A benefits framework for eliminating avoidable blindness and visual impairment

The Fred Hollows Foundation

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Final Report Update

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pwc

Mr Brian Doolan
Chief Executive Officer
The Fred Hollows Foundation
Level 2, 61 Dunning Avenue
Rosebery NSW 2018

30 January 2012

Dear Brian

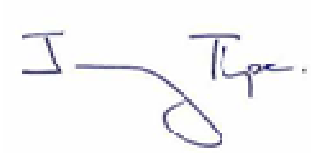
Subject: The development of a benefits framework for eliminating avoidable blindness

We are pleased to provide our report detailing a benefits framework which will be used in the future to estimate the benefits likely to be sustained from the investment in the global elimination of avoidable blindness. This is a direct follow on from our work on the estimate of the investment required to eliminate avoidable blindness globally by 2020. The results of our initial analysis were that US$26.7 billion (2009) would be required to eliminate the current backlog and future incidence to 2020 across developing and developed countries.

Our approach in developing the benefits framework was based on information obtained from a comprehensive literature scan and several consultations with key informants in the eye health industry.

We would like to thank The Fred Hollows Foundation and the key stakeholders whom with we engaged in consultations for the valuable industry perspective they have provided us with on issues surrounding avoidable blindness. We trust that this report makes a valuable contribution to the understanding of the substantial benefits that would arise from the elimination of avoidable blindness.

Yours sincerely



Jeremy Thorpe
Partner
Economics and Policy

Glossary

DALY	**Disability Adjusted Life Year**
FHF	The Fred Hollows Foundation
GP	General practitioner
IAPB	International Agency for the Prevention of Blindness
MDG	Millennium Development Goal
NGO	Non-government organisation
PwC	PricewaterhouseCoopers
QALY	Quality Adjusted Life Year
US	United States Dollars
WHO	World Health Organization

Executive summary

Globally there are 32.4 million people who are blind, and a further 190.6 million people who are visually impaired to the point that their ability to function is negatively impacted[1]. A large proportion of the world's blind and visually impaired live in low and middle income countries. The cost of expanding and sustaining primary and secondary health services to treat avoidable blindness and vision impairment is substantial. In 2011 PwC and Three Rivers estimated the need for additional expenditure of US$394.2 billion over 10 years if the goal of eliminating avoidable blindness is to be achieved by 2020, noting that $266.0 billion, over two thirds of this is required in the developed world rather than in poorer countries, where $128.2 billion is allocated. Excluding high income countries, the additional investment required to eliminate avoidable blindness and visual impairment was estimated to be US$128.2 billion. The US$394.2 figure represents an increase in global eye health expenditure of around 7% over that period, with two thirds of the expenditure being directed to high income economies[2].

PwC and The Fred Hollows Foundation have agreed that the scope of this new piece of work is to quantify, to the degree that is possible, the benefits of eliminating avoidable blindness and vision impairment within a framework that incorporates economic, health and social benefits. The purpose of this report is to outline the benefits gained from making the investment to eliminate avoidable blindness and vision impairment on a global scale and develop a **"benefits framework"** which could act as a starting point for the quantification of benefits. It is the precursor to a quantification of benefits that will be undertaken in the next phase of this work.

To date, these phases combined will be the first analysis where the health, economic and social benefits of eliminating avoidable blindness and vision impairment are brought together on a global scale. Past studies range in the breadth of geographic scope, from one country, to one region to global, and have broadly speaking analysed one aspect (such as the economic cost) rather than multiple. This analysis will also be the first to bring together the benefits for all avoidable blindness and vision impairment conditions.

Within this scope, our approach will be to bring together country and regional level findings to first form a benefits framework (this project and report) and then aggregate these to form a global estimate.

In order to identify the benefits and subsequently develop this first step of a benefits framework, an extensive literature scan and several consultations with key stakeholders have been carried out.

This initial research identified major benefits, grouped into the 3 categories below: economic, health and societal.

[1] Revised data are lower than the previously as calculations are based on the WHO's estimates of declining trends in visual impairment and blindness and 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 is from WHO 2010, Prevention of Blindness and Visual Impairment, available at<http://www.who.int/blindness/table/en/index.html>, viewed March 2011

[2] The World Bank 2012, Country and lending groups, available < http://data.worldbank.org/about/country-classifications/country-and-lending-groups>, accessed 18 January 2012.

Economic	Health	Social
• Increased employment • Increased productivity • Reduced welfare costs • Achieving universal primary education	• Improved quality of life (measured in DALYs averted and QALYs gained) • Reduced co-morbidities and mortality (including HIV/AIDS, malaria – MDG 6) • Reduced child mortality (MDG 4) • Reduced hospitalisations, length of stay and other system costs	• Reduced extreme poverty and hunger (MDG 1) • Increased independence • Increased self esteem and improved social networks • Increased gender equality • Increased community participation

Based on the initial costing framework, investing to reduce avoidable blindness and visual impairment will require an understanding of the potential benefits arising from different types of investment. We identify four levels of investment which could be undertaken:

1 Business as usual

2 Eliminate the backlog

3 Develop the secondary health system

4 Develop the primary health system

The benefits framework is intended to form the basis for a more detailed exercise to quantify the benefits of eliminating avoidable blindness and visual impairment, and put the 7% proposed increase in investment into the context of the returns which can be achieved in both the developed and developing world.

Structure of the report

This report is presented in the following sections:

Table 1: Report structure

Section	Heading	Description
1	Background	Provides context and scope for this report and an overview of the earlier costing study prepared by PwC and Three Rivers. This section contains the method for developing the framework.
2	Framework	A diagrammatic representation of the framework described in detail.
3	Health Benefits	Describes the health benefits of eliminating avoidable blindness and visual impairment
4	Economic Benefits	Describes the economic benefits of eliminating avoidable blindness and visual impairment
5	Societal Benefits	Describes the social benefits of eliminating avoidable blindness and visual impairment
6	Levels of Investment	Details the added benefits that would arise from strengthening the broader health system

7	Roadmap – Phase 2 quantification	Provides a roadmap to the next steps in estimating the benefits of eliminating avoidable blindness and visual impairment
Appendices	Appendix A:	Bibliography
	Appendix B:	Literature scan of benefits

Contents

1 Background

The Fred Hollows Foundation (FHF) engaged PwC, with the assistance of Three Rivers, to develop a framework outlining the benefits of the global elimination of avoidable blindness and vision impairment.

The World Health Organization (WHO) estimates that, globally, there are 32.4 million people who are blind, and a further 190.6 million people who are visually impaired to the point that their ability to function is negatively impacted. A large proportion of the world's blind and visually impaired live in developing countries, the majority of which are avoidably blind. For many of these people, it is often the case that their sight has the potential to be restored substantially through taking antibiotics or a undergoing a straightforward surgical procedure.

Overview of study: the cost of avoidable blindness and visual impairment

This report follows an initial report prepared by PwC and Three Rivers on the estimated investment needed to eliminate avoidable blindness and visual impairment globally by 2020.

The costing framework distinguished three primary categories of investment:

- The investment required to build and provide an ongoing **primary care system** with the capacity to prevent avoidable blindness and visual impairment
- The investment required to build and provide an ongoing **secondary care system** with the capacity to treat patients at risk of avoidable blindness and visual impairment
- The investment required to **eliminate the 'backlog'** of avoidable blindness and visual impairment, predominantly in the developing world where access to basic health care is severely limited. The 'backlog' comprises individuals who experience avoidable blindness and visual impairment conditions as well as individuals who are at risk of experiencing avoidable blindness and visual impairment conditions by 2020.

Using this framework, several key results were obtained

The direct health cost/investment required only to treat the current and anticipated backlog of avoidable blindness and visual impairment over ten years (2011 to 2020) was estimated to be US$23.1 billion over this ten year period.[3]

However, to meet the broader goals of Vision 2020 – The Right to Sight (the global initiative for the elimination of avoidable blindness and visual impairment), an additional investment estimated at US$394.2 billion[4] over the period 2011-2020 was needed to eliminate avoidable blindness and visual impairment, noting that over two thirds of this is required in the developed world rather than in poorer countries. Excluding high income countries, the additional investment required to eliminate avoidable blindness and visual impairment was estimated to be US$128.2 billion. This is the equivalent of an average of US**$2.20 per person per year** for people living in poorer countries over this 10 year period.[5]

[3] The cost of treating the backlog of Macular Degeneration has not been included as it is considered prohibitively high and evidence to support ceasing blindness is continuing to evolve

[4] Costs are expressed in US nominal terms, using a 2009 3 year average GDP inflator to determine indexation

[5] Based on 2009 population data

Globally, the additional investment is the equivalent of an average of US**$5.70 per person per year over this ten year period**[6], and represents an increase of 7% in global eye health expenditure over this same time period.

The estimated additional investment required in the primary health care sector is the largest component of this cost, at US$308.4 billion.

