

Investing in vision – making a difference across the Commonwealth



The Queen Elizabeth Diamond Jubilee Trust

Measuring the economic benefits of investing in vision



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Dear Andrew,

Investing in vision – making a difference across the Commonwealth

We are pleased to provide this report, which considers the benefits of investing in vision – at a programmatic level, and across the Commonwealth. It builds on the work that PwC has previously completed in partnership with others in the blindness sector, and contributes to the growing evidence base around investments in vision representing value for money.

The analysis and case studies which have been led by our colleagues from PwC Consulting (Australia) Pty Ltd, Marty Jovic, Renee Martin and Nicholas Dimitropolous, will provide an evidence base to assist decision makers – Ministers of Health and Finance in Commonwealth countries, international donor agencies, private sector investors and potential philanthropists – as they prioritise investments in public health interventions, including avoidable blindness and vision impairment initiatives.

We would like to thank the team at the Queen Elizabeth Diamond Jubilee Trust for working with us in a true partnership to deliver this important piece of work. We would also like to acknowledge the valuable contributions and support that we received through the steering committee, membership of which was comprised of Dr Andrew Bastawrous (CEO Peek Vision), Ms Eleanor Fuller OBE (Director of Advocacy and Commonwealth Engagement, The Queen Elizabeth Diamond Jubilee Trust), Mr Steve Hillier (Commonwealth Institutions Team Leader, UK Department for International Development-DFID), Ms Virginia Sarah (Global Partnership Executive, The Fred Hollows Foundation) and Professor Hugh Taylor (University of Melbourne). Finally, we appreciate the specialist technical and policy inputs from Professor Claire Gilbert (London School of Hygiene and Tropical Medicine), colleagues at the World Health Organization, and The Fred Hollows Australia team for contributions around gender.

Yours sincerely

A handwritten signature in black ink that reads 'Kevin Lowe'. The signature is written in a cursive, flowing style.

Kevin Lowe
for and on behalf of PricewaterhouseCoopers LLP

Executive summary

Blindness and vision impairment affect economic and educational opportunities and reduce quality of life. Loss of eyesight does not discriminate: all sectors of the population are affected, from infants through to older people, people who live in high, middle and low income countries, women and men. In 2015, there were 14 million people in the Commonwealth who were blind and an additional 70 million people with medium to severe vision impairment¹.

The impact of blindness and vision impairment on individuals, their families, communities and countries is considerable. People are unable to work, access education, and lead independent fulfilled lives. Globally, it is estimated that vision loss costs \$168 billion per annum in lost productivity².

We know what needs to be done to treat or prevent 80% of blindness and the evidence shows that treating and preventing blindness provides some of the largest returns on investment compared with other health interventions³.

The limited need for infrastructure, low treatment costs, and relatively high potential for cost recovery for interventions such as cataract surgery, makes interventions in eye care a compelling investment. This is especially relevant in low income countries, where prevalence of blindness and vision impairment far exceeds that of high-income regions.

Ageing populations around the world are causing a substantial increase in the number of people with blindness and vision impairment⁴. Failing to intervene with treatment and prevention initiatives at scale could see the number of people around the world affected by blindness, vision impairment and poor vision triple by 2050⁵. The importance of increasing action across the Commonwealth should not be underestimated. There is an opportunity to act at scale to provide eye care services for all citizens.

Targeted investments in vision will enable people to increase productivity (both those with avoidable blindness and vision impairment and their carers) – contributing to better economic outcomes at the individual, household, community, national and global level.

This study has shown that, for every £1 invested in tackling avoidable blindness across the Commonwealth, £5 is returned.

¹ Vision for the Commonwealth: <http://www.trachomacoalition.org/sites/default/files/Vision%20pdf.pdf>

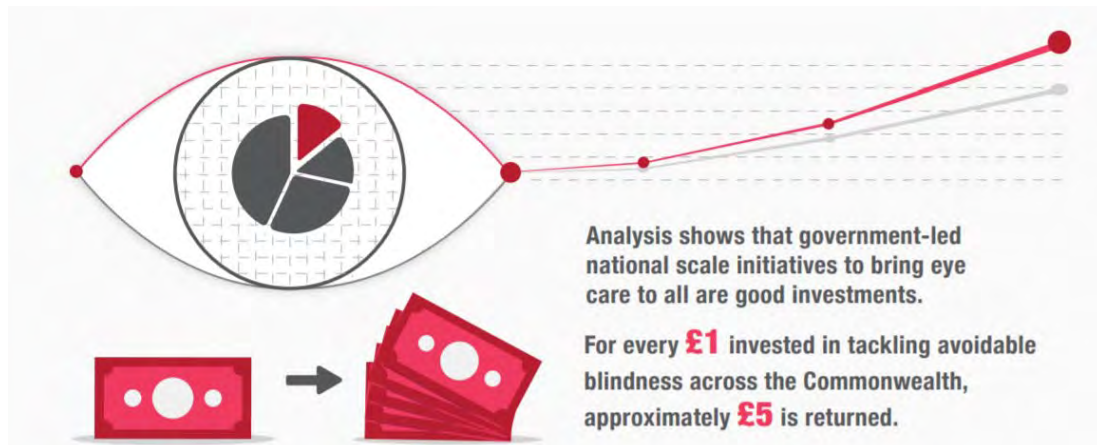
² The Global Economic Cost of Visual Impairment. Access Economics. March 2010

³ Op cit.

⁴ Op cit.

⁵ Bourne, R. et al. *Magnitude, temporal trends, and projections of the global prevalence of blindness and distance and near vision impairment: a systematic review and meta-analysis*. Lancet Global Health 2017: e 888-97

Figure 1 Tackling avoidable blindness across the Commonwealth is a good investment



There are also benefits to which a monetary value has not been assigned in this analysis. These benefits include health system savings generated through reduced co-morbidities, as well as benefits related to improvements in well-being and quality of life. The full benefit of investing in vision will be greater than has been quantified here.

Tackling avoidable blindness and low vision contributes to the achievement of some of the goals of the Commonwealth Heads of Government Meeting in April 2018 in the UK:

- *a more sustainable future* – through strengthened health systems which embed access to quality eye health services such that citizens are able to access treatment and/or prevention services for avoidable blindness and vision impairment, enabling them to work and support themselves and their families
- *a fairer future* – by tackling an issue that disproportionality affects women and people living in low income countries⁶, and
- *a more prosperous future* – enabling people to achieve their educational potential and fully contribute to the economy.

The Queen Elizabeth Diamond Jubilee Trust (the Trust) has invested more than £62m in its Avoidable Blindness Programme since 2014. This analysis considers the return on £25.6m that was invested in its Trachoma, Diabetic Retinopathy and Retinopathy of Initiatives over the period 2014-2017 (see Table 1).

Analysis shows that this has been money well spent, with a return of £12 for each £1 invested. Furthermore, the Trust's investments have resulted in averted productivity loss of more than £300 million split across both the individuals with blindness/vision impairment and their carers.

