

Global data on visual impairment in the year 2002

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Abstract This paper presents estimates of the prevalence of visual impairment and its causes in 2002, based on the best available evidence derived from recent studies. Estimates were determined from data on low vision and blindness as defined in the *International statistical classification of diseases, injuries and causes of death*, 10th revision. The number of people with visual impairment worldwide in 2002 was in excess of 161 million, of whom about 37 million were blind.

The burden of visual impairment is not distributed uniformly throughout the world: the least developed regions carry the largest share. Visual impairment is also unequally distributed across age groups, being largely confined to adults 50 years of age and older. A distribution imbalance is also found with regard to gender throughout the world: females have a significantly higher risk of having visual impairment than males.

Notwithstanding the progress in surgical intervention that has been made in many countries over the last few decades, cataract remains the leading cause of visual impairment in all regions of the world, except in the most developed countries. Other major causes of visual impairment are, in order of importance, glaucoma, age-related macular degeneration, diabetic retinopathy and trachoma.

Keywords Vision, Low/epidemiology; Blindness/epidemiology; Vision, Low/etiology; Blindness/etiology; Cataract/complications; Glaucoma/complications; Macular degeneration/complications; Refractive errors/complications; Cost of illness; Age factors; Sex factors (source: MeSH, NLM).

Mots clés Baisse vision/épidémiologie; Cécité/épidémiologie; Baisse vision/étiologie; Cécité/étiologie; Cataracte/complication; Glaucome/complication; Dégénérescence maculaire/complication; Troubles réfraction oculaire/complication; Coût maladie; Facteur âge; Facteur sexuel (source: MeSH, INSERM).

Palabras clave Visión subnormal/epidemiología; Ceguera/epidemiología; Visión subnormal/etiología; Ceguera/etiología; Catarata/complicaciones; Glaucoma/complicaciones; Degeneración macular/complicaciones; Errores de refracción/complicaciones; Costo de la enfermedad; Factores de edad; Factores sexuales (fuente: DeCS, BIREME).

الكلمات المفتاحية: الرؤية الضعيفة، وبائيات الرؤية الضعيفة؛ وبائيات العمى؛ سبببات العمى؛ سبببات الرؤية الضعيفة؛ مضاعفات الساد (الكاتاراكت)؛ مضاعفات الزرق (الغلوكوما)؛ مضاعفات التنكس البقعي؛ مضاعفات أخطاء الانكسار؛ تكاليف المرض؛ عوامل العمر؛ عوامل الجنس (المصدر: رؤوس الموضوعات الطبية: المكتب الإقليمي لشرق المتوسط).

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Voir page 850 le résumé en français. En la página 850 figura un resumen en español.

يمكن الاطلاع على الملخص بالعربية في صفحة 850.

Introduction

The first estimate of the global data on blindness was published in 1995 (1), based on the world population data for 1990. This estimate was extrapolated to the 1996 world population, and to the world population and demographic shifts projected for 2020. These data provided the basis for the 1999 launch of the Global Initiative for the Elimination of Avoidable Blindness, which is known as "VISION 2020: the Right to Sight" (2).

Since the publication of the Global Data on Blindness in 1995, population-based studies on the prevalence of blindness and visual impairment have been carried out in nearly all WHO regions. Most of these surveys have used the WHO

simplified population-based assessment methodology for visual impairment and causes (3), with some adaptation in a few instances.

In several countries rapid assessment of cataract surgical services (RACSS) (4) has been conducted (see for example 5–8). The results of these studies also provide general information on the status of visual impairment in adults 50 years of age and older. In addition to the RACSS surveys, many recent studies have specifically targeted older adults.

The availability of new data has allowed the update of the global and regional estimates of visual impairment and its causes.

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Methods

Definitions

The definitions for visual impairment, low vision and blindness used in the present study follow those given in the *International statistical classification of diseases, injuries and causes of death*, 10th revision (ICD-10): H54 (9) where:

- visual impairment includes low vision as well as blindness;
- low vision is defined as visual acuity of less than 6/18, but equal to or better than 3/60, or a corresponding visual field loss to less than 20 degrees in the better eye with best possible correction (ICD-10 visual impairment categories 1 and 2);
- blindness is defined as visual acuity of less than 3/60, or a corresponding visual field loss to less than 10 degrees in the better eye with best possible correction (ICD-10 visual impairment categories 3, 4 and 5).

Regions, subregions and population estimates

The classification of WHO Member States into 17 subregions was carried out according to the Global Burden of Disease 2000 Project (10); for details see Murray et al. 2001 (11).

Estimates of population size and structure were based on the 2002 demographic assessment of the United Nations Population Division (12), as used by the *World health report 2003* (13).

