Rapid assessment of avoidable blindness and diabetic retinopathy in Republic of Moldova

Tatiana Zatic,[1] Eugen Bendelic,[2] Ala Paduca,[2] Mansour Rabiu,[3] Angela Corduneanu,[2] Angela Garaba,[2] Victoria Novac,[2] Cristina Curca,[2] Inga Sorbala,[2] Andrei Chiaburu,[2] Florentina Verega,[2] Victoria Andronic,[2] Irina Guzun,[2] Olga Căpățină,[2] Iulea Zamă-Mardari[2]

[1]Ministry of Health of the Republic of Moldova, Head of Directorate Primary Care, Chisinău, Republic of Moldova
[2]State University of Medicine and Pharmacy "Nicolae Testemiteanu", Faculty of Medicine, Department of Ophthalmology of Republic of Moldova
[3]International Agency of Prevention of Blindness Eastern Mediterranean region, Riyadh, Saudi Arabia

Correspondence to
Dr Ala Paduca, Department of Ophthalmology, State University of Medicine and Pharmacy 'Nicolae Testemiteanu', CuzaVodă bd. ap 207, Chișinău, Republic of Moldova; paducaa@yahoo.com

Received 12 July 2014
Revised 19 October 2014
Accepted 19 November 2014
Published Online First 30 December 2014

ABSTRACT

Objective To evaluate the prevalence and causes of blindness and visual impairment, the prevalence of diabetes mellitus and diabetic retinopathy among people aged ≥50 years in the Republic of Moldova using Rapid Assessment of Avoidable Blindness plus Diabetic Retinopathy ('RAAB+DR') techniques.

Materials and Methods 111 communities of people aged ≥50 years were randomly selected. In addition to standard RAAB procedures in all people with diabetes (previous history of the disease or with a random blood glucose level >11.1 mm/L (200 mg/dL)), a dilated fundus examination was performed to assess the presence and the degree of diabetic retinopathy using the Scottish DR grading system.

Results 3877 (98%) people out of the 3885 eligible people were examined. The prevalence of blindness was 1.4% (95% CI 1.0% to 1.8%). The major causes of blindness and severe visual impairment were untreated cataract (58.2%), glaucoma (10.9%), and other posterior segment causes (10.9%). The estimated prevalence of diabetes was 11.4%. Among all people with diabetes, 55.9% had some form of retinopathy, and sight threatening diabetic retinopathy affected 14.6%.

Conclusions The RAAB+DR survey in the Republic of Moldova established that untreated cataract is the major cause of avoidable blindness in rural areas. This needs to be tackled by expanding the geographical coverage of cataract surgical services.

INTRODUCTION

WHO estimates that there are about 39 million blind people worldwide and another 246 are visually impaired.[1] The magnitude and causes of blindness and visual impairment (VI) vary greatly in different regions and countries of the world.

The number of blind and visually impaired people will continue to increase due to an ageing population unless concerted efforts are made to address the causes of blindness and VI.[2] WHO in partnership with international agencies, professional bodies and governments has developed an international initiative to eliminate the causes of avoidable blindness by the year 2020: VISION 2020—the Right to Sight.[2]

To develop locally appropriate strategies, reliable and up-to-date, data on the magnitude and causes of blindness and VI are necessary. The Republic of Moldova has no national data on blindness and VI. So the Moldovan Ministry of Health in collaboration with Fred Hollows Foundation (UK), Help Age International Moldova, and State Medical and Pharmaceutical University 'Nicolae Testemiţanu' conducted a national survey to estimate the magnitude and causes of blindness and VI in the country using the Rapid Assessment of Avoidable Blindness plus Diabetic Retinopathy (RAAB+DR) methodology.[3]

RAAB+DR is a simple, affordable and rapid survey method to collect reliable data on the magnitude and causes of blindness and diabetic retinopathy (DR) at a district/regional level. RAAB+DR only includes people over age 50 years in whom the prevalence of blindness and VI is highest.[3] Therefore, required sample sizes are minimised, relatively straightforward sampling and examination techniques are used, and the time and costs are also reduced. The RAAB+DR survey provides information on the prevalence of avoidable blindness, VI and DR. It identifies the main causes of blindness and VI which guide strategies for action, and identifies problems related to access to and quality of current services.