These high returns reflect the Trust's ability to be selective about the countries and types of programme that it supports. The Trust's investments have built on the significant achievements in eye health over recent years, which are the result of collaborations between governments, NGOs, philanthropists and private sector organisations with expertise in eye health. For example, the trachoma work that the Trust has supported in high prevalence countries in Africa and the Pacific has generated a very high return on investment of £13 for

⁶ According to the WHO's Global Action Plan (2014-2019) for Universal Eye Health, about 90% of the world's visually impaired live in developing countries

every £1 invested. This has been generated through investments in prevention and education as well as providing treatment.

Table 1: Trust’s programmatic impact (2014-2017)

Results summary	Overall
Return on Investment (for every £1 invested, £x in economic benefit is returned)	12.0*
Total investment (GBP)	25.6 mil
Total benefit to visually impaired (GBP)	234.7 mil
Total benefit to carers (GBP)	71.5 mil
Total averted productivity loss (GBP)	306.2 mil

*Rounded up from 11.96 to nearest whole number

The Trust has focused on a health systems strengthening approach to improving eye care. The Trust’s disease-specific investments have been complemented with support for enhanced technical capacity across the Commonwealth through the establishment of the Commonwealth Eye Health Consortium (the Consortium). The Consortium is a group of training institutions and Colleges of Ophthalmology from around the Commonwealth working in partnership to develop human capacity, generate and share research, and develop and deploy accessible technology for eye care. These investments are critical to strengthening health systems and achieving a sustainable impact. The benefits associated with these investments are in addition to those quantified above.

A comprehensive investment in vision means investing in human resources, service delivery, information management systems, financing, leadership and governance and access to medicines – these are the pillars of a health system which will together, when appropriately supported, enable better eye health outcomes at scale. Specific investments of adequate finance at the right time in some or all of these pillars can catalyse significant improvement to both the health systems and the broader economy. This can also help contribute towards the needs of those working to end extreme poverty, achieve access to universal primary education, achieve greater gender equity and address disability.

This analysis has verified and further contributed to the building evidence base around investments in vision representing value for money. This report includes case studies to show how different countries from across the Commonwealth are utilising these pillars to improve access to care for diabetic retinopathy.

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***Context and
approach to analysis***

1 *Context and approach to analysis*

In preparation for the 2018 Commonwealth Heads of Government Meeting (CHOGM), The Queen Elizabeth Diamond Jubilee Trust (the Trust) engaged PricewaterhouseCoopers LLP (PwC UK) to:

1. Calculate the potential return on investment (ROI) associated with investments in vision aggregated across the Commonwealth
2. Quantify the returns on investments in vision made by the Trust
3. Develop case studies that investigate the differing approaches to diabetic retinopathy (DR) in four selected Commonwealth countries.

Colleagues from PricewaterhouseCoopers Consulting (PwC Australia) Pty Ltd led the development of the analysis and case studies which will provide an evidence base to assist decision makers – Ministers of Health and Finance in Commonwealth countries, international donor agencies, private sector investors and potential philanthropists – as they decide to allocate resources across public health interventions, including avoidable blindness and vision impairment.

PwC has completed analysis to quantify the real and potential returns associated with investment in vision. The approach builds on work that PwC has previously led with other partners in the blindness sector including:

- Investing in Vision – Comparison of the cost and benefits of eliminating avoidable blindness and visual impairment & Value of sight (2013)
- Global SAFE Implementation Calculator – Final summary report (2015)
- The value of Indigenous sight (2015).

In addition to previous work, the analysis has also drawn on a collation of data from the Trust and consultations with programme managers in each of the four countries that were selected for diabetic retinopathy case studies. External literature and data has also been sourced and validated to underpin the analysis, including data from the International Agency for the Prevention of Blindness (IAPB) Vision Atlas, the World Health Organization, the World Bank and programme implementing partners such as the Fred Hollows Foundation, the London School of Hygiene & Tropical Medicine, the Public Health Foundation of India, the International Coalition for Trachoma Control, and Sightsavers.

Drawing on these sources of information enables access to validated costing data relating to trachoma, diabetic retinopathy, cataract, age-related macular degeneration (AMD) and glaucoma. The analysis calculates the economic returns on investments (ROI) in each of these types of avoidable blindness aggregated across the Commonwealth (see Chapter 2). A lack of cost data across countries with different economic circumstances (i.e. from low and middle income countries) meant that it was not appropriate to model economic returns across the Commonwealth for investments in retinopathy of prematurity. That being said, analysis has been conducted to calculate the economic returns associated with the specific investments made by the Trust in trachoma, diabetic retinopathy and retinopathy of prematurity in a number of Commonwealth countries (Chapter 5).

Context and approach to analysis

To ensure that that the analysis approach undertaken by PwC was appropriate, a validation process across all phases of the engagement was put in place. This included:

- the convening of Steering Committee meetings to validate separately the ROI analysis approach, methodology and analysis findings. Steering Committee members comprised the Trust, PwC, and a number of experts in the avoidable blindness sector
- confirmation of our understanding of some specific areas of the work (including gender and retinopathy of prematurity) with a number of subject matter experts
- communication of the approach, methodology and results to a broader selected reference group for additional feedback and validation
- internal model review and quality assurance.

The full methodology that underpins the quantification of the returns is described in Appendix A.



Vision is a good investment

2 *Vision is a good investment*

2.1 *Overview*

Targeted investments that promote collective action and partnerships across sectors are needed to address the increasing prevalence of vision impairment across the Commonwealth, where each country has different models of health care and varying levels of health system maturity. In an effort to contribute to the evidence base necessary to inform optimal allocative decisions, PwC has modelled the potential returns on investment associated with investing in vision.

Analysis shows that investing £1 in vision could generate a return of between £4.60 and £5.30 (depending on targeted prevalence) across the Commonwealth.

This overall positive return takes into account the diversity of member countries and their unique demographic, health system, economic and geographic factors:

- more than half (30 of 53) of all Commonwealth countries are Small Island Developing states⁷ confronted with some significant challenges including size, remoteness, country-wide exposure to natural disasters and vulnerability to economic shocks
- more than 45% of Commonwealth countries have small populations (under 1.5 million people) which can limit ability to benefit from economies of scale and can result in high per capita costs of some goods and services, including provision of health care
- approximately 60% of the Commonwealth population is aged 29 or under which means that the eye health problems associated with ageing, e.g. cataract and glaucoma, will increase in the future but equally, that there is currently an opportunity to establish system level preparedness for this projected increase in eye health challenges
- the Commonwealth comprises countries across all levels of the World Bank's income classification bands, however the majority are currently low or lower middle income countries but that there is an emerging upper middle income group. This economic shift is associated with increasing average wages, in some cases higher per unit costs and increasing demands for better health outcomes associated with patient centric care.