Sources of epidemiological data

Recent survey results from 55 countries were selected (Table 1); in some countries there had been several surveys. The selection criteria were as follows: studies were population-based and representative of the area sampled. They provided:

- clear, unequivocal definitions of visual impairment; both WHO and non-WHO definitions of visual impairment were acceptable if classifiable within the ICD-10 ranges of visual loss;
- cross-sectional design with a description of sample design and sampling plan; sample size; response rate; assessment of non-sampling errors; and
- a description of ophthalmic examinations and visual acuity testing.

The 2002 *Global update of available data on visual impairment* (14) was an important source of data. Results from as yet unpublished surveys that met the relevant criteria were also selected. In the case of countries for which data were scarce, national sources were investigated. These included: ministries of health, national prevention of blindness programmes, academic institutions, regional WHO offices and consultants. The data on childhood blindness were obtained from the report of a 1999 WHO scientific meeting (15), as well as from a comprehensive review of available data (16).

Estimates of prevalence

Prevalence of blindness (ICD-10 visual impairment categories 3, 4 and 5)

Prevalences for blindness (Table 2) were obtained for the 17 WHO epidemiological subregions using a model based on the data from the 55 countries listed in Table 1 and from other sources, as described below. The model estimated the prevalence of blindness for three age groups: children less than 15 years; adults from 15 to 49 years; and adults aged 50 years and older.

The prevalences of blindness in children were estimated for the 17 WHO subregions. This was done using the data from

Table 1. Studies used for the global estimate of visual impairment

Subregion	Studies
Afr-D	Surveys from 13 countries (Benin, Cameroon, Cape Verde, Equatorial Guinea, Gambia, Ghana, Mali, Mauritania, Niger, Nigeria, Sierra Leone, Sudan, Togo)
Afr-E	Surveys from 6 countries (Central African Republic, Congo, Ethiopia, Kenya, South Africa, United Republic of Tanzania)
Amr-A	Surveys from 1 country (United States of America)
Amr-B	Surveys from 3 countries (Barbados, Brazil, Paraguay)
Amr-D	Survey from 1 country (Peru)
Emr-B	Surveys from 4 countries (Lebanon, Oman, Saudi Arabia, Tunisia)
Emr-D	Survey from 1 country (Morocco)
Eur-A	Surveys from 7 countries (Denmark, Finland, Iceland, Ireland, Italy, Netherlands, United Kingdom)
Eur-B1	Surveys from 2 countries (Bulgaria, Turkey)
Eur-B2	Survey from 1 country (Turkmenistan)
Eur-C	No population-based surveys were identified
Sear-B	Surveys from 4 countries (Indonesia, Malaysia, Philippines, Thailand)
Sear-D	Surveys from 4 countries (Bangladesh, India, Nepal, Pakistan)
Wpr-A	Surveys from 1 country (Australia)
Wpr-B1	Surveys from 2 countries (China and Mongolia)
Wpr-B2	Surveys from 3 countries (Cambodia, Myanmar, Viet Nam)
Wpr-B3	Surveys from 2 countries (Tonga and Vanuatu)

Afr, WHO African Region; Amr, WHO Region of the Americas; Emr, WHO Eastern Mediterranean Region; Eur, WHO European Region; Sear, WHO South-East Asia Region; Wpr, WHO Western Pacific Region.

the two reports that had used criteria for grouping of countries similar to those used in the WHO classification of subregions.

In adults aged from 15 to 49 years the prevalences of blindness were estimated for each subregion according to the mortality stratum:

- for subregions with mortality stratum A — 0.1%;
- for subregions with mortality stratum B or C — 0.15%; and
- for subregions with mortality stratum D or E — 0.2%.

(See 13 for the current assignment of mortality stratum to the WHO subregions.)

These estimates were based on data from the studies selected and on interpolations previously derived from the data on childhood blindness and data for subjects aged 50 years and older (15).

The prevalences for the age group 50 years and older were taken from population-based surveys. Prevalences calculated for the age group as a whole, adjusted for sex and age composition of the sample and/or of the survey area, were used. For areas for which no data were available, prevalence was extrapolated from areas similar in terms of availability of eye and health care and

Table 2. Age-specific prevalence of blindness and number of blind people, by age and WHO subregion, 2002^a

WHO subregion	Prevalence of blindness (%)			No. of blind persons (millions)		
	<15 years of age	15–49 years	≥50 years	<15 years of age	15–49 years	≥50 years
Afr-D	0.124	0.2	9	0.191	0.332	3.124
Afr-E	0.124	0.2	9	0.196	0.336	3.110
Amr-A	0.03	0.1	0.4	0.021	0.114	0.560
Amr-B	0.062	0.15	1.3	0.085	0.369	0.937
Amr-D	0.062	0.2	2.6	0.017	0.075	0.241
Emr-B	0.08	0.15	5.6	0.039	0.117	0.920
Emr-D	0.08	0.2	7	0.043	0.146	1.217
Eur-A	0.03	0.1	0.5	0.021	0.204	0.713
Eur-B1	0.051	0.15	1.2	0.020	0.136	0.462
Eur-B2	0.051	0.15	1.3	0.009	0.043	0.090
Eur-C	0.051	0.15	1.2	0.021	0.192	0.822
Sear-B	0.083	0.15	6.3	0.102	0.332	3.779
Sear-D	0.08	0.2	3.4	0.390	1.423	6.530
Wpr-A	0.03	0.1	0.6	0.007	0.070	0.315
Wpr-B1	0.05	0.15	2.3	0.162	1.166	6.404
Wpr-B2	0.083	0.15	5.6	0.041	0.120	1.069
Wpr-B3	0.083	0.15	2.2	0.002	0.006	0.017
World				1.368	5.181	30.308