MATERIALS AND METHODS

The study population included individuals aged 50 years or over who had been randomly selected from 111 communities (towns/villages) in the Republic of Moldova during May–July 2012. The sampling and examination procedures of the RAAB +DR methodology were followed. A minimum sample of 3813 people aged 50 years and older was calculated based on the assumed prevalence of severe VI (SVI) and blindness in this population of 2.5%. There was a maximum error of ±0.6%, design effect of 1.5 and non-response rate of 5%, with the population of people aged 50 years and older of 868 113.

The sample was selected through a stratified multistage cluster random sampling technique using the RAAB software. Stratification was on urban, rural residence as categorised by the Moldovan population data. The population data were obtained from the National Bureau of Statistics of the Republic of Moldova. A total of 111 communities (towns/villages) were randomly selected in the first sampling from the sampling frame of each of the regions. As rural populations constitute 61% of the Moldovan population, a total of 68 clusters were selected from rural areas and the remainder were urban clusters. This selection was by probability proportional to size sampling. Using the compact segment technique in each selected community, the area was divided into segments that contained about

To cite: Zatic T, Bendelic E, Paduca A, *et al*. *Br J Ophthalmol* 2015;**99**: 832–836.

35 people aged ≥50 years and one segment was randomly chosen. The population data of the community and a map of the community showing the distribution of residential houses were used to approximately divide the communities into segments. All households in the selected segment were included in the survey until the required 35 people aged 50 years and over were identified. If the segment did not have 35 people aged ≥50 years, another segment was randomly selected to complete the number. The survey was carried out from May to July 2012. In each cluster, the survey team visited households door-to-door, accompanied by a local village/community guide.

All consenting participants had their presenting visual acuity (VA) tested in each eye using a modified Snellens E chart at 6 m. Pinhole vision was tested for any eye with VA less than 6/18. The VA testing was done by the ophthalmic residents. All subjects were examined by the ophthalmologists for lens opacity, or aphakia/pseudophakia. All people with vision less than 6/18 in one or both eyes were examined further by the ophthalmologists to determine the cause of VI in each eye. The ophthalmologists used pen torches, direct ophthalmoscopes, and portable indirect ophthalmoscopes for the examinations. The WHO guidelines were used to determine the cause of VI for each eye and for the person.[4] If necessary, pupils were dilated to examine the posterior segment.

In addition to the above standard RAAB procedures, the diabetic status of all participants was assessed through interview and a random (non-fasting) blood glucose test. The random blood sugar test was done using a Digital Glucometer Accu-check blood sugar machine which was regularly calibrated. 'People with diabetes' were defined as people with a previous diagnosis of diabetes, or with a random blood glucose level >11.1 mm/L (200 mg/dL). In all people with diabetes who had consented, a dilated fundoscopy using a portable indirect ophthalmoscope (Keeler indirect ophthalmoscope.) was performed in each eye to assess the presence and the degree of DR. The Scottish DR grading system was used for the grading of DR.

People that needed further assessment and treatment were referred to the appropriate nearest health facility. At the end of each day's field work, the survey team ensured that all examined subjects had no complaint or problem. In addition, all forms were reviewed to ensure there were no missing data.

The survey was conducted by three survey teams and each team consisted of the following: one ophthalmologist or ophthalmic clinical officer and two ophthalmic residents. The teams received 1 week of training by an experienced trainer. The training included inter-observer variation assessment on the VA measurement, lens opacity grading, causes of VI and DR grading. The teams attained at least 75% inter-observer Kappa agreement in all the above parameters before the commencement of the survey.

Data management

All data were recorded in the simple two-page survey form. The survey forms were cross checked daily to identify and correct mistakes. Data were then entered into the new RAAB+DR software by double entry, which has an in-built consistency check. The data were analysed using RAAB V.4 β April 2012 to provide:

- age–sex adjusted prevalence of blindness and VI at different VA levels, by age, sex, residence;
- age–sex adjusted prevalence of cataract and aphakia/pseudophakia;
- causes of blindness and VI at different VA levels,
- cataract surgical coverage (CSC) by person sex,
- the prevalence of diabetes (known and newly diagnosed) by age, sex and residence and other demographics;
- the prevalence of DR and sight-threatening DR by age, sex and residence and other demographics.

To ensure minimal data collection error, all collected data were entered within 24 h of collection and errors were identified and reported back to the field teams for correction.

