

A Simple Method for Estimating the Economic Cost of Productivity Loss Due to Blindness and Moderate to Severe Visual Impairment

Kristen A. Eckert, Marissa J. Carter, Van C. Lansingh, David A. Wilson, João M. Furtado, Kevin D. Frick & Serge Resnikoff

To cite this article: Kristen A. Eckert, Marissa J. Carter, Van C. Lansingh, David A. Wilson, João M. Furtado, Kevin D. Frick & Serge Resnikoff (2015) A Simple Method for Estimating the Economic Cost of Productivity Loss Due to Blindness and Moderate to Severe Visual Impairment, *Ophthalmic Epidemiology*, 22:5, 349-355, DOI: [10.3109/09286586.2015.1066394](https://doi.org/10.3109/09286586.2015.1066394)

To link to this article: <http://dx.doi.org/10.3109/09286586.2015.1066394>



Published online: 23 Sep 2015.



Submit your article to this journal [↗](#)



View related articles [↗](#)



View Crossmark data [↗](#)

ORIGINAL ARTICLE

A Simple Method for Estimating the Economic Cost of Productivity Loss Due to Blindness and Moderate to Severe Visual Impairment

Kristen A. Eckert¹, Marissa J. Carter¹, Van C. Lansingh², David A. Wilson³, João M. Furtado⁴, Kevin D. Frick⁵, and Serge Resnikoff³

¹Strategic Solutions, Inc., Cody, WY, USA, ²International Agency for the Prevention of Blindness (IAPB) Latin America, Queretaro, Mexico, ³Brien Holden Vision Institute (BHVI), University of New South Wales, Sydney, New South Wales, Australia, ⁴Department of Ophthalmology, Otorhinolaryngology, and Head and Neck Surgery, School of Medicine of Ribeirão Preto, University of São Paulo, Ribeirão Preto, São Paulo, Brazil, and ⁵Johns Hopkins Carey Business School, Baltimore, MD, USA

ABSTRACT

Purpose: To estimate the annual loss of productivity from blindness and moderate to severe visual impairment (MSVI) using simple models (analogous to how a rapid assessment model relates to a comprehensive model) based on minimum wage (MW) and gross national income (GNI) per capita (US\$, 2011).

Methods: Cost of blindness (COB) was calculated for the age group ≥ 50 years in nine sample countries by assuming the loss of current MW and loss of GNI per capita. It was assumed that all individuals work until 65 years old and that half of visual impairment prevalent in the ≥ 50 years age group is prevalent in the 50–64 years age group. For cost of MSVI (COMSVI), individual wage and GNI loss of 30% was assumed. Results were compared with the values of the uncorrected refractive error (URE) model of productivity loss.

Results: COB (MW method) ranged from \$0.1 billion in Honduras to \$2.5 billion in the United States, and COMSVI ranged from \$0.1 billion in Honduras to \$5.3 billion in the US. COB (GNI method) ranged from \$0.1 million in Honduras to \$7.8 billion in the US, and COMSVI ranged from \$0.1 billion in Honduras to \$16.5 billion in the US. Most GNI method values were near equivalent to those of the URE model.

Conclusion: Although most people with blindness and MSVI live in developing countries, the highest productivity losses are in high income countries. The global economy could improve if eye care were made more accessible and more affordable to all.

Keywords: Blindness, cost of blindness, GNI, minimum wage, simple model, visual impairment

INTRODUCTION

Globally, an estimated 32–39 million people are blind and another 191–246 million have moderate to severe visual impairment (MSVI).^{1,2}

Blindness and MSVI have a wide range of socioeconomic implications when considering an individual's unemployment, caretaking requirements, increased dependence on others, and lower quality

of life. Some costs, such as productivity loss, can be given monetary values. There has not yet been one standard method to carry out cost analyses of blindness.³ Thus, the global cost of blindness (COB) and cost of MSVI (COMSVI) are not known with certainty.