Afr, WHO African Region; Amr, WHO Region of the Americas; Emr, WHO Eastern Mediterranean Region; Eur, WHO European Region; Sear, WHO South-East Asia Region; Wpr, WHO Western Pacific Region.

^a Blindness defined as in the ICD-10:H54 tables refers to visual acuity in the better eye with best possible correction (see ref. 9).

epidemiology of eye diseases and services for which data were available. Population size in different areas was estimated from national census data; population structure was determined from the United Nations estimate for that country.

In other instances, the data from one area were estimated to be representative of the country as a whole and applied to all the population. Finally, some surveys provided nationwide results.

For countries for which recent epidemiological data were not available, the prevalence of blindness was extrapolated from data collected in countries within the same subregion or from neighbouring subregions that share similar epidemiological, socioeconomic, ecological and eye care service characteristics.

Age-group-specific prevalence was used to estimate the total number of blind people in each country of a subregion. This number was then used to calculate the subregional prevalence of blindness. This method could not be applied to the subregion Eur-C, as no suitable population-based surveys were available for any of the countries of this subregion: in this case the prevalences were assumed to be the same as for the subregion EurB1.

Prevalence of low vision (ICD-10 visual impairment categories 1 and 2)

The prevalences of low vision for each subregion was estimated from the same surveys as were used to determine the prevalence of blindness. Owing to the paucity of data on age-specific prevalence of low vision it was not possible to construct a model similar to that described above for blindness. Specific prevalences for both blindness and low vision were reported in 43 studies from 15 subregions; additional studies that reported data on low vision in children were also taken into account (17–20). The extrapolations between countries made for blindness were

assumed also to be valid for low vision. All-ages prevalences of low vision were calculated as described for blindness. The ratio of low vision to blindness was calculated. The mean value of the ratios from 15 subregions was applied to the subregions Eur-C and Wpr-B1 because ratios for these regions could not be calculated due to lack of data.

Causes of visual impairment

The causes of visual impairment were ascertained from the cause attributions reported in the surveys listed in Table 1. Data were available to determine causes of blindness in all subregions except Eur-C. Due to scarcity of data, the causes of low vision could not be quantified with confidence either at regional or global level.

Results

Prevalence and causes of visual impairment by subregion

According to the model presented, based on the most recent available data, and using the ICD-10 definition of best-corrected visual acuity and the 2002 world population, the estimated number of people with visual impairment was in excess of 161 million: 37 million were blind and 124 million had low vision (Table 3). The ratios of people with low vision to those with blindness, by subregion, ranged from 2.4 to 5.8 with a median value of 3.7. The leading cause of blindness was cataract, followed by glaucoma and age-related macular degeneration (Table 4).

Distribution of visual impairment by age and gender

Although childhood blindness remains a significant problem (there are an estimated 1.4 million blind children below the age

Table 3. Global estimate of visual impairment by WHO subregion, 2002^a

WHO subregion	Total population (millions)	No. of blind people (millions)	Prevalence of blindness (%)	No. of people with low vision (millions)	Prevalence of low vision (%)	No. of persons visually impaired (millions)
Afr-D	354.324	3.646	1.0	10.715	3.0	14.361
Afr-E	360.965	3.642	1.0	10.573	3.0	14.215
Amr-A	322.309	0.694	0.2	4.029	1.2	4.723
Amr-B	456.432	1.392	0.3	7.600	1.7	8.992
Amr-D	73.810	0.332	0.5	1.488	2.0	1.820
Emr-B	142.528	1.076	0.8	3.580	2.5	4.656
Emr-D	144.405	1.406	0.97	4.116	2.9	5.522
Eur-A	415.323	0.937	0.2	5.435	1.3	6.372
Eur-B1	169.716	0.618	0.4	2.546	1.5	3.164
Eur-B2	53.130	0.142	0.3	0.590	1.1	0.731
Eur-C	239.717	1.035	0.4	4.219	1.8	5.254
Sear-B	405.313	4.214	1.0	9.669	2.4	13.883
Sear-D	1394.045	8.344	0.6	28.439	2.0	36.782
Wpr-A	150.867	0.393	0.3	1.883	1.2	2.276
Wpr-B1	1374.838	7.731	0.6	26.397	1.9	34.128
Wpr-B2	148.469	1.229	0.8	2.898	1.9	4.127
Wpr-B3	7.677	0.025	0.3	0.090	1.2	0.115
World	6213.869	36.857	0.57	124.264	2	161.121

Afr, WHO African Region; Amr, WHO Region of the Americas; Emr, WHO Eastern Mediterranean Region; Eur, WHO European Region; Sear, WHO South-East Asia Region; Wpr, WHO Western Pacific Region.