This software appropriately accounts for the variations and clustering effect expected in multistage cluster sampling design. In the first instance, a design effect of 1.5 was used to calculate the sample size to make up for the clustering effect. Then the study sample was selected by probability proportional to size.

Ethical approval and service component

The survey secured ethical approval from the Ethical Committee and from the Ministry of Health of the Republic of Moldova. Written/thumb-printed consent was obtained from all subjects for participation in the survey. All information on the subjects was confidentially handled. People identified with diabetes and/or ocular conditions requiring treatment or follow-up were referred to the nearest ophthalmic or medical centres as appropriate.

RESULTS

A total of 3877 subjects out of the 3885 eligible subjects aged ≥50 years were examined, giving a response rate of 98%. Five people were not available, two refused examination, and one was incapable of being examined. The sample population resembles the age and sex distribution of the Moldovan population as depicted in table 1.

Blindness and visual impairment

A total of 55 people had a presenting vision of less than 3/60 in the better eye. Thus, blindness prevalence was 1.4% (95% CI 1.0% to 1.8%), with the prevalence in men being 1.7% and in women 1.3%. But the age and sex standardised prevalence was 1.57% (95% CI 1.1% to 2.0%): men 1.5% and women 1.6%. The prevalence of SVI was 2.2% (95% CI 1.7% to 2.6%), with the prevalence in men being 2.5% (95% 1.6% to –3.4%) and women 2.0% (95% CI 1.4% to 2.6%) (table 2).

The prevalence of blindness was slightly higher in the rural areas (1.7%; CI 1.3% to 2.4%) than in the urban areas (1.5%; CI 1.4% to 1.9%), but the difference was not statistically significant. Also SVI was higher in the rural areas (2.6%; CI 2.0% to 3.3%) compared with urban areas (1.4%; CI 0.9% to 2.2%) and was statistically significant with p=0.019.

The prevalence of blindness increased with age: 0.4% for the age group of 50–59 years, increasing to 11.7% for those aged 80+ years.

Causes of blindness and VI

The majority of cases of blindness were attributable to cataracts (58.2%), followed by glaucoma (10.9%) and posterior segment diseases (10.9%). Also, for SVI, cataract (70. 2%) was the major cause followed by other posterior segment diseases (9.5%), while refractive error (64.9%) was the major cause of moderate VI (table 3).

The main cause of blindness in rural areas was cataract (67.4%), while in urban areas the main cause of blindness was glaucoma (33.3%).

Cataract and cataract surgery

The age and sex standardised prevalence of cataract responsible for blindness (vision less than 3/60 in better eye) among the

Table 1 Age and gender distribution of people examined in the sample

	Men		Women		Total	
Age group (years)	Sample	All population	Sample	All population	Sample	All population
50–59	521 (41.0)	176 950 (48.1)	1244 (47.7)	206 269 (41.1)	1765 (45.5)	383 219 (44.1)
60–69	417 (32.8)	108 999 (29.7)	808 (31.0)	151 205 (30.1)	1225 (31.6)	260 204 (29.9)
70–79	267 (21.0)	65 469 (17.8)	440 (16.9)	109 003 (21.7)	707 (18.2)	174 472 (20.1)
80+	66 (5.2)	16 142 (4.4)	114 (4.4)	35 614 (7.1)	180 (4.6)	51 756 (6.0)
Total	1271 (100)	367 560 (100)	2606	502 091 (100)	3877 (100)	869 651 (100)

study population was 0.65% (men 0.54%, women 0.72%); for unilateral cataract the prevalence was 3.46%. Applying this to the whole Moldovan population translates to 5623 people who are blind because of cataract and 30 069 eyes with unilateral cataract. The age and sex standardised CSC for people with cataract responsible for vision less than 3/60 was 77.8%, with similar rates among both sexes.

A total of 85.5% (148/173) of the eyes undergoing surgery for cataract had intraocular lens (IOL) inserted, 23 eyes (13.2%) had no IOL; most were cases of traumatic aphakia. Of all the eyes undergoing surgery, 83.3% (145/173) of operations were performed in the government hospital. Only 16.2% were done in private hospitals.

The age and sex adjusted prevalence of bilateral aphakia/pseudophakia was 1.14% (men 0.74%, women 1.44%). Another 2.42% of the study population had unilateral pseudophakia/aphakia.

