Spectacle Coverage Report

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Cover photo
Eye care in Pakistan by Courtenay Holden, chosen from IAPB's #StrongerTogether photo contest

Contents

Improving vision among school-going children in India.

Photo by **Amal Gupta #Stronger Together**

Foreword

Uncorrected Refractive Error (URE) is a major cause of public health concern. URE not only has an important impact on the physical and mental wellbeing of the people whose lives are affected by this condition, but it creates an economic burden on countries and societies – it was estimated in 2012 that the annual global productivity loss due to uncorrected refractive error is 269 billion international dollars[1,2].

Impaired vision due to URE can be found in people of all ages. Detecting refractive errors in children has a vital impact on their academic life, and ultimately contributes to a better educated adult population[3]. In adulthood, URE leads to a decrease in overall productivity. URE has an impact on lifestyle, wellbeing and quality of life for everyone affected by this condition.

Most refractive errors can be easily corrected with a simple and low-cost solution: the use of spectacles. Alternative refractive corrective methods include the use of contact lenses and refractive surgery, which are more expensive and accessible mostly in high income countries.

This IAPB report looks at the current data on spectacle coverage, in 27 countries where national level data are available. Spectacle coverage is presented for both distance vision and near vision loss due to URE.

Introduction

"VISION 2020: The Right to Sight", is a global initiative supported by the World Health Organization and IAPB, which aims to eliminate avoidable blindness. One of the main problems identified and confronted in this important initiative is that of URE[4].

Distance vision loss

As stated by the WHO in 2014: *"285 million people are estimated to be visually impaired worldwide: 39 million are blind and 246 million have low vision"*[5] *and "globally, uncorrected refractive errors are the main cause of moderate and severe visual impairment; cataracts remain the leading cause of blindness in middle- and low-income countries"*[5]. The World Health Organization estimates that 43% (123 million) of this disease burden is due to URE (myopia, hyperopia or astigmatism)[5,6].

It is also known that the majority of visually impaired people (90%) come from developing countries and that 65% of visually impaired persons are aged 50 years or over[5,6].

It is estimated by Holden et al., that in the year 2000 there were 1,406 million people living with myopia (22.9% of the world population), and 163 million people with high myopia (2.7% of the world population). The projections for 2050 describe 4,758 million people living with myopia (49.8% of the world population) and 938 million people affected by high myopia (9.8% of the world population).[7]

Near Vision loss

In addition, many people are also affected by near vision loss. Definitions of vision loss, as categorised by the International Classification of Diseases – 10th revision, only consider distance vision impairment and due to these the numbers of those affected by presbyopia have not been included in previous WHO estimates.

Presbyopia affects almost everyone as they age, so unsurprisingly a 2005 study estimated that the condition could be found in 1.04 billion people worldwide. Most startlingly, it was estimated that of these 517 million had either inadequate or simply no spectacles whatsoever[8]. Due to this inadequate access to the correct prescription spectacles 410 million of these people could not perform near tasks in a normal way[8].

Methodology and data sources

The majority of Rapid Assessment of Avoidable Blindness (RAAB) studies conducted to date have measured access to spectacle coverage in sub-national geographic areas which cannot be interpreted to represent the national picture. However some RAABs have been conducted that provide national information – spectacle coverage data from 27 countries were available for distance vision refractive errors and 17 countries for presbyopia. Disaggregated data by gender were available.

The data are shown in the Appendix section in Table 1 and were provided by Dr Hans Limburg from the RAAB repository[9]. While data on uncorrected refractive error and spectacle coverage are available from all RAABs, uncorrected presbyopia in people aged 50 and over is recorded since 2013.

The Spectacle coverage for distance vision was calculated using the following formula:

$$\frac{\text{(\% Prevalence of refractive errors – \% Prevalence of uncorrected refractive errors)}}{\text{(\% Prevalence of refractive errors)}}$$

The Spectacle coverage for presbyopia was calculated assuming 100% of prevalence of presbyopia, and with the following formula:

100% – % of people aged 50+ not using reading glasses

The World Bank International Comparison Program Database was accessed to provide data for:

- Gross Domestic Product (GDP) per capita converted to international dollars using purchasing power parity (PPP) rates[10].
- Government Health Expenditure (HE) per capita, current US$[11].

For GDP and Health Expenditure, the data were accessed for the year in which the RAAB study providing the spectacle coverage information was conducted. The data is shown in the Appendix section, Table 2.

GDP data was available for 24/27 countries (not available for Argentina, Moldova and Palestine). Health expenditure data was available in 26/27 countries (not available for Palestine).

Analyses were done in Microsoft Office Excel and Stata 14 by Dr Adriane Becker Contreras and Dr Jennifer Evans.

A delighted patient experiences seeing clearly again.

Photo by **Graham Coates #Stronger Together**

Limitations of the data used in this report

It is not possible to come to global conclusions as data was only available from 27 countries. This represents about 1/7th of the total number of countries in the world (about 4.4% of the world's population).

The 27 countries are not drawn equally from around the world: 13 are Latin American, 6 are Asian, 5 are African, 2 European and 1 Eastern Mediterranean.

The RAAB studies only focus on a population aged 50 and over, not providing data on younger populations in which refractive errors are important and have significant implications for their development and later contributions to society.

The prevalence of presbyopia is assumed to be 100% in the 50+ age group. While it is likely that close to 100% of the people aged 50 years and over have reduced accommodation, this does not mean they all need glasses for near vision. Most people who have mild myopia, a quite common condition in places like Asia[12], may simply take off their distance glasses to read. A more accurate estimate of the need would be to ascertain the prevalence of functional presbyopia. This is defined *"as needing a significant optical correction added to the presenting distance refractive correction to achieve a near visual acuity"*[13]. It is important to mention that in the future RAAB will be developed to include a near vision test to calculate functional presbyopia needs more accurately[14].