Frick and Foster used gross domestic product (GDP) per capita to estimate that, without further intervention, the global economic productivity loss for visual impairment (VI) was projected to grow from \$42 billion

Received 18 June 2014; Revised 2 December 2014; Accepted 10 February 2015; Published online 15 September 2015

Correspondence: Marissa J. Carter, PhD, MA, Strategic Solutions, Inc., 1143 Salsbury Avenue, Cody, WY 82414, USA. Tel/fax: +1 307 587 5352. Email: mcarter@strategic-solutions-inc.com

in 2000 to \$110 billion in 2020.⁴ Smith and colleagues⁵ used purchasing power parity (PPP)-adjusted GDP, labor force participation rate (LFPR), employment rate, and caretaker costs to estimate that the global productivity loss of uncorrected refractive error (URE) ranged between \$91.3 billion and \$327.7 billion.⁶

This study estimates the annual loss of economic productivity from blindness and MSVI in a sample of countries using two simplified models based on minimum wage (MW) and gross national income (GNI) per capita (in current US\$). The loss of economic productivity is defined as the loss of income/earnings incurred by people with blindness or MSVI, who are not able to work or work at reduced productivity as a result of their VI.

MATERIALS AND METHODS

Demographic, Economic, and Prevalence Data

A sample of nine countries representing different global regions, economies, and population sizes were included (Table 1). Population data were obtained from the 2011 United Nations World Population Prospects.⁷ MW data were obtained from the International Labor Organization.⁸ GNI per capita data (Atlas Method in current US\$, 2011) were from the World Bank.⁹

National, age-standardized data for blindness and MSVI were obtained for the population ≥ 50 years from the 2010 Global Burden of Disease (GBD) study, whose methodology was previously described.² Blindness was defined as visual acuity in the better eye $< 3/60$ at presentation and MSVI as $< 6/18$ but $\geq 3/60$ at presentation.

COB and COMSVI Calculations

The simple methods considered loss of earnings (from lack of/reduced employment) and incorporated adjustment factors to calculate the annual loss of economic productivity due to blindness and MSVI for the age group ≥ 50 years in each country. For people with blindness, we assumed loss of productivity through lack of labor force participation, meaning they were unable to work as a result of their blindness. For people with MSVI, we assumed loss of productivity through some combination of not working and not being as productive at work as a result of their MSVI. COB was calculated by assuming the loss of current MW and by using the GNI per capita instead of MW. Data from the US Census Bureau and US Bureau of Labor Statistics demonstrated that the average monthly earnings of people who reported difficulty seeing was \$2,281, which was

approximately 30% less than the \$3,262 average earnings of all Americans in 2009.^{10,11} Thus, for COMSVI, a 0.3 economic factor due to reduced productivity was applied.

It was assumed that half of blindness prevalent in the ≥ 50 years age group occurs in the 50–64 years age group, based on GBD data that show that nearly 85% of blindness and 78% of VI occur in the ≥ 50 years age group, with just over half of blindness occurring in the 50–69 years age group.²

To calculate productivity loss in US\$ billions due to blindness using MW in a given country, data of the corresponding columns in the first row of Table 1 were inserted in the following formula: $A \times B \times C \times E \times 0.5$. A simple sensitivity analysis was carried out for the proportion of blindness in the 50–64 years age group, substituting a lower parameter of 0.3 and an upper parameter of 0.7 for 0.5.

Calculations for COMSVI were similar, except that MW was multiplied by the 0.3 economic factor and the prevalence of MSVI was used: $A \times B \times C \times 0.3 \times F \times 0.5$. In addition to performing a simple sensitivity analysis for the proportion of blindness in the 50–64-years age group, sensitivity analysis was also carried out for the 0.3 economic factor for COMSVI, substituting a lower parameter of 0.1 and an upper parameter of 0.5 for 0.3. The exact same calculations were carried out for the GNI method, except MW was replaced by GNI per capita. The sum of COB and COMSVI was calculated for both methods to obtain the total cost of VI (COVI).

Comparing the MW and GNI Methods with the URE Model

Results of the simple MW and GNI methods were compared with values of the more comprehensive URE model for global productivity loss (complete methodology previously described),⁵ which used PPP-adjusted GDP for people of all ages with VI and for sighted individuals who serve as their caretakers (assuming a 10% productivity loss of caring for each person with blindness and a 5% loss for MSVI). Costs were adjusted by LFPR and employment rate in each country. A disability weight was applied for the working age group (0.7 for blindness and 0.345 for MSVI).

For comparative analysis, the economic formulas were adjusted to only include the ≥ 50 -years age group. URE prevalence data were replaced with 2010 GBD study prevalence data. LFPR and GDP PPP per capita (in US\$) were obtained from the CIA World Factbook.¹² The employment rate was adjusted for the 50–64 years age group to 0.612 based on 2011 composite data of older workers in 34 countries within the Organization for Economic Co-operation and Development (OECD).¹³ COB and COMSVI were

TABLE 1. Country socioeconomic, demographic, blindness and moderate to severe visual impairment (MSVI) prevalence data.