Diabetes and DR

There were 444 people with either a history of diabetes or newly diagnosed diabetes in the study, giving a prevalence of diabetes of 11.4% among the study population. The prevalence was 10.3% in the rural areas and 13.5% in the urban areas. Most people with diabetes (85.8%) had a previous diagnosis of diabetes while 14.2% were 'diagnosed' during the survey and two-thirds of them were men. More than half (55%) of the people with known diabetes had random blood sugar of less than 200 mg/dL (11.1 mmol/L), suggesting a good blood sugar control; there was no significant difference between the sexes. About 60% of people with known diabetes were using tablets to control the disease, 19.2% of them were using insulin. About 10.5% of all known people with diabetes were not using any treatment for the disease.

Diabetic retinopathy

Among all the people with diabetes, 248 (55.9%) had some form of retinopathy, maculopathy or both (table 4). There were 243 (54.7%) people with any form of retinopathy and 161 (36.3%) people with maculopathy. Sight-threatening retinopathy (grades R4 and or M2) was detected in 65 (14.6%) of people with diabetes.

Among people with known diabetes, about 30% had never had an eye examination for DR. But over 54% had had an eye examination for DR in the past year.

Blindness prevalence was 1.6% among people with diabetes and 1.4% among those without diabetes. For SVI, the figures were 2.5% versus 2.1%, and for MVI, 15.1% versus 12.7%, for people with and without diabetes, respectively.

DISCUSSION

The study attained an excellent coverage of 98% due to effective mobilisation of people in the study areas with the aid of the Ministry of Health using its primary health centres. There was also some media advertising for the survey in rural areas and the sample population resembled the study population. The RAAB+DR survey estimated that in the Republic of Moldova, the prevalence of blindness in adults aged 50 years or older is 1.4% (CI 1.0% to 1.8%). The cause of blindness in rural areas was mainly cataract (67.4%), while it was glaucoma (33.3%) and posterior segment diseases (16.7%) in the urban areas.

For SVI, cataract is also the major cause followed by other posterior segment diseases. However, for moderate VI, refractive error was the major cause, followed by cataract. As most cataract surgical service facilities are in the urban areas it is not surprising that cataract is the major cause of blindness in the rural areas compared with glaucoma in the urban areas.

Leading causes worldwide in 1990 and 2010 for blindness were cataract (39% and 33%, respectively), uncorrected refractive error (20% and 21%), and macular degeneration (5% and 7%), and for moderate and severe VI the causes were uncorrected refractive error (51% and 53%), cataract (26% and 18%) and macular degeneration (2% and 3%).[5]

Cataract was the most frequent cause of blindness in all subregions in 1990, but macular degeneration and uncorrected refractive error became the most frequent causes of blindness in 2010 in all high-income countries except for Eastern/Central Europe, where cataract remained the leading cause.[6]

Table 2 Sample prevalence of blindness, severe (SVI) and moderate visual impairment (MVI)—bilateral presenting visual acuity (PVA)

	Men		Women		Total	
VA category	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Blindness (PVA <3/60)	22	1.7 (1.0 to 2.5)	33	1.3 (0.8 to 1.7)	55	1.4 (1.0 to 1.8)
SVI (<6/60–3/60)	32	2.5 (1.6 to 3.4)	52	2.0 (1.4 to 2.6)	84	2.2 (1.7 to 2.6)
MVI (<6/18–6/60)	161	12.7 (10.4 to 14.9)	341	13.1 (11.4 to 14.7)	502	13.0 (11.5 to 14.4)
Functional low vision	20	1.6 (0.9 to 2.2)	58	2.2 (1.5 to 2.9)	78	2.0 (1.5 to 2.5)

VA, visual acuity.

Table 3 Principal cause of blindness, severe (SVI) and moderate visual impairment (MVI) in people (presenting visual acuity, PVA)

	Blindness		SVI		MVI	
Conditions	**n**	**%**	**N**	**%**	**n**	**%**
1. Refractive error	0	0.0	4	4.8	326	64.9
2. Aphakia uncorrected	3	5.5	0	0.0	6	1.2
3. Cataract untreated	32	58.2	59	70.2	120	23.9
4. Cataract surgical complications	1	1.8	0	0.0	4	0.8
5. Non-trachomatous corneal opacity	2	3.6	0	0.0	0	0.0
6. Glaucoma	6	10.9	4	4.8	9	1.8
7. Diabetic retinopathy	2	3.6	4	4.8	18	3.6
8. ARMD	3	5.5	5	5.9	6	1.2
9. Other posterior segment disease	6	10.9	8	9.5	12	2.4
10. All other globe/CNS abnormalities	0	0.0	0	0.0	1	0.2
Total	55	100	84	100	502	100