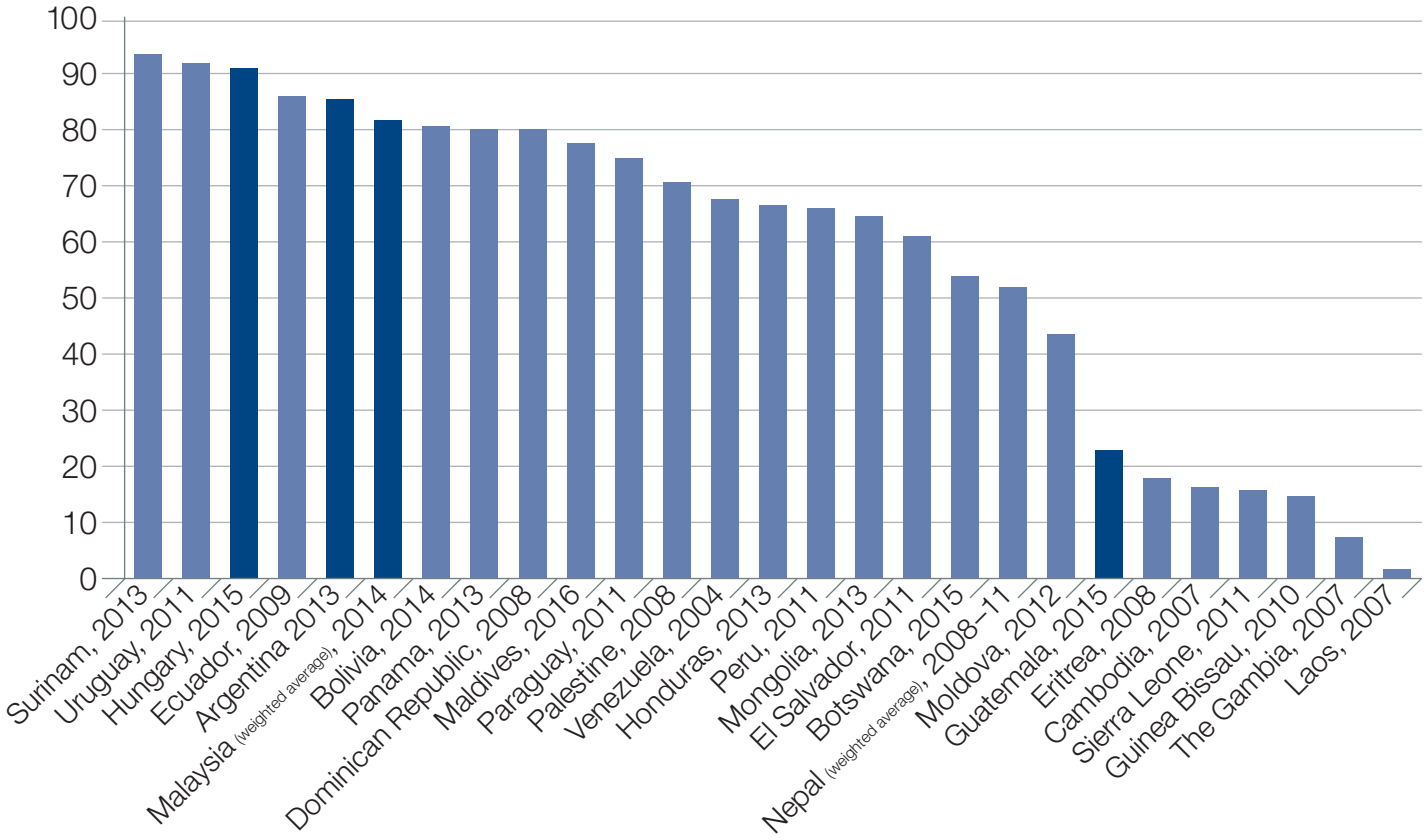
The VA definition for the diagnosis "refractive error" depends on the version of the RAAB software that is used. In the RAAB6 VA < 6/12 (for Argentina, Malaysia, Hungary and Guatemala) is used as the lowest level of visual impairment; in RAAB5 it is VA < 6/18 in the rest of the countries in this report. Accordingly the data from these two groups are not directly comparable.

Finding 1 The prevalence of spectacle coverage was very variable across the countries where data was available

Observation 1.1

Levels of spectacle coverage to correct distance vision refractive error were very variable across the 27 countries, ranging between 93% and 2%.

Figure 1. Percentage of spectacle coverage for distance vision in 27 countries



Argentina, Hungary, Malaysia and Guatemala (dark blue): VA definition of < 6/12. Rest of countries VA definition of <6/18

The spectacle coverage for distance vision in people aged 50+ with a refractive error who are using distance vision correction, is shown in Fig 1. As mentioned in the limitations these data are not directly comparable as they were collected with different definitions and over a quite long period of time (8 years).

There is no internationally accepted target as to what constitutes adequate spectacle coverage for distance vision. The highest spectacle coverage of all was seen in Surinam with 93% and 9/27 countries had a coverage of ≥80%, whilst 7/27 countries had a coverage of ≤25%.

All the thirteen Latin American countries had a coverage of ≥60%, whilst all five African countries were in the range of 7–23%. Cambodia (16%) had low coverage as did Laos, which at 2% was the lowest of all 27 countries.

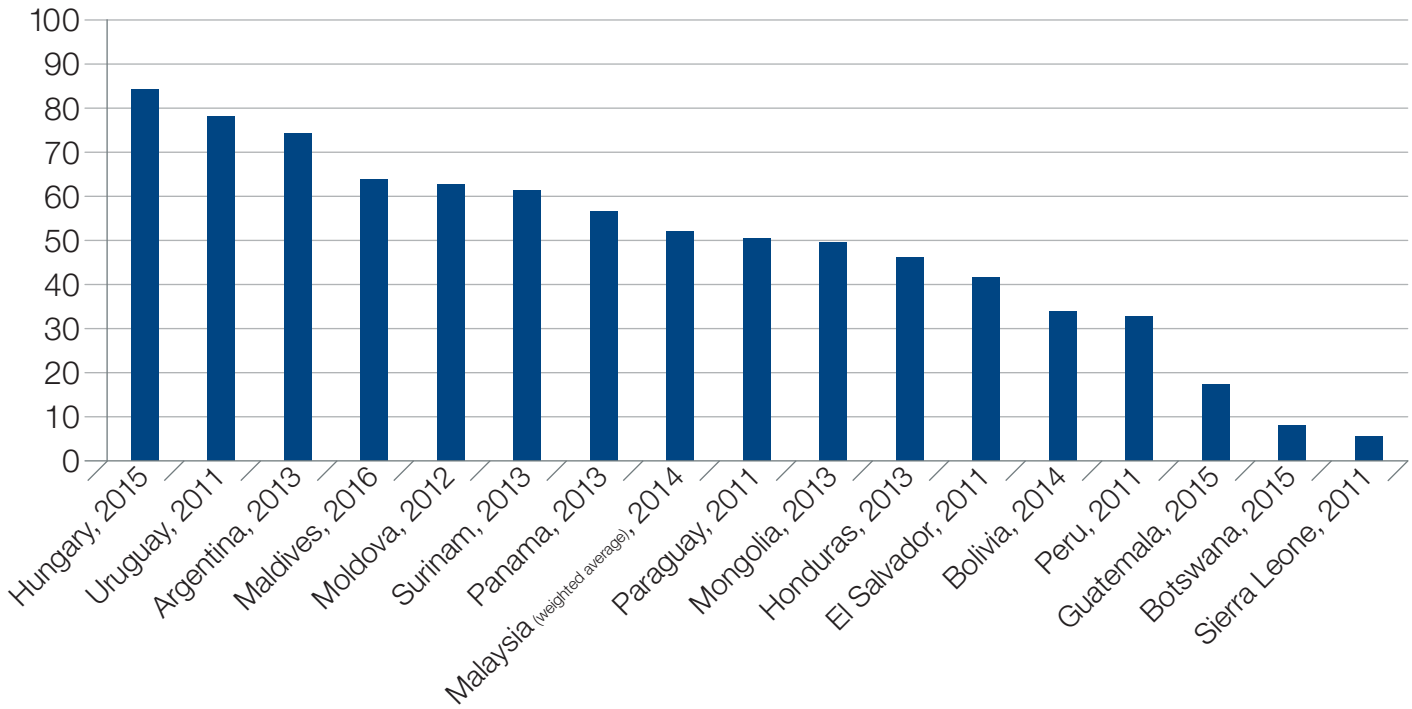
Better vision improves quality of life, Guatemala.

Photo by **Guillermo Alvarez #Stronger Together**

Observation 1.2

Levels of spectacle coverage to correct presbyopia were very variable across the 17 countries, ranging between 84% and 6%.