Country	A: Population, <i>n</i> millions, 2011 ⁷	B: Proportion of population ≥50 years ⁷	C: Minimum wage, annual US\$ ⁸	D: Gross national income per capita 2011, US\$ ⁹	E: Prevalence of blindness in those ≥50 years ²	F: Prevalence of MSVI in those ≥50 years ²
Japan	126.5	0.496	21,683	42,150	0.003	0.016
Brazil	199.7	0.216	3897	11,500	0.018	0.101
Nigeria	158.4	0.108	1332	1180	0.057	0.176
United States	310.4	0.357	15,080	47,140	0.003	0.021
Mexico	116.4	0.190	1676	15,120	0.018	0.092
Pakistan	173.6	0.184	894	1050	0.053	0.222
Honduras	7.8	0.131	3840	3717	0.029	0.147
Australia	22.3	0.354	30,726	43,740	0.003	0.044
Malaysia	28.4	0.172	3264	7900	0.014	0.123

TABLE 2. Cost of blindness (COB) and cost of moderate to severe visual impairment (COMSVI) using minimum wage and gross national income per capita in US\$ billions in 2011.

Country	Minimum wage method, US\$ billions						Gross national income per capita method, US\$ billions					
	COB	COB range	COMSVI	COMSVI range	Total ^a	Total range	COB	COB range	COMSVI	COMSVI range	Total ^a	Total ^a range
Japan	2.0	1.2–2.9	3.3	0.7–7.6	5.3	1.9–10.5	4.0	2.4–5.6	6.3	1.3–14.8	10.3	3.6–20.4
Brazil	1.5	0.9–2.1	2.6	0.5–5.9	4.1	1.4–8.1	4.5	2.7–6.3	7.5	1.5–17.5	12.0	4.2–23.8
Nigeria	0.6	0.4–0.9	0.6	0.1–1.4	1.3	0.5–2.3	0.6	0.3–0.8	0.5	0.1–1.2	1.1	0.5–2.0
United States	2.5	1.5–3.5	5.3	1.1–12.3	7.8	2.6–15.8	7.8	4.7–11.0	16.5	3.3–38.4	24.3	8.0–49.4
Mexico	0.3	0.2–0.5	0.5	0.1–1.2	0.8	0.3–1.7	3.0	1.8–4.2	4.6	0.9–10.8	7.6	2.7–15.0
Pakistan	0.8	0.5–1.1	1.0	0.2–2.2	1.7	0.6–3.3	0.9	0.5–1.2	1.1	0.2–2.6	2.0	0.8–3.9
Honduras	0.1	0.0–0.1	0.1	0.0–0.2	0.1	0.0–0.3	0.1	0.0–0.1	0.1	0.0–0.2	0.1	0.1–0.3
Australia	0.4	0.2–0.5	1.6	0.3–3.7	2.0	0.5–4.2	0.5	0.3–0.7	2.3	0.5–5.3	2.8	0.8–6.0
Malaysia	0.1	0.1–0.2	0.3	0.1–0.7	0.4	0.1–0.8	0.3	0.2–0.4	0.7	0.1–1.7	1.0	0.3–2.0

^aTotal cost of blindness and MSVI, or the sum of COB and COMSVI.

then calculated using the URE methodology. Costs associated with unadjusted and adjusted GDP PPP per capita loss were divided by the costs associated with MW and GNI per capita to determine if there were consistent adjustment factors between the MW and/or GNI methods and the URE model.

RESULTS

COB (MW method) in 2011 ranged from \$0.1 billion in Honduras (range \$0.0–0.1 billion) and Malaysia (range \$0.1–0.2 billion) to \$2.5 billion in the US (range \$1.5–3.5 billion; Table 2). COMSVI ranged from \$0.1 billion in Honduras (range \$0.0–0.2 billion) to \$5.3 billion in the US (range \$1.1–12.3 billion). Annual productivity loss due to all VI using MW ranged from \$0.1 billion in Honduras (range \$0.0–0.3 billion) to \$7.8 billion in the US (range \$2.6–15.8 billion; Table 2).