Cataract is still a cause of avoidable blindness in older people in some regions of Eastern Europe: the Balkan Peninsula, the Caucasus region, some rural areas in Russia and in former USSR central Asian republics.[7] In Europe, the most frequent causes of blindness are age-related macular degeneration (AMD) (26%), glaucoma (20.5%) and DR (8.9%).[7 8] On average, Western European countries, such as France (40%)[8 9] and Germany (36.3%),[7 10] tend to have a higher prevalence of AMD than Eastern European countries, including Russia (16.30%)[11] and Bulgaria (14%).[8] In people of working age, DR, retinopathy pigmentosa and optic atrophy are the most frequently reported causes of blindness.[8]

DR is estimated to be responsible for 4.8% of blindness globally[3] and it occurs in 6.4% of all people aged 50 years and older in Moldova, but among 56% of people with diabetes in the same age group in the country. According to the literature reviewed, DR affects 3%[12] to 4.1%[13] of Europeans between 50 and 75 years. Recent epidemiological studies have shown that France (16.6%)[14] and Germany (10.6%)[15] show the highest prevalence of DR in Europe. Its incidence was similar among other European countries, being the highest in the UK (43.3%) and closely followed by Switzerland (42.3%), Poland (31.8%) and Germany (29.9%).[16]

In the Republic of Moldova, nearly 11.4% of the survey population had diabetes. Among people with diabetes, there was a high prevalence of DR (55.9%). DR was responsible for 3.6% of blindness, and this is likely to increase further as the magnitude of diabetes rises further. The high DR prevalence may be related to lack of awareness among people with diabetes, as nearly 50% of people with diabetes have not had an eye exam in the past year while over 30% have never had any eye exam for DR. Laser treatment is effective in reducing loss of sight among people with sight-threatening DR.[1] The coverage of laser services seems to be deficient in Moldova as only about a third of those needing laser treatment were found to have laser marks on their retina (5.6% vs 14.6%).

Comparative data from similar RAAB+DR surveys from Saudi Arabia and Mexico give the prevalence of blindness and diabetes to be higher in Taif, Saudi Arabia (2.6% blindness and 29.7% diabetes)[1] and Chiapas, Mexico (2.3% blindness and 21.0% diabetes)[17] than estimates from the Republic of Moldova (1.4% blindness and 11.4% diabetes). However, the estimated prevalence of DR in Chiapas (38.9%) and Taif (36.8%) is lower than estimated in the Republic of Moldova (55.9%), and sight-threatening DR was lower in the Republic of Moldova (14.6%) than in Taif (17.5%) and Chiapas (21.0%). Blindness from cataract is highest in Chiapas (63.0%) and lowest in Taif (41.0%), with the intermediary position held by the Republic of Moldova (58.2%) (table 5).

Glaucoma is one of the leading causes of blindness in Europe and worldwide[18] and is the second most common cause of blindness among older people in developed countries.[19] Population projections for the years 2010 and 2020 indicate that open-angle glaucoma will become the most prevalent type of glaucoma in Europe, with a prevalence of 23.9% and 21.1%, respectively.[20] In the Republic of Moldova, the proportion of blindness caused by glaucoma represented 10.9%, with the predominance in urban areas.

The proportion of blindness caused by glaucoma in 2010 varied notably, with the lowest values being seen in South Asia

Table 4 Prevalence of diabetic retinopathy (DR) in people with diabetes and in the entire sample

