Prevalence and causes of vision loss in North Africa and the Middle East: 1990–2010

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ABSTRACT

Background To describe the prevalence and causes of visual impairment and blindness in North Africa and the Middle East (NAME) in 1990 and 2010.

Methods Based on a systematic review of medical literature, we examined prevalence and causes of moderate and severe vision impairment (MSVI; presenting visual acuity <6/18, ≥3/60) and blindness (presenting visual acuity <3/60).

Results In NAME, the age-standardised prevalence of blindness decreased from 2.1% to 1.1% and MSVI from 7.1% to 4.5%. In 2010, 3.119 million people were blind, and 13.700 million had MSVI. Women were generally more often affected than men. Main causes of blindness were cataract, uncorrected refractive error, macular degeneration and glaucoma. Main causes of MSVI were cataract and uncorrected refractive errors. Proportions of blindness and MSVI from trachoma significantly decreased.

Conclusions Although the absolute numbers of people with blindness and MSVI increased from 1990 to 2010, the overall age-standardised prevalence of blindness and MSVI among all ages and among those aged 50 years and older decreased significantly ($p<0.05$). Cataract and uncorrected refractive error were the major causes of blindness and MSVI.

INTRODUCTION

Although some countries have made significant progress in implementing prevention of blindness activities under the agenda of Vision 2020 and the socioeconomic situation in North Africa and the Middle East (NAME) had improved markedly, vision loss has remained a major public health problem in countries of the NAME region and elimination of avoidable blindness is still a challenge. A recent analysis of the global prevalence and causes for vision loss revealed that worldwide 32.4 million people were blind (defined as presenting visual acuity <3/60) in 2010 and 191 million people had moderate or severe vision impairment (MSVI; defined as presenting visual acuity <6/18 but ≥3/60).[1]

The purpose of the present study is to report prevalence and causes of blindness and MSVI in different countries in the NAME region in 1990 and 2010 and to examine changes and find implications for planning and prioritisation of vision health services in the NAME region. We used the data collected for the recent Global Burden of Disease Study GBD 2010, which presented a comprehensive assessment of mortality and loss of health due to diseases, injuries and risk factors for all regions of the world.[1]

METHODS

Detailed information regarding the GBD Vision Loss Project has been reported previously.[1 2] In brief, a systematic review of all medical literature published from 1 January 1980 to 31 January 2012 that reported the incidence, prevalence and causes of blindness and/or MSVI were considered for inclusion. Only population-based cross-sectional studies that are representative of the general population were considered for data extraction (table 1). The definition of blindness used is presenting visual acuity of <3/60 and MSVI is <6/18 to ≥3/60 in the better eye. Unpublished data and data from studies following the protocol of Rapid Assessment of Avoidable Blindness (RAAB) were also included. More detailed description of the methodology and statistical analysis has been recently published in a companion article relating to the High-income countries and Eastern & Central Europe.[3]

RESULTS

Age-standardised prevalence of blindness across all ages decreased from 2.1% in 1990 to 1.1% in 2010 ($p<0.05$). All-age age-standardised prevalence of MSVI decreased from 7.1% in 1990 to 4.5% in 2010 ($p<0.05$) (table 2).

Age-standardised blindness and MSVI prevalence rates in NAME were higher than the global average for both sexes in 1990 and 2010. Mean age-standardised blindness and MSVI prevalence rates were higher in women than in men in 1990 and 2010 in the NAME region, as was the case globally. There was a statistically significant decrease in age-standardised prevalence of blindness and MSVI for male and female adults ≥50 years since 1990 in different countries from the NAME region ($p<0.05$) (figures 1 and 2).

Although the age-standardised prevalences decreased, the overall numbers of people who were blind increased from 2.995 million in 1990 to 3.118 million in 2010, and the number of people with MSVI increased from 11.800 million in 1990 to 13.700 million in 2010 (table 3).