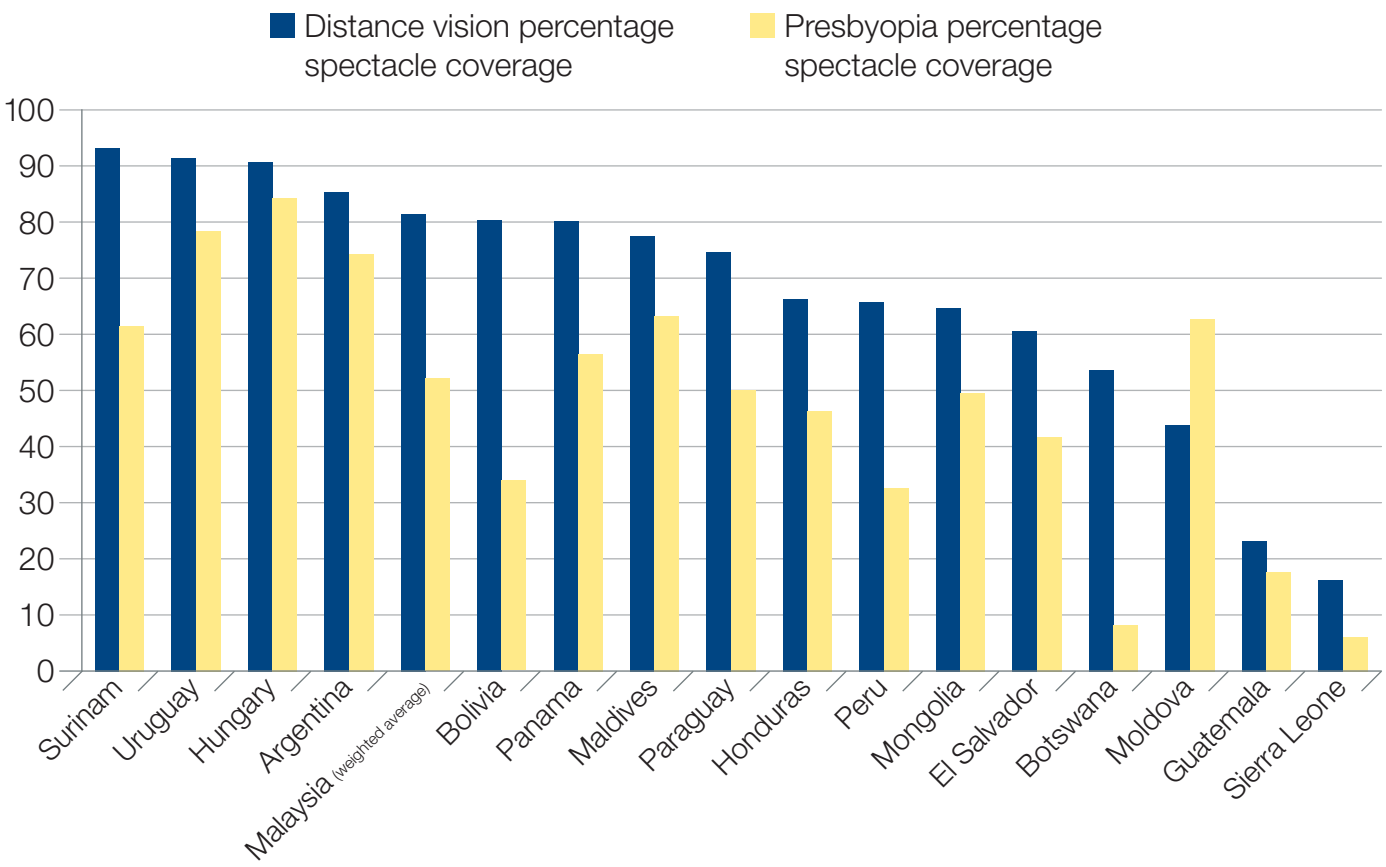
Figure 2. Percentage of spectacle coverage for presbyopia in 17 countries



The spectacle coverage for presbyopia is shown in Figure 2. As with distance vision, considerable variation was seen across the 17 countries that data was available for.

Only Hungary recorded a spectacle coverage rate for presbyopia of ≥80% whilst the two African countries recorded the lowest rates at ≤10%.

Figure 3. Comparison for percentage of spectacle coverage for distance vision and presbyopia



In most countries (16/17) the spectacle coverage for presbyopic correction was lower than that recorded for distance vision. However the shortcoming in estimating the need for presbyopic correction – i.e. the assumption that all persons over the age of 50 require correction as opposed to calculating the functional presbyopic need- would have the effect of depressing the presbyopic coverage rates.

Children enjoying school in their spectacles.

Photo by **Edgardo Contreras #Stronger Together**

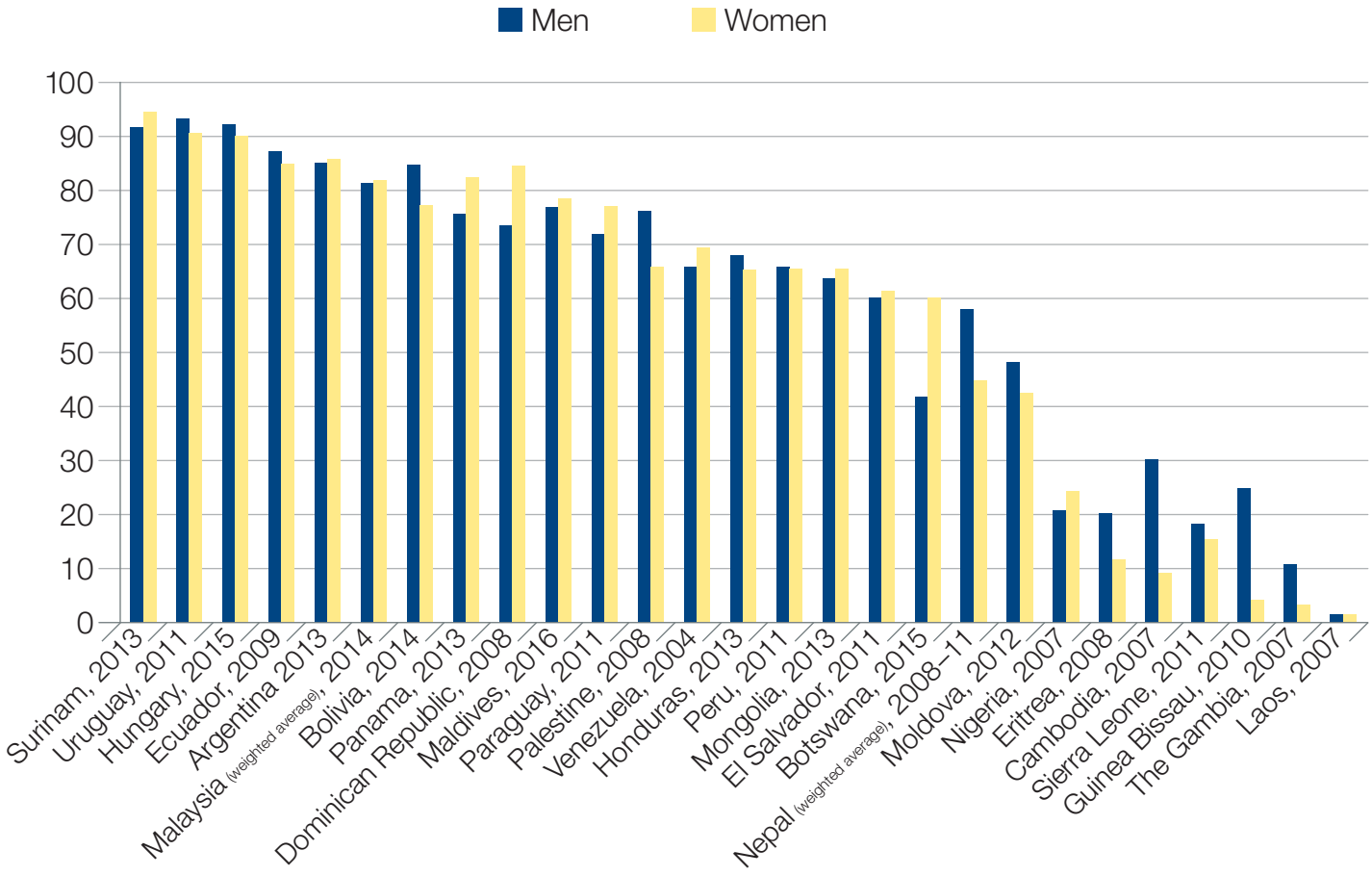
Finding 2 No clear trend was apparent in terms of the spectacle coverage of men compared with women