The modelled returns have been generated by quantifying the productivity benefit realised by persons who, through eye health interventions, are no longer avoidably blind and/or suffering avoidable visual impairment as well as by their associated carers. The analysis relied on data provided by the Trust, external eye disease data from the IAPB, and from costs and inputs from global avoidable blindness work and strata matrix (see Appendix A). There are also benefits to which a monetary value has not been assigned in this analysis. These benefits include health system savings generated through reduced co-morbidities, as well as benefits related to improvements in well-being and quality of life. The full benefit of investing in vision will be greater than has been quantified here.

⁷ Antigua and Barbuda, The Bahamas, Barbados, Belize, Dominica, Fiji, Grenada, Guyana, Jamaica, Kiribati, Maldives, Mauritius, Nauru, Papua New Guinea, Samoa, Seychelles, Singapore, Solomon Islands, Saint Lucia, St Kitts and Nevis, St Vincent and The Grenadines, Tonga, Trinidad and Tobago, Tuvalu and Vanuatu

The estimated economic returns of investment in vision (comprising investments targeting trachoma, diabetic retinopathy, cataract, age-related macular degeneration and glaucoma), measured in terms of contributions to productivity aggregated across the Commonwealth is presented in Table 2.

Table 2: Aggregate Commonwealth return on investment (ROI) results

	Trachoma	Diabetic Retinopathy	Cataract	Age related Macular Degeneration	Glaucoma	Overall
ROI when targeting low prevalence levels (10%)	6.2	7.6	5.2	0.1	2.2	5.3
ROI when targeting medium prevalence levels (25%)	5.9	6.8	4.9	0.1	2.0	4.9
ROI when targeting high prevalence levels (50%)	5.6	6.1	4.8	0.1	1.9	4.6

2.2 Interpreting the returns across the various causes of avoidable blindness

Across the Commonwealth, investments in vision, regardless of the level of prevalence targeted, generate positive returns. And whilst the quantum of return is related to the cause of vision impairment, investments in each or all of the vision impairment types complement a commitment to health system strengthening.

2.2.1 Trachoma

Trachoma is the leading infectious cause of blindness worldwide, and is responsible for the blindness or visual impairment of about 1.8 million people globally. Women and children are the most affected – with women up to four times more likely to need eye surgery. Trachoma further disadvantages children when it interrupts their education. For girls, trachoma can be an extra burden, as caring responsibilities often fall to them. The disease impacts on livelihood, limiting access to education and preventing men and women from being able to work and lead fulfilled lives. Trachoma is both preventable and treatable. Trachoma remains a public health problem in 39 countries⁸. The Trust is working in twelve of these Commonwealth countries: Australia (where endemic trachoma is found predominantly in remote and very remote Aboriginal communities), Fiji, Kenya, Kiribati, Malawi, Mozambique, Nigeria, Solomon Islands, Tanzania, Uganda, Vanuatu and Zambia.

The elimination of trachoma as a public health problem is a global commitment endorsed by the World Health Organization (WHO), and the SAFE strategy (Surgery, Antibiotics, Facial cleanliness and Environmental improvement) is the WHO recognised package of interventions for its elimination. Efforts to eliminate trachoma using the SAFE strategy in areas where it is endemic have had significant impact and several countries have been declared to have eliminated the disease as a public health problem⁹. The number of people with trichiasis worldwide is estimated to have decreased from 8.2 million in 2009 to 2.8 million in 2016, while the number of people needing the A, F and E components of SAFE has decreased from 1.2 billion in 2007 to 190 million in 2016¹⁰.

⁸ <http://www.trachomacoalition.org/trachomastatistics>

⁹ WHO Alliance for the Global Elimination of Trachoma by 2020: progress report on elimination of trachoma, 2014–2016. *Weekly Epidemiological Record*. 2017;92(26):359-68

¹⁰ Op cit.

To help target funding and resources towards known preventative/treatment interventions in an efficient and effective manner, the SAFE calculator was developed. It can be used to determine where the funding gaps lie in terms of the continued effort to eliminate trachoma.

This analysis has leveraged the inputs and methodology that underpin the SAFE calculator and combined this with data from the Trust. **The returns on investment in trachoma across the Commonwealth range between 5.6 and 6.2** (targeting high to low prevalence respectively). These returns have been modelled for the period from 2018 to 2030, or to the year by which the countries are predicted to have eliminated trachoma should that be before 2030. This narrow return on investment range reflects the relatively higher per unit costs that are associated with the increasingly fewer and more difficult to reach trachoma cases as the disease nears elimination.

Future investment context – For investors, trachoma elimination is a known and inexpensive proposition with positive returns on investment. While progress towards the Global Elimination of Trachoma by 2020 has been significant, there remains much work to be done to effectively tackle trachoma where it still exists, including:

- targeted investments to address the remaining gaps in global progress, some of which may come from domestic budget allocations in endemic countries
- practical and coordinated engagement from a range of technical partners
- financing commitments with time horizons sufficient to see the elimination effort through to completion.

2.2.2 Diabetic Retinopathy

Diabetes is on the rise – the global prevalence (age-standardised) of diabetes has nearly doubled since 1980, rising from 4.7% to 8.5% in the adult population. Over the past decade, diabetes prevalence has risen faster in low- and middle-income countries than in high-income countries¹¹. The association between increasing economic development and obesity and thus risk of diabetes is well understood. Everyone with diabetes is at risk of developing diabetic eye disease¹² and studies suggest that prevalence of any retinopathy in persons with diabetes is 35% while proliferative (vision-threatening) retinopathy is 7%¹³. Diabetic retinopathy is the leading cause of blindness among working-aged adults in the world. Diabetic retinopathy has the potential to be the leading cause of visual impairment and blindness worldwide¹⁴.

Diabetic retinopathy prevention and treatment strategies require investments across all health system pillars and alignment with national diabetes and non-communicable disease policies and strategies. Treatment for diabetic retinopathy can be expensive and difficult to access. And currently, diabetic retinopathy screening services in developing and developed countries remain patchy, and are challenged by unclear guidelines on the most appropriate method to screen (e.g. clinical examination vs fundus photography), and the increasing resources needed for implementation and maintenance of a comprehensive diabetic retinopathy screening programme. Thus, diabetic retinopathy is an increasingly significant public health problem, especially in many middle-to-low income countries where access to

¹¹ WHO 2016 Report on Diabetes

¹² Deloitte Access Economics. *The economic impact of diabetic macular oedema in Australia*. April 2015

¹³ WHO 2016 Report on Diabetes

¹⁴ Yau and Associates, *Global prevalence and major risk factors of diabetic retinopathy*. *Diabetes Care* 35:556–564, 2012

trained eye-care professionals and secondary and tertiary eye-care services (e.g. access to laser and intra-vitreous therapies) may be limited¹⁵.

Despite these challenges, this analysis has found **that a one pound invested in diabetic retinopathy will return between 6.1 and 7.6 times the investment at the Commonwealth level.** This relatively high ROI stems from the fact that

- prevalence and incidence are increasing, and
- treatment occurs earlier in life than for other types of avoidable blindness (e.g. cataract, AMD, glaucoma) thus releasing productive capacity into the economy for the person with DR and associated carer(s).