It is essential to note that these cost estimates were developed using a range of high level assumptions, and are hence subject to considerable uncertainty. In particular, the results are subject to the following data limitations:

- an overall lack of available data on eye health and primary care expenditure in most countries
- inability to draw accurate comparisons across different analyses
- missing data items.

1.1 Project scope

PwC and The Fred Hollows Foundation have agreed that the scope of this new piece of work is to quantify, to the degree that is possible, the benefits of eliminating avoidable blindness and vision impairment within a framework that incorporates economic, health and social benefits. The purpose of this report is to outline the benefits gained from making the investment to eliminate avoidable blindness and vision impairment on a global scale and develop a **"benefits framework"** which could act as a starting point for the quantification of benefits. It is the precursor to a quantification of benefits that will be undertaken in the next phase of this work.

To date, these phases combined will be the first analysis where the health, economic and social benefits of eliminating avoidable blindness and vision impairment are brought together on a global scale. Past studies range in the breadth of geographic scope, from one country, to one region to global, and have broadly speaking analysed one aspect (such as the economic cost) rather than multiple. This analysis will also be the first to bring together the benefits for all avoidable blindness and vision impairment conditions.

1.2 Method

In order to develop the benefits framework presented in this report, four key steps were undertaken:

1. **Initial information gathering** via two main approaches which were to search an array of health databases and publically available information published on the internet prior to engaging with a panel of subject matter experts who assisted to provide relevant peer reviewed journal articles. The purpose of the initial information gathering was to identify evidence-based examples of the benefits of eliminating avoidable blindness and visual impairment. The bibliography of documents reviewed is provided in Appendix A.

   The literature scan provided a body of information regarding avoidable blindness and visual impairment to inform the development of the benefits framework and development of the discussion paper for the subsequent subject matter expert interviews. The scan searched for research related to blindness, avoidable blindness and visual impairment, benefits and costs. The team reviewed peer reviewed journal articles, economic reports and other documents to gather evidence of the key benefits.

   The articles used in the benefits framework were those with a focus on the benefits of eliminating avoidable blindness and visual impairment or the cost implications of avoidable blindness and visual impairment. Other research, such as cost-effectiveness analysis of treatments was informative for context but focused on the cost of elimination, not the implications of elimination and as such, were relied upon less for the development of the framework. As per the costing analysis, macular degeneration is not included in this benefits analysis.

[6] Based on 2009 population data

2. **Benefit identification and categorisation**. Based on the literature scan and the emerging themes, the benefits were determined to be both quantitative and qualitative, and easily grouped into three categories: health, economic, societal. Each of the benefits identified in the framework are further discussed in the report and examples of these benefits are provided based on both the literature scan and the consultations. These categories link to a triple bottom line (TBL) analysis. TBL considers the key criteria for measuring the success of a specific measure/ organisation/ program and includes three pillars - people, planet and profit. Further, when considering cost benefit analysis, elements of benefit outside the direct impact should be measured – in this case, not solely health benefits, but also economic and social impacts.

3. **Subject matter expert interviews**. To gain further insight into the initial benefits identified and to gather further information and evidence including information that was not publically available, interviews with subject matter experts were conducted. The outcome of these meetings was that receipt of a number of additional resources and relevant peer reviewed journal articles.

   A discussion guide based on the literature scan was prepared and given to all stakeholders prior to the interviews to inform their thinking.

   - The stakeholder interviews sought feedback on the initial work across the following five areas:

   a) The benefits identified from the literature

   b) The classification of benefits into economic, health and societal

   c) The inclusion of benefits to strengthen the overall health system capacity

   d) Additional resources of references

   e) The limitation of benefits measurement.

   - Telephone consultations were carried out with the following key eye health informants:

   – Professor Clare Gilbert – Professor of International Eye Health in the International Centre for Eye Health; Medical Advisor to Sight Savers International

   – Doctor Richard Le Mesurier – Medical Director for The Fred Hollows Foundation; Chair of the Western Pacific Region with the International Agency for the Prevention of Blindness

   – Serge Resnikoff, MD –Coordinator for Prevention of Blindness and Deafness, WHO

   – Professor Kevin Frick – Health economist and Professor at the Johns Hopkins Bloomberg School of Public Health in the Department of Health Policy and Management

   – Professor Hugh Taylor – Lead of Indigenous Eye Health Unit in the Melbourne School of Population Health

4. **Development of the draft benefits framework.** The draft benefits framework was developed as presented in this report based on the information gathered and received as well as the insights gained from the subject matter expert interviews.

The literature scan of benefits (see Appendix C) is the collation of reviewed literature and informed benefit categorisation. This scan shows how the literature was used in identifying and categorising benefits and informed the subsequent framework development.

To outline the steps that will follow this process, a roadmap has been developed which outlines how the quantification analysis will proceed (see section 7 of this report). The roadmap indicates at what points the key subject matter experts will continue to be consulted and inform the process. It also outlines recommendations in regards to ongoing evaluation to the initial estimates in future as data improves.

1.3 Purpose of this report

The purpose of this report is to outline the benefits from making this additional investment in eliminating avoidable blindness and visual impairment, and put the estimated 7% increase in costs into perspective as to what can be achieved in health, economic and social benefits.

Each country is at a different stage in developing their health systems, and so will face different investment decisions, and achieve different benefits by making that investment. This report also considers the potential benefits arising from different types of investment, to help agencies and government with limited resources to consider how best to invest in eye health. We have identified four levels of investment which could be undertaken, based on the previous costing framework:

1 Business as usual

2 Eliminate the backlog

3 Develop the secondary health system

4 Develop the primary health system

It is important to note that these levels of investment are not necessarily sequential even though they can be reported individually as per the cost analysis. In reality, investment would likely need to occur concurrently across the areas outlined below in order to achieve the elimination of avoidable blindness and visual impairment.

This report presents the first step in the benefits estimation process, a **"benefits framework**" for the elimination of avoidable blindness and visual impairment. Here we establish the benefits framework for the elimination of avoidable blindness and visual impairment and provides examples of these benefits as derived from the literature and stakeholder consultations. The report lends itself to highlight the importance of quantifying the benefits in terms of the level of investment and furthermore by time and region or country.

Ultimately the benefits framework will provide the foundation for a more detailed analysis and quantification of the benefits associated with eliminating avoidable blindness and visual impairment. This can assist as a platform for advocacy and the quest for funds and support from governments and non-government organisations in the future, noting that given the lack of available data, benefit estimates will require a range of high level assumptions and will be subject to considerable uncertainty.

2 Framework

The purpose of the Benefits Framework is to identify and categorise the diverse benefits that could be achieved with the elimination of avoidable blindness and visual impairment. Key findings from the literature scan and interviews with stakeholders have informed the development of a benefits framework for eliminating avoidable blindness and visual impairment. Figure 1 below illustrates the three categories of benefits, those being social, health and economic. We note that as this is a global estimate, regional differences will need to be considered. The arrow which indicates difficulty of quantification is present to acknowledge that generally it is more straightforward to value economic benefits compared to social benefits.

