

Investing in Vision – Comparing the costs and benefits of eliminating avoidable blindness and visual impairment

*The Fred Hollows
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Preface: Investing in Vision

In the world of eye health we often use the following mantra: 80% of all blindness is preventable or treatable - it is needless or avoidable blindness. 90% of all people who are blind and visually impaired live in the developing world – and the majority are women.

In commissioning PricewaterhouseCoopers (PwC) to undertake this groundbreaking series, looking at both the costs and benefits of achieving the global elimination of avoidable blindness and vision impairment, we were acutely aware of the potential for the findings to be such that they would undermine our collective efforts to achieve our ambitious goal. Yet, on the contrary, what this highly credible and authoritative contribution has achieved is to lay out the strong economic arguments for reinventing our efforts to achieve this ambitious goal.

This series, summarised in the final **Investing in Vision** report, is the first of its kind to calculate the costs and benefits of achieving the elimination of avoidable blindness and visual impairment, on a global scale, by the year 2020.

The findings support additional investments required to build the eye health systems in developing countries that are needed to eliminate avoidable blindness and visual impairment.

The overwhelming burden of avoidable blindness and visual impairment, which affects 285 million individuals directly, is heavily skewed toward developing countries. It is in these countries that the benefits of investments far exceed the costs. Even with conservative assumptions, the reports estimate that every dollar invested to target avoidable blindness and visual impairment generates four dollars of economic benefits.

In reality, the true economic benefits from eliminating avoidable blindness and visual impairment in the developing countries are likely to be higher than we have reported. This is because there are many benefits to which a dollar value was not assigned due to the lack of reliable data. These additional benefits from eliminating avoidable blindness and visual impairment include increased education, gender equity and reduced child mortality, along with intangible benefits to individuals including improved self-esteem and expanded social networks.

The message for the international community is that ending avoidable blindness and vision impairment is the unpicked “low-lying fruit” of economic development and health improvement in the world’s poorest countries. It is not a stand-alone activity, but has to be firmly embedded in national health plans and systems. The effort to end avoidable blindness and visual impairment will contribute to stronger national health systems, stronger national economies and stronger communities in developing countries.

The key message for the international development community, including private financiers, is that support of eye health initiatives in the poorest countries of the world provides significant stimulus to both the health systems and the broader economy while addressing the needs of those struggling to end extreme poverty, achieve access to universal primary education, achieve greater gender equity and address disability, including avoiding needless disability.

The key message for national governments and ministries of health is that investing in the eye health needs of the population is one of the least expensive and high impact interventions that will demonstrate the Government’s capacity to deliver on behalf of its people, and will also provide a positive economic return and a stronger health system.

This pioneering piece of collaborative research uses methodologies that have been tested, reviewed and validated by international health and research academics and practitioners. On behalf of the commissioning and collaborating agencies, Sightsavers International, Light for the World, CBM International, the Secretariat of the International Agency for the Prevention of Blindness, Operational Eyesight Universal and The Fred Hollows Foundation, I extend our thanks and congratulations to PricewaterhouseCoopers (PwC), and to Three Rivers Consulting for their early support, for this important contribution to the elimination of avoidable blindness and vision impairment.



Brian Doolan
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Investing in Vision

Eliminating avoidable blindness and visual impairment stands to generate substantial benefits to individuals, their carers and to economies more broadly. The burden of avoidable blindness and visual impairment, which affects 223 million individuals directly (WHO, 2013)¹, is strongly skewed towards developing countries. It is these countries that will gain the most from eliminating avoidable blindness and visual impairment, and it is these countries where the investment required to achieve positive outcomes are also the lowest. As we show in this report, for a relatively small investment, the potential benefits generated from eliminating avoidable blindness and visual impairment are substantial.