Future investment context – Working through strong health systems is the most effective way of responding to the complex health needs of people with diabetes to ensure that they are supported in an ongoing way as they battle lifelong chronic disease. A variety of stakeholders need to be involved in these challenges. Early and scaled investments in effective diabetes prevention and community screening programmes will contribute to staving the growth in diabetic retinopathy prevalence. Leasher et al 2016¹⁶ suggest the following strategies for preserving the vision of adults with diabetes:

- development of evidence-based, cost-effective strategies to screen for diabetic retinopathy
- improve control of systemic risk factors (e.g., glucose and blood pressure) among persons with diabetes
- increase health education and awareness of the risk of visual loss from diabetic retinopathy
- intensified prevention and treatment of diabetic retinopathy through the introduction of laser treatments, intra-vitreous injections of steroids, and anti-VEGF drugs
- reduction of differences between regions in the screening and management of diabetes and diabetic retinopathy, socioeconomic factors, and medical infrastructure

2.2.3 Cataract

Over half of the world's blindness is caused by cataract, and as people live longer, the number of people with cataract is projected to grow. In fact, the WHO forecasts that cataract operations will increase from 12 million in 2000 to 32 million in 2020.

The low cost of the consumables, the short operating time and stay in a clinical facility post-surgery for patients and the substantial impact on people's quality of life, mean that cataract surgery is one of the most cost-effective of all health interventions¹⁷. This analysis shows that **the returns on investment in cataract treatment across the Commonwealth**

¹⁵ Ting, D., Cheung, G. and Wong, T. *Diabetic retinopathy: global prevalence, major risk factors, screening practices and public health challenges: a review.* Clinical and Experimental Ophthalmology 2016; 44: 260–277 doi: 10.1111/ceo.12696

¹⁶ Leasher, J. et al *Global Estimates on the Number of People Blind or Visually Impaired by Diabetic Retinopathy: A Meta-analysis From 1990 to 2010* Diabetes Care 2016;39:1643–1649

¹⁷ Grimes CE, Henry JA, Maraka J, Mkandawire NC, Cotton M. Cost-effectiveness of surgery in low-and middle-income countries: a systematic review. World journal of surgery. 2014;38(1):252-63

range between 4.8 and 5.2. Moreover, a systematic literature review¹⁸ shows the high value of some surgical interventions in low-income and middle-income settings, one of which was cataract surgery, which could be classified as a priority 1 disorder in areas with high burden of disease. Priority 1 disorders are those that have a large public health burden, for which there is a surgical procedure that is highly effective, and for which the surgical procedure (and related ancillary services and treatments) is cost effective and feasible to promote globally¹⁹.

Future investment context – Many countries in the Commonwealth have or are undergoing a demographic transition and recent research findings show that even in the poorest and slowest ageing Commonwealth countries, where a majority of deaths are still caused by communicable diseases, poor nutrition and childbirth, a large and growing proportion of the population is surviving to ages where elders are more likely to die from chronic non-communicable conditions than anything else. In all Commonwealth countries the older population (>65 years) is set to grow more quickly than the total population, and an ageing population means that cataracts will remain a cause of vision impairment for the foreseeable future. Thus it is prudent to embed eye health within health systems such that there is an appropriately sized and trained health workforce to enable ongoing delivery of this simple, cost effective surgical intervention at a rate that responds to the increasing demand for services.

2.2.4 Age-Related Macular Degeneration and Glaucoma

Glaucoma and age-related macular degeneration are both chronic eye diseases which affect the aged population which cannot be prevented and which require early detection before the onset of vision loss, followed by treatment and life-long follow up. The number of persons estimated to be blind as a result of primary glaucoma is 4.5 million, accounting for slightly more than twelve per cent of all global blindness. Amongst glaucoma patients, adherence to topical medication which has to be used every day is a challenge globally, and in some countries, surgery is not accepted by patients. Only one form of age-related macular degeneration can currently be treated, and then only after highly technical and expensive investigations.

The analysis shows a lower return on investment for these types of blindness and vision impairment which largely relates to them occurring late in life thus limiting ability to participate in the productive economy. Some productivity associated with carers has been accounted for.

Future investment context – Further research and innovation is required as well as the expansion of tertiary eye care services with sub-speciality expertise, combined with health education and counselling for patients.

2.2.5 Retinopathy of Prematurity

Retinopathy of prematurity is a potentially blinding disease of infants born pre-term. It presents a significant burden worldwide, with an estimated 185,000 babies affected in 2010 and 43,000 visually impaired survivors²⁰. The risk of sight-threatening retinopathy of prematurity can be reduced by a course of antenatal steroids to women threatening preterm delivery, and by high quality neonatal care from immediately after birth. This includes

¹⁸ Tiffany E Chao, Ketan Sharma, Morgan Mandigo, Lars Hagander, Stephen C Resch, Thomas G Weiser, John G Meara. *Cost-effectiveness of surgery and its policy implications for global health: a systematic review and analysis*. Lancet Global Health 2014; 2: e334-45

¹⁹ Some disorders included in this category are trauma-related disorders, obstetric emergencies, hernia repairs, exploratory laparotomy for acute abdomen, and male circumcision

²⁰ Op cit.

careful delivery and monitoring of supplemental oxygen, reducing sepsis, feeding babies breast milk, and supportive care such as kangaroo care²¹. (Kangaroo mother care is a method of care of preterm infants. It involves infants being carried, usually by the mother, with skin-to-skin contact. There is evidence that it is effective in reducing both infant mortality and the risk of hospital-acquired infection, and increasing rates of breastfeeding and weight gain).

Retinopathy of prematurity is the most widely recognised cause of visual impairment after preterm birth and is defined as a vision-threatening disease²². The proportion of affected babies is low in the lowest-income regions, notably sub-Saharan Africa, because of the excess mortality for preterm babies. The proportion is higher in middle-income regions because of increasing access to neonatal intensive care, with challenges in the quality of care. In high-income, low-mortality settings, the proportion of visually impaired babies is lower, which is likely related to improved quality of care (prevention) and systematic approaches to ophthalmological management and follow-up.

Rising affluence across economies means that retinopathy of prematurity will likely become an increasingly more significant cause of avoidable blindness and vision impairment as has been the case in China, Southeast and South Asia, Latin America, and parts of Eastern Europe²³. Widespread introduction and refinement of screening protocols to include those most at risk of visually impairing disease and timely treatment has reduced the burden in high income countries, despite the increasing number of extremely preterm survivors. However, even in urban settings in low and middle income countries with increasing provision of neonatal intensive care units, awareness of retinopathy of prematurity as a possible vision-impairing disease is frequently lacking among those providing neonatal care²⁴.