COB (GNI method) ranged from \$0.1 billion in Honduras (range \$0.0–0.1 billion) to \$7.8 billion in the US (range \$4.7–11.0 billion; Table 2). COMSVI ranged from \$0.1 billion in Honduras (range \$0.0–0.2 billion) to \$16.5 billion in the US (range \$3.3–38.4 billion). Honduras again had the lowest total annual loss due

to all VI of \$0.1 billion (range \$0.1–0.3 billion), and the US had the highest combined loss of \$24.3 billion (range \$8.0–49.4 billion; Table 2).

GDP PPP per capita, GDP PPP per capita for the population ≥50 years, and LFPR for each country were used to calculate the unadjusted disability adjusted life year (DALY) GDP PPP per capita loss and adjusted GDP PPP per capita loss (Table 3), per the URE model methodology. The unadjusted DALY GDP PPP per capita loss for all VI ranged from \$0.3 billion in Honduras to \$51.8 billion in the US. The adjusted GDP PPP per capita loss for all VI ranged from \$0.1 billion in Honduras to \$15.6 billion in the US.

The MW adjustment factors for adjusted and unadjusted GDP PPP per capita loss varied greatly; a pattern among the costs was not observed from one country to the next (Table 4). The same was demonstrated for the GNI per capita adjustment factor for unadjusted GDP PPP per capita loss. However, the GNI per capita adjustment factor for adjusted GDP PPP per capita loss ranged between 0.5 and 1.1, and values in most countries appeared to be closer to 1. Figure 1 graphically compares the total COVI by the GNI method with the adjusted GDP PPP per capita loss, and most of the costs are near equivalent.

TABLE 3. Economic data and total cost of visual impairment (US\$ billions) in 2011 using the uncorrected refractive error model.⁵

Country	GDP PPP per capita, US\$	GDP PPP per capita of population ≥ 50 years, US\$ billions	Labor force participation rate ^b	DALY GDP PPP per capita loss ^c , US\$ billions	Adjusted GDP PPP per capita loss, US\$ billions
Japan	35,300	2,216.6	0.500	16.9	5.2
Brazil	12,000	517.6	0.510	24.6	7.7
Nigeria	2600	44.5	0.320	4.5	0.9
United States	50,000	5540.6	0.491	51.8	15.6
Mexico	15,100	334.0	0.413	14.8	3.7
Pakistan	2900	92.6	0.298	10.5	1.9
Honduras	4600	4.7	0.419	0.3	0.1
Australia	42,400	334.7	0.545	5.8	1.9
Malaysia	16,600	81.1	0.405	4.2	1.1

GDP, gross domestic product; PPP, purchasing power parity; DALY, disability adjusted life year.

^bFor the total working age population, or the 15–64 years age group.¹²

^cTotal unadjusted DALY loss per country, including disability weights of 0.700 for blindness and 0.345 for moderate to severe visual impairment (of which 0.100 is for care).⁵

TABLE 4. Adjustment factors of minimum wage (MW) and gross national income (GNI) per capita cost models with uncorrected refractive error model gross domestic product (GDP) purchasing power parity (PPP) per capita loss.

Country	MW adjustment factors		GNI adjustment factors	
	Unadjusted GDP PPP per capita loss	Adjusted GDP PPP per capita loss	Unadjusted GDP PPP per capita loss	Adjusted GDP PPP per capita loss
Japan	3.2	1.0	1.6	0.5
Brazil	6.1	1.9	2.1	0.6
Nigeria	3.6	0.7	4.1	0.8
United States	6.7	2.0	2.1	0.6
Mexico	17.5	4.4	1.9	0.5
Pakistan	6.1	1.1	5.2	0.9
Honduras	2.2	0.7	2.1	0.7
Australia	3.0	1.0	2.1	0.7
Malaysia	10.3	2.7	4.3	1.1

DISCUSSION

This study estimates COVI as loss of economic productivity, which could be avoided if people with VI were able to enter the work force and work at full (or increased) productivity. The results support conclusions made in previous research that, although most blindness and VI is found in developing countries, the economic burden is still high in developed countries,^{14–18} such as the US and Japan.

When comparing the total costs from both MW and GNI methods (Table 2), the costs are generally greater at the country level using the GNI method, but even more so in Japan, Brazil, the US, Mexico, and Malaysia, where they are at least double the costs of the MW method. Mexico, although a middle income country with costs that generally fall in the mid-range, had costs using the GNI method that were 9.5 times greater than the MW method costs. Perhaps the MW of these countries has less correlation with their GNI per capita. This correlation may depend on the proportion of people on MW, if lower income

economies have a higher proportion of their population paid only MW.