This report is the final in a series of four by PwC, commissioned by The Fred Hollows Foundation and other key NGOs across the eye care sector. The series addresses the costs and benefits of VISION 2020 - the global initiative for the elimination of avoidable blindness, a joint program of the World Health Organisation and the International Agency for the Prevention of Blindness. This report synthesises the key findings of the previous three reports in the series:

- *The Price of Sight* which estimates the global cost of eliminating avoidable blindness and visual impairment, developed in partnership with Three Rivers Consulting
- A benefits framework for eliminating avoidable blindness and visual impairment, and
- *The Value of Sight* which estimates the value of benefits associated with the effort to eliminate avoidable blindness and visual impairment.

This report compares the costs of implementing a gold-standard system that embeds eye health into national health systems in order to eliminate avoidable blindness and visual impairment with the corresponding benefits provided to individuals, carers, the community and the economy. The results demonstrate that at the global level **the benefits of eliminating avoidable blindness and visual impairment far exceed the investment required** – in fact, when we sum simply the dollar value of productivity gains for those of working age (15–65), deadweight loss, and health systems savings from fewer co-morbidities (such as falls), we estimate that the benefits exceed the costs **by a multiple of 2.1 times** the cost. The benefit value is estimated to be at least US\$843.5 billion over the ten years from 2011 to 2020, significantly outweighing the additional investment required (US\$394.2 billion).

The overall net benefit of eliminating avoidable blindness at the global level, almost entirely reflects developing countries where prevalence is greatest. This provides compelling evidence for the importance of focusing on developing countries. In developing countries, we estimate the total benefits to be at least \$517.1 billion (2009 USD) over the ten years from 2011 to 2020, significantly outweighing the additional investment required (\$128.2 billion 2009 USD), **a benefit cost ratio of some 4.0 times the cost.** In developed countries, we estimate these benefits to be at least \$326.4 billion (2009 USD), outweighing the additional investment required (\$266.0 billion 2009 USD), a benefit cost ratio of some 1.2 times the cost.

Importantly, these are conservative estimates of the benefits of eliminating avoidable blindness and visual impairment. There are many benefits to which we did not assign a dollar value due to the lack of available data.

¹ These revised data are lower than the previous calculations and are based on the WHO's estimates of declining trends in visual impairment and blindness. A large portion of the difference stems from the newer reduced estimate of visual impairment in China. New data were attained from Stevens, personal comms in 2013. Previous data was from WHO 2010.

The most important of these were the substantial gains in quality of life which arise for individuals and their carers. The implication is that the true benefits of eliminating avoidable blindness and visual impairment will be greater than we have quantified here. Where possible, this report highlights and describes the other benefits that individuals and developing countries stand to gain from eliminating avoidable blindness and visual impairment.

Cost and benefit estimates are based on the most recent unpublished data on the prevalence of those impacted by blindness and visual impairment (severe and moderate). However, there remains considerable uncertainty around the exact number of people that are blind or otherwise visually impaired. This report relies on the central estimate of 223 million; though there is a 95% likelihood that the true estimate lies somewhere between 206 million and 261 million (Stevens, pers comms, 2013). This confidence interval suggests that estimates from this analysis should be treated as indicative and with caution. Future analyses into the cost-effectiveness of eliminating avoidable blindness would therefore benefit greatly from research that increases the precision of these data.

The series of four reports forms a pioneering piece of work in the eye care sector that brings together an analysis of avoidable blindness and visual impairment on a global scale using the most recent data available. The methodologies used have been reviewed by clinical and academic experts in order to validate the approach, key assumptions, and find solutions to meet the gaps in information and data in this sector. Through this work, we have identified priorities for future research which will help to further refine future estimates.

The Price of Sight and *The Value of Sight* reports include detailed explanations of the methodology and assumptions used to develop the cost and benefit estimates contained in this report, and we encourage you to refer to them. A summary is presented below.