There is literature that indicates the cost effectiveness of early treatment for retinopathy of prematurity^{25, 26} but this evidence tends to be limited to high income countries. Whilst it is certainly acknowledged that retinopathy of prematurity is emerging as an increasingly more significant cause of avoidable blindness, at this stage there is very limited data about the costs of programming, particularly in low income countries. On this basis the analysis has not considered retinopathy of prematurity as part of the overall suite when investing in vision. At a programme level it has been found that investments in retinopathy of prematurity generate a positive return (see section 5.2) however there was insufficient data available in the literature to underpin reasonable assumptions about the costs and benefits of investments in retinopathy of prematurity across the Commonwealth.

²¹ Askie LM, Darlow BA, Davis PG, Finer N, Stenson B, Vento M, et al. Effects of targeting lower versus higher arterial oxygen saturations on death or disability in preterm infants. *The Cochrane Library*. 2017

²² Blencowe, H., Lawn, J., Vazquez, A, and Gilbert, C. Preterm-associated visual impairment and estimates of retinopathy of prematurity at regional and global levels for 2010. *Pediatric research*. 2013;74(Suppl 1):35

²³ Op cit.

²⁴ Sathiamohanraj SR, Shah PK, Senthilkumar D, Narendran V, Kalpana N. Awareness of retinopathy of prematurity among pediatricians in a tier two city of South India. *Oman J Ophthalmol* 2011;4:77–80

²⁵ Kamholz, K. et al *Cost-effectiveness of Early Treatment for Retinopathy of Prematurity*. www.pediatrics.org/cgi/doi/10.1542/peds.2007-2725

²⁶ Dunbar, J. et al *Cost-utility analysis of screening and laser treatment of retinopathy of prematurity*. *Journal of American Association for Paediatric Ophthalmology and Strabismus*. April 2009



Vision is an enabler

3 *Vision is an enabler*

This analysis has limited quantification of benefits to the valuing of economic contributions. However, in reality, the true economic benefits from eliminating avoidable blindness and vision impairment are likely to be higher than we have reported. This is because there are many benefits to which a monetary value was not assigned. These additional benefits from eliminating avoidable blindness and vision impairment include increased education, gender equity and reduced child mortality, along with intangible benefits to individuals including improved self-esteem and expanded social networks.

Gender and gender equity

Vision impairment and blindness in women is an issue with complex interdependencies, as well as differing implications across different countries and geographies²⁷. Vision impairment and blindness has far reaching implications not just for the women affected, but also for their families and for societal progress. Women with vision impairment and blindness report having less control over their life circumstances and a weakened ability to plan for the future – education, employability, health seeking behaviours and ability to start a family. It negatively impacts on women’s ability to generate income, gender-wage equality and carers’ independence. It is related to social exclusion and participation and increases a woman’s risk of vulnerability to violence, depression and injury.

Women in low and lower middle income countries are significantly more likely to experience blindness than men, compared to women in high income countries. There are some biological reasons for this, such as higher life expectancies among women and higher incidence rates of certain eye diseases, however, biology alone does not explain the gender difference. Rather, a panel of experts found that there is a clear gender bias in low and lower middle income countries where unequal access to treatment is not justified on the basis of an underlying health condition²⁸. This means that women’s health care concerns are diagnosed, counselled and treated or managed differently and with less adherence to established standards of care, compared to men with comparable health status. It also recognises that in low and lower middle income countries women do not experience the same level of access to eye care as men, perhaps because of lack of access to finance and/or decision making power within the household²⁹.

A review of inequity in vision loss concluded that insufficient data for analysis of inequality remains a problem in eye care and highlights the need for equity-relevant goals targets, and indicators for eye healthcare programmes³⁰. To this end, gender and vision impairment and blindness is an issue that warrants investments in **research to illicit a better understanding of the gendered experiences of eye health patients as they navigate programmes and health systems**. Doing so will help build locally relevant approaches/strategies thus ensuring that the barriers to accessing and fully capitalising on available eye health interventions are addressed equitably by both genders. This will contribute to achievement of *Sustainable Development Goal 5: achieve gender equality and empower women and girls*.

Embedding a gender sensitive approach to programming and investing in vision will take time. At present there is limited **gender disaggregated data** and what is available is not sufficient to underpin locally nuanced, gendered approaches to eye health. To this end the

²⁷ *Restoring women’s sight: Relationships between visual impairment and blindness, empowerment and the Sustainable Development Goals*. A report by the Economist Intelligence Unit 2017

²⁸ Op cit

²⁹ Op cit.

³⁰ Op cit.

prioritising of quality data to inform a baseline and to better understand the starting position will be a significant step forward.

Education

Avoidable blindness and vision impairment can contribute to preventing children from receiving an education, in two ways – those who cannot participate in education because of their avoidable blindness or vision impairment condition and those who cannot participate in education because they are carer for another individual (family member or friend) who suffers from avoidable blindness or vision impairment.

This inability to optimise access to education is manifested in diminished employment opportunities even if the person has subsequently accessed services to restore sight – it is assumed that those persons who were previously blind are less likely to secure a well-paid job based on a likely lower standard of education and/or less work experience³¹.

Eliminating avoidable blindness and vision impairment shows economic benefit from increasing income due to higher participation in education during childhood. This benefit could be amplified through provision of inclusive education for those blind or visually impaired students. Doing so will contribute to achieving *Sustainable Development Goal 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all*, with associated social and economic benefits subsequent to completion of schooling.

Reduced child mortality

It is difficult to obtain prevalence and incidence data about blindness in children because blindness in children is relatively rare. Approximately three-quarters of the world's blind children live in the poorest regions of Africa and Asia³². Data from industrialised countries suggest that the incidence of blindness in children resulting from acquired conditions has declined over the last few decades, but there are no reliable data from developing countries. In the latter, a high proportion of children who become blind die within a few years of becoming blind, either from systemic complications of the condition causing blindness (e.g. vitamin A deficiency, measles, meningitis, and congenital rubella syndrome), or because poor parents have more difficulty in caring for their blind children than their sighted siblings. Estimates of the number of prevalent cases of blindness in children therefore markedly underestimate the magnitude of the problem of blindness in children.

Against this background, the control of blindness in children is considered a high priority within the WHO's VISION 2020 – The Right to Sight³³ programme for several reasons:

- 1 children who are born blind or who become blind and survive have a lifetime of blindness ahead of them, with all the associated emotional, social and economic costs to the child, the family, and society
- 2 many of the causes of blindness in children are either preventable or treatable
- 3 many of the conditions associated with blindness in children are also causes of child mortality (e.g. premature birth, measles, congenital rubella syndrome, vitamin A

³¹ PwC *The Value of Sight: the quantification of the benefits associated with eliminating avoidable blindness and visual impairment*. February 2013

³² Glibert, C., and Foster, A. *Childhood blindness in the context of VISION 2020 – The Right to Sight*. Bulletin of the WHO 2001, 79 (3)

³³ VISION 2020: The Right to Sight is the global initiative for the elimination of avoidable blindness, a joint programme of the WHO and the IAPB

deficiency, and meningitis). **Control of blindness in children is, therefore, closely linked to child survival.**

Good primary health care and personnel trained in primary eye care are essential for the control of blindness in children. This applies particularly to developing countries, where a high proportion of blindness in children is due to preventable conditions acquired during childhood. In fact, many of the causes of corneal scarring in children would be prevented if the following eight essential elements of primary health care were in place: services for immunisation; maternal and child health care; health education; good nutrition; essential drugs; clean water supplies and good sanitation; control of endemic diseases; and treatment of common conditions³⁴. Better eye health outcomes are delivered through this health systems led approach to primary care. Doing so contributes to the achievement of *Sustainable Development Goal 3 which aims to end preventable deaths of newborns and children under 5 by 2030*.