Cataract was the most common cause of blindness in NAME and worldwide in 1990 and 2010 for all ages. However, the proportion of blindness attributable to cataract in NAME was lower than was globally. Proportions of blindness from

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Table 1 Reference studies that met the GBD inclusion criteria from North Africa and the Middle East

Country	Reference	Study years	Demographic levels	Age group	Total examined	Urban /rural	Rapid assessment yes/no	Presenting of best-corrected acuity	Cause data available
Egypt	13	1994	Subnational	7–15	5839	Urban	No	Both	All-cause, refractive error
Egypt	Egypt Fayoum Kasr Baseal Rapid Assessment	2009	Local	50–99	2905	Rural	Yes	Both	All-cause
Egypt	Egypt Kafarelsheakhshabas Rapid Assessment	2009	Local	50–99	2918	Rural	Yes	Both	All-cause
Egypt	Egypt Sohag Baga Rapid Assessment	2010	Local	50–99	2953	Rural	Yes	Both	All-cause
Egypt	Egypt Banisweilf Mazora Rapid Assessment	2010	Local	50–99	2811	Rural	Yes	Both	All-cause
Egypt	Egypt Menya Qalta Rapid Assessment	2010	Local	50–99	2706	Rural	Yes	Both	All-cause
Iran	10	2002	Local	1–99	4565	Urban	No	Both	All-cause, glaucoma, cataracts, macular degeneration, refractive error
Iran	9	2005	Local	7–15	5544	Both	No	Both	All-cause
Iran	17	2006	Local	0–15	136 000	Both	No	Presenting	All-cause
Iran	15	2009	Local	50–99	2819	Both	Yes	Presenting	All-cause
Iran	16	2008–2009	Local	40–64	5190	Urban	No	Presenting	All-cause
Lebanon	4	1995	National	3–98	10 148	Both	No	Presenting	All-cause, glaucoma, cataracts, macular degeneration, refractive error
Morocco	5	1992	National	0–99	8878	Both	No	Best-corrected	All-cause, glaucoma, cataracts, macular degeneration
Palestine	6	1982–1983	Local	0–99	9054	Both	No	Presenting	All-cause, glaucoma, cataracts, macular degeneration, refractive error
Palestine	18	2008	Local	50–99	3579	Both	Yes	Presenting	All-cause
Oman	12	1996–1997	National	0–99	11 417	Both	No	Presenting	All-cause, glaucoma, cataracts, macular degeneration, trachoma, refractive error
Qatar	19	2009	National	50–99	2433	Both	Yes	Best-corrected	All-cause
Tunisia	7	1993	National	0–99	3547	Both	No	Presenting	All-cause
Turkey	8	1989	Subnational	0–99	7497	Both	No	Presenting	All-cause
Yemen	Yemen Amran Rapid Assessment	2009	Local	50–99	1789	Rural	Yes	Both	All-cause
Yemen	Yemen Lahj Rapid Assessment	2009	Local	50–99	1836	Rural	Yes	Both	All-cause

From North Africa and the Middle East, data were not available from the following countries: Algeria, Libya, Bahrain, Iraq, Jordan, Kuwait, Syrian Arab Republic, Saudi Arabia and the United Arab Emirates.

macular degeneration, glaucoma, diabetic retinopathy and trachoma were higher in NAME than those reported globally for every cause in 1990 and 2010 (table 4). Since 1990, a decrease of proportions of blindness due to cataract and trachoma was observed. Conversely, an increase of the proportions of blindness due to uncorrected refractive errors (URE) (12.7% vs 13.1%), macular degeneration (6.4% vs 10.3%), glaucoma (5.6% vs 9.6%) and diabetic retinopathy (2.7% vs 3.5%) for the period from1990 to 2010 was reported.

URE and cataract were the most frequent causes of MSVI in the NAME region and globally in 1990 for all ages (table 5). Other causes included trachoma, macular degeneration, diabetic retinopathy and glaucoma. The mean frequencies of MSVI were similar in NAME and globally, except for trachoma, which was more frequent in NAME (3.7% vs 1.3%), and URE, which were more frequent globally (41.4% vs 51.1%).