The Price of Sight – the cost of eliminating avoidable blindness

This report analysis estimates the global cost of eliminating avoidable blindness and visual impairment. The analysis uses a health systems approach – that is, the required investment to build and maintain a sustainable primary and secondary eye health care sector to prevent, treat and ultimately eliminate avoidable blindness and visual impairment. The estimates are built from a framework comprising:

- the annual recurrent cost of the existing eye health sector, i.e. the ongoing costs needed to maintain today's primary and secondary eye health systems,
- the investment needed to fill the 'gap' to achieve the ideal health system, measured by the difference between the present eye health sector and the VISION 2020 human resource to population ratio, and
- the investment required to eliminate the 'backlog'. The 'backlog' comprises individuals who currently experience avoidable blindness and visual impairment conditions as well as individuals who are at risk of experiencing avoidable blindness conditions by 2020.

The costing frameworks are depicted in Figure 1 and Figure 2. The cost of eliminating the backlog includes addressing current prevalence as well as the incidence of avoidable blindness and visual impairment that is projected to arise over the coming decade. The results of the cost analysis are disaggregated by World Bank subregions (Sub-Saharan Africa, Latin America and the Caribbean, South Asia, Middle East and North Africa, Europe and Central Asia, East Asia and Pacific, High Income Nations).

Figure 1: Costing framework for the primary/secondary health care sectors

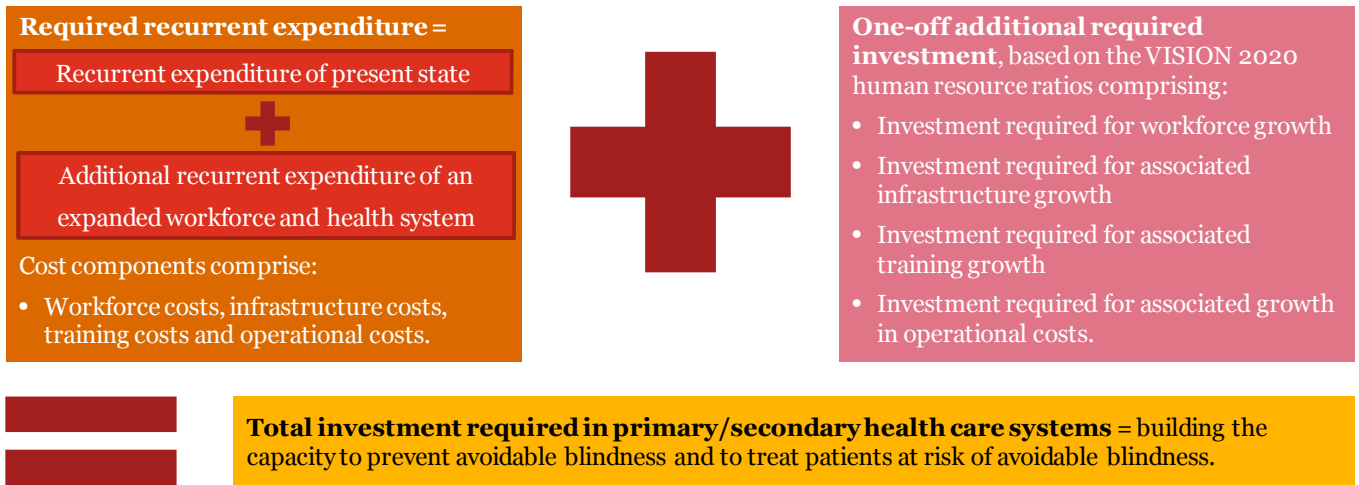
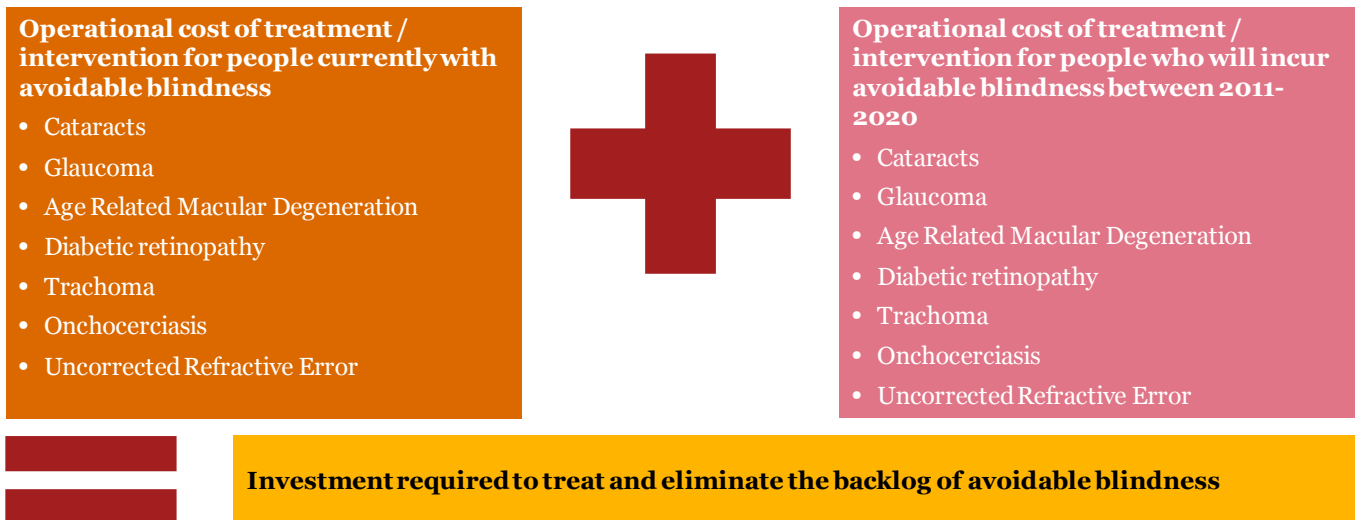