^a Visual impairment defined as in the ICD-10:H54 tables refers to visual acuity in the better eye with best possible correction (see ref. 9).

of 15 years), its magnitude is relatively small when compared to the extent of blindness in older adults: more than 82% of all blind people are 50 years and older (Table 2).

The number of women with visual impairment, as estimated from the available studies, is higher than that in men even after adjustment for age. Female/male prevalence ratios indicate that women are more likely to have a visual impairment than men in every region of the world: the ratios range from 1.5 to 2.2 (data not shown).

Discussion

Limitations

The model of visual impairment presented is based partly on population-based surveys and partly on assumptions: both sources place limitations on the accuracy of the estimates. Potential sources of error arise due to one or more of the following:

- heterogeneity of the survey methods with regard to data collection and ophthalmic examinations, despite the use of the standardized WHO protocol (3);
- extrapolations of data from different areas of a country to provide national estimates;
- different estimates of population structure used in the surveys;
- correction factors used to determine the prevalences of best-corrected visual acuity in studies that used non-WHO definitions;
- extrapolation to present populations of prevalences determined in studies conducted over the last 5–10 years;
- assumptions made in obtaining estimates of blindness for the age group 15–49 years;
- extrapolation of data for countries and regions for which no data are available;

- extrapolations of survey results from a specific area of a highly populated and diverse country to the country as a whole;
- reporting bias in the determination of causes of visual impairment in surveys designed for specific pathologies; and
- possibly non-standardized definitions of eye diseases, criteria for diagnosis, examination methods and comorbidity.

To minimize the bias introduced by the limitations listed above, the studies were selected according to the criteria described in Methods. The extrapolations between countries were made according to information gathered internally by prevention of blindness programmes in the course of their activities throughout the world. Country estimates were compared with the information from national sources to check for significant inconsistencies.

For the age group 15–49 years it was assumed that prevalences were similar in subregions with the same mortality stratum. These prevalences were consistent with data from surveys. Though small variations might exist between subregions they would not significantly affect the determination of the global extent of blindness, because the contribution from this age group to the total is less than 15%.

With regard to correction factors to determine prevalences according to ICD-10 from different definitions of visual impairment, there were a sufficient number of studies reporting data with both definitions to enable a table of conversion to be calculated.

Most of the available data on low vision were for the age group 50 years and older. If the ratio of low vision to blindness for this age group were applied to the population aged between 15 and 49 years, this would greatly underestimate the magnitude of the problem of low vision, because the ratio is higher in age groups with a low prevalence of blindness. The data on low

Table 4. Causes of blindness as a percentage of total blindness – by WHO subregion, 2002

Region	Cataract	Glaucoma	AMD ^a	Corneal opacities	Diabetic retinopathy	Childhood blindness	Trachoma	Oncho-cerciasis	Others
Afr-D	50	15		8		5.2	6.2	6	9.6
Afr-E	55	15		12		5.5	7.4	2	3.2
Amr-A	5	18	50	3	17	3.1			3.9
Amr-B	40	15	5	5	7	6.4	0.8		20.8
Amr-D	58.5	8	4	3	7	5.3	0.5		13.7
Emr-B	49	10	3	5.5	3	4.1	3.2		22.2
Emr-D	49	11	2	5	3	3.2	5.5		21.3
Eur-A	5	18	50	3	17	2.4			4.6
Eur-B1	28.5	15	15	8	15	3.5			15.0
Eur-B2	35.5	16	15	5	15	6.9			6.6
Eur-C	24	20	15	5	15	2.4			18.6
Sear-B	58	14	3	5	3	2.6			14.4
Sear-D	51	9	5	3	3	4.8	1.7		22.5
Wpr-A	5	18	50	3	17	1.9	0.025		5.0
Wpr-B1	48.5	11	15	3	7	2.3	6.4		6.8
Wpr-B2	65	6	5	7	3	3.6	3.5		6.9
Wpr-B3	65	6	3	3	5	9.5	4.3		4.2
World	47.8	12.3	8.7	5.1	4.8	3.9	3.6	0.8	13.0

Afr, WHO African Region; Amr, WHO Region of the Americas; Emr, WHO Eastern Mediterranean Region; Eur, WHO European Region; Sear, WHO South-East Asia Region; Wpr, WHO Western Pacific Region.

^a AMD, age-related macular degeneration.

vision in children have been used when available. The extent of low vision worldwide is probably underestimated.