Although the MW method did not reach the level of approximation observed between the GNI method and URE model, the use of MW still provides a real world application to people without training in economic and/or epidemiological modeling. In Australia, Taylor and co-workers¹⁷ carried out a national COVI study in 2004, which included direct health costs, indirect costs, and loss of well-being. Productivity loss (also based on lost earnings) after adjustment for 2011 dollars was approximately \$1.5 billion, which is comparable to our study calculations for the MW method (\$2.0 billion) and supports the use of the MW method to calculate estimated productivity loss. However, the GNI method would generally be recommended over the MW method, given that the MW data are not as precise and the results of the GNI method more closely match the URE model. True costs may lie in between the MW and GNI methods.

COMSVI depends on how much people ≥ 50 years with MSVI are able to work. The OECD supports the idea that most 50–64-year-olds remain economically

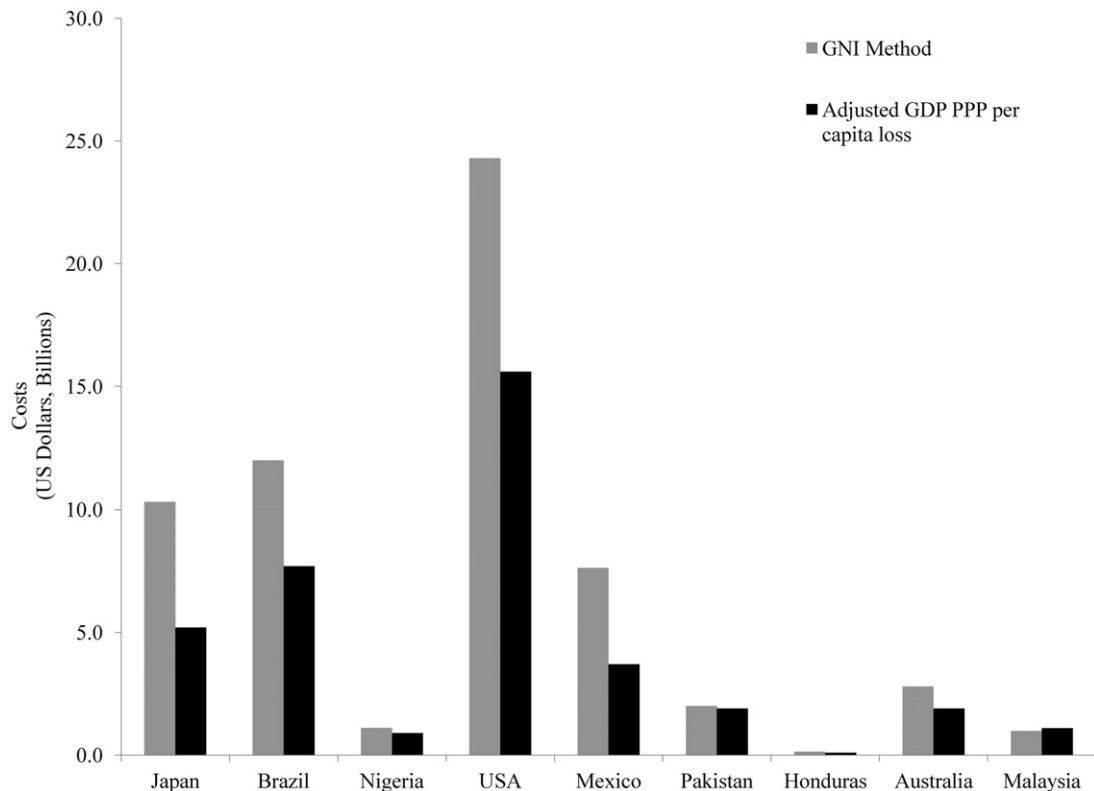


FIGURE 1. Total costs of visual impairment: Gross national income (GNI) per capita loss vs. adjusted gross domestic product (GDP) purchasing power parity (PPP) per capita loss, for ≥ 50 -years age group.

active.¹³ However, nearly 12% of the US population between the ages of 40 and 65 years have an eye disease, and only a little over one-third of all visually impaired, working-age Americans are employed.^{19,20}

The strengths of this current study include the development of relatively simple formulas for productivity loss from VI that any professional working in the government, non-governmental organizations, or eye care could easily understand and apply as a simple advocacy tool. Both the MW and GNI methods are simplified models that can be applied to any country with available data. Results can be updated annually as economic data, demographics, and VI prevalences change in response to trends in the labor market, health care (with new novel therapies and technology), and the increase in the aging population. Additionally, an important strength of the quality of data used in these models is that the data are internationally standardized from the 2010 GBD study,² the United Nations,⁷ the International Labor Organization,⁸ and the World Bank,⁹ thus allowing for a measurable comparison in costs of productivity loss from one country to the next.