3.1 Working through health systems to sustain the benefits

The legacy of disease-specific programmes in eye care has created a circumstance where in many instances, vision is not as well as integrated into the continuum of care and coordinated across the levels and sites of care. As such, eye care is often invisible in recurrent government planning, financing and human resource development³⁵. This is despite the fact that ‘there is ample evidence that comprehensive eye care services need to become an integral part of primary health care and health systems development. While it is critical, as an example, for preventing vision impairment from diabetes and premature birth, it is true for the prevention and management of almost all causes of avoidable vision impairment’³⁶.

Aligned with this need to embed eye health in health systems is the shift towards ‘Comprehensive Eye Care Services’ which is defined as “the provision of a continuum of health promotion, disease prevention, diagnosis, treatment, disease management, and rehabilitation that addresses the full spectrum of eye diseases, is coordinated across and integrated within the community, primary, secondary and tertiary levels within and beyond the health sector, and according to people’s needs throughout the life course³⁷.

Elements of Comprehensive Eye Care comprise:

- inclusion of vision in general health promotion activities
- attention to disease prevention – proven interventions that can prevent eye diseases are included as an important component of services, in eye care and also integrated to other services
- appropriate and timely diagnosis – as is critical to defining appropriate management
- effective treatment and disease management
- rehabilitation – to optimize functioning for people with irreversible vision loss and reduce disability

³⁴ Glibert, C., and Foster, A. *Childhood blindness in the context of VISION 2020 – The Right to Sight*. Bulletin of the WHO 2001, 79 (3)

³⁵ WHO draft report on vision march 2018

³⁶ WHO *Universal eye health: a global action plan 2014-2019*. 2013

³⁷ Op cit.

Services can be provided across community, primary, secondary and tertiary levels of the care. For this approach to succeed it is necessary that eye care is seen as part of the recurrent planning and financing cycle. This outcome relies on stewardship from government, stakeholder collaboration (across financing, service delivery and data collection), adequate resourcing and a medium to long-term planning horizon. Opportunities for incorporation of eye health in national non-communicable disease strategies should be explored as a means of securing political commitment to an embedded systems approach to eye health.

3.2 Highlighting innovation in a system led approach

An example of innovation within a health systems approach is that of Peek Vision. Peek Solutions are technology-enabled tools and processes for eye health services. Specifically designed for remote and low resource settings, they include:

- smartphone-based vision screening
- real time data reporting
- eye health service analytics

The smartphone screening tools enable non-specialists to conduct large-scale vision screening in schools and communities. Patients requiring specialist review are identified rapidly and reliably, and real-time data connects them to local services. The Trust funded the development of Peek and supported the piloting of Peek's incorporation across the health system in Botswana. Peek school screening has been used with partners in Kenya, Botswana and India. Botswana has committed to ensuring every school child in the country is screened by 2020 – the first country in the world to do so.



Diabetic retinopathy – a series of case studies

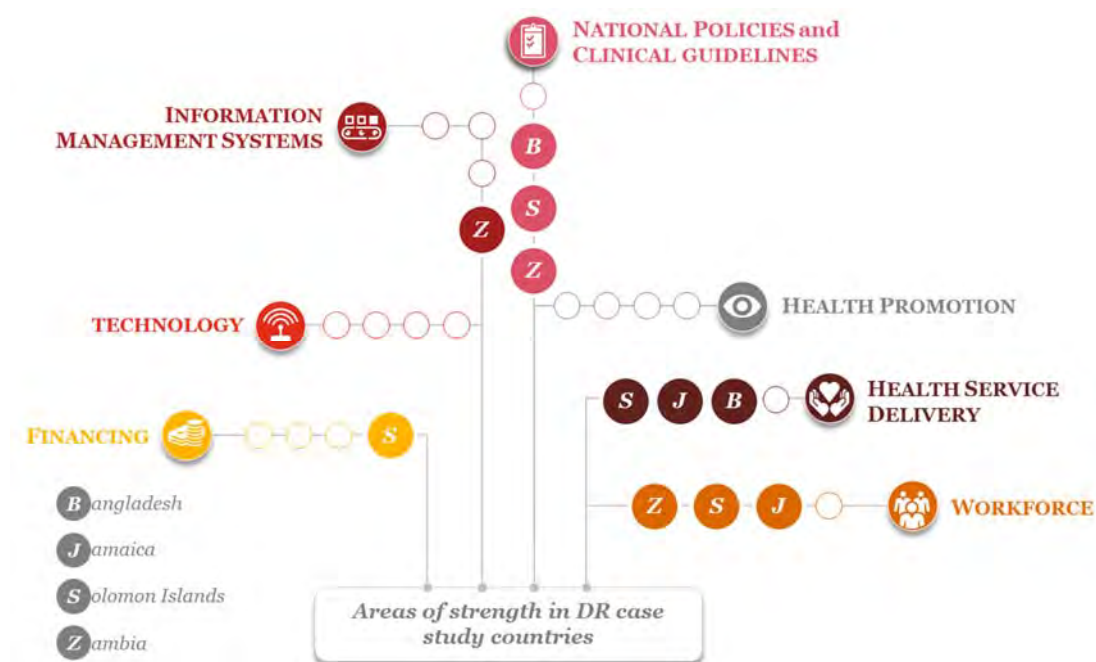
4 Diabetic retinopathy – a series of case studies

4.1 Strengthening health systems to address diabetic retinopathy

Diabetes (and diabetic retinopathy) is increasing worldwide. Countries need to develop system level responses that are appropriate to local conditions and which support a patient’s evolving needs as they battle a lifelong chronic illness. In an effort to understand some of the ways that countries are addressing the emerging diabetic retinopathy issues within their health systems, four country level case studies have been developed using *The Tool for Assessment of Diabetes and Diabetic Retinopathy (TADDS)* (WHO, 2015) as a framing to identify areas of programmatic strength for each country programme. The Trust selected Bangladesh, Jamaica, Solomon Islands and Zambia as the countries to investigate as case studies based on the diversity of conditions and approaches that each of the countries is taking.

Figure 2 illustrates the areas in which each country demonstrated areas of good practice with case studies provided thereafter.

Figure 2: Key strengths of country diabetic retinopathy programmes



Diabetic Retinopathy case study: Solomon Islands

Region: Oceania

Return on Trust's investment: **2.5**

For every £1 spent, £2.5 is returned through averted productivity loss

The Solomon Islands programme has an embedded approach to DR that benefits from high level stewardship, and public sector financing with extensive collaboration across the Pacific.