URE and cataracts remained the most frequent causes of MSVI in NAME and the world in 2010 (table 5). There were similar proportions of MSVI from cataract in NAME and globally. Proportions of MSVI from URE were lower in NAME than worldwide. Proportions of MSVI from macular degeneration, glaucoma, diabetic retinopathy and trachoma were higher in NAME than in the world. The proportion of MSVI attributable to cataract decreased since 1990 (from 43.2% to 41.4%) in contrast to the proportion of MSVI caused by URE, which demonstrated a slight increase (from 51.1% to 52.9% worldwide). Proportions of MSVI attributable to trachoma decreased from 1990 to 2010 (from 3.7% to 2.1%); however, proportions

Table 2 Age-standardised prevalence of moderate and severe vision impairment (MSVI; presenting visual acuity <6/18 but ≥3/60) and blindness (presenting visual acuity <3/60) by sex and year in North Africa and the Middle East (NAME)

	Adults ≥50 years						All ages					
	Men		Women		All		Men		Women		All	
Region	Blind (%)	MSVI (%)	Blind (%)	MSVI (%)	Blind (%)	MSVI (%)	Blind (%)	MSVI (%)	Blind (%)	MSVI (%)	Blind (%)	MSVI (%)
1990												
NAME	7.1 (5.2 to 9.0)	23.5 (17.5 to 28.9)	9.4 (7.0 to 11.7)	26.5 (20.1 to 31.9)	7 (5.1 to 8.9)	23.1 (17 to 28.5)	1.8 (1.3 to 2.2)	6.6 (4.7 to 8.3)	2.4 (1.7 to 2.9)	7.5 (5.5 to 9.3)	1 (0.7 to 1.3)	3.9 (2.7 to 5.1)
World	2.8 (2.4 to 3.2)	13.8 (11.6 to 15.6)	3.2 (2.9 to 3.7)	14.8 (12.5 to 16.8)	2.9 (2.6 to 3.4)	14.2 (12 to 16.1)	0.7 (0.6 to 0.8)	3.9 (3.2 to 4.4)	0.9 (0.7 to 1.0)	4.3 (3.5 to 4.9)	0.6 (0.5 to 0.7)	3.2 (2.7 to 3.7)
2010												
NAME	3.8 (2.9 to 4.9)	15.5 (13.1 to 20.0)	5.3 (4.1 to 6.7)	17.9 (15.1 to 29.3)	4 (3 to 5)	15.3 (12.8 to 19.8)	0.9 (0.7 to 1.2)	4.1 (3.5 to 5.4)	1.3 (1.0 to 1.6)	4.8 (4.0 to 6.3)	0.7 (0.5 to 0.9)	3.1 (2.5 to 4.1)
World	1.7 (1.5 to 1.9)	9.7 (8.8 to 11.5)	2.1 (1.9 to 2.4)	11.0 (10.0 to 13.1)	1.9 (1.7 to 2.2)	10.4 (9.4 to 12.3)	0.4 (0.4 to 0.5)	2.7 (2.4 to 3.2)	0.5 (0.5 to 0.6)	3.1 (2.8 to 3.7)	0.5 (0.4 to 0.5)	2.8 (2.5 to 3.3)

95% uncertainty interval is shown in parentheses.

of MSVI from macular degeneration (from 1.8% to 4.1%), diabetic retinopathy (from 1.6% to 2.4%) and glaucoma (from 1.4% to 3.0%) increased (table 5).

DISCUSSION

Published data on blindness and MSVI from countries belonging to the NAME region were relatively old and were not available for all countries of the region.[4–13] Recent data (published since 2010) were reported for Iran,[14–17] occupied Palestinian territories[18] and Qatar.[19] Recent data from other North African countries were particularly lacking. According to these publications, reported mean prevalences of blindness and MSVI in NAME countries were ranging from 0.4 to 8.25% and 1.8 to 10.9%, respectively.[4–19]

The results of this study provide the first meta-analysis on the prevalence of blindness and MSVI in NAME. In this study, data sources were available from the majority of countries belonging to the region. Data that met the GBD inclusion criteria included 21 studies from Iran, Palestine, Oman, Tunisia, Turkey, Qatar, Egypt, Yemen, Lebanon and Morocco. Of these studies, 10 (48%) involved the rapid assessment methodology, and the majority were regional and not national in scope.

Our results show a 48% decrease in age-standardised prevalence of blindness in NAME from 1990 to 2010 (all ages: 2.1% vs 1.1%), as well as a 37% decrease in the age-standardised prevalence of MSVI (7.1% vs 4.5%). Overall, prevalence rates of blindness and MSVI were higher than those reported worldwide in 1990 and in 2010 for all age groups and for people ≥50 years group. However, there was a 4.1% increase in overall numbers of people who were blind in NAME from 1990 to 2010 (2.995 million vs 3 118 757), and a 16.1% increase in overall numbers of people who had MSVI (11.800 million vs 13.700 million). This may be the consequence of population growth and the relative increase in older adults.