Figure 1: High level benefits framework

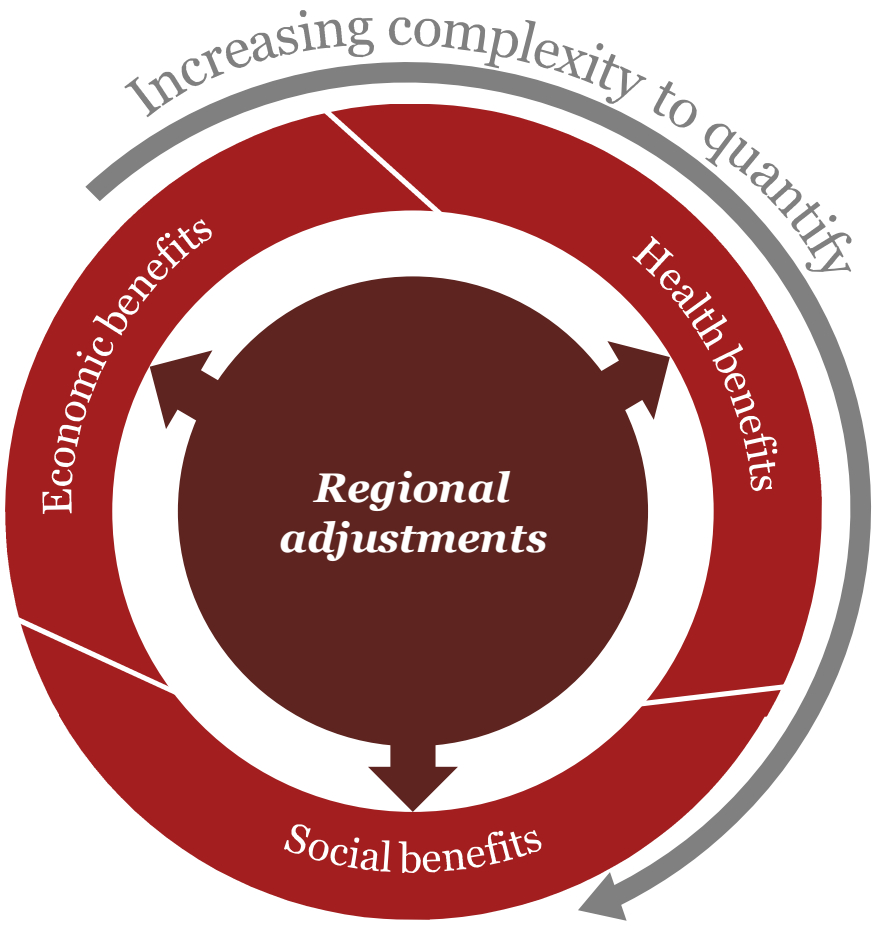
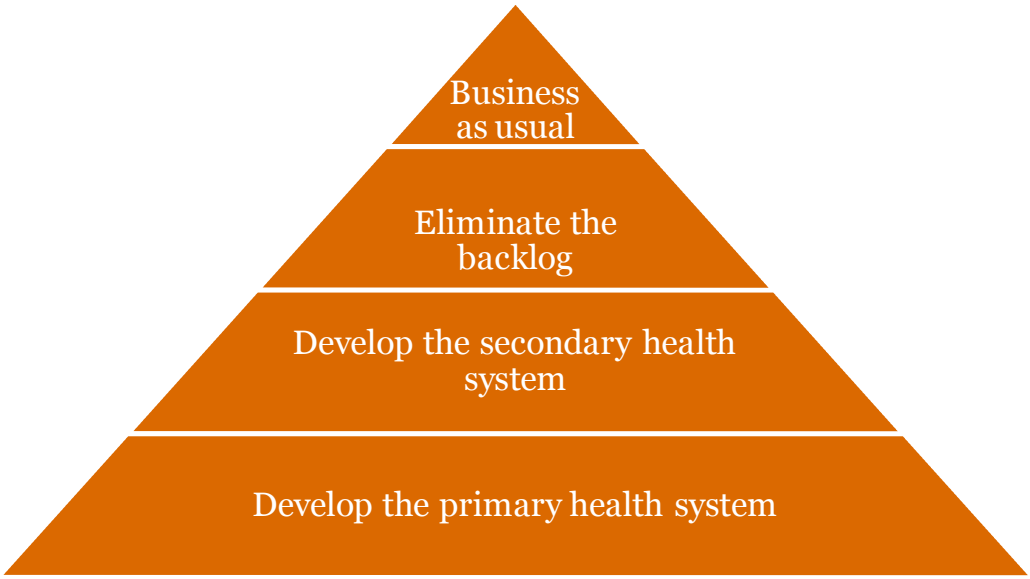


Figure 2 depicts the four levels of investment for eliminating avoidable blindness and visual impairment. The specified levels of investment are based on the costing framework that was developed for the estimate of the investment required to eliminate avoidable blindness and visual impairment.

Figure 2: Levels of investment



Defining the benefits

Health, economic and societal benefits are to some extent inter-related and may be interdependent. Health benefits are the obvious first benefits to be realised through any strategy aimed at eliminating avoidable blindness and visual impairment. Secondly, economic benefits follow health benefits and can largely be attributed to the realisation of a greater number of healthy people being able to participate in the workforce and thus economic growth. Thirdly, social benefits are largely indirect benefits resulting from the culmination of the realisation of health and economic benefits.

It is recognised that there are a number of benefits that are fluid and may sit between two categories, or in all three. For the purpose of developing a framework that can categorise benefits in a mutually exclusive manner, the team have assigned each benefit to one discrete category.

Health Benefits are the most immediate benefits to be realised from any intervention to eliminate avoidable blindness and visual impairment. Health benefits are those that result from increased health outcomes. Health benefits encompass those that are realised by the individual as well as the benefits to the overarching health care system and associated payers. On an individual level, health benefits are those that improve the general health, well-being and quality of life of people as well as a reduced burden of disease. These may be quantified by examining changes in prevalence and incidence statistics or quality of life/burden of disease measures such as DALYs and QALYs. These will be aggregated and reported on a regional and then global scale. Health system benefits may include a reduction in costs associated with hospitalisation rates and length of stay.

QALYs are one such benefit that could be considered a health or an economic benefit, or appropriate to both categories as they reflect functional capacity in differing socioeconomic situations. In this framework we have placed them under health benefits as they relate to quality of life and wellbeing, which have been considered part of this category.

Economic Benefits are those that relate to the economy, for example, employment and productivity. Economic benefits are usually measured in terms of economic growth and associated changes in productivity through employment and income. A further economic benefit resulting from increased employment is the potential decrease in welfare payments and an increase in education. This framework is limited to the direct benefits that will be accrued to the economy.

Social Benefits: are community-wide benefits. Social benefits are largely indirect benefits and result from the realisation of the economic and health benefits. Social benefits are often more difficult to quantify than health and economic benefits and may require more assumptions to build an estimate or a qualitative analysis.

The tables below define the benefits across each of the three categories of economic, health and societal in terms of individual and society benefits. It is important to note that some of these benefits may come at some unintentional costs (for example, achieving universal primary education is a significant benefit, but may come with additional infrastructure and teaching costs).

Several benefits correspond to the World Health Organisation's Millennium Development Goals (MDGs). Examples of these include: a reduction in global extreme poverty, achieving universal primary education and gender equality. Thus, a commitment to VISION 2020 and the elimination of avoidable blindness and visual impairment is likely to be a noteworthy step forward for governments world-wide to achieve these goals.

Table 2: Health benefits

Types of health benefits gained from eliminating avoidable blindness and visual impairment
• **Improved quality of life/reduced burden of disease (DALYs averted; QALYs gained)** • **Reduced co-morbidities & mortality (including HIV/AIDS and malaria-MDG 6)** • **Reduced child mortality (MDG 4)** • **Reduced hospitalisations, length of stay and other health system costs (possibly including emergency department presentation and ambulatory care where applicable)**

A flow on association drawn from the health benefits cited above is depicted in Figure 4 below:

Figure 4: Health benefits

Table 3: Economic benefits

Types of economic benefits from eliminating avoidable blindness and visual impairment
• **Increased employment to the visually impaired and carer** • **Reduced welfare costs to the visually impaired and carer** • **Achieving universal primary education (MDG 2) by either the ability for current carers to receive education or visually impaired children to access education**

A flow on association drawn from the economic benefits cited above is depicted in Figure 3 below:

Figure 3: Economic benefits

Table 4: Social benefits

Types of soical benefits from eliminating avoidable blindness and visual impairment
• **Increased independence** • **Increased self-esteem and improved social networks** • **Reduced extreme poverty and hunger (MDG 1)** • **Increased gender equality** • **Increased community participation**

Benefits realisation

In broad terms, good health is essential to human welfare and sustained economic and social development. The economic, health and social benefits described above contribute to individual, as well as society, system and community benefits.

Many of these benefits are interrelated and interdependent, meaning that when one benefit is realised a second indirect benefit may also be realised.

These benefits are not additive – in fact many of them overlap and lead on to the other benefits identified – for example, increased employment goes hand in hand with reducing extreme poverty. Nevertheless, it is worth identifying all these potential benefits, to develop a full picture of the outcomes possible.

Benefits of eliminating avoidable blindness and visual impairment will be realised incrementally largely based on the individual country's distribution of money, power and resources and more broadly the social determinants of health, these being the conditions in which people are born, grow, live, work and age, including the health system. Avoidable blindness and visual impairment disproportionately affects poorer low-income countries followed by middle income countries and high income countries. Avoidable blindness and visual impairment can be linked to disadvantaged communities, poor household wealth, low education levels, poor hygiene practices and crowding to name a few.

The case study presented below, averted falls, highlights the varying degrees to which this particular benefit may be realised and also identifies the indirect benefits that stem from the realisation of this benefit.

CASE STUDY: AVERTED FALLS

In Australia, falls accounted for 1,348 deaths registered in 2008 which represented 0.9% of all registered deaths and 15% of all external causes of death (ABS Causes of Death, Australia 2008). Statistics have also shown a 54% increase in falls from 2004 to 2008 (ABS Causes of Death Australia, 2008).

Visual impairment has been cited as a risk factor for falls, with one study documenting that 22% of multiple fallers and 6% of single fallers suffering from blindness or poor vision (Gaebler, 1993). There have been several more recent studies that have documented the positive correlation between falls in the elderly population and blindness. Kallstrand-Ericson and Hildingh (2008) noted that visual impairment was a causal factor of falls and fall injuries of a sample of patients 65 years and over. Similarly, in The Shihpai Eye Study, Kuang et al (2008) found a strong association between visual impairment and falls in their sample Chinese population. Patino et al (2010) undertook a similar study, with results supporting those already mentioned.