No attempt was made in this study to perform uncertainty analysis.

Estimate of the global burden of visual impairment

The model presenting data by WHO region and mortality stratum, based mostly on recent surveys, is the best available estimate of visual impairment in 2002 (Table 5 (web version only, available at <http://www.who.int/bulletin>) and Table 6). The estimates had the added strength of being based on recent data available from countries with large populations.

Because of the structure of the model, the percentage of the population in each of the three age groups weighs strongly on the prevalence calculated for all ages. In 2002, the population 50 years and older, with the highest prevalence of visual impairment, represented more than 30% of the population in developed countries and 15% of that in developing countries (12).

If the prevalence of blindness is taken as an indicator, all subregions with prevalences above 0.5% for all ages should be considered for priority action according to WHO objectives (21). The eight subregions concerned (Afr-D, Afr-E, Emr-B, Emr-D, Sear-B, Sear-D, Wpr-B1 and Wpr-B2) are home to 70% of the world's population and contribute 85% of the total number of blind people.

The extent of visual impairment in 2002 is not strictly comparable with the estimates from 1994 or with subsequent extrapolations, as the models were derived using different methodologies (1). While in 1990 there were an estimated 148 million people who were visually impaired, of whom 38 million were blind, in 2002 the estimated number of visually impaired people was 161 million, of whom 37 million were blind.

In the developed countries the number of blind people was estimated to be 3.5 million in 1990 and 3.8 million in

2002, an increase of 8.5%. During the same period the size of the population aged 50 years and older in these countries had increased by 16%. The change in the number of people with low vision is more significant: there were an estimated 18 million people with low vision in 2002, compared to 10 million in 1990. This figure represents an increase in unavoidable causes of visual impairment linked to an increase in the size of the population over 60 years of age. One report has also suggested that older members of the population do not seek eye care (22).

In developing countries, excluding China and India, 18.8 million people were blind in 1990 compared to 19.4 million in 2002, an increase of 3%. In China and India the estimated numbers of blind people in 1990 were 6.7 and 8.9 million, respectively; in 2002 there were an estimated 6.9 million blind people in China and 6.7 million in India. These figures indicate an increase of 3% in the number of blind people in China and a decrease of 25% in India.

The world population in 2002 had increased by 18.5% compared to that in 1990; the population 50 years of age and older had increased by 30%. In developed countries the increase in the population aged 50 years and older was 16%; in developing countries, excluding China, it was 47%, and in China, the increase was 27%. Taking into account these changes, the extent of visual impairment in 2002 appears to be lower than in past estimates and projected extrapolations. The difference could be due to either an overestimate in previous projections or to underestimates in the present model; however, it is likely that this change reflects the more accurate data now available. Differences could also be the direct consequence of concerted national efforts such as that made in India (23) and of the improvements in factors such as political and professional commitments to the prevention of blindness, the delivery of services, patient awareness, and socioeconomic development.

Table 6. Global estimate of visual impairment, by WHO region (millions), 2002

	Afr	Amr	Emr	Eur	Sear	Wpr
Population	672.238	852.551	502.823	877.886	1590.832	1717.536
No. of blind People	6.782	2.419	4.026	2.732	11.587	9.312
No. with low vision	19.996	13.116	12.444	12.789	33.496	32.481
No. with visual impairment	26.778	15.535	16.469	15.521	45.083	41.793

Afr, WHO African Region; Amr, WHO Region of the Americas; Emr, WHO Eastern Mediterranean Region; Eur, WHO European Region; Sear, WHO South-East Asia Region; Wpr, WHO Western Pacific Region.

Because the above estimates exclude refractive error as a cause of visual impairment, by virtue of the definition used, they significantly underestimate the actual burden of uncorrected disabling refractive error. The prevalence of blindness when defined as “presenting vision” is higher than when defined as “best corrected vision” by about 15%, for all ages. However, for older adults this difference could be as high as 25–30%, as indicated by the results of many studies (4–8, 24, 25). The increase in prevalence of low vision in older adults could be up to 60% (26, 27). Given the significance of the unmet need for correction of visual impairment due to refractive errors, changes in the definitions of visual impairment are being proposed for the next ICD revision.

Causes of visual impairment

The largest proportion of blindness is necessarily related to ageing. Although cataract is not a major cause of blindness in developed countries, globally it is still the leading cause, accounting for almost half of all cases, despite improved delivery of cataract surgical services in many parts of the world (Fig. 1). Cataract is even more significant as a cause of low vision; it is the leading cause of low vision in all subregions.