Another important strength is that the values calculated with these simple formulas are comparable to those calculated with a much more complex formula (the URE model). Most countries' GNI per capita values were equivalent or near equivalent to the adjusted GDP PPP per capita loss. This is relevant

because, although the URE model introduced additional disability weights and adjustment considerations to increase the precision of the estimate of lost productivity, it is a much more complex method that also requires a great deal more data and is not as easy to use. Comparative analysis supports that the GNI method is a simpler model that can obtain similar results to the URE model.

The main limitation to this loss of productivity model is that it uses simple methods with general assumptions that include standardized variables and factors. For example, not everyone with VI would have full-time employment if they had normal vision, although the OECD agrees that the 50–64-year age group remains economically active.¹³ Changing labor markets, however, may lead to greater impact on those with VI over those with normal vision. The assumed retirement age of 65 years will vary among countries, as well as individuals, depending on their health, personal choices, and socioeconomic circumstances. However, a standard retirement age of 65 years is reasonable for a simple model. The assumption that productivity loss to MSVI is a factor of 0.3 is only based on US data, while economic activity will vary between high, middle, and low income countries. Furthermore, the reduced productivity loss due to MSVI may change over time; if economic productivity loss for VI is $>30\%$, then the COMSVI is even higher. Likewise the OECD employment composite

rate used is based on data from 34 countries in Europe, North America, the Pacific region, and Asia, and may be different when considering Africa and South America.¹³ The assumption that half of the VI occurring in the ≥ 50 years age group occurs in the 50–64 years age group may be an over-estimation, as we can only ascertain from the GBD study that 51% of VI occurs in the 50–69 years age group.² Furthermore, the 0.5 factor that accounts for half of blindness in the 50–64 years age group should be considered dynamically over time. As the global population ages, the ratio of people 50–64 years to ≥ 65 years (and their respective prevalence rates) will change.

With regard to the above limitations, the assumptions used in the GNI and MW models follow a simplified approach to estimating the cost of productivity loss due to blindness and MSVI. The models presented are not statistically precise tools that require inordinate amounts of information, complex formulas, or sensitivity analysis. The simple models are to the more comprehensive models, such as the URE model, as a rapid assessment epidemiological methodology is to a full-fledged population-based epidemiological study. The models provide a simple estimation meant to serve as a planning and advocacy tool, which when using GNI per capita appear quite accurate as compared to the URE model that incorporates many complex parameters. The concept guiding the development of these models was to use simple factors based on available data, and being aware of these limitations, the results were compared with a considerably more comprehensive model. Furthermore, it should be reiterated that the factors and variables used in the equations can be adjusted by the people working with these models; they can be replaced with new data in each country or adjusted to better fit a new trend. Another study limitation is that calculations for every country are still needed. A future study could calculate global productivity loss using these methods and include additional analysis, such as the percentage of GNI per capita lost each year due to VI. Another limitation is that total COVI was not calculated, as treatment, rehabilitation, and caregiver costs were not included. However, total COVI was not the objective of this study, which sought to develop a simplified model to estimate annual productivity loss in a given country, which can then be used to develop more complex, total cost models. For example, Gordoïs and co-authors¹⁸ included direct and indirect costs of VI for every region to estimate for 2010 the most comprehensive global COVI to date of \$3 trillion. Their calculations did not use a standardized age group, and productivity loss was not calculated for developing countries, because data were incomplete. The current study method could be integrated into this more comprehensive model to find a more complete estimation of global productivity loss and, therefore, a more

complete total COVI, and to better understand what percentage of the total costs are due to productivity loss.

This study supports previous work on the tremendous COVI to global society. The global economy would, therefore, have much to gain if eye care were made more accessible and more affordable to all.

DECLARATION OF INTEREST

Eckert is a paid consultant to Strategic Solutions and IAPB; Carter is employed by Strategic Solutions and is a paid consultant to ORBIS and IAPB; Lansingh is employed by IAPB; Wilson is employed by BHVI; Furtado is employed by the University of São Paulo; Frick is employed by Johns Hopkins University; Resnikoff is a consultant to BHVI.