	Among people with diabetes		Full sample
DR grading	**N**	**p (95% CI)**	**p (95% CI)**
Retinopathy grade			
No retinopathy (R0)	195	43.9% (38.1% to 49.7%)	5.0% (4.2% to 5.8%)
Background DR—mild (R1)	157	35.4% (29.8% to 40.9%)	4.0% (3.2% to 4.8%)
Background DR—observable (R2)	52	11.7% (8.5% to 14.9%)	1.3% (1.0% to 1.7%)
Background DR—referable (R3)	17	3.8% (2.1% to 5.6%)	0.4% (0.2% to 0.6%)
Proliferative DR (R4)	11	2.5% (1.0% to 4.0%)	0.3% (0.1% to 0.5%)
Ungradable DR (R6)	6	1.4% (0.3% to 2.4%)	0.2% (0.0% to 0.3%)
Any retinopathy	243	54.7% (48.9% to 60.6%)	6.3% (5.3% to 7.2%)
Maculopathy grade			
No maculopathy (M0)	277	62.4% (56.8% to 67.9%)	7.1% (6.2% to 8.1%)
Maculopathy to observable (M1)	83	18.7% (14.2% to 23.2%)	2.1% (1.6% to 2.7%)
Maculopathy referable (M2)	61	13.7% (10.5% to 17.0%)	1.6% (1.2% to 2.0%)
Any maculopathy	161	36.3% (30.6% to 42.0%)	4.1% (3.4% to 4.9%)
Any retinopathy and/or maculopathy	248	55.9% (49.9% to 61.8%)	6.4% (5.4% to 7.4%)
Sight-threatening DR (R4 and/or M2)	65	14.6% (11.3% to 18.0%)	1.7% (1.2% to 2.1%)
Any laser scars	25	5.6% (3.6% to 7.6%)	0.6% (0.4% to 0.9%)

Table 5 Comparative data about blindness and diabetes/DR prevalence from Rapid Assessment of Avoidable Blindness plus Diabetic Retinopathy (RAAB+DR) surveys in Republic of Moldova, Taif, Saudi Arabia, and Chiapas, Mexico

Prevalence	Republic of Moldova (%)	Saudi Arabia (Taif) (%)	Mexico (Chiapas) (%)
Blindness	1.4	2.6	2.3
Blindness from cataract	58.2	41.0	63.0
Diabetes	11.4	29.7	21.0
Diabetics with DR	55.9	36.8	38.9
Sight-threatening DR	14.6	17.5	21.0

DR, diabetic retinopathy

(4.7%; CI 3.3% to 7.5%), East and West sub-Saharan Africa (4.0%; 3.1% to 5.4%; and 4.4%; 3.4% to 5.9%, respectively), and Oceania (4.2%; 2.5% to 7.2%), and the highest value being seen in tropical Latin America (15.5%; 9.6% to 21.9%).[5] In Europe, it is highest in Germany (14%)[21] and the European North of Russia (11.9%),[16] and is lower in France (3.4%)[1 22] and the UK (3.3%).[10] A cross-sectional study from the European North of Russia estimated the incidence of glaucoma at a level of 1.3 cases per 1000 persons.

Limitations of this study include the fact that basic ophthalmic equipment was used so full diagnosis of conditions like glaucoma needing tonometry and perimetry was not possible. Therefore, the prevalence of glaucoma was likely to have been underestimated. Also, as the survey methodology used only aims to identify avoidable causes of blindness, most other cases of posterior segment diseases were clumped together as 'Other posterior segment diseases'. This means that other studies need to be done to understand what makes up this group as it is the third major cause of blindness in this study.

CONCLUSION

The RAAB+DR survey in the Republic of Moldova established that untreated cataract is the major cause of avoidable blindness in rural areas. This can be addressed by expansion of cataract surgical services in rural areas.

Contributors TZ supervised the fieldwork and made the arrangement with local medical staff. MR developed the survey protocol, carried out training, supervised the fieldwork and wrote the paper with Eugen Bendelic and Ala Paduca. AG, VN, CC, IS, AC, FV, VA, IG, OC undertook the fieldwork and examination of participants and IZ-M data entry staff. AC provided expertise on DR assessment. Help Age Organisation organised the fieldwork.

Funding This study was supported with funding from Fred Hollows Foundation (UK).

Competing interests None.

Patient consent Obtained.