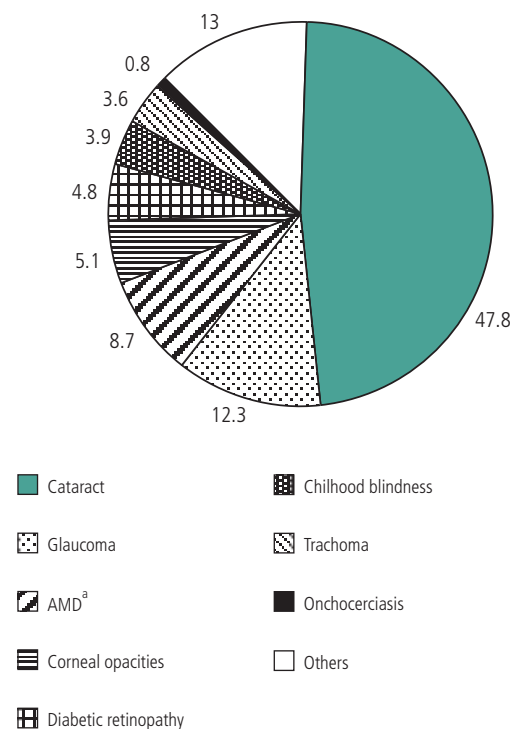
According to the surveys, glaucoma is the second leading cause of blindness globally as well as in most regions; age-related macular degeneration is the third leading cause. Trachoma, other corneal opacities, childhood blindness and diabetic retinopathy are all of approximately equal magnitude (i.e. all roughly 4–5%). It is noteworthy that trachoma has decreased in significance as a cause of blindness as compared to earlier estimates.

As would be expected given the growing number of people over 70 years of age, age-related macular degeneration is increasing in significance as a cause of blindness; it is the primary cause of blindness in the developed countries and the third leading cause worldwide. Corneal blindness may be primarily attributed to trachoma in areas in which this condition is known to be endemic. In other areas it is caused primarily by trauma and vitamin A deficiency (16).

Conclusions

Periodic estimations of the magnitude and causes of all categories of visual impairment are essential to improve global efforts aimed at monitoring and eliminating avoidable blindness and for use in priority-setting and resource allocation. Disaggregated, within-country data are important in ensuring greater equity in service provision and monitoring.

Fig. 1. Global causes of blindness as a percentage of total blindness in 2002



^aAMD = Age-related macular degeneration.

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To this end, countries are encouraged to carry out periodic population-based surveys, particularly densely populated countries and countries in regions where data are scarce. They are advised to use the standardized WHO protocol (3) with the following refinements:

- adding the measure of presenting vision, to include visually disabling refractive errors;
- in those studies that use definitions other than those given in the WHO ICD-10, visual acuity consistent with the WHO definitions should also be recorded; and
- diagnosis and recording of the causes of low vision in addition to those of blindness. Particular attention should be paid to glaucoma and macular degeneration. ■

Conflicts of interest: none declared.

Résumé

Données mondiales sur les déficiences visuelles pour l'année 2002

Le présent article estime la prévalence des déficiences visuelles et de leurs causes en 2002 à partir des meilleures données disponibles tirées d'études récentes. Les estimations ont été établies d'après les données de malvoyance et de cécité, telles que définies dans la *Classification statistique internationale des maladies, traumatismes et causes de décès de l'OMS*, 10^e révision. Le nombre de personnes dans le monde atteintes d'une déficience visuelle dépassait en 2002 les 161 millions, dont environ 37 millions d'aveugles.

La charge des déficiences visuelles n'est pas répartie uniformément à travers le monde : ce sont les régions les moins développées qui en supportent la plus forte part. Les déficiences visuelles se répartissent aussi inégalement selon les tranches d'âge,

les adultes de 50 ans et plus étant de loin les plus touchés. On relève également un déséquilibre entre les sexes dans le monde entier : les femmes présentent un risque significativement plus important de souffrir de déficience visuelle que les hommes.

Nonobstant les progrès réalisés par la chirurgie dans de nombreux pays au cours des dernières décennies, la cataracte demeure la cause principale de déficience visuelle dans toutes les régions du monde, à l'exception des pays les plus développés. Les autres causes majeures de déficience visuelle sont, par ordre d'importance, le glaucome, la dégénérescence maculaire liée à l'âge, la rétinopathie diabétique et le trachome.

Resumen

Datos mundiales sobre la deficiencia visual en el año 2002

En este artículo se estima la prevalencia de la deficiencia visual y sus causas en 2002 a partir de la mejor evidencia disponible aportada por los estudios más recientes. Las estimaciones se han basado en datos referentes a la disminución de la agudeza visual y la ceguera, según se definen en la *Clasificación Estadística Internacional de Enfermedades, Traumatismos y Causas de Defunción*, 10^a revisión. En 2002 el número de personas con deficiencia visual en todo el mundo superó los 161 millones, y de ellos 37 millones sufrían ceguera.