Distance vision

Observation 2.1

For distance vision spectacle coverage an overall parity was apparent between genders. 14/27 countries leaning towards men, 11/27 towards women, and 2 equal.

Figure 4. Percentage spectacle coverage in men versus women for distance vision

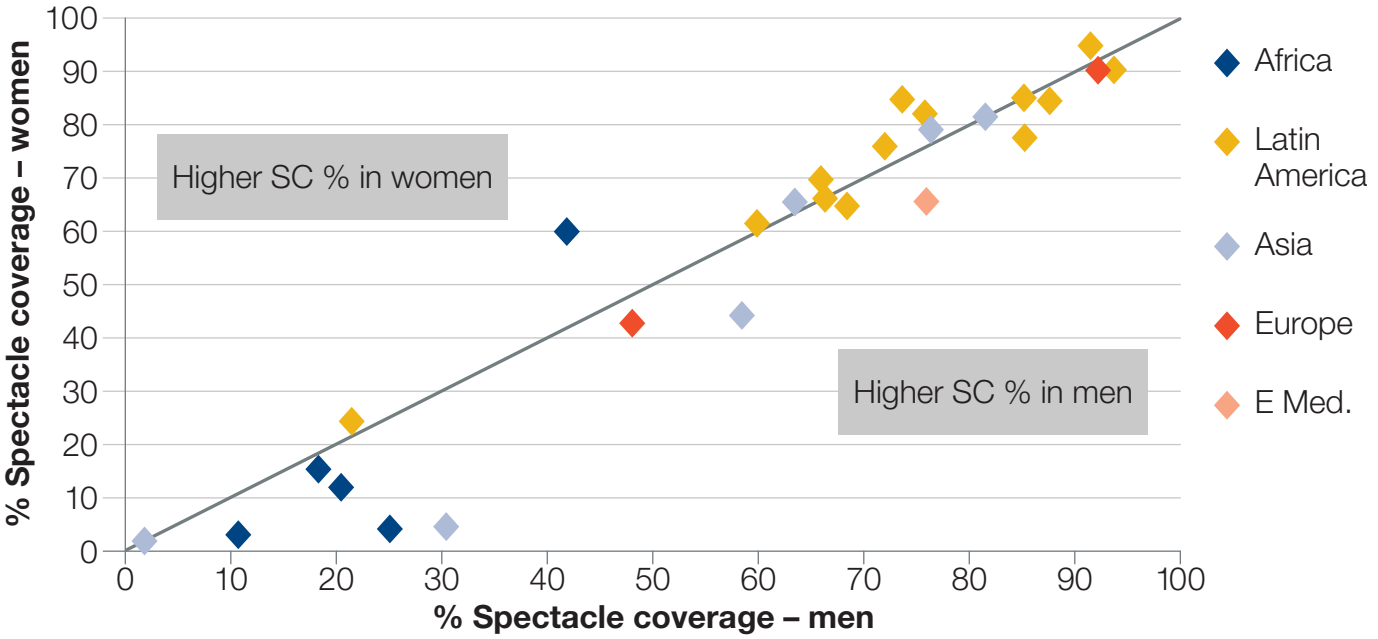


Figures 4 and 5 represent the spectacle coverage between men and women for distance vision. Globally, a clear picture does not emerge.

It is welcome to see that over half of the Latin American countries have a higher uptake of spectacle wearing amongst women. In Africa four out of five countries favoured men.

There are only two European countries included in this report, both showing a higher spectacle coverage in men, while the six Asian countries tend to show equal spectacle coverage.

Figure 5. Percentage spectacle coverage in men versus women for distance vision: regional distribution



Presbyopia

Observation 2.2

Spectacle coverage for presbyopia favoured women in twelve of the seventeen countries.

Figures 6 and 7 represent the comparison between Spectacle coverage in men and women for near vision correction.

The five Asian and European countries favoured women in this regard. This may reflect the fact that there will be more elderly women in the age 50+ cohort compared to men and the need for presbyopia correction will be greater as they age. Additionally the tasks that older women engage in compared with men may require better near vision. Seven of the ten Latin America countries had greater spectacle coverage for presbyopia for women than men with El Salvador almost at parity, and Bolivia, Peru and Guatemala favouring men.

Of the two African countries that had data for presbyopic spectacle coverage, one favoured women (Botswana) and the other favoured men (Sierra Leone).