The benefit associated with averted falls resulting from the investment in the elimination of avoidable blindness can be broken down into three tiers:

Individual: a higher quality of life is able to be maintained through the avoidance of injury and possible hospitalisation due to falls. Studies have also shown that an initial fall by a patient is more likely to be followed by a repeat fall, suggesting longer term benefits (Gaebler, 2003).
Society: Australian hospital statistics show that falls accounted for a total of 257,725 separations by external cause in 2009/2010. A reduction in the number of falls will free up hospital capacity, as well as leading to productivity gains such as increased employment and reduced welfare payments.
Longer term benefits: Over time, benefits to society in terms of health system capacity and productivity will increase. Given the global demand for health services is likely to continue to grow spurred largely by the ageing population, current efforts to minimise future avoidable admittances to hospital will prove extremely valuable.

Benefits measurement

Often there are a number of ways in which to quantify benefits. The approach taken will be guided by the methods presented in the peer reviewed research collated during phase 2. When developing the estimates, all assumptions will be documented in order to aggregate a national or regional estimate of the benefit of eliminating avoidable blindness and visual impairment to a global scale. Further, the degree to which benefits can be attributed to avoidable blindness and visual impairment and guided by the peer reviewed literature will also be identified.

3 Health benefits

Benefit	Quantification & Examples from the Literature
***Improved Quality of Life*: This occurs at an individual level, and encompasses the improvement in one's health status.**	***Metric*:** *DALYs:* measures the sum of years of potential life lost due to premature mortality and the years of productive life lost due to disability. It is a measure of overall disease burden, combining mortality and morbidity into a single metric unit. One DALY is equal to one year of life without disability lost. DALYs can be represented in monetary values using the value of a statistical life. *QALYs*: provide a common currency to assess the extent of the benefits gained from a variety of interventions in terms of health related quality of life and survival for the patient. ***Examples:*** • *Gordon et al, 2011 – 'The cost of vision loss in Canada 1. Methodology' uses DALYs to measure the loss of healthy life from accountable to vision loss, converted to a dollar figure using the value of a statistical life. The linked results report found that their cost to Canada was $11.7 billion in 2007.* • *Baltussen et al, 2004 – 'Cost-effectiveness Analysis of Cataract Surgery'*: used DALYs as a measure of benefits for cataract surgery globally. • *Roberts et al, 2010 – 'Economic Cost of Visual Impairment in Japan',* uses DALYs to proxy wellbeing and estimates the years of life lost from disability and premature mortality (DALYs) at 5,863 billion Yen. • *Taylor et al, 2006 – 'The Economic Impact and Cost of Visual Impairment in Australia'*: estimated the loss of wellbeing attributable to visual disorders to be 40,068 years in 2004 in Australia. • *Weale, 2011 – 'A Cost Benefit Analysis of Cataract Surgery'*: used the English Longitudinal Survey of Ageing to determine the expected QALYs gained as a result of cataract surgery.
***Reduced co-morbidities and mortality*: studies have shown that blindness is associated with a**	***Metric*:** Hospital statistics detailing mortality and co-

higher risk of infectious diseases due to them being unable to see public health promotion posters, compromised in reading instructions for medications and more likely to miss out on community health programs. Visually impaired individuals are also more prone to risk of death caused by falls, hip fracture, motor vehicle accidents and depression.	morbidity figures ***Examples:*** • *Access Economics, 2004 – 'Clear Insight: The Economic Impact and Cost of Vision Loss in Australia'*: estimated that of the 70,668 visually impaired Australians who died in 2004, 584 could be attributed to visual impairment • *Gaebler, 1993 – 'Predicting which patient will fall again…and again'*: showed that 22% of multiple fallers and 6% of single fallers in one study suffered from blindness or poor vision. • *Horowitz,* 2003 – *'Depression and Vision and Hearing Impairments in Later Life':* examines the extent and nature of the relationship between age-related vision loss and depression and discusses the implications • *Casten and Rovner, 2008 – 'Depression in Age-Related Macular Degeneration*: discusses the effect of depression on vision-related disability in patients with AMD • *Kallstrand-Ericson, 2008 – 'Visual Impairment and falls: a register study'*: investigates falls and fall injuries of inpatients 65 years and over to determine whether a causal factor of visual impairment was documented. • *Kuang, TM et al, 2008 – 'Visual Impairment and Falls in the Elderly: The Shihpai Eye Study'*: investigates the association between visual impairment and falls in a metropolitan elderly Chinese population, finding a strong correlation. • *Patino et al, 2010 – 'Central and Peripheral Visual Impairment and the Risk of Falls and Falls with Injury*': documents the associated increased risk for falls and falls with injury with central and peripheral visual impairment.
***Reduced child mortality*: An association between child mortality and blindness has been established due to the fact that several risk factors for blindness are the same as those for child mortality: vitamin A deficiency, measles and meningitis.**	***Metric:*** Child mortality data ***Example:*** • *Gilbert & Faal, 2007 – 'Convincing Governments to Act: VISION 2020 and the Millennium Development Goals'*: commented that up to half a million children become blind each year, with up to 60% of children in the developing world dying within one or two years of becoming blind.
***Reduced hospitalisations, length of stay & other health system costs:* refers to decreased admission rates to hospitals, fewer overnight bed-days, reduced equipment, aid and other costs. This may also include emergency department presentation and ambulatory care where applicable.**	***Metric:*** Hospital separation statistics, hospital length of stay statistics ***Example:*** • *Gordon et al, 2011 – 'The cost of vision loss in Canada 1. Methodology'* estimated the direct health system expenditure related to vision loss at $8.6 billion in 2007.

- *Access Economics, 2010 – 'The Global Cost of Visual Impairment':* Estimated total health care system expenditure per person in Australia to be $7,186 (2008 USD).
- *Access Economics, 2010, Clear Focus: The Economic Impact and Cost of Vision Loss in Australia, 2009, An overview of the report prepared for Vision 2020 Australia by Access Economics Pty Limited, June 2010*

4 Economic benefits

Benefit	Quantification & Examples from the Literature
Increased employment **– for both visually impaired individuals and carers: occurring by means of these individuals (re)entering the workforce and the reduced cost of care.**	***Metric*****:** Changes in employment statistics globally ***Example:*** • *Javitt, 1993 – 'The Cost-Effectiveness of Restoring Sight'*: found that in a study group in India, 85 of males and 58% of females were able to return to the workforce after receiving cataract surgery. • *Frick et al 2001 – 'Epidemiological, demographic, and economic analyses: measurement of the value of trichiasis surgery in The Gambia'* costed trichiasis in terms of lost lifetime economic productivity. This study expressed the cost of the illness as a function of life expectancy, probability of the condition (corneal opacity) and yearly lost productivity. Of the patients that fit these criteria, it was found that their decreased lifetime economic productivity was $325 which is similar to the value of GNP per capita in the Gambia ($340 in 1998). • *Keeffe et al 2009 – 'The Cost of Care for People with Impaired Vision in Australia'* – estimated opportunity cost of care-giving to adults with impaired vision, finding that the median annual opportunity cost was $915 in 2009. • *Smith TST et al 2009 - 'Potential lost productivity from the global burden of uncorrected refractive error'*: used Gross Domestic Product adjusted by labour force factors to estimate that the loss from uncorrected refractive error is $268.8 billion (International dollars) in 2007. • *Frick, Foster 2005 – 'Analysis of the Costs and Benefits of the Gambian Eye Care Program'*: estimated the net lifetime productivity gain to be US$1.01 million from 1986 until 2050. • *Access Economics, 2010 – 'Global Economic Cost of Visual Impairment'*: estimated the loss in productivity to be US$168 billion globally and the informal care burden to be US$246 billion in 2010. • *Gordon et al, 2011 – 'The cost of vision loss in Canada 1. Methodology' uses a number of measures for productivity loss including the cost of care, employment participation, absenteeism and presenteeism. Combined these cost Canada $4.4*

	billion in 2007. • *Levine, 2007 – 'Controlling onchocerciasis (river blindness) in sub-Saharan Africa'*: notes the huge impact the Onchocerciasis Control Program has had in Africa in terms of increasing productivity. This is largely due to the fact that the threat of disease has led people to abandon more than 250,000 square km of arable land which had aggravated poverty prior to the program's implementation.
***Reduced welfare costs*: refers to the decreased number of disability pensions distributed across welfare systems globally.**	***Metric:*** Changes in the number of individuals on disability welfare payments due to blindness ***Example:*** • *Gordon et al, 2011 – 'The cost of vision loss in Canada 1. Methodology'* measures the dead weight loss associated with the transfer payments made to those with vision loss and the reduced taxation revenue. In 2007 this was estimated at $1.8 billion. • *Access Economics, 2010 – 'Global Economic Cost of Visual Impairment'*: estimated the 'deadweight' welfare loss to be US$238 billion globally in 2010
***Achieving universal primary education:* aligns with MDG 2, and encompasses both visually impaired children and child carers in developing countries being able to receive a primary education. This will ultimately contribute to increased employment and productivity.**	***Metric:*** Education statistics in low/middle income countries ***Example:*** • It has been estimated that approximately 90% of visually impaired children in developing countries do not attend school due to a lack of necessary education materials, a shortage of qualified teachers and distances needed to be travelled from a child's home to school.