La carga de deficiencia visual no se distribuye uniformemente en todo el mundo, pues las regiones menos desarrolladas son las más afectadas. La deficiencia visual se distribuye también de forma

dispar entre los grupos de edad, pues la padecen sobre todo adultos de más de 50 años. Se observa también un desequilibrio en lo tocante al género en todo el mundo: el riesgo de deficiencia visual es significativamente mayor en las mujeres que en los hombres. A pesar de los progresos de la cirugía logrados en muchos países durante los últimos decenios, la catarata sigue siendo la principal causa de deficiencia visual en todas las regiones del mundo, exceptuando los países más desarrollados. Otras causas importantes de deficiencia visual son, en orden de importancia, el glaucoma, la degeneración macular relacionada con la edad, la retinopatía diabética y el tracoma.

ملخص

معطيات عالمية حول ضعف البصر في عام ٢٠٠٢

إذ يتركز إلى حد كبير بين البالغين من العمر ٥٠ عاماً فأكثر. ويُلاحظ أيضاً عدم التوازن في توزيع ضعف البصر بين الذكور والإناث في العالم: فالإناث أكثر تعرضاً لمخاطر الإصابة به من الذكور.

وبرغم التقدم الذي أحرز في المداخلات الجراحية في العديد من البلدان خلال العقود الأخيرة، ما يزال الساد (الكاتاراكت) هو المسبب الرئيسي لضعف البصر في جميع مناطق العالم، باستثناء البلدان الأكثر تقدماً. ويُعزى ضعف البصر أيضاً لعدد من المسببات الرئيسية، يمكن ترتيبها وفقاً لأهميتها على النحو التالي: الغلوكوما (الزرق)، والتنكس البقعي المرتبط بالعمر، واعتلال الشبكية السكري، والتراخوما (الحشر).

ملخص: تقدم هذه الورقة تقديرات لمعدل انتشار ضعف البصر ومسبباته في عام ٢٠٠٢، استناداً إلى أدق البيانات المتاحة والمستمدة من الدراسات التي أجريت حديثاً. وتم تقدير هذه المعدلات من المعطيات الخاصة بالرؤية الضعيفة والعمى، وفقاً للتعريفات الواردة في المراجعة العاشرة لتصنيف الإحصائي الدولي للأمراض والإصابات ومسببات الوفاة، الذي أعدته منظمة الصحة العالمية. ويتبين من هذه المعطيات أن عدد المصابين بضعف البصر في العالم في عام ٢٠٠٢ يزيد على ١٦١ مليون شخص، وأن نحو ٣٧ مليوناً منهم مصابون بالعمى. ولا يتوزع ضعف البصر توزيعاً متساوياً بين بلدان العالم، إذ إن المناطق الأقل نمواً تحظى بالنصيب الأكبر. كما لا يتوزع توزيعاً متساوياً بين الفئات العمرية،

References

1. Thyrefors B, Négrel A-D, Pararajasegaram R, Dadzie KY. Global data on blindness. *Bulletin of the World Health Organization*. 1995;73(1):115-21.
2. World Health Organization. *Prevention of blindness and deafness. Global initiative for the elimination of avoidable blindness*. Geneva: WHO; 2000. WHO document WHO/PBL/97.61 Rev2.
3. World Health Organization. *Coding instructions for the WHO/PBL eye examination record (version III)*. Geneva: WHO; 1988. WHO document PBL/88.1.
4. Limburg H, Kumar R, Indrayan A, Sundaram KR. Rapid assessment of prevalence of cataract blindness at district level. *International Journal of Epidemiology* 1997; 26:1049-54.
5. Limburg H, Kumar R. Follow-up study of blindness attributed to cataract in Karnataka State, India. *Ophthalmic Epidemiology* 1998;5:211-23.
6. Limburg H, Vasavada AR, Muzumdar G, Khan MY, Vaidyanathan K, Trivedi R, et al. Rapid assessment of cataract blindness in an urban district in Gujarat. *Indian Journal of Ophthalmology* 1999;47:135-41.
7. Amansakhatov S, Volokhovskaya ZP, Afanasyeva AN, Limburg H. Cataract blindness in Turkmenistan: results of a national survey. *British Journal of Ophthalmology* 2002;86:1207-10.
8. Duerksen R, Limburg H, Carron JE, Foster A. Cataract blindness in Paraguay – results of a national survey. *Ophthalmic Epidemiology* 2003;10:349-57.