The prevalence rates of blindness and MSVI are higher in people ≥50 years group than all age groups in 1990 and 2010. A very strong correlation between aging and the incidence of blindness has been reported in the developing countries.[20]

In this study, the prevalence rates of blindness and MSVI in women were significantly higher than in men for all age groups and for people ≥50 years in 1990 and 2010. There were significantly more women who were blind or had MSVI than men. This finding is consistent with previous meta-analyses of various worldwide studies that revealed a consistent pattern of sexual inequality in eye health, and reported that higher proportion of worldwide blindness was in women, a difference that was significant in most countries.[21 22] In these surveys, the excess of blindness in women was more marked among the elderly and not entirely explained by differential life expectancy.[21] For example, the high prevalence of vision loss in women in Oman is due in part to a lower cataract surgical coverage in women than men.[23] Moreover, data on trachoma have also revealed a preponderance of women with trichiasis and associated vision loss as compared with men.[24]

This difference in gender may be explained by the fact that women often have less access to family financial resources to pay for eye care or transportation to reach a hospital, and by the lack of access to information and resources. In fact, female literacy, especially among the elderly, is low and women are less likely to know about the possibility of surgery for cataract or trichiasis than men and may have limited access to time and money to seek eye care services. Global awareness of and local approaches to improving gender equity in eye care service use in NAME will be critical.

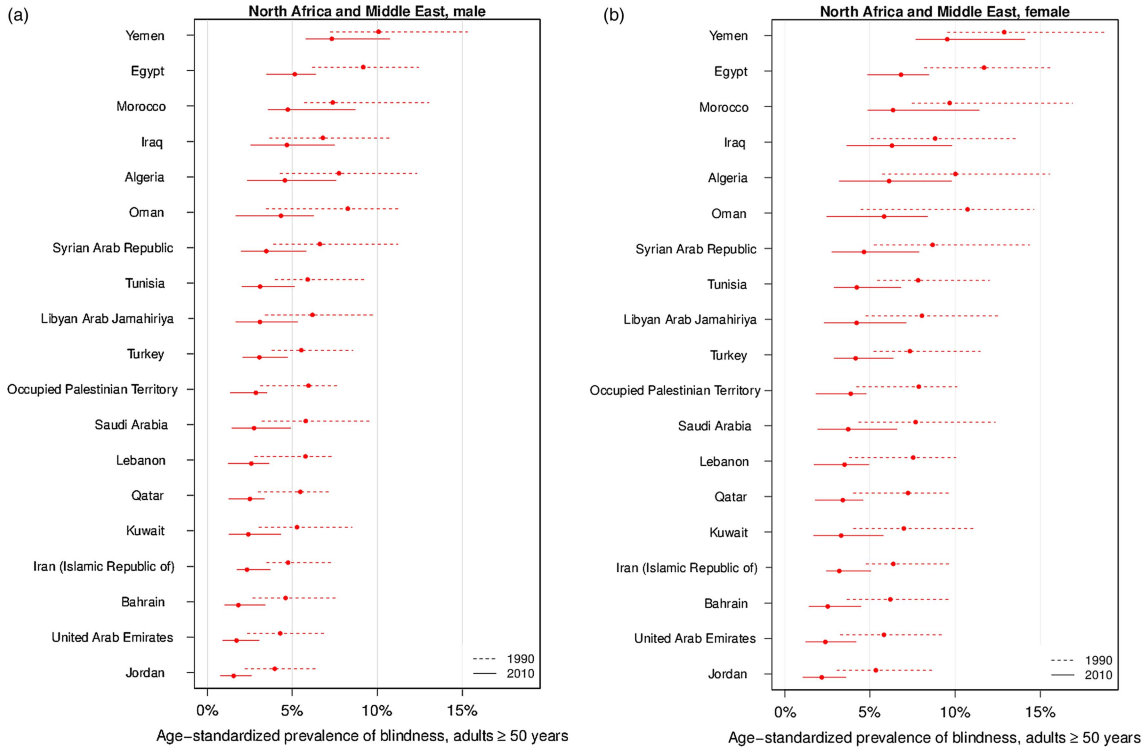

Figure 1 (A) Ladder plot showing the age-standardised prevalence of blindness and change in men aged 50+ years for 1990 and 2010. These estimates are derived from the statistical model. (B) Ladder plot showing the age-standardised prevalence of blindness and change in women aged 50+ years for 1990 and 2010. These estimates are derived from the statistical model.