Figure 6. Percentage spectacle coverage in men versus women for presbyopia

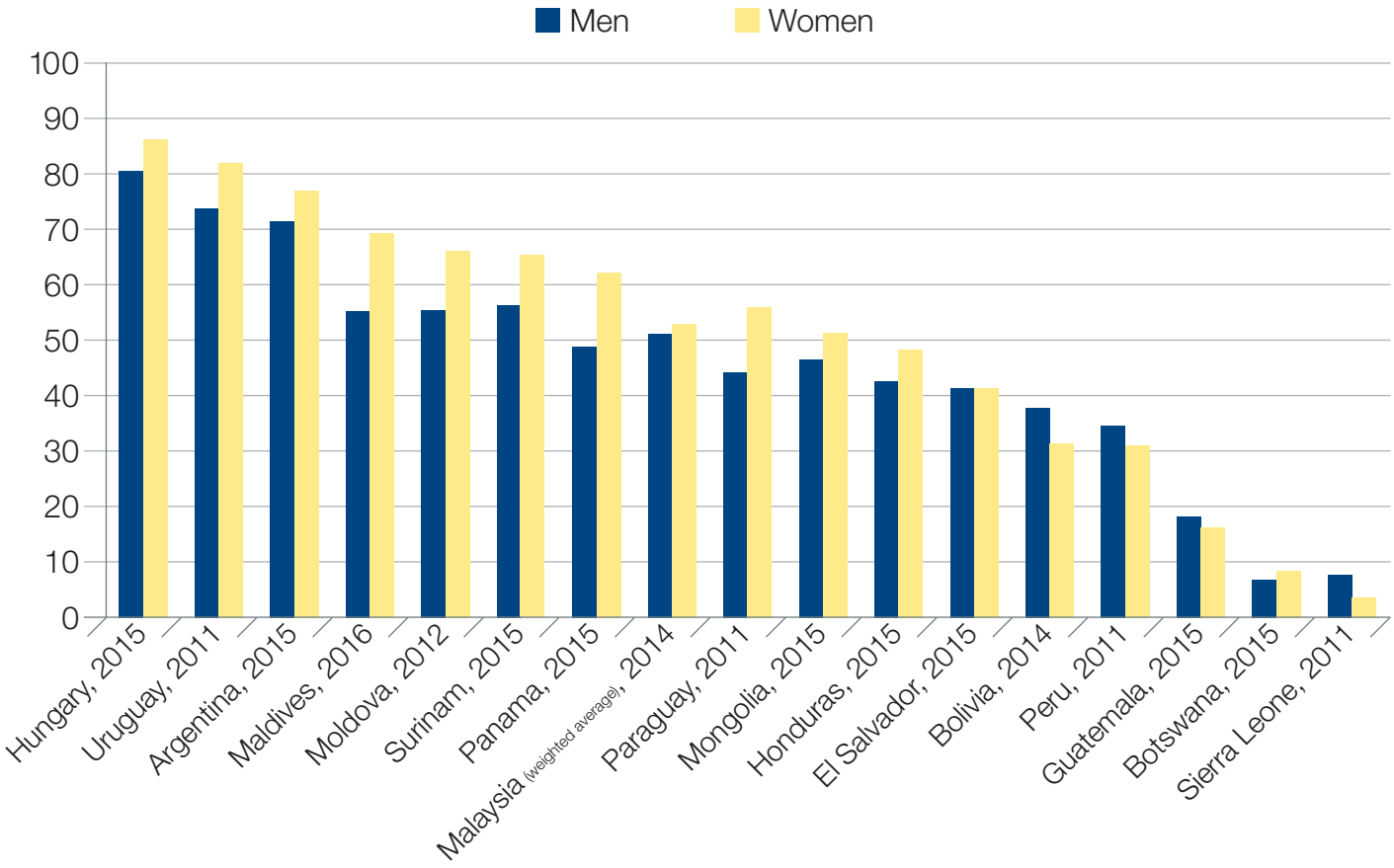
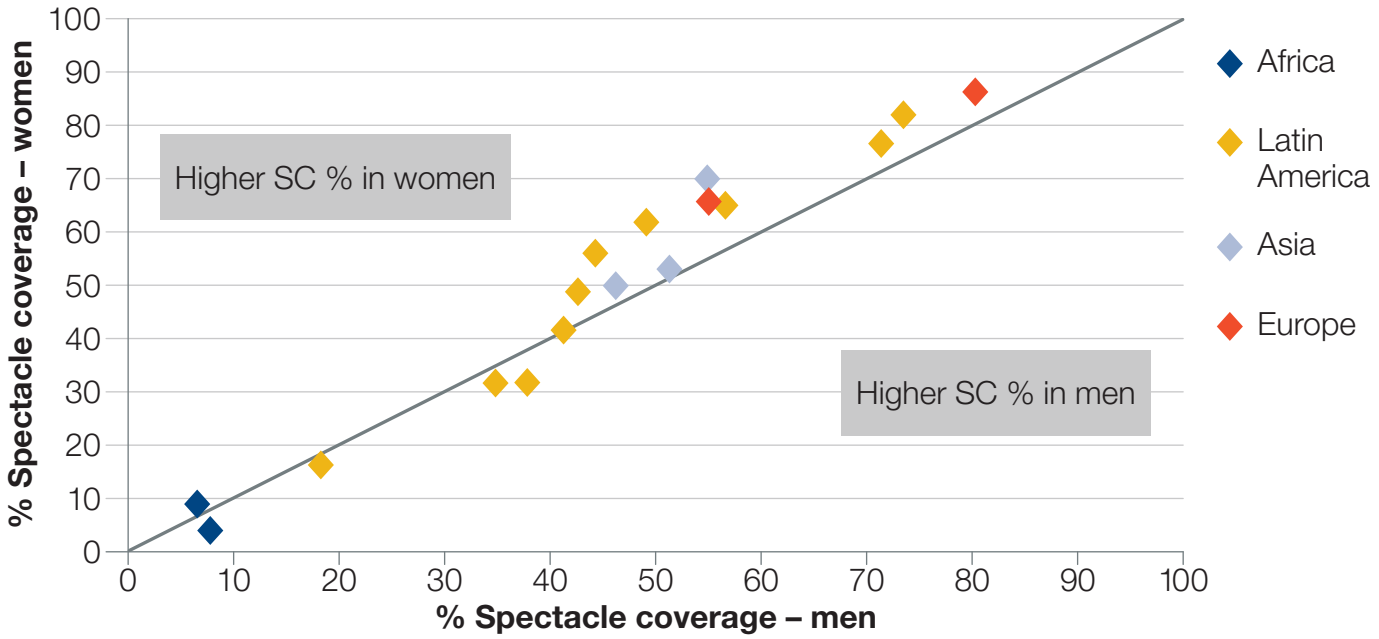


Figure 7. Percentage spectacle coverage in men versus women for presbyopia: regional distribution



A young patient enjoying life with his grandfather in Bangladesh.

Photo by **Duke #Stronger Together**

Finding 3 There is a correlation between gross domestic product and government health expenditure with spectacle coverage

GDP

Observation 3.1

Spectacle coverage improves as GDP increases, although variations become evident with some poorer countries outperforming wealthier countries.