5 Social benefits

Benefit	Quantification & Examples from the Literature
***Reduced extreme poverty and hunger (MDG 1)*: a strong correlation between blindness and extreme poverty in lower developed countries has been drawn. The term poverty must be understood to encompass not only economic measures such as low income and unemployment, but other social and psychological elements. These include access to education and healthcare, limited social interaction, limited marriage prospects and higher exposure to violence and social stigma.** **In some studies the causation is such that eliminating avoidable blindness and visual impairment can also impact on poverty levels (see example 2).**	***Metric***: Changes in proportion of global population living in extreme poverty ***Example:*** • *Naidoo, 2007 – 'Poverty and Blindness in Africa'*: highlights the disproportionate prevalence of blindness in Africa which mirrors the distribution of the burden of extreme poverty. With approximately 10% of the world's population, Africa bears 19% of the world's blindness. • *Kuper et al, 2010-'Does Cataract Surgery Alleviate Poverty'*: used per capita expenditure, asset ownership and self rated wealth to assess the relationship between poverty and visual impairment from cataract in Kenya, the Philippines and Bangladesh. The study concluded that cataract surgery can contribute to poverty alleviation, especially amongst the most vulnerable members of society. • *Gilbert et al, 2008-'Poverty and Blindness in Pakistan'*: documented the link between poverty and blindness in Pakistan, showing that lower access to health care is a main contributory factor.
***Increased independence*: refers to the renewed ability of individuals to attend to their day to day lives, eliminated dependence on carers and decreased feelings of incompetency.**	***Metric*: Not easily quantified** ***Examples:*** • *Long et al, 1996 – 'Older Persons and Community Travel: the effect of visual impairment':* observed that individuals with visual impairment travelled infrequently by themselves and were dissatisfied with the number of opportunities they had to leave their homes, meanwhile also reporting feelings of difficulty using public transport.
***Increased self-esteem and improved social networks*: refers to reduced feelings of isolation and loneliness commonly associated with blindness. This may also encompass reduced rates of depression.**	***Metric:*** Depression and other mental illness prevalence statistics ***Example:*** • *Nyman et al, 2010 – 'Psychological Impact of Visual Impairment in Working Age Adults':* produced a review of the psychological impact of visual impairment, with results showing an increased risk of depression and reduced

	quality of life and social functioning compared with sighted individuals. • *Evans et al, 2007 – 'Depression and Anxiety in Visually Impaired Older People'*: carried out a study on depression and visual impairment on older people in Britain, finding that 13.5% of the visually impaired sample group were depressed.
Increased gender equality (MDG 3): **Women bear the majority burden of blindness globally, with rates of visual impairment amongst women two to three times higher than in men.**	***Metric:*** Not easily quantified, however data such as female employment statistics in the developing world may be useful. ***Example:*** • *Congdon et al, 1993 –' Exposure to Children and Risk of Active Trachoma in Tanzanian Women'*: comment that this disparity is likely to have arisen particularly in lower income countries due to increased exposure and infection as a result of child rearing. • *Abou-Gareeb et al, 2001 –'Gender and Blindness: A meta-analysis of population-based prevalence surveys':* notes that 90% of women living with blindness are also living in poverty • *Lewallen, Courtright, 2002 – 'Gender and Use of Cataract Surgical Services in Developing Countries'*: provide recent research on the fact that blindness from cataracts could be reduced by as much as 11% in developing countries if women were to receive cataract surgery at the same rate as men • *Cromwell et al, 2009 – 'The excess burden of trachomatous trichiasis in women: a systematic review and meta analysis'*: highlights the gender disparity in the prevalence of trachoma towards women • *Nepal Gender and Eye Health Group Policy Brief, 2010 – 'Gender Equity in Health: Lessons from Eye Care':* reinforces the extent of the gender gap, using Nepal as an example. • *Courtright et al, 2004 – 'Contribution of sex-linked biology and gender roles to disparities with trachoma'*: documents the link between infection of trachoma and child rearing in developing countries
Increased community participation**: refers to the renewed capacity of older members of the community to fulfil societal roles such as acting as informal carers or sources of knowledge transfer to younger generations.**	***Metric:*** Not easily quantified

6 Level of investment

Additional benefits are expected to arise from investment in expanding the capacity of the wider health system.

Based on the initial costing framework investing to reduce avoidable blindness and visual impairment will require an understanding of the potential benefits arising from different types of investment. The benefits framework discussed in Section 3 identifies four levels of investment. The specified levels of investment are based on the costing framework that was developed for the estimate of the investment required to eliminate avoidable blindness and visual impairment:

- business as usual
- eliminating the backlog
- developing the secondary health system
- developing the primary health system.

These four levels of investment are based on the framework developed for the analysis which provided a cost estimate for the elimination of avoidable blindness and visual impairment globally. Each level of investment is discussed in further detail below. However it is important to note that while the levels of investment described can be reported individually as per the cost analysis, they are not necessarily sequential. In reality, investment would likely need to occur concurrently across the areas outlined below in order to achieve the elimination of avoidable blindness and visual impairment.

Business as usual:

Business as usual encompasses all the global initiatives currently taking place with the intention of reducing the strain of avoidable blindness and visual impairment on our economy, health system and society. Benefits will still accrue to those individuals receiving treatment however on a much smaller scale compared to if additional investment was being made.

Eliminate the backlog:

The backlog refers to all those individuals who currently experience avoidable blindness and visual impairment conditions as well as individuals who are at risk of experiencing avoidable blindness and visual impairment by 2020. The timeframe thus spans 2011-2020.

Develop the secondary health system:

Following the investment to eliminate the backlog of avoidable blindness and visual impairment, an additional investment can be made after 2020 to build the secondary health system. This is likely to be directed at expanding hospital services and capacity.

Develop the primary health system:

Following the investment to eliminate the backlog of avoidable blindness and visual impairment, an additional investment can be made after 2020 to expand the primary health care system. This encompasses nurse or GP visits and preventative care initiatives.

Benefits realisation

Working through the four levels of investment specified, progressively a wider range of people are exposed to the potential benefits of eliminating avoidable blindness and visual impairment, and a broader range of benefits become available to those people. For example, eliminating the backlog of avoidable blindness and visual impairment will open up advantages for those people treated, such as employment opportunities, reduced poverty and greater community participation.

The SAFE Strategy is an example where investment spans across the primary and secondary health systems. The first component of the strategy: surgery, falls under secondary care, while antibiotics, facial cleanliness and environmental change are examples of preventative care initiatives and fall under the primary system.

CASE STUDY: SAFE STRATEGY

In 1997, the WHO organised the Alliance for the "Global Elimination of Trachoma by 2020" and recommended the 'SAFE' strategy as a basic framework for dealing with trachoma. The strategy consists of:

- Surgery
- Antibiotic treatment
- Facial cleanliness
- Environmental change

The SAFE Strategy is currently being implemented in over 30 countries to eliminate the backlog of the disease, and will no doubt play a huge part in reducing future incidence of trachoma through positive changes in sanitation and primary care. (The End in Sight, 2011). The 'E' component of the strategy focuses on improving water supplies to prevent the spread of the disease and ties in with MDG 7: Ensuring environmental sustainability.

There is a body of evidence available that specifically focuses on the benefits of the preventative components of the strategy in low income countries. Ngondi et al (2008) undertook a study testing the impacts of the SAFE strategy in southern Sudanese communities, finding that hygiene and environmental factors were key in protecting against active trachoma. Polack et al (2006) undertook a study examining the relationship between prevalence of active trachoma in children and water availability and use in a Tanzanian village, finding that there was a lower prevalence of trachoma amongst children who regularly used water for personal hygiene. Roba et al (2010) have drawn the same positive correlation, underlining the value of simple preventative measures in low income countries where trachoma is especially rampant.

There is also considerable evidence supporting the surgical and antibiotic elements of the strategy. To reach the subset of people with late stage trachoma who require surgery effectively, a high volume of operations needs to be performed at the community level. Bowman et al (2000) have shown that in the Gambia region, making trichiasis surgery available at the community level has increased acceptance rates from 44% in health centres to 66%. Kuper et al (2003) have carried out a detailed critical review of the SAFE strategy, adding strong support for the efficacy of the surgery and antibiotics components in decreasing the backlog of trichiasis and rapidly reducing the prevalence of trachoma in children.

Morocco is an example where the strategy has been successfully implemented. The Ministry of Health in Morocco has adopted a policy of decentralisation and devolution which have enabled the health service to maximise the resources available for the prevention of trachoma in endemic regions (Chami et al, 2004). It was also the first country to use the mass distribution of azithromycin for antibiotic treatment of the disease.

Aboriginal communities in Australia on the other hand is an example where minimal progress has been made in combating the disease. Taylor (2001) highlights the extent of the issue, particularly given that Australia is the only developed country in which trachoma still exists. Whilst the SAFE strategy has been accepted and implemented by the Federal Government, until recently little has been seen to have changed in comparison to the marked progress observed in developing countries. While Wright (2007) undertook a study examining the impact of the SAFE strategy in two Aboriginal communities, finding that the 'A' and 'F' aspects were found to be statistically significant against the prevalence of trachoma, it is reiterated that the implementation of the strategy in Australia has been less than optimal. It is only much more recently, after the 2009 commitment by the Australian Government, that enhanced activities have begun to result in an appreciable eduction in trachoma prevalence in many outback Aboriginal communities (Adams et al, 2009) .