Figure 2: Costing framework for the backlog of avoidable blindness and visual impairment



Using this approach, the estimated additional investment required to eliminate avoidable blindness and visual impairment (in addition to costs already incurred) is estimated at \$394.2 billion over the ten year period from 2011 to 2020. These results are shown in Table 1.

Expressed another way, the additional investment required to eliminate global avoidable blindness and visual impairment is an average of \$5.70 per person per year over this ten year period.

Approximately 84% of the world’s population lives in developing countries, but less than one-third (\$128.2 billion) of the total global investment is required there. **This translates to an investment of \$2.20 per person per year in developing countries** (including those without avoidable blindness or visual impairment, based on 2009 population data).

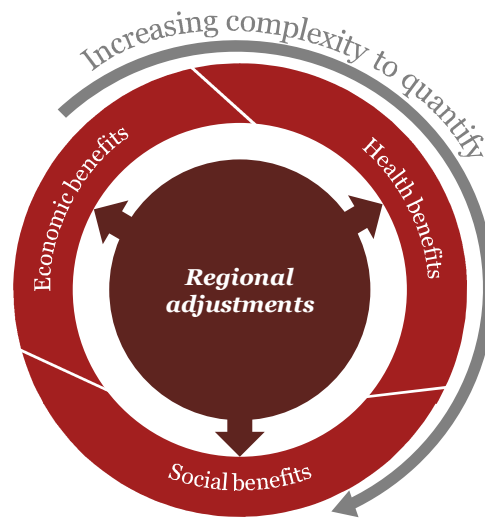
Table 1: Summary of global cost by sector over 2011-2020, 2009 USD billions

Sector	Total Cost	Developed Countries (High Income World Bank region) Cost (% of total)	Developing Countries (all other regions) Cost (% of total)
Share of population (2010)		16%	84%
Investment in primary health care system	308.4	251.8 (82%)	56.6 (18%)
Investment in secondary health care system	62.7	4.7 (7%)	58 (93%)
Investment to treat the backlog of avoidable blindness and visual impairment	23.1	9.5 (41%)	13.6 (59%)
TOTAL	394.2	266.0 (67%)	128.2 (33%)

The Value of Sight – quantifying the benefits of eliminating avoidable blindness and visual impairment

This report puts a dollar value on the benefits of eliminating avoidable blindness and visual impairment within a framework that incorporates economic, health and social benefits, depicted in Figure 3. However, many of the health and social benefits that accrue from eliminating avoidable blindness are complex and difficult to quantify. So as to ensure that the results are not overly assumption-driven, the report is limited to identifying and discussing those additional benefits to which a dollar value could not be reliably assigned using the information available. As such, our estimates of the benefits are likely to be conservative.

