order to obtain meaningful statistical data on the prevalence and incidence of eye disease,[1] good epidemiological methods must be followed. Thus, it is necessary to estimate the least prevalent eye disease on which one wishes to obtain data and to determine, on this basis, the size of the sample that will yield accurate information on the prevalence of this particular defect.

The following general considerations are always necessary in planning large-scale examinations : (1) a clear concept of the aims of the investigation ; (2) selection of the method best suited to provide the answers under local conditions (i.e., a prevalence survey, a case control study, a prospective study, or a case finding survey, such as screening for

[1] Prevalence is the number of cases present in a population sample at a given time. Incidence is the number of new cases developing within a specified period of time in a population at risk.

xerophthalmia or trachoma) ; and (3) a clear definition of the numerator and denominator, the numerator being the number of persons having the defined condition and the denominator being based on a random sample of the population under study — schoolchildren, an occupational group, or the total population of a community. The general methods to be applied are found in textbooks of epidemiology and in WHO publications.[1]

Epidemiological investigations are needed in order to learn more about the natural history of a disease and its prevalence, incidence, and duration. They are also useful in health planning and in the efficient operation of new or existing eye health services.

The Study Group suggested that WHO should establish a data bank for the collection, analysis, and distribution of all pertinent information in the field of public health ophthalmology. For international comparison it is essential to standardize the protocols.

Other sources of information on the local importance of eye diseases that may cause loss of vision are: blindness statistics, hospital and clinical records, social security statistics, data from school and occupational health programmes, physician's records, statistics from institutions for the blind, and census returns. It should be recognized that these sources are not suitable for assessing the incidence or prevalence of eye diseases in the general population because they rarely fulfil the conditions required for this purpose, however useful they may be for others. It should also be kept in mind that there are other important disease determinants that may influence incidence and prevalence. An outstanding example is the seasonal variation in the frequency of certain eye diseases, such as the infections associated with trachoma and xerophthalmia.

6. MANPOWER REQUIREMENTS AND TRAINING PROGRAMMES FOR OPHTHALMOLOGICAL SCREENING EXAMINATIONS

The manpower requirements for the screening of ocular diseases and the techniques used in such screening procedures do not differ appreciably from those used in other mass health examinations. Many of the screening examinations carried out in the past for various ocular problems have been of limited value, but the state of knowledge of epidemiology and public health procedures has now progressed to the point where much more meaningful data can be obtained, provided that a health team is properly organized to perform such studies.

---

[1] *Wld Hlth Org. techn. Rep. Ser.*, 1966, No. 336; *Mass health examinations*, 1971 Geneva, World Health Organization (*Publ. Hlth Pap.*, No. 45).

Screening examinations for eye conditions can be carried out by personnel of various educational levels and disciplines. Ideally such a team should include an ophthalmologist and auxiliary health personnel, assisted further by specialists in other disciplines if needed. The planning, execution, and evaluation of the project should be made in close cooperation with an experienced epidemiologist or equally well trained public health administrator.

This ideal team may not always be available, and in some instances the ophthalmologist may have to assume the responsibilities of a public health expert or epidemiologist, either by seeking expert advice or by preparing himself in this area of medical knowledge. In other instances an ophthalmologist may not be available to the health team, and the public health expert may have to rely on the assistance of a general practitioner who has had special training in ophthalmology, or on auxiliary health personnel who have been specially trained in vision testing and in the examination of the eye for specific ocular defects.

As far as the actual examination of the patient is concerned, the ophthalmologist may at times delegate certain tasks to auxiliary health personnel. Such tasks may include vision testing, the recording of visual fields, the checking of intraocular pressure with an easily used and sterilized tonometer such as the Schiøtz tonometer, and the external examination of the eye for specific defects. Pictorial illustrations of some of these external conditions are valuable in training. One such set of photographic material has already been assembled by WHO in connexion with trachoma control activities.

One example of how auxiliary health personnel are utilized is provided by trachoma control programmes, in which these health workers may select cases for topical chemotherapy but do not diagnose cases for purposes of statistical evaluation, since many other conditions can be confused with trachoma. Thus, in any large-scale survey for trachoma, auxiliary health personnel need the guidance of an ophthalmologist to make a differential diagnosis of the possible causative factors of the lesions. Similar considerations apply to onchocerciasis and other ocular diseases. Auxiliary health personnel should therefore always work under the technical direction of an ophthalmologist. An ophthalmologist should also be available for consultation during screening procedures.

In some surveys a more detailed ophthalmological examination will be required, such as slit-lamp microscopy of the anterior segment of the eye or ophthalmoscopy, particularly of the periphery of the fundus. In such instances it is essential that physicians specifically trained in ophthalmology perform these studies. While it is true that certain general practitioners can perform these examinations, it is unlikely that they would be able to make a differential diagnosis of the multiple

lesions that can involve the anterior and posterior segments of the globe.

In any successful screening programme, personnel should be trained not only to recognize ophthalmological lesions but also to detect conditions that need to be referred for therapy or further professional assistance.

7. TEACHING OF PUBLIC HEALTH OPHTHALMOLOGY [1] AND DEVELOPMENT OF SERVICES

At the present time most ophthalmological training programmes are primarily concerned with the training of clinical ophthalmologists in the diagnosis and therapy of specific diseases of the eye and ocular adnexa. Training is also given in the ocular manifestations of general diseases and in neuro-ophthalmological problems. In some institutions, considerable encouragement is given to the participation of ophthalmologists in clinical research and certain phases of basic laboratory investigations in physiology, immunology, pharmacology, and the clinico-pathological correlations of eye disease. These forms of research have greatly advanced our knowledge of eye disease and led to a corresponding progress in therapy.