9. World Health Organization. *International statistical classification of diseases, injuries and causes of death, tenth revision*. Geneva: WHO; 1993.
10. Murray CJL, Lopez AD, editors. *The global burden of disease: a comprehensive assessment of mortality and disability from diseases, injuries and risk factors in 1990 and projected to 2020*. Cambridge, MA: Harvard School of Public Health on behalf of the World Health Organization and the World Bank; 1996 (Global Burden of Disease and Injury Series, Vol. 1). Available from URL: <http://www.who.int/entity/en/>
11. Murray CJL, Lopez AD, Mathers CD, Stein C. *The Global Burden of Disease 2000 Project: aims, methods and data sources*. Geneva: World Health Organization; 2001. Global Programme on Evidence for Health Policy Discussion paper N. 36. Available from URL: <http://www.who.int/entity/en/>
12. United Nations, Population Division. *World population prospects — the 2002 revision*. New York (NY): United Nations; 2003.
13. World Health Organization. *The world health report 2003: shaping the future*. Geneva: WHO; 2003. Available from URL: <http://www.who.int/whr/en/>
14. Pascolini D, Mariotti S, Pokharel GP, Pararajasegaram R, Etya'ale D, Négrel A-D, et al. 2002 Global update of available data on visual impairment: a compilation of population-based prevalence studies. *Ophthalmic Epidemiology*, 2004;11:67-115.
15. World Health Organization. *Preventing blindness in children*. Report of a WHO/IAPB scientific meeting Hyderabad, India 1999. Geneva: WHO; 2000. WHO document WHO/PBL/00.77.
16. Gilbert CE, Anderton L, Dandona L, Foster A. Prevalence of visual impairment in children: a review of available data. *Ophthalmic Epidemiology* 1999;6:73-82.
17. Zhao J, Pan X, Sui R, Munõz SR, Sperduto RD, Ellwein LB. Refractive error study in children; results from Shunyi District, China. *American Journal of Ophthalmology* 2000;129:427-35.
18. Pokharel GP, Négrel AD, Munõz SR, Ellwein LB. Refractive error study in children: results from Mechi Zone, Nepal. *American Journal of Ophthalmology*, 2000;129:436-44.
19. Dandona R, Dandona L, Srinivas M, Sahare P, Norsaiyah S, Munõz SR, et al. Refractive error in children in a rural population in India. *Investigative Ophthalmology and Visual Science* 2002;43:615-22.
20. Murthy GVS, Gupta SK, Ellwein LB, Munõz SR, Pokharel GP, Sanga L, et al. Refractive error in children in an urban population in New Delhi. *Investigative Ophthalmology and Visual Science* 2002;43:623-31.
21. World Health Organization. *Formulation and management of national programmes for the prevention of blindness*. Geneva: WHO; 1990. WHO document PBL/90.18.
22. VanNewkirk MR, Weih LA, McCarty CA, Stanislavsky YL, Keeffee JE, Taylor HR. Visual impairment and eye diseases in elderly institutionalised Australians. *Ophthalmology* 2000;107:2203-8.
23. National Programme for Control of Blindness and Vision 2020. *The right to sight initiative. Cataract surgery rate 2002–2003*, Vol. 2. New Delhi India: National Programme for Control of Blindness-India, Ophthalmology Section, Directorate General health services, Ministry of Health and Family Welfare.
24. Michon JJ, Lau J, Chan WS, Ellwein LB. Prevalence of visual impairment, blindness, and cataract surgery in the Hong Kong elderly. *British Journal of Ophthalmology* 2002;86:133-9.
25. Nrmalan PK, Thulasiraj RD, Maneksha V, Rahmathullah R, Ramakrishnan R, Padmavathi A, et al. A population based eye survey of older adults in Tirunelveli district of south India: blindness, cataract surgery, and visual outcomes. *British Journal of Ophthalmology* 2002;86:505-12.
26. National Programme for the Control of Blindness. *National survey on blindness and visual outcomes after cataract surgery*. 2002. New Delhi, India: Directorate General of Health Services, Ministry of Health and Family Welfare; 2002.
27. Dineen BP, Bourne RRA, Ali SM, Noorul Huq DM, Johnson GJ. Prevalence and causes of blindness and visual impairment in Bangladeshi adults: results of the national blindness and low vision survey of Bangladesh. *British Journal of Ophthalmology* 2003;87:820-8.

Table 5. 2002 Global estimate of visual impairment, by WHO region mortality stratum (millions)

	Africa		The Americas			Eastern Mediterranean		Europe			South-east Asia		Western Pacific	
	Mortality stratum		Mortality stratum			Mortality stratum		Mortality stratum			Mortality stratum		Mortality stratum	
	High child	High child	Very low child	Low child	High child	Low child	High child	Very low child	Low child	Low child	Low child	High child	Very low child	Low child
	High adult	Very high adult	Very low adult	Low adult	High adult	Low adult	High adult	Very low adult	Low adult	High adult	Low adult	High adult	Very low adult	Low adult
Population	311.273	360.965	333.580	445.161	73.810	142.527	360.296	415.323	222.846	239.717	298.234	1292.598	155.400	1562.136
Blind	3.140	3.642	0.729	1.358	0.332	1.076	2.950	0.937	0.760	1.035	3.672	7.915	0.404	8.908
Low vision	9.423	10.573	4.220	7.408	1.488	3.580	8.864	5.435	3.135	4.219	7.158	26.338	1.992	30.489
Visually impaired	12.563	14.215	4.949	8.766	1.820	4.656	11.813	6.372	3.895	5.254	10.830	34.253	2.395	39.398