Figure 8. Correlation of GDP and spectacle coverage for distance vision

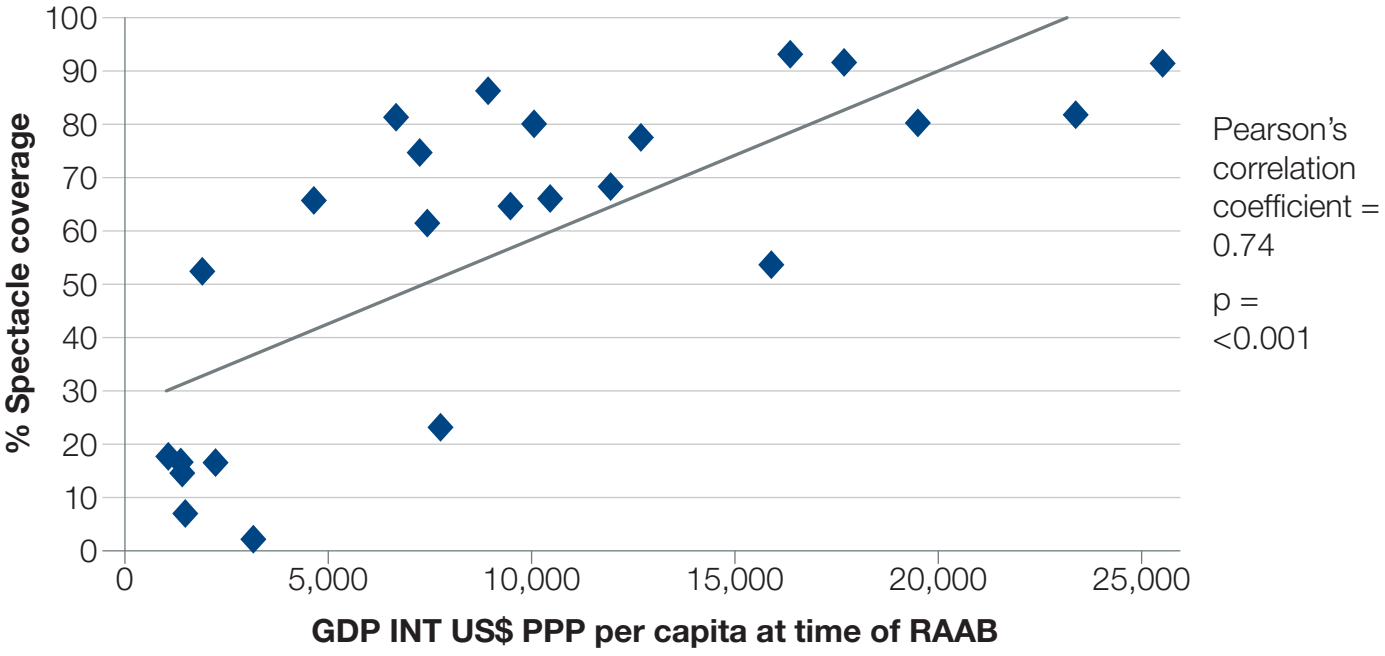
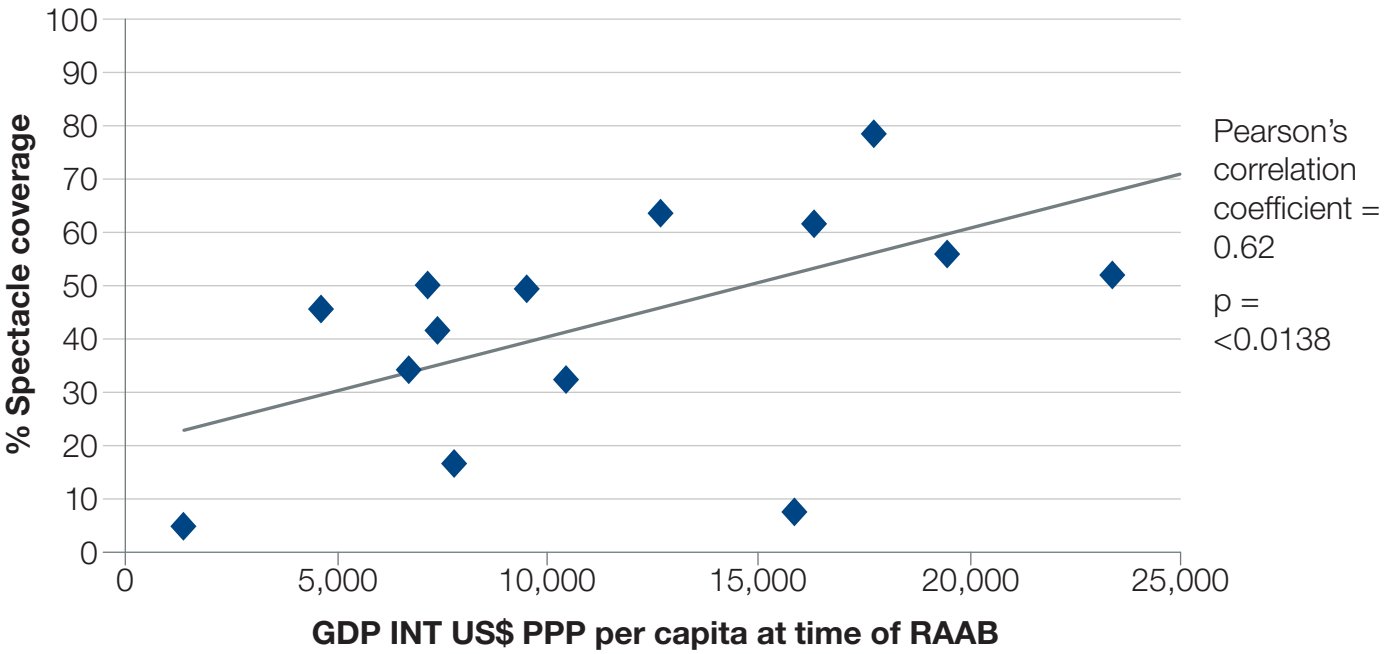


Figure 9. **Correlation of GDP and spectacle coverage for presbyopia**



Health expenditure

Observation 3.2

Spectacle coverage improves as government expenditure in health increases, while it is possible to find some countries that have a lower coverage with a higher investment in health.

Figure 10. **Correlation of health expenditure and spectacle coverage for distance vision**

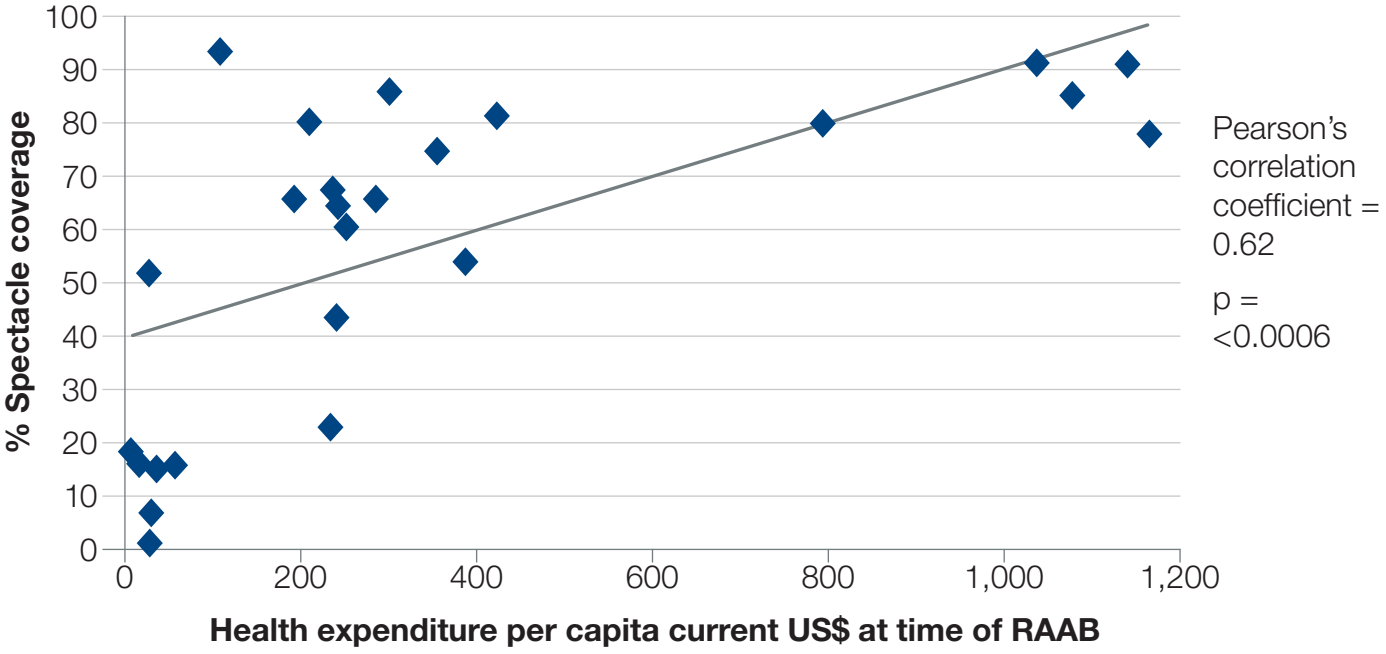
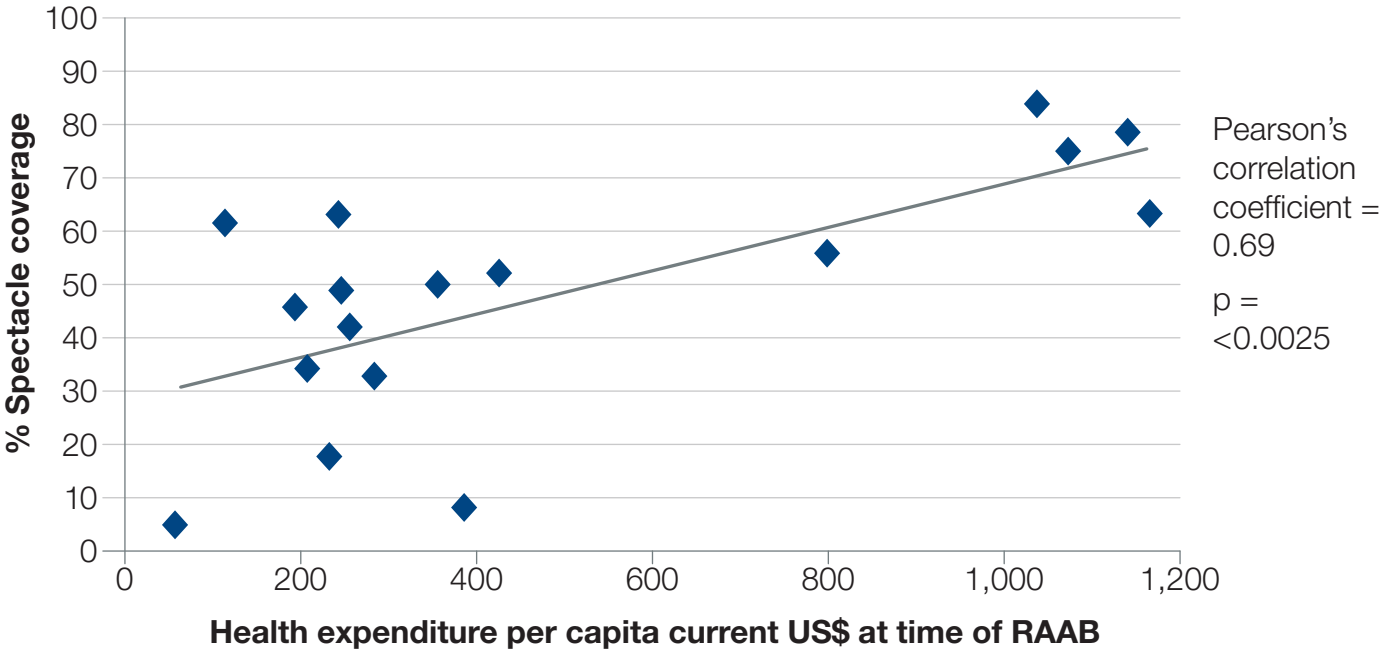