Developing the primary care sector can impact a far greater range of people, and provide broader benefits than those that may be achieved from restoring the sight of those with avoidable blindness and visual impairment. One study has recognised the importance of the primary sector in relation to diabetic retinopathy, with research

showing that early diagnosis and timely treatment can prevent vision loss in more than 90% of patients with diabetes, yet approximately half of all people with diabetic retinopathy are diagnosed at a stage when it is too late for treatment to be effective (Ferris, 1993). The benefits arising from early diagnosis of conditions such as this will have a more profound impact in terms of long term prevention of eye disease and maintenance of general health.

Clinicians in primary care settings are well positioned to actively contribute to the prevention of blindness through screening and controlling known risk factors for visual loss, and through the prompt referral of certain patients to qualified eye care professionals. Goldzweig et al (2004) reinforce the important role of primary care workers as educators, citing that there are often misunderstandings in regards to patients' conceptions of their own eye disease, with up to half of all patients with glaucoma unaware that they have the disease.

Experts in the field have stressed the need for eye health to be incorporated into general health, commenting that it is too often separated as a splinter group. This is particularly so in low-income countries where health services are scarce, in which case it has been recommended that preventative eye screening be performed at the same time as immunisations and the delivery of other basic health services.

The level of investment is a key determinant of the level of benefits realisation as summarised below:

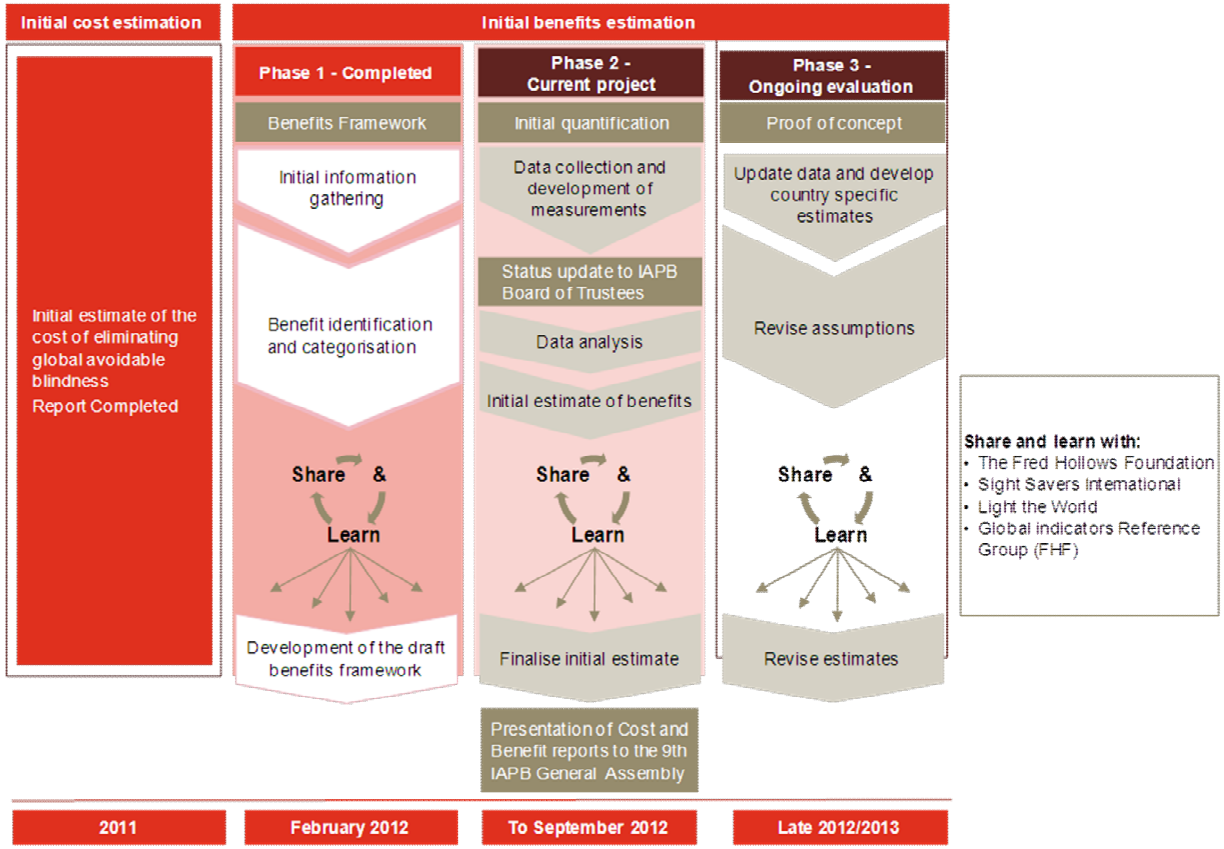
- Depending on the level of investment pursued, varying degrees of the identified economic, health and societal benefits are likely to occur. A likely scenario is the higher the investment level and the longer the time frame of the investment, the greater the benefits realised.
- Regional and country differences will play a major role in relation to the benefits realised. For example, the benefits likely to occur following the investment in basic public health initiatives such as clean water will have a much more profound impact in Africa than in the Western World, as primary health care systems are less developed in these regions.
- Depending on the region / country in question, specific beneficiaries may vary. For example, governments distributing higher welfare payments will be likely to benefit more from the reduction in welfare costs that will follow the elimination of avoidable blindness and visual impairment. The same notion can be applied to productivity gains depending on a country's average earnings, and health system costs.

7 Roadmap – Phase 2 quantification

The benefits defined in this framework will form the basis of Phase 2 – a more detailed exercise in which these benefits will be quantified to provide a more holistic view of benefits realisation as attributed to the elimination of avoidable blindness and visual impairment.

The next steps may be broken into a number of key steps (Figure 3). The steps that sit under phase 2 include data collection and development of measures through to finalising the estimates based on a share and learn round. Subsequent steps beyond Phase 2 will be important to ensure that information remains timely and of relevance estimate in future.

Figure 3: Roadmap - Phase 2 quantification



Each step is outlined in more detail below:

7.1 Initial quantification

Data collection and development of measurements

The literature scan undertaken to inform this report has provided a foundation upon which the economic and health benefits measures have been built, for example, DALYs averted and productivity gains. The quantification of social benefits however is likely to be notably more limited.

The data collection step will require the following tasks:

1. Develop specific metrics for each benefit based on Benefits Framework and literature scan (Appendix B)

- Attribute measures to those that are clearly linked to avoidable blindness and visual impairment and those that are more loosely linked.
- Develop quantifiable and updateable measures where feasible

2. Collect and collate relevant available data. Useful public resources that may inform the quantification of benefits include:

- Global hospital statistics
- World Development Indicator data
- WHO: International Classification of Functioning Disability and Health (ICF)
- WHO: Monitoring and evaluation of health systems strengthening
- USAID: Measuring the Impact of Health Systems Strengthening: A review of the literature
- the Global Burden of Diseases, Injuries and Risk Factors Study (GBD 2010 Study),

3. Identification of benefits that will be easily quantified because data exists to compile these measures and those that will not

4. Define additional data required to quantify benefits that cannot be quantified as per step 1

5. Determine the research required to 'fill the gap' in the above data

6. Determine the feasibility of undertaking further research to assist in the quantification of benefits where data are not currently available.

7. Undertake a research exercise or pilot study to gather additional data where feasible

Data analysis

The data analysis step involves the following activities:

1. Based on data collected, develop assumptions where data is missing or limited based on evidence.

2. Quantify benefits at each of the four investment levels which are based on the framework developed for estimating the cost of eliminating avoidable blindness

3. Undertake a detailed quantification of benefits by World Health Organization subregions which are as follows:

- AFRO (D, E) - Africa
- AMRO (A, B, D) – Americas
- EMRO (B, D) – Eastern Mediterranean
- EURO (A, B, C) – Europe
- SEARO (B, D) – South-East Asia
- WPRO (A, B) – Western Pacific

Each subregion maps individual countries according to patterns if child and adult mortality where 'A' indicates the lowest mortality rates and 'E' includes those countries with the highest rates (WHO 2012).

Analysis will not be conducted on an individual country level in this phase as the measures and assumptions developed will be on a regional level for all regions so that a global estimation can be developed. A more appropriate opportunity in which to do so will be in a subsequent phase where these assumptions and measures can be tested.

4. Undertake a detailed quantification of benefits for a defined and agreed time period. Justifiably, a longer time horizon will lead to a higher value being placed on the benefits.

Benefits will be measured in constant dollars with consideration given to the potential changes in value to future benefits.