Ethics approval Ethical Committee from the Ministry of Health of the Republic of Moldova.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

1 Pascolini D, Mariotti SPM. Global estimates of visual impairment: 2010. *Br J Ophthalmol* 2012;96:614–18.
2 Vision 2020: The Right to Sight. *Global Initiative for the elimination of avoidable blindness. Action plan 2006–2011*. Geneva: World Health Organization, 2007.
3 Al Ghamdi AH, Rabiu M, Hajar S, *et al*. Rapid assessment of avoidable blindness and diabetic retinopathy in Taif, Saudi Arabia. *Br J Ophthalmol* 2012;96:1168–72.
4 World Health Organization. Coding instructions for the WHO/PBL eye examination record (version III). WHO PBL/88.1
5 Bourne RRA, Stevens GA, White RA, *et al*. Causes of global vision loss: 1990–2010. *The Lancet Global Health* 2013. E-Published 11 November 2013.
6 Bourne RR, Jonas JB, Flaxman SR, *et al*. on behalf of the Vision Loss Expert Group of the Global Burden of Disease Study. Prevalence and causes of vision loss in high-income countries and in Eastern and Central Europe: 1990–2010. *Br J Ophthalmol* 2014;98:629–38.
7 Prokofyeva E, Zrenner E. Epidemiology of major eye diseases leading to blindness in Europe: a literature review. *Ophthalmic Res* 2012;47:171–88.
8 Kocur I, Resnikoff S. Visual impairment and blindness in Europe and their prevention. *Br J Ophthalmol* 2002;86:716–22.
9 Cohen D, Sartral M, Nounou P, *et al*. Evaluation of moderate and severe visual impairments in patients attending an ophthalmology clinic. A prospective study of 1,172 patients (in French). *J Fr Ophtalmol* 2000;23:437–43.
10 Gray SF, Spry PG, Brookes ST, *et al*. The Bristol Shared Care Glaucoma Study: outcome at follow-up at 2 years. *Br J Ophthalmol* 2000;84:456–63.
11 Bannikova RV, Sannikov AL, Konovalov AV. Characteristics of ophthalmic pathology under the conditions of the European North of Russia (in Russian). *ProblSotsialnoi Gig Zdravookhranenniiailstor Med* 2002:35–6.
12 Resnikoff S, Pascolini D, Etya'ale D, *et al*. Global data on visual impairment in the year 2002. *Bull World Health Organ* 2004;82:844–51.
13 Simmons D, Clover G, Hope C. Ethnic differences in diabetic retinopathy. *Diabet Med* 2007;24:1093–8.
14 Waked N, Saad A, Mehanna C, *et al*. Prevalence, causes, and risk factors for blindness and visual impairment among nursing home residents in Lebanon (in French). *J Fr Ophtalmol* 2007;30:497–502.
15 Blum M, Kloos C, Muller N, *et al*. Prevalence of diabetic retinopathy. Check-up program of a public health insurance company in Germany 2002–2004 (in German). *Ophthalmologe* 2007;104:499–500, 502–494.
16 Keen H, Lee ET, Russell D, *et al*. The appearance of retinopathy and progression to proliferative retinopathy: the WHO Multinational Study of Vascular Disease in Diabetes. *Diabetologia* 2001;44(Suppl 2):S22–30.
17 Polack S, Yorston D, López-Ramos A, *et al*. Rapid assessment of avoidable blindness and diabetic retinopathy in Chiapas, Mexico. *Ophthalmology* 2012;119:1033–40.
18 Thylefors B, Negrel AD. The global impact of glaucoma. *Bull World Health Organ* 1994;72:323–6.
19 Tuulonen A, Airaksinen PJ, Erola E, *et al*. The Finnish evidence-based guideline for open-angle glaucoma. *Acta Ophthalmol Scand* 2003;81:3–18.
20 Quigley HA, Broman AT. The number of people with glaucoma worldwide in 2010 and 2020. *Br J Ophthalmol* 2006;90:262–7.
21 Gruener F. Prävalenz, Inzidenz und Ursache von Blindheit und wesentlicher Sehbehinderung in Hessen, Marburg. Dissertation, Marburg, 2001.
22 Weinreb RN, Khaw PT. Primary open-angle glaucoma. *Lancet* 2004;363:1711–20.

Rapid assessment of avoidable blindness and diabetic retinopathy in Republic of Moldova

Tatiana Zatic, Eugen Bendelic, Ala Paduca, Mansour Rabiu, Angela Corduneanu, Angela Garaba, Victoria Novac, Cristina Curca, Inga Sorbala, Andrei Chiaburu, Florentina Verega, Victoria Andronic, Irina Guzun, Olga Capatina and Iulea Zama-Mardari

Br J Ophthalmol 2015 99: 832-836 originally published online December 30, 2014
doi: 10.1136/bjophthalmol-2014-305824