Figure 3: Benefits Framework



The benefits quantified are those that can be achieved from the additional investment made to eliminate avoidable blindness and visual impairment, by addressing the ‘gap’ between the present eye health system and the ideal eye health system (measured by the difference between the present eye health sector and the VISION 2020 human resource to population ratios). The total benefit value comprises:

- the benefits of treating the current prevalence or backlog of avoidable blindness and visual impairment. This benefit is spread over a ten year period (2010-2020), assuming that the entire backlog is eliminated by 2020, and
- the benefits of treating the portion of new incidence that cannot be treated under the current health system. This benefit accrues annually for the ten year period 2010-2020.

The benefits that were quantified in monetary terms are:

- **The productivity benefit** realised by persons aged 15 to 65 with avoidable blindness and visual impairment, a portion of whom were not previously working due to their condition and would enter the workforce upon treatment and by carers (an economic benefits).
- **The deadweight loss value** per person with avoidable blindness and visual impairment, which stems from the additional tax revenue that the government must raise to fund the associated direct health costs. Thus, regions with higher average direct health system costs are expected to incur a larger deadweight loss (DWL) cost. The size of this extra tax burden will depend on the means in which the government chooses to raise additional revenue and also the proportion of a country’s direct health costs funded by the government (an economic benefit).

- **Direct health system savings**, comprised of averted health costs associated with co-morbidities (a health benefit)

In addition to these benefits are substantial improvements in well-being and quality of life that are quantified in terms of Disability Adjusted Life Years (DALYs) averted, but are not valued in monetary terms. To assign a monetary value to DALYs averted, the value of a statistical life is required. This analysis takes the form of an Incremental Cost Effectiveness Ratio (ICER) analysis, focusing on the incremental cost of an intervention and the associated achieved outcomes (for example, what is the incremental cost of treatment, per life year saved). Given that the net cost (cost minus benefits) is negative, it is not necessary to incorporate the value of life years saved because on a pure net cost basis, the investment is positive. As such, the well being benefit is reported as total DALYs averted.

Benefits that were not able to be quantified due to a lack of supporting data that have been analysed qualitatively include increased primary education, reduced extreme poverty, increased independence, self esteem and improved social networks and increased gender equality.

Whilst the *Price of Sight* analysis disaggregates total cost estimates by World Bank subregions, the results of the *Value of Sight* analysis are disaggregated by the World Health Organisation subregion which are categorised according to mortality strata. Each subregion maps individual countries according to patterns of child and adult mortality where 'A' indicates the lowest rates of mortality and 'E' indicates the highest (WHO 2012).

Using this approach, the estimated dollar value of the benefits of eliminating avoidable blindness and visual impairment is estimated at \$843.5 billion over the ten year period from 2011 to 2020. These results are shown in Table 2.

Table 2: Summary of global benefit value by benefit category over 2011-2020 (2009 USD billions)

Benefit	Total benefit value	Developed countries (WHO Stratum A) benefit value	Developing countries (WHO Strata B-E) benefit value
Share of population		14%	86%
Economic	802.0	308.0	494.0
Productivity benefit to avoidably blind and visually impaired persons	670.0	206.9	463.0
Productivity benefit to carers	43.5	14.7	28.8
Deadweight loss benefit to avoidably blind and visually impaired persons	88.5	86.3	2.2
Health	41.4	18.4	23.0
Averted falls benefit	41.4	18.4	23.0
TOTAL	843.5	326.4	517.1