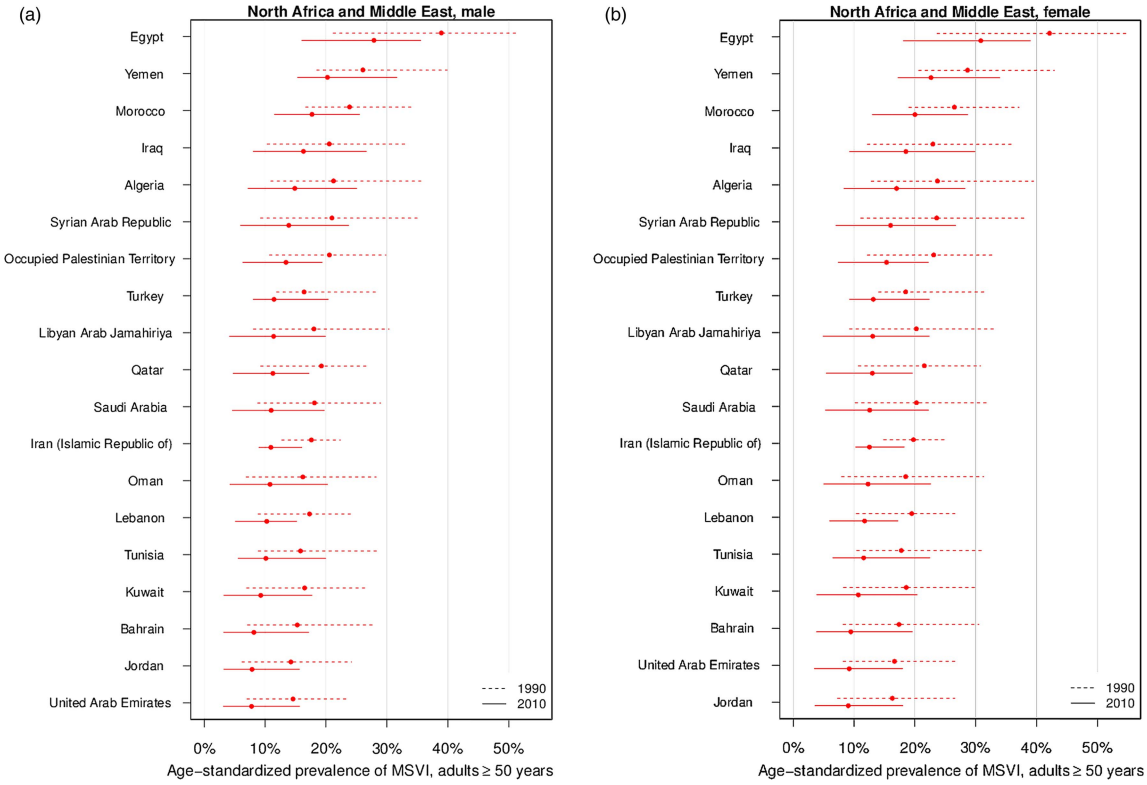

Figure 2 (A) Ladder plot showing the age-standardised prevalence of moderate and severe vision impairment (MSVI) and change in men aged 50+ years for 1990 and 2010. These estimates are derived from the statistical model.(B) Ladder plot showing the age-standardised prevalence of MSVI and change in women aged 50+ years for 1990 and 2010. These estimates are derived from the statistical model.