While the benefits quantification exercise is intended to be a valuable resource for health departments worldwide, an emphasis should be placed on its use for Ministries of Finance, Health Education and Planning as well as corporate organisations globally, as it is ultimately these organisations that will be the main drivers in terms of allocating and contributing funding towards the goal of eliminating avoidable blindness and visual impairment.

7.2 Initial estimates and share and learn

The data collected will be brought together with the analysis to compile the estimate of the value of benefits of eliminating avoidable blindness and visual impairment. The initial estimates will be presented in a report that also provides discussion of benefits which/that have not been able to be quantified. In a process similar to that used to finalise the Benefits Framework, the initial estimates will be disseminated amongst key subject matter experts for input. These will be incorporated to form a finalised estimate of the value of benefits to be gained from eliminating avoidable blindness and visual impairment.

7.3 Phase 3 - Subsequent ongoing evaluation

Ongoing monitoring will ensure that that the estimate values remain relevant in the context of updated and improved data. Ideally, new data will re-inform the latest estimate and feed into the data analysis to provide a revised estimate. The following tasks comprise the ongoing monitoring step:

1. Update data as it becomes available through its source

2. Revise assumptions according to updated research

3. Revise estimates of the value of benefits of eliminating avoidable blindness and visual impairment accordingly

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Appendix B Literature scan of benefits

Health Benefits

Our literature scan and consultations with key stakeholders indicate that the health benefits expected to arise are:

- Improved quality of life
- Reduced co-morbidities and mortality, including HIV/AIDS and malaria (MDG 6)
- Reduced child mortality (MDG 4)
- Reduced hospitalisations, length of stay and other health system costs

Improved quality of life/reduced burden of disease: DALYs and QALYs

The elimination of visual impairment will have a profound impact on the individual's quality of life. Several studies have quantified this improvement in terms of Disability Adjusted Life Years averted and Quality Adjusted Life Years gained. These studies have been the most widespread in relation to blindness caused by cataract and trachoma, two of the leading preventable causes of blindness worldwide. For example, Baltussen et al (2004) undertook a comprehensive global cost-effectiveness analysis of two types of cataract surgeries, quantifying benefits in terms of DALYs averted across regions distinguished by mortality stratum, concluding that extra capsular surgery for cataracts at a high level of coverage was the most cost-effective way of restoring sight in all epidemiological sub regions considered. The World Health Organization (WHO) has also estimated the benefits of cataract surgery in terms of cost per DALY saved, in the range of US$20-$40 per DALY, concluding that cataract surgery is as cost-effective as immunization (WHO, 1997).

Gordon et al (2011) used DALYs to estimate the loss of healthy life from accountable to vision loss and converted this to a dollar figure using the value of a statistical life. Their results show that the cost to Canada was $11.7 billion in 2007.

In a study on the costs of visual impairment in Australia, the loss of wellbeing attributable to visual disorders was estimated at 40,068 years in 2004. Combining this figure with an estimated number of years of life lost of 1,119, the total lost years of healthy life in 2004 was 41,187 DALYs. As in the Canadian study, this final figure was then converted into a financial equivalent by assuming a value for a statistical life year (Taylor et al, 2006).

Using a similar methodology, a study that examined the economic cost of visual impairment in Japan for 2007 found that there were 220,022 DALYs lost as a result of disability from visual impairment (Roberts et al, 2010). Not including costs borne by the individual, the net cost of the loss of wellbeing in Japan was monetarised using an estimate of the value of a statistical life and calculated at 5,863 billion Yen in this article.

Weale (2011) performed a cost-benefit analysis of cataract surgery, using the English Longitudinal Survey of Ageing to determine the expected QALYs gained as a result of the surgery. Participants reported their individual outcomes and experiences following cataract surgery, and results were calibrated to other studies exploring the effect of imperfect sight on the quality of life. This study drew upon utility values associated to various states of eye health used in a previous study by Brown et al (2003).

In the study undertaken by Brown et al (2003), it was discussed that based on the participant group and utility values used, slight visual loss in the presence of ocular disease reduced the quality of life to the same degree as

having diabetes mellitus or a mild stroke. Participants who experienced severe visual loss, to the point of blindness, had a similar quality of life score to an individual with severe angina or a moderately severe stroke.

Reduced child mortality (MDG 4)

It has been estimated that up to half a million children become blind each year, with up to 60% of children in the developing world dying within one or two years of becoming blind (Gilbert, 2007). This is primarily attributed to the fact that many risk factors for blindness are the same as those for child mortality such as vitamin A deficiency, measles and meningitis.

Further, in many of the world's poorest countries where food is scarce, blind children are discriminated against based on the fact that they are unable to contribute to family chores and work. There has been a positive association drawn between blind children and those that are malnourished as a result (Gilbert, 2007), which can lead to higher mortality rates in children.

Consequently investments targeted towards eliminating avoidable blindness and visual impairment will extend to having a positive impact on child mortality rates.

CASE STUDY: ONCHOCERCIASIS CONTROL PROGRAMME (OCP) & AFRICAN PROGRAMME FOR ONCHOCERCIASIS CONTROL (APOC)

- Onchocerciasis is a parasitic disease, transmitted through the bite of the *Simulium* fly, which has been a main cause of blindness across Africa.
- The OCP (West Africa) and the APOC have been implemented to eliminate onchocerciasis as a disease of public-health importance and as an obstacle to socioeconomic development.
- Both programmes target and serve some of the poorest populations, assisting to develop national health systems and build local capacity where health resources are minimal.
- Over the long term, as a health and development programme, OCP has achieved its goals in ten of 11 West African countries (WHO, 2002)

Reduced co-morbidities & mortality, including HIV/AIDS and malaria (MDG 6)

The literature articulates that blind individuals may be at a higher risk of infectious disease simply due to the fact that they are unable to see valuable public health promotion posters, are compromised in reading written instructions for medications, and are more likely to miss out on community health programs. In essence, this translates to the elimination of blindness being able to have a significant impact on the reduction in other co-morbidities such as the spread of infectious diseases such as HIV/AIDS and malaria.

In terms of its impact on mortality, Access Economics (2004) have estimated that of the 70,668 visually impaired Australians who died in 2004, 584 could be said to have been the result from visual impairment (comprising an 'attributable fraction' for mortality of 0.83%). The risk of death caused by falls, hip fractures, motor vehicle accidents and depression for a visually impaired individual over 40 was 4.3% compared to 1.6% for a sighted individual (Access Economics, 2004).

Falls are the cause behind many lengthy hospital stays and permanent disabilities, posing a considerable burden on both the individual and the health system. Visual impairment has been shown to have a high association with falls, with 22% of multiple fallers and 6% of the single fallers in one study documented to suffer from blindness or poor vision (Gaebler, 1993). Kallstrand-Ericson and Hildingh undertook a retrospective non-randomised register study in which all documented falls of inpatients aged 65 years and over were examined. It was found that the majority of the inpatients that experienced falls were mostly affected by visual impairment. Other studies have also documented this association, for example:

- The Shihpai Eye Study in China
- Patino et al 2010
- Coleman et al 2004
- Boer et al 2004

While several studies have documented the link between increased likelihood of falls and visual impairment, in their review of the literature, Odom et al concluded that there was not a strong consistent body of evidence to support this association.

Horowitz has reviewed population based studies (including Bazargan & Baker, 2001) examining the link between depression and visual impairment, concluding that these studies indicate a two to five times as likely risk of older adults experiencing depression compared to their nonimpaired peers. In terms of actual prevalence, Horowitz's review (including Rovner and Casten, 2002; Wallhagen et al, 2001) indicated that between 25% and 33% of all visually impaired elders have been found to report a significant number of depressive symptoms.

In their analysis of the association between depression and age-related macular degeneration (AMD) in the elderly, Casten and Rovner found a strong correlation, with rates of depression in AMD substantially greater than those found in the general population of older people.

Reduced hospitalisations, length of stay and other health system costs

Identified benefits accruing to the health system are reduced hospitalisations and equipment expenses and reduced length of stay. Moreover, the reduction in blindness related injuries such as falls, infectious diseases such as HIV/AIDS and reduced child mortality will relieve the system's current cost strain, freeing up capacity to treat other conditions.

Gordon et al estimated the health system expenditures from vision loss using both a top down and a bottom up approach that included the costs to hospitals, physicians, pharmaceuticals, vision care (including vision related equipment), research and other. The total costs to the health system were estimated at $8.6 billion in 2007.

In their 2010 study on the global cost of visual impairment, Access Economics estimated total health care system costs per person with sight loss per year. These were estimated at $7,186 (2008 USD) in Australia, $25,228 (2008 USD) in the USA and $14,346 (2008 USD) in Japan to give an indication of the magnitude of the health system costs likely to be averted through the elimination of avoidable blindness and visual impairment.

Economic Benefits

Our literature review and consultations with key stakeholders indicate that economic benefits likely to arise include the following:

- Increased employment
- Increased productivity
- Reduced welfare payments
- Achieving universal primary education

Avoidable blindness and visual impairment poses a significant public cost to the government, and its elimination is likely to produce valuable economic benefits in the domains of increased employment and productivity. These benefits will not only accrue to the visually impaired individual, but also lend themselves to the informal carer who has taken take time off work to attend to them. In many developing countries, the carer is often a child, in which case the benefits can be far more extensive due to the child not losing the opportunity to receive an education.