Preparation of this manuscript was funded by Orbis and the International Agency for the Prevention of Blindness.

REFERENCES

1. Pascolini D, Mariotti SP. Global estimates of visual impairment: 2010. *Br J Ophthalmol* 2012;96:614–618.
2. Stevens GA, White RA, Flaxman SR, et al., on behalf of the Vision Loss Expert Group. Global prevalence of vision impairment and blindness: magnitude and temporal trends, 1990–2010. *Ophthalmology* 2013;120:2377–2384.
3. Frick KD, Kymes SM, Lee PP, et al., on behalf of The Vancouver Economic Burden of Vision Loss Group. The cost of visual impairment: purposes, perspectives, and guidance. *Invest Ophthalmol Vis Sci* 2010;51:1801–1805.
4. Frick KD, Foster A. The magnitude and cost of global blindness: an increasing problem that can be alleviated. *Am J Ophthalmol* 2003;2:110–114.
5. Smith TST, Frick KD, Holden BA, et al. Potential lost productivity resulting from the global burden of uncorrected refractive error. *Bull World Health Organ* 2009;87:431–437.
6. Fricke TR, Holden BA, Wilson DA, et al. Global cost of correcting vision impairment from uncorrected refractive error. *Bull World Health Organ* 2012;90:728–738.
7. United Nations, Department of Economic and Social Affairs. Population Division, Population Estimates, and Projection Section. *World Population Prospects: The 2011 Revision*. Accessed October 24, 2012 from: <http://esa.un.org/wpp/Excel-Data/population.htm>.
8. International Labour Organization. *ILOSTAT – database of labour statistics*. Accessed October 24, 2012 from: <http://laborsta.ilo.org/>.
9. The World Bank. GNI per capita, Atlas method (current US\$). *The World Bank*, 2012. Accessed October 24, 2012, <http://data.worldbank.org/indicator/NY.GNP.PCAP.CD>.
10. Brault MW. Americans with disabilities: 2010. Household Economic Studies. *U.S. Census Bureau*, July 2012. Accessed February 20, 2014 from: <http://www.census.gov/prod/2012pubs/p70-131.pdf>.

11. Clinton A, Coughlan J, Dahlin B. New all-employee hours and earnings from the CES survey. *Monthly Labor Review*. March 2010:34–40.
12. Central Intelligence Agency. *The World Factbook*. 2011. Accessed September 19, 2013 from: <https://www.cia.gov/library/publications/download/>.
13. The Organization for Economic Co-operation and Development (OECD). Employment policies and data. Ageing and employment policies. *Scoreboard on older workers, 2001, 2005, and 2011, 34 OECD countries*. Accessed October 1, 2013 from: www.oecd.org/employment/emp/ageingandemploymentpolicies.htm.
14. Frick KD, Kymes SM. The calculation and use of economic burden data. *Br J Ophthalmol* 2006;90:255–257.
15. Wittenborn JS, Zhang X, Feagan CW, et al., on behalf of the Vision Cost-effectiveness Study Group. The economic burden of vision loss and eye disorders among the United States population younger than 40 years. *Ophthalmology* 2013;120:1728–1735.
16. Foundation for the Blind. Facts and figures on adults with vision loss. *American Foundation for the Blind*, 2012. Accessed May 23, 2012 from: <http://www.afb.org/section.aspx?SectionID=15&TopicID=413&DocumentID=4900>.
17. Taylor HR, Pezzullo ML, Keeffe JE. The economic impact and cost of visual impairment in Australia. *Br J Ophthalmol* 2006;90:272–275.
18. Gordois A, Cutler H, Pezzullo L, et al. An estimation of the worldwide economic and health burden of visual impairment. *Glob Public Health* 2012;7:465–481.
19. Li Y, Xirasagar S, Punkam C, et al. Vision insurance, eye care visits, and vision impairment among working age adults in the United States. *JAMA Ophthalmol* 2013;131:449–506.
20. Disability Statistics & Demographics. Rehabilitation Research & Training Center. *2012 Annual Disability Statistics Compendium*. Institute on Disability; University of New Hampshire: 2012. Accessed September 5, 2013 from: <http://www.disabilitycompendium.org/docs/default-source/2012-compendium/disabilitycompendium2012.pdf?sfvrsn=2>.