Table 3 Absolute numbers of subjects affected by moderate and severe vision impairment (MSVI; presenting visual acuity <6/18 but ≥3/60) and blindness (presenting visual acuity <3/60) by sex and year in North Africa and the Middle East (NAME) (all ages)

	Men			Women			All		
Region	Blindness ('000s)	MSVI ('000s)	Total population of the region ('000s)	Blindness ('000s)	MSVI ('000 s)	Total population of the region ('000s)	Blindness ('000 s)	MSVI ('000s)	Total population of the region ('000s)
1990									
NAME	1229 (894 to 1584)	5413 (3706 to 7057)	153 000	1772 (1276 to 2243)	6408 (4474 to 8167)	149 000	2995 (2154 to 3834)	11 800 (8160 to 15,300)	301 000
World	12 775 (11,059 to 14,746)	75 315 (61,143 to 86,983)	2 673 690	19 039 (16,811 to 22,103)	96 892 (79,823 to 111,438)	2 633 378	31 816 (28,143 to 36,745)	172 213 (142,749 to 198,125)	5 300 000
2010									
NAME	1226 (926 to 1,585,512)	6106 (5034 to 8174)	228 000	1890 (1441 to 2400)	7543 (6125 to 9942)	218 000	3118 (2347 to 3969)	13 700 (11,200 to 18,200)	446 000
World	12 848 (11,418 to 14,626)	82 740 (74,444 to 99,069)	3 491 935	19 611 (17,719 to 22,165)	108 883 (99,159 to 130,141)	3 434 618	32 411 (29,351 to 36,524	191 342 (173,910 to 229,823)	6 890 000

95% uncertainty interval is shown in parentheses.

In this study, although proportions of blindness and MSVI attributable to cataract decreased significantly from 1990 to 2010, cataract remained to be the most common cause of blindness, causing 29.2% and 23.4% in 1990 and 2010, respectively, and the second most common cause of MSVI. Improvement of cataract surgical care has taken place in many areas in NAME with intraregional cooperation; however, much better access to health services for early cataract surgery and much better training to improve the quality of cataract surgery are needed.

URE was the most common cause of MSVI, causing 41.4% and 43.2% in 1990 and 2010, respectively, and the second most common cause of blindness. Early detection, by performing vision tests in the beginning of every school year, and correction of refractive errors mainly in schoolchildren are necessary to avoid visual impairment from URE. Given that the statistical model used the difference in prevalence of vision impairment between best-corrected and presenting vision, some caution must be exercised when interpreting the contribution of URE. There is likely more uncertainty around the contribution of URE in the more distant past on account of fewer older studies measuring best-corrected and presenting vision (favouring measurement of one or other) than more recently.

Proportions of blindness and MSVI from trachoma showed a significant decline most likely because of socioeconomic development and programmes that aim to eliminate avoidable causes of blindness since many countries from NAME are part of the WHO Alliance for the Elimination of blinding Trachoma by the year 2020 (GET 2020).[24] According to the WHO Global Health Atlas, more than half a million cases of trachoma occur in the NAME region, with the largest number in Yemen, followed by Algeria and Iraq.

Morocco, Iran and, recently, Oman reported to WHO the achievement of the intervention targets for the elimination of blinding trachoma as a public health problem through the specific implementation of the SAFE (surgery, antibiotics, facial cleanliness and environmental control) strategy. Oman was verified for achieved elimination in November 2012, and Morocco will be verified in October 2013. Overall, elimination targets are on track in the nations of Algeria, Libya, Saudi Arabia and the United Arab Emirates, Egypt by 2019 and Yemen by 2020.[25]

In contrast, proportions of blindness and MSVI due to macular degeneration, glaucoma and diabetic retinopathy showed an increase in 2010 compared with 1990, probably because of an increased life expectancy and improvement of the overall socioeconomic situation and industrialisation in NAME. In fact, some developed countries have declared posterior segment disorders such as age-related macular degeneration, diabetic retinopathy and optic nerve atrophy as the main cause of blindness.[21 22] A continuous effort to improve early detection and appropriate treatment is the main strategy to reduce the number of patients suffering from visual loss caused by the late diagnosis of glaucoma. Appropriate interventions must also include diabetes prevention and optimal medical and ocular care and screening of diabetic retinopathy.

In the light of the reported major causes of visual loss in NAME, cataract, URE, trachoma, childhood blindness, diabetic retinopathy, macular degeneration and glaucoma are the regional priority. Particular attention to women, ageing population, rural groups and those with little or no education is needed in the creation of targets for blindness reduction and in the development of interventions as these are the high-risk groups for visual impairment.