Comparing Costs and Benefits

On a global scale, the benefits of eliminating avoidable blindness and visual impairment, estimated to be at least US\$843.5 billion over the ten years from 2011 to 2020, significantly outweigh the additional investment required (US\$394.2 billion), a **benefit cost ratio of 2.1**. Comparing costs and benefits by region is more challenging. This is in part because of slightly different data and methodologies meaning that The Price of Sight results are presented by World Bank Region because of the delineation between high-income nations, whereas those in The Value of Sight report are presented by WHO sub-regions as prevalence data is only available on this basis. Nevertheless, the WHO's low mortality stratum 'A' represent developed countries and are broadly consistent with the World Bank's 'High Income' regions, while the remaining mortality strata regions (B through E) comprise the world's developing countries (WHO 2003) and are broadly consistent with the World Bank's other regions. This means we can compare results for developed and developing countries as a whole.

In developing countries, we estimate the total benefits to be at least \$517.1 billion (2009 USD) over the ten years from 2011 to 2020, significantly outweighing the additional investment required (\$128.2 billion 2009 USD), a **benefit cost ratio of some 4.0 times the cost**.

In developed countries, we estimate the total benefits to be at least \$326.4 billion (2009 USD) over the ten years from 2011 to 2020, significantly outweighing the additional investment required (\$266.0 billion 2009 USD), a **benefit cost ratio of some 1.2 times the cost**.

The relatively high pay-off rate for developing countries reflects, in part, the relatively lower cost of the health workforce, and the lower cost of treatments for disease in these settings. It also partly reflects the relatively large numbers of people affected by blindness and visual impairment in developing countries. Consequently, investment in health systems in developing countries appears to be particularly worthy; in addition to potentially yielding substantial productivity gains, the estimated \$2.20 per capita per investment costs over the decade are likely to be dwarfed by the average estimated benefit of \$8.30 per capita (where per capita is the total population including persons without avoidable blindness and visual impairment).

These results are further enhanced by qualitatively analysing those benefits that are not valued in monetary form, such as Disability Adjusted Life Years (DALYs) and social benefits, for example increased gender equality and improved social networks. We suspect that these benefits will be substantially weighted toward developing countries because the rate of disability and disease is generally higher. As an example, the DALYs analysis affirms this notion, illustrating that **94%** of the world's DALYs associated to visual impairment is borne by developing countries.

Table 3: DALYs averted by WHO mortality strata (2004)

Mortality Stratum	DALYs (000s)	DALY share	Population share	Prevalence share of avoidably blind and visually impaired persons
Developed countries	2,861	6%	16%	9%
Developing countries	48,623	94%	84%	91%
TOTAL	51,484	100%	100%	100%

Cost and benefit estimates are based on the most recent unpublished data on the prevalence of those impacted by blindness and visual impairment (severe and moderate). These data estimate that 223 million people are blind or otherwise visually impaired. The confidence interval around this prevalence estimate suggests that both the calculated costs and benefits should be treated as indicative and with caution given the uncertainties associated with current data sources. It should also be noted, however, that whilst the actual dollar estimates are sensitive to the uncertainties associated with current data sources, the overall net benefit of eliminating avoidable blindness is

likely to remain weighted toward developing countries, irrespective of the prevalence estimate (presuming that the prevalence remains heavily skewed in favour of developing countries – a strong assumption in our opinion). Nonetheless, future research efforts will be well placed to increase the precision of these estimates.

As noted, estimates such as the ones presented in this paper are always subject to uncertainty, and in the more detailed reports, we propose key areas for future research which will help to refine future estimates. These include:

- average income and level of employment of the blind and visually impaired in developing countries;
- the extent to which caring for blind or visually impaired people impacts on a person's productivity; and
- data detailing current expenditure on eye health services and on the current workforce in respect to eye health and primary care on a country basis

Despite these limitations, the analysis indicates that the benefits of eliminating avoidable blindness and visual impairment substantially outweigh the costs; particularly in developing countries.

Appendix A References

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