Public health ophthalmology, in contrast, has received comparatively little attention and therefore few people are competent to carry out the activities that have been described in the preceding chapter. There are several solutions to this problem.

(1) Some ophthalmologists could be given combined training in both public health and ophthalmology in those schools that have programmes in the two disciplines.

(2) Qualified ophthalmologists could be given further training in public health.

(3) Specialists in public health could be trained in ophthalmology.

(4) Relatively short courses or seminars could be instituted for medical and allied personnel in public health ophthalmology.

(5) Courses in ophthalmology could be made compulsory in all medical schools (as has been previously recommended [2]); all physicians would then have at least an adequate basic knowledge of ophthalmo-

---

[1] Public health ophthalmology is a discipline that encompasses the comprehensive community approach to the promotion of eye health and particularly to the prevention of disability due to visual impairment and blindness. The basic tools for research and practice in this field, in addition to clinical knowledge, are epidemiological and modern management procedures.

[2] *Wld Hlth Org. techn. Rep. Ser.*, 1962, No. 239, p. 35.

logical problems and could thus participate in epidemiological surveys, manage simple ophthalmic cases, and provide initial care of emergency cases.

Ocular lesions and blinding diseases are more common in the developing than in the developed countries. Since they affect a larger proportion of younger individuals, they are of particular economic importance and represent a much greater burden on society and on the resources of the community. For this reason alone greater time and stress should be placed on the education of medical students in public health ophthalmology in developing countries.

The same considerations apply to the development of ophthalmological services. It was the opinion of the Group that a considerable portion of the effort and the time of ophthalmologists, as well as of other physicians, is spent in routine care and other activities that could be delegated to auxiliary health personnel. Thus, in the development of an ophthalmological service, attempts should be made to educate the young physician in the proper use of auxiliary health personnel so that a greater proportion of his time can be spent on duties of which only he is capable — decision making, differential diagnosis, and ordering specific therapy. In addition to the specific problems of differential diagnosis and therapy, the ophthalmologist should be interested in the development of programmes for the delivery of eye care to the entire community. This is particularly important in the developing countries.

Most of the preventable eye diseases require a multidisciplinary approach, in which ophthalmologists, epidemiologists, and other specialists should cooperate. Outstanding examples of this approach are vector control in onchocerciasis, immunization in measles and smallpox, nutritional management in vitamin A deficiency, mass therapy and improved sanitation in trachoma, and health education in all ocular diseases.

8. CONCLUSIONS AND RECOMMENDATIONS

A number of recommendations for specific action by WHO and other agencies and organizations have been made in the body of this report and will not be reiterated here.

8.1 International action

The Study Group was pleased to note the resolution of the Twenty-fifth World Health Assembly requesting the Director-General to intensify technical assistance to national programmes for the prevention of blindness, particularly in programmes against trachoma, onchocerciasis and xerophthalmia.

In view of the increasing international interest in the causes of world blindness it would be tempting to establish priority programmes for a number of other diseases and eye conditions that are a cause of intense concern among specialized bodies. However, the Group considered that caution should be exercised in formulating priorities at an international level, not only because of limited resources but also because an international programme loses impact if it is too diverse. To obtain top priority an international programme must have a massive impact in the countries concerned, and research and practical treatment must have advanced to the point where the programme has a reasonable hope of success.

The following conditions were considered in the light of these criteria: glaucoma, cataract, amblyopia, diabetic retinopathy, genetic diseases, vascular and degenerative eye conditions, internal inflammations of the eye, inflammations of the optic nerve, and ocular injuries. The Group recommended that only cataract surgery would justify a large-scale programme in addition to WHO's present priorities. It would constitute an immediate objective with a good prospect for effective international action. In implementing this programme, the methods used should be both economic and of high professional standard.

8.2 Coordination

Over the past few years there has been a striking increase in international awareness of the extent of blindness as a cause of needless human suffering and economic loss. The need has also been recognized, both nationally and internationally, for combined action by official and nongovernmental organizations. Preliminary efforts at coordination have been made, and the time has now come for concerted international action through an acceptable and effective coordinating mechanism.

WHO is well placed to initiate this mechanism and to act as the centre for coordination. The body established to promote coordination must contain full representation of the appropriate agencies of the United Nations system and must provide for the essential contribution of international nongovernmental organizations. It should also be compact, expert, and regionally representative.

8.3 National action

The Group supports the recommendation of the Director-General that information on the blind and on blindness should be centralized at the national level, and, if at all possible, a register of the blind and visually impaired should be established.

The case that has been made for the prevention of blindness at an international level is equally important at the national level. Many developing nations have not yet been able to undertake programmes for the prevention of blindness, and in other countries such programmes are not yet fully developed. The Group called the attention of governments to the economic and social implications of preventable and curable blindness and recommended that WHO should provide consultant advice to countries that request it.

National governments should establish ophthalmic health services, making the best use of available resources and requesting additional help where necessary. The health authorities should identify the major local causes of blindness and should institute a campaign for controlling these causes. Public interest in eye diseases should be stimulated by appropriate health education, which would emphasize the importance of early treatment of eye diseases and injuries and the value of school ophthalmic services.

In many countries voluntary organizations have been very effective in raising funds and in stimulating public opinion on the prevention of blindness. The Group considered that such organizations perform extremely useful services and should receive all possible support. Community participation in the fight against blindness is essential.

ACKNOWLEDGEMENTS

The Group acknowledged the special contributions to its deliberations made by the following staff members: Dr A. Vessereau, Medical Officer, International Classification of Diseases, and Dr B. Waddy, Medical Officer, Parasitic Diseases, World Health Organization, Geneva, Switzerland.