In terms of available data estimating the economic benefits, several studies have been carried out. One of the more recent studies by Access Economics on the 'Global Economic Cost of Visual Impairment' based their estimates on the WHO subregions, which were broke down into direct health care costs, indirect costs (productivity losses, informal care costs, welfare loss), and burden of disease (measured in DALYs). The results of the study showed that the direct health care costs totalled US$2.3 trillion in 2010,[7] with an expected 'deadweight' welfare loss of $238 billion, a productivity loss of US$168 billion and an estimated informal care burden of US$246 billion. This made for a total global cost of visual impairment of nearly US$3.0 trillion in 2010.

Another study by Smith et al (2009) estimated the potential lost productivity that results from the global burden of uncorrected refractive error. Productivity was measured using GDP lost (adjusted by labour force participation and unemployment) and the results of this study were an estimate of $268.8 billion (International dollars) for the 158 million individuals visually impaired by uncorrected refractive error. That the majority of this potential productivity loss was experienced in the Western Pacific Region highlights the importance of disaggregating the global estimate by region.

In another study by Access Economics, that focused on Australia alone, the loss of productivity attributable to visually impaired individuals was estimated at AU$1.8 billion in 2004, which was in addition to the lost productivity of carers which was calculated to be AU$845 million.

Other studies that detail the predicted economic benefits include one on the Gambian Eye Care Program, in which a net lifetime productivity gain of US$1.01 million was estimated from the introduction of the Program in 1986, until 2050 (Frick et al, 2005). A study on blindness in India refers more specifically to the resulting increase in employment rates, revealing that 85% of males and 58% of females in the study were able to return to the workforce after receiving cataract surgery (Javitt, 1993).

Another study focussed in Gambia cost the value of trichasis in terms of lost lifetime economic productivity (Frick et al 2001). This study expresses the cost of the illness as a function of life expectancy, probability of the condition (corneal opacity) and yearly lost productivity. Of the patients that fit this criteria, it was found that their decreased lifetime economic productivity was $325 which is similar to the value of GNP per capita in the Gambia ($340 in 1998).

[7] All costs expressed in 2008 USD

In their Canadian focused study, Gordon et al 2011) use a number of measures for productivity loss including the cost of care, employment participation, absenteeism and presenteeism. Combined these cost Canada $4.4 billion in 2007. They also measured the dead weight loss that is associated with the government transfer payments made to those with vision loss and the reduced taxation revenue. In 2007 this was estimated at $1.8 billion.

The increased economic value to carers having freed time is an important consideration that one Australian study has analysed. Keeffe et al 2009 estimated opportunity cost of caregiving to adults with impaired vision, finding that the median annual opportunity cost was $915 in 2009.

While there is a considerable amount of literature documenting the productivity losses associated to visual impairment, these estimates have been observed to vary widely and comparisons across studies can hence be difficult. Taylor et al (2006) have remarked on the need for the collection of more precise and reliable epidemiological information to allow for more reflective estimates of these benefits to be made.

Societal benefits

Our literature review and consultations with key stakeholders indicate that societal benefits likely to arise include the following:

- Reduced extreme poverty and hunger (MDG 1)
- Increased independence
- Increased self-esteem and improved social networks
- Increased gender equality and empowerment of women (MDG 3)
- Increased community participation

Social benefits are likely to vary substantially depending on whether the developed or the developing world is the point in question. For example, the elimination of avoidable blindness and visual impairment is likely to have a more prominent impact on achieving the MDGs in lower developed countries.

Reduced extreme poverty and hunger (MDG 1)

Several studies disclose a strong positive correlation between blindness and poverty in the developing world. Poverty must both be viewed in terms of its economic measures such as low income and unemployment, as well as other aspects of life such as access to education and health care. The literature has emphasised the importance of including social and psychological elements into the understanding of poverty, for example limited social interaction, limited marriage prospects, low self esteem, and higher exposure to violence and social stigma (Gilbert & Faal, 2005).

The prevalence of trachoma in the developing world is a key example where poverty is directly linked to avoidable blindness and visual impairment. Poor regions are known for their poor sanitation and water quality which acts as a breeding ground for trachoma. Communities living in poverty are further more susceptible to vitamin A deficiency and measles infections, increasing the likelihood of visual impairment.

Several other studies have documented the positive correlation between extreme poverty and blindness, one of which focuses on poverty and blindness in Pakistan and concludes that lower access to health care is a main contributory factor to this association (Gilbert et al, 2008). Another study used three measures – per capita expenditure, asset ownership and self rated wealth to assess the relationship between poverty and visual impairment from cataract in Kenya, the Philippines and Bangladesh (Kuper et al 2010). Although noted as a short term measure of poverty, this study found that individuals receiving free cataract surgery experienced a significant increase in per capita expenditure (Kuper et al 2010).

Increased independence of individuals

Loss of sight severely hinders an individual's ability to attend to their day to day activities, leading to a dependence on carers and feelings of incompetency on behalf of the blind individual. Long et al (1996) observed that individuals with visual impairment travelled infrequently by themselves and were dissatisfied with the number of opportunities they had to leave their homes as well as reporting feelings of difficulty using public transport.

Increased self-esteem and improved social networks

Several studies have documented the association between loss of sight and feelings of loneliness and isolation, contributing to sentiments of low self-esteem. For example, Nyman et al (2010) produced an extensive review of the psychological impact of visual impairment, with results showing an increased risk of depression and mental illness and reduced quality of life and social functioning compared to sighted individuals.

A study by Evans et al (2007) investigated the association between visual impairment and depression in older people in Britain. Depression was assessed using the Geriatric Depression Scale (GDS-15), a set of short questions about feelings over the previous week, with results showing that 13.5% of the visually impaired sample (75 years and older) were depressed. Another study drew similar conclusions, with results showing that visually impaired individuals were more likely to have five or more depressive symptoms than individuals with intact vision (Rovner et al, 1998).

CASE STUDY: CAMBODIA

- An estimated 28,800 Cambodians become blind each year
- Second country in Asia to sign VISION 2020 in 1999
- The National Eye Health Program is being implemented, with a focus on human resource development, the development of facilities and materials and sourcing financial resources
- A patient subsidy program is in place which ensures the poorest individuals have access to quality eye care
- In a case study undertaken by the Fred Hollows Foundation, 90.8% of people surveyed reported that following sight restoring surgery, they enjoyed no longer requiring round the clock care and the ability to return to daily activities such as visiting friends, family and attending ceremonies.

Increased gender equality and empowerment of women (MDG 3)

The literature scan has also revealed the existence of a gender disparity in relation to the prevalence of blindness, with rates among women two to three times higher than in men (Lewallen et al, 2002). The World Health Organisation accounts for women bearing approximately 64% of the world's blind population. They are also less likely to receive vision restoring surgery, with recent research documenting that blindness from cataracts could potentially be reduced by 11% if women were to receive surgery at the same rate as men (Lewallen, 2009). In a study undertaken by Abou-Gareeb in 2001, it is cited that over ninety percent of women living with blindness are also living in poverty.

The extent of this gender disparity is likely to have arisen due to discrimination in developing countries based on gender and disability. Based on this discrimination, women are less likely to have access to health care services, employment and education which places them in a disadvantaged position in terms of caring for themselves and their family.

Women are also more likely to be exposed to infectious causes of blindness such as trachoma as a result of child rearing (Congdon et al, 1993). Surveys have indicated that approximately 75% of people with advanced trachoma are women (Courtright, 2002).

A review of published, population based surveys of blindness with Bassett et al (2001) shows the extent of the disparity in blindness worldwide. Odds ratios of blind women to men were found to range from 1.39 in Africa, 1.41 in Asia and 1.63 in industrialised countries. More specifically, comparing the prevalence of trichiasis in women compared to men, it was observed that women were between 0.83 and 3.82 times more likely to bear the disease (Courtright, Cromwell et al, 2009). In another study with Lewallen (2008), a systematic review was carried out of population based surveys reporting cataract surgical coverage in low and middle income countries. Out of the 23 surveys included in the 2008 review, 21 were observed to find higher coverage among men.

A study undertaken by the Nepal Gender and Eye Health Group has also indicated the extent of the problem. It was observed that utilization of eye care services by women was disproportionately low. It was also found that less

than 15 percent of the total service users in the study were children, despite children constituting 40% of Nepal's population, indicating an even more dramatic gender gap among children.

These studies are only a few of an extensive body of research that is available to support this correlation, indicating that improved gender equality would be a highly probable benefit arising out of the elimination of avoidable blindness and visual impairment.

Increased Community participation

This is particularly relevant to older members of the community who are visually impaired. While they may no longer be active participants in the workforce, and so potential productivity losses are not pertinent, they are able to engage in other roles, such as acting as an informal carer.