Figure 11. Correlation of health expenditure and spectacle coverage for presbyopia



The effectiveness and coverage of public health interventions is influenced by economic determinants. As might be expected the data shows there is a positive correlation between spectacle coverage and GDP and health expenditure.

More detailed information on specific expenditure on eye health care policies would provide a better and more specific insight for this correlation, but this kind of information is virtually non-existent and not specifically provided.

It is crucial to acknowledge that health care expenditure within developing countries is more focused on life threatening diseases and conditions and they need to prioritise their spending.

Discussion

UREs are extremely common and prevalent throughout the world's population. They are an unnecessary burden on society and have a major impact on a person's quality of life.

Sight is often taken for granted, but it plays a huge part in a person's ability to function and be a productive member of their community. Refractive error can affect a person in different ways, from blurry vision to becoming visually impaired and losing one's sight entirely. A simple pair of ready-made or tailored prescription glasses can have the power to change someone's life in unimaginable ways.

With the knowledge that it is such a large, widespread problem with such a low cost solution, awareness needs to be spread. Unfortunately, it is those most vulnerable and unable to access services that are most affected.

Most Latin American countries represented in this report have relatively better results for spectacle coverage, as do the Asian and European countries. Those in Africa, however, mostly have low spectacle coverage. Several factors such as an inequitable access to refractive and optical services and a critical shortage of eye health staff contribute to the low coverage in Africa. Additionally one study that addressed the situation in Zanzibar (although not part of our report) stated that the likely causes for the low spectacle coverage are: not considering it a priority, cost, and the unwillingness of a person to travel and spend money on prescription glasses[15].

A young woman with her new spectacles, Colombia.

Photo by **Yaacov Pena #Stronger Together**

Gender equality is far from being achieved in most of the African countries included in this study, where society is still strongly dominated by men (arguably this is true for most of the countries included in this report). It is important to consider the social factors preventing women from gaining access to healthcare, even though there are strategies aimed directly at women's health. Some women are prevented from access to spectacles simply because it is an expense that is deemed inessential.

Interestingly, in regards to presbyopic spectacle coverage Hickenbotham et al noted that *"increased association of presbyopia for women is not due to a physiologic difference in accommodation but rather due to other sex differences, such as tasks performed and viewing distances"*[16].

Economic factors are, as always, a factor. However, cultural, societal and religious factors as well as education also play a role in how people perceive and prioritise eye health. There is also the fact that the prevalence of other diseases amongst a country's population often leads to eye health being overlooked due to more serious life threatening concerns.

The greatest burden of URE is found in the older population. Investment in URE services for this age group will ensure that older generations will remain productive members of society and will receive a better quality of life. In addition to this many injuries caused by the inability to see correctly will be avoided, which in turn will alleviate health care expenditure in other areas.

Policy change is required to ensure better evaluation and coverage for those most at risk of URE and to lessen the rate of uncorrected refractive errors. These policies should, most specifically, address helping those in poorer countries and those who are most excluded from mainstream society. It is important to ensure everyone that needs treatment receives it, regardless of wealth, race, geography, or social status.

Specific goals and targets should be created for refractive error correction; not only to facilitate its detection and treatment but to accumulate data and use this as an indicator of sight and quality of life and identify areas where improvements need to be made.

IAPB supports the call made by other authors[17], that better monitoring of refractive errors and its treatment is required.

It is imperative that spectacle services be made affordable and the means of detection and diagnosis be readily available to all people, in every country, especially in those remote communities where neglect is greater and access is almost non-existent. This would be a massive step towards equality in health care distribution and universal health care for all.

Never too late to see again! An elderly woman tries on her new spectacles in Papua New Guinea.

Photo by **Lea Emerson #Stronger Together**

Conclusion

Spectacle coverage data in the 27 countries included in this report indicate considerable difference in the diagnosis and treatment of URE. 7/27 countries had a spectacle coverage rate greater than 80% for distance vision related refractive errors. In contrast 6/27 countries had coverage figures of less than 20%. A variation was found in the 17 countries where data on spectacle coverage for presbyopia was available; 1/17 countries had a coverage of over 80%, and 3/17 had a coverage of less than 20%.

Spectacle coverage could also contribute to the measurement of universal health coverage and the state of the eye health system in a country. It is, as in the IAPB cataract surgical coverage issue[18], a useful indicator in determining broader health coverage and unmet needs for older persons.

The issue of uncorrected refractive error in younger generations has not been addressed in this report, due to the lack of available data, but is equally important to achieve universal eye health.