TADDs assessment strengths



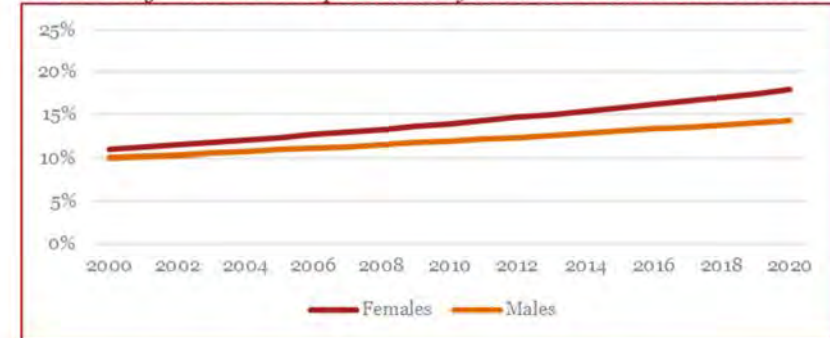
Total population: **600 thousand**

Approx. age-standardised diabetes prevalence (2017): **14%**

Income group: **Lower middle**

Employment rate (age 15+): **48%**

Trends in age-standardised prevalence of diabetes within Solomon Islands



Strength of programme: **National Policies and Clinical Guidelines**

- In the Solomon Islands diabetes mellitus (DM) is listed as a national health priority and there is a National Plan and programme for diabetes. Whilst DR is not a prioritised eye condition in the country's national prevention of blindness plan, the national diabetes plan includes diabetes prevention strategies as well as diabetes including vision.

Strength of programme: **Financing**

- Despite a fiscally constrained environment in recent years, the Government of the Solomon Islands has continued to allocate domestic resources to the DR program.

Strength of programme: **Workforce**

- There are 34 eye care nurses, 25 diabetes trained nurses and 4 skilled ophthalmologists working in the country many of whom were trained at the Pacific Eye Institute in Fiji – the Pacific region's first training facility for eye health professionals where postgraduate students are trained specifically to provide eye care in Pacific conditions.

Strength of programme: **Health Service Delivery**

- The geographic disbursement of the population across remote islands poses challenges for service delivery in the Solomon Islands. The screening of high risk patients for complications of DM such as DR is only possible in a few provincial hospitals and in Honiara. A new eye facility which is a Fred Hollows Foundation New Zealand initiative, the Regional Eye Centre (REC), was opened in July 2015 in Honiara and is well equipped for DR screening and management of DR. Some outreach screening is taking place in remote locations.



All country demographic data sourced from World Bank and IAPU Vision Atlas

Diabetic Retinopathy case study: Bangladesh

Region: South Asia

Return on Trust's investment: **5.3**

For every £1 spent, £5.3 is returned through averted productivity loss

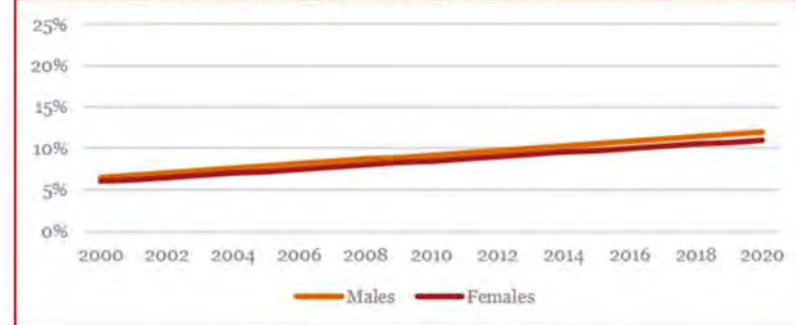
The Bangladesh DR programme is now part of the public health system. It has high level Government stewardship, and there is a commitment to improved accessibility for women.

TADDs assessment strengths



 Total population: **166 million**
 Approx. age-standardised diabetes prevalence (2017): **11%**
 Income group: **Lower middle**
 Employment rate (age 15+): **56%**

Trends in age-standardised prevalence of diabetes within Bangladesh



Strength of programme: **National Policies and Clinical Guidelines**

- The Bangladesh Trust funded DR programme is supported by the Government and DR is included in the national eye care plan, the national prevention of blindness plan and the national eye care programme.
- There are plans to expand the programme to make DR management and screening accessible for more communities, particularly targeting women.
- High level programme stewardship by the Government and private sector.



Strength of programme: **Health Service Delivery**

- The Bangladesh Diabetic Retinopathy programme offers more accessibility for women, with the programme developing an awareness campaign for women, with gender sensitive training for various medical staff and data collectors.
- There are women only screening sessions and a women based model with information shared through local mosques.
- A divisional level steering committee was formed to oversee the quality of DR service in the upgraded facilities.



All country demographic data sourced from World Bank and IAPB Vision Atlas

Diabetic Retinopathy case study: Jamaica

Region: Caribbean

Return on Trust's investment: **7.9**

For every £1 spent, £7.9 is returned through averted productivity loss

Jamaica has an emerging DR programme with a commitment to establishing and improving diabetic health services.

TADDs assessment strengths



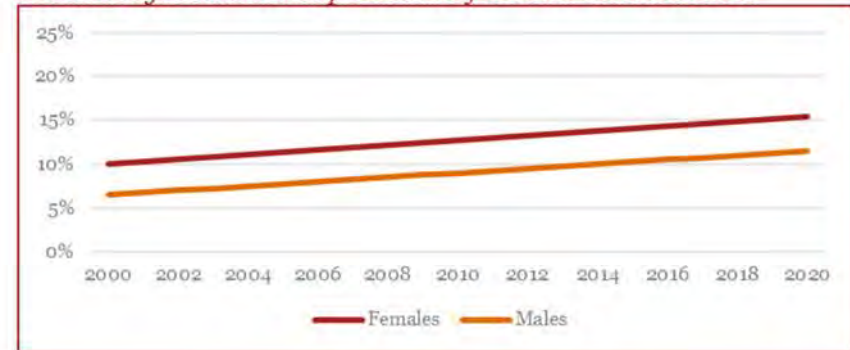
Strength of programme: **Workforce**

- DR management is included in the teaching curriculum for primary health care workers
- Recognising that a sustainable DR programme requires functioning equipment, the Jamaican team has implemented an equipment maintenance and training programme which supports the capacity of local engineers which limits the risk of 'down time' associated with malfunctioning/dormant and broken equipment.



Total population: **3 million**
 Approx. age-standardised diabetes prevalence (2017): **12%**
 Income group: **Upper middle**
 Employment rate (age 15+): **55%**

Trends in age-standardised prevalence of diabetes within Jamaica



Strength of programme: **Health Service Delivery**

- The Jamaica Diabetic Retinopathy programme has established a screening and referral pathway to support DR service provision at the tertiary level to overcome risks associated with inconsistent referral processes and pathways.
- The pathway process helps to track the patient journey and identify when patients drop out or miss appointments. Data sharing across regions has been an important enabler of better health service delivery with current discussion underway regarding best practice for cloud based data platforms and server based platforms as the Jamaica DR programme expands nation-wide.