Our study has some limitations. In fact, many country-years remained without data (including Algeria, Libya, Bahrain, Iraq,

Table 4 Percentage of blindness (presenting visual acuity <3/60) by cause, in North Africa and the Middle East (NAME) and the world, 1990 and 2010, all ages

Region	Cataract (%)	Uncorrected refractive error (%)	Macular degeneration (%)	Glaucoma (%)	Diabetic retinopathy (%)	Trachoma (%)	Other causes/ unidentified (%)
1990							
NAME	29.2 (25.5 to 33.4)	12.7 (7.6 to 16.6)	6.4 (5.2 to 8.0)	5.6 (4.4 to 7.6)	2.7 (2.3 to 3.5)	5.1 (3.4 to 6.2)	38.3 (34.2 to 42.8)
World	38.6 (35.2 to 42.0)	19.9 (14.9 to 24.9)	4.9 (4.4 to 5.8)	4.4 (4.0 to 5.1)	2.1 (1.9 to 2.5)	2.8 (2.3 to 3.1)	27.4 (24.9 to 30.0)
2010							
NAME	23.4 (18.7 to 28.6)	13.1 (7.8 to 17.1)	10.3 (7.8 to 13.6)	9.6 (7.5 to 13.2)	3.5 (2.8 to 5.0)	2.6 (1.6 to 3.3)	37.6 (31.6 to 43.3)
World	33.4 (29.6 to 36.4)	20.9 (15.2 to 25.9)	6.6 (6.0 to 7.9)	6.6 (5.9 to 7.9)	2.6 (2.2 to 3.4)	1.4 (1.2 to 1.7)	28.6 (26.1 to 31.5)

95% uncertainty interval is shown in parentheses.

Table 5 Proportion of moderate and severe vision impairment (MSVI; presenting visual acuity <6/18 but ≥3/60) by cause, in North Africa and the Middle East (NAME) and the world, 1990 and 2010, all ages

Region	Cataract (%)	Uncorrected refractive error (%)	Macular degeneration (%)	Glaucoma (%)	Diabetic retinopathy (%)	Trachoma (%)	Other causes/ unidentified (%)
1990							
NAME	25.1 (20.8 to 29.4)	41.4 (33.1 to 49.2)	1.8 (1.4 to 2.6)	1.4 (1.1 to 1.9)	1.6 (1.3 to 2.1)	3.7 (2.0 to 5.0)	25.0 (21.3 to 29.7)
World	25.6 (22.7 to 28.4)	51.1 (45.6 to 56.0)	1.9 (1.6 to 2.4)	1.2 (1.1 to 1.5)	1.3 (1.2 to 1.6)	1.3 (0.97 to 1.5)	17.6 (15.4 to 20.3)
2010							
NAME	18.0 (13.3 to 22.6)	43.2 (34.5 to 50.1)	4.1 (3.0 to 6.2)	3.0 (2.1 to 4.7)	2.4 (1.8 to 3.9)	2.1 (1.1 to 3.1)	27.1 (21.8 to 32.5)
World	18.4 (15.8 to 20.9)	52.9 (47.2 to 57.3)	3.1 (2.7 to 4.0)	2.2 (2.0 to 2.8)	1.9 (1.6 to 2.7)	0.71 (0.56 to 0.91)	20.8 (18.4 to 23.8)

95% uncertainty interval is shown in parentheses.

Jordan, Kuwait, Saudi Arabia, Syrian Arab Republic and the United Arab Emirates), or only had subnational or local data. Moreover, some data sources did not report prevalence by age.

CONCLUSION

In conclusion, this analysis of data from NAME shows that although the absolute numbers of people with blindness and MSVI have increased between 1990 and 2010, the overall age-specific prevalences and the prevalences in those aged 50+ years have decreased significantly. It suggests the enhanced eye care programmes such as Vision 2020 are having an impact, although clearly there remains more work to be done as over half of the existing vision loss is preventable or treatable.

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Collaborators Group Information: A list of the Vision Loss Expert Group members appears at http://www.anglia.ac.uk/ruskin/en/home/microsites/veru/other_research_areas/global_burden_of_diseases.html.

Contributors MK, RK , SRF, JK, JL, KN, KP, HP, RAW, TYW, HRT and RRB made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data. MK, RK, RRB, SRF and HRT were responsible for drafting the article or revising it critically for important intellectual content. MK, RK, JK, JL, KN, KP, HP, RAW, TYW, SRF, HRT and RRB gave final approval of the version to be published.

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