Appendix

Table 1. Prevalence of refractive error and spectacle coverage for distance and near vision

Country	Location	Distance Vision									Near Vision					
		Prev. refractive errors (DV)			Prev. URE (DV)			Spectacle coverage (DV)			Prev. URE (Near VA)			Spectacle coverage (NV)		
		Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
Argentina (2013)	Latin America	48.7	53.6	**51.4**	7.3	7.7	**7.6**	85.0%	85.6%	**85.2%**	28.4	23.0	**25.4**	71.6	77.0	**74.6**
Cambodia (2007)	Asia	13.9	9.4	**11.1**	9.7	9.0	**9.3**	30.2%	4.3%	**16.2%**	Not recorded					
Dominican Republic (2008)	Latin America	19.9	26.7	**23.4**	5.3	4.1	**4.7**	73.4%	84.6%	**79.9%**	Not recorded					
Ecuador (2009)	Latin America	24.7	26.2	**25.5**	3.2	4.0	**3.6**	87.0%	84.7%	**85.9%**	Not recorded					
El Salvador (2011)	Latin America	20.2	24.5	**22.8**	8.1	9.5	**8.9**	59.9%	61.2%	**61.0%**	58.4	58.5	**58.5**	41.6	41.5	**41.5**
Eritrea (2008)	Africa	8.9	5.2	**6.8**	7.1	4.6	**5.6**	20.2%	11.5%	**17.6%**	Not recorded					
Guinea Bissau (2010)	Africa	9.2	7.20	**8.1**	6.9	6.9	**6.9**	25.0%	4.2%	**14.8%**	Not recorded					
Honduras (2013)	Latin America	17.8	22.5	**20.6**	5.7	7.8	**7.0**	68.0%	65.3%	**66.0%**	57.4	51.6	**54.0**	42.6	48.4	**46.0**
Laos (2007)	Asia	6.3	5.8	**6.0**	6.2	5.7	**5.9**	1.6%	1.7%	**1.7%**	Not recorded					
Malaysia (2014) weighted average	Asia	30.0	32.7	**31.5**	5.6	6.0	**5.8**	81.3%	81.7%	**81.6%**	48.5	47.2	**47.8**	51.5	52.8	**52.2**
Moldova (2012)	Europe	12.5	14.3	**13.7**	6.5	8.2	**7.7**	48.0%	42.7%	**43.8%**	44.5	34.0	**37.4**	55.5	66.0	**62.6**
Mongolia (2013)	Asia	16.2	14.6	**15.2**	5.9	5.1	**5.4**	63.6%	65.1%	**64.5%**	53.3	48.8	**50.6**	46.7	51.2	**49.4**
Nepal (2008-2011) weighted average	Asia	12.1	9.4	**10.7**	5.1	5.2	**5.1**	58.2%	44.6%	**51.8%**	Not recorded					
Palestine (2008)	E. Med	16.1	12.2	**13.9**	3.9	4.2	**4.1**	75.8%	65.6%	**70.5%**	Not recorded					
Panama (2013)	Latin America	28.2	43.2	**36.4**	6.9	7.7	**7.3**	75.5%	82.2%	**79.9%**	50.8	37.8	**43.7**	49.2	62.2	**56.3**
Paraguay (2011)	Latin America	26.9	40.1	**33.9**	7.6	9.4	**8.6**	71.7%	76.6%	**74.6%**	55.8	44.0	**49.6**	44.2	56.0	**50.4**
Peru (2011)	Latin America	23.8	23.6	**23.7**	8.1	8.1	**8.1**	66.0%	65.7%	**65.8%**	65.2	68.8	**67.3**	34.8	31.2	**32.7**
Sierra Leone (2011)	Africa	9.4	8.4	**8.8**	7.7	7.1	**7.4**	18.1%	15.5%	**15.9%**	92.3	96.3	**94.4**	7.7	3.7	**5.6**
The Gambia (2007)	Africa	7.6	6.5	**7.0**	6.8	6.3	**6.5**	10.5%	3.1%	**7.1%**	Not recorded					
Uruguay (2011)	Latin America	49.6	61.9	**56.7**	3.4	5.9	**4.9**	93.1%	90.5%	**91.4%**	26.2	18.4	*21.7*	73.8	81.6	**78.3**
Venezuela (2004)	Latin America	24.9	30.9	**28.1**	8.5	9.6	**9.1**	65.9%	68.9%	**67.6%**	Not recorded					
Hungary (2015)	Europe	39.7	51.0	**46.9**	3.2	5.0	**4.3**	91.9%	90.2%	**90.8%**	19.3	13.7	**15.7**	80.7	86.3	**84.3**
Surinam (2013)	Latin America	43.6	58.2	**51.6**	3.8	3.2	**3.5**	91.3%	94.5%	**93.2%**	43.5	34.7	**38.6**	56.5	65.3	**61.4**
Bolivia (2014)	Latin America	24.4	21.6	**22.7**	3.7	4.9	**4.4**	84.8%	77.3%	**80.6%**	62.3	68.5	**66.0**	37.7	31.5	**34**
Botswana (2015)	Africa	9.4	9.5	**9.5**	5.5	3.8	**4.4**	41.5%	60.0%	**53.7%**	92.8	91.5	**91.9**	7.2	8.5	**8.1**
Guatemala (2015)	Latin America	24.2	26.6	**25.6**	19.1	20.1	**19.7**	21.1%	24.4%	**23.0%**	81.7	83.3	**82.7**	18.3	16.7	**17.3**
Maldives (2016)	Asia	30.7	27.2	28.6	7.2	5.8	6.4	76.5%	78.7%	77.6%	44.7	30.7	36.4	55.3	69.3	63.6

Table 2. Gross Domestic Product and Health Expenditure

Country	Location	GDP Int US$ PPP per capita at time of RAAB	Health expenditure per capita current US$ at time of RAAB
Argentina	Latin America & Europe	n/a	1,074
Cambodia	Asia & E. Med	2,187	22
Dominican Republic	Latin America & Europe	10,012	208
Ecuador	Latin America & Europe	8,850	302
El Salvador	Latin America & Europe	7,352	252
Eritrea	Africa	1,045	9
Guinea Bissau	Africa	1,340	38
Honduras	Latin America & Europe	4,593	193
Laos	Asia & E. Med	3,107	29
Malaysia (2014) weighted average	Asia & E. Med	23,338	423
Moldova	Latin America & Europe	n/a	241
Mongolia	Asia & E. Med	9,435	244
Nepal (2008–2011) weighted average	Asia & E. Med	1,867	29
Palestine	Asia & E. Med	n/a	n/a
Panama	Latin America & Europe	19,416	796
Paraguay	Latin America & Europe	7,186	354
Peru	Latin America & Europe	10,429	284
Sierra Leone	Latin America & Europe	1,319	58
The Gambia	Africa	1,440	30
Uruguay	Latin America & Europe	17,645	1,138
Venezuela	Latin America & Europe	11,921	239
Hungary (2015)*	Latin America & Europe	25,582	1,037
Surinam (2013)	Latin America & Europe	16,276	108
Bolivia (2014)	Latin America & Europe	6,654	209
Botswana (2015)*	Africa	15,807	385
Guatemala (2015)*	Latin America & Europe	7,707	233
Maldives (2016)**	Asia	12,637	1,165

*HE data 2014 **GDP data 2015, HE data 2014

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