Diabetic Retinopathy case study: Zambia

Region: Eastern Sub-Saharan Africa

Return on Trust's investment: **5.3**

For every £1 spent, £5.3 is returned through averted productivity loss

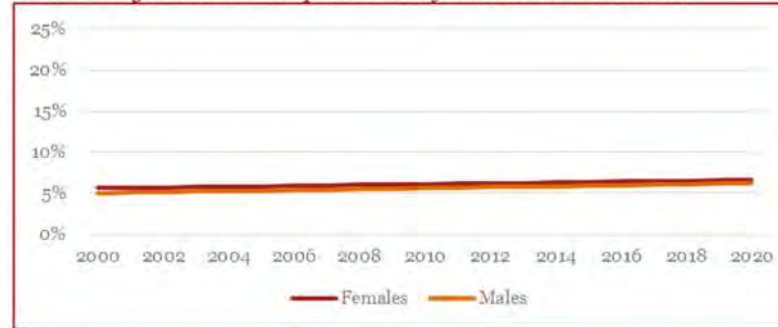
Zambia has an expanding DR programme with policy priority, and has provided targeted investment to the development of a national diabetic register to support patient management.

TADDs assessment strengths



 Total population: **17 million**
 Approx. age-standardised diabetes prevalence (2017): **6%**
 Income group: **Lower middle**
 Employment rate (age 15+): **61%**

Trends in age-standardised prevalence of diabetes within Zambia



Strength of programme: **National Policies and Clinical Guidelines**

- The Ministry of Health's (MoH) commitment to DR policy and service delivery is complemented by leadership from the National Eye Health Coordinator whose efforts have kept DR on the national radar. Diabetes is a national health priority for Zambia and DR is listed as a priority in the National Eye Health programme.

Strength of programme: **Information Management Systems**

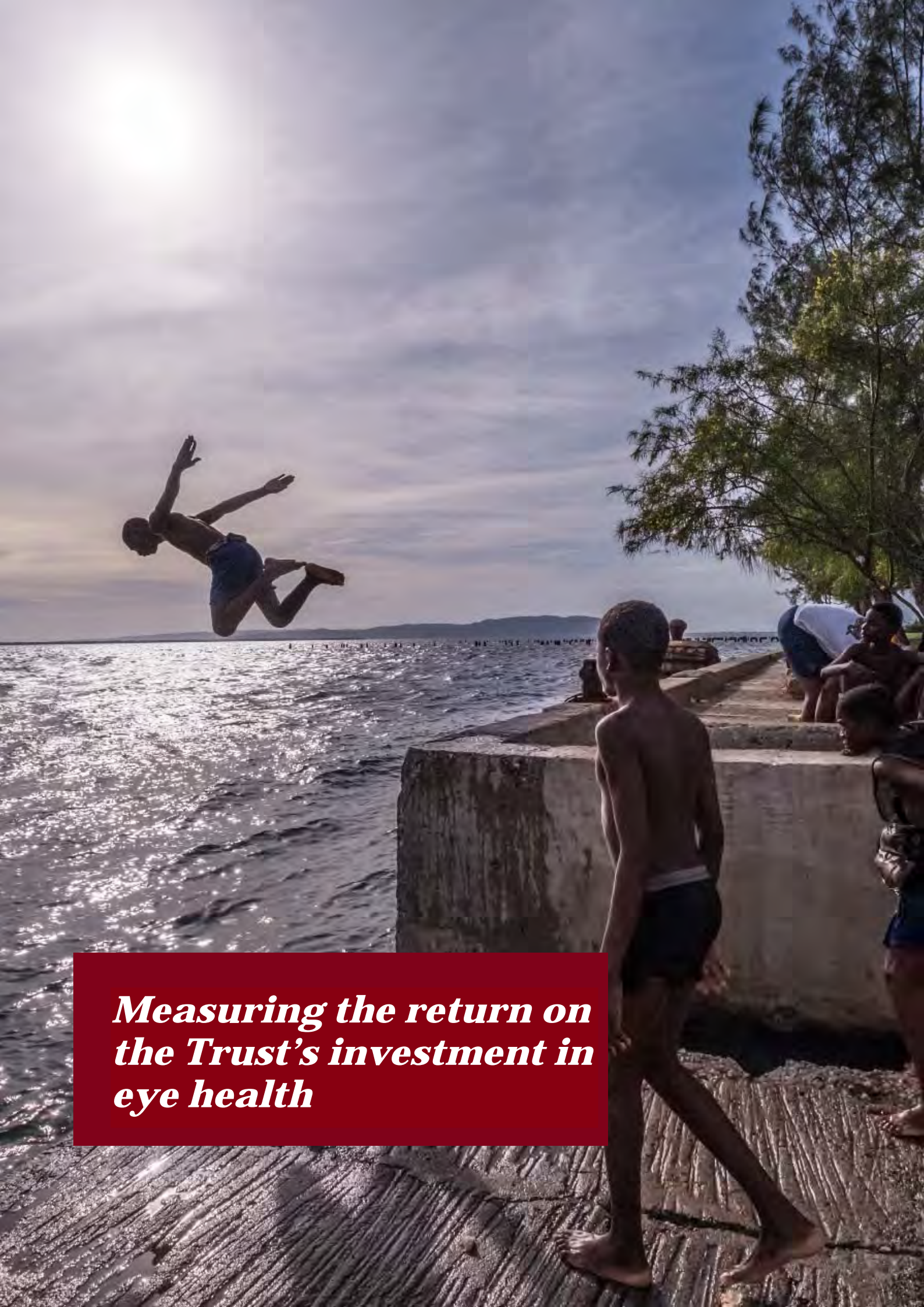
- The Zambia Diabetic Retinopathy programme has established a diabetic register, the first of its kind in Zambia, which allows staff to create a database of patients who are being treated for diabetes and offer them eye screening, track treatment, and follow up consultations. Establishment of this register required high level stakeholder support from across the country.

Strength of programme: **Workforce**

- In an innovative approach to staffing (in a human resource poor environment) Zambia has used 'patient aids' – people who are neither doctors or nurses but who are generally responsible for taking care of patients on the ward. Almost 100 patient aids have been trained in DR and it is expected that a train-the-trainer model will see the training cascade to the rest of the practice team.



All country demographic data sourced from World Bank and IAPD (From Africa)



***Measuring the return on
the Trust's investment in
eye health***

5 *Measuring the return on the Trust's investment in eye health*

5.1 *Overview*

The Trust's investments in vision in the Commonwealth support programmes that target the following avoidable blindness types: blinding trachoma, diabetic retinopathy and retinopathy of prematurity. These programmatic investments are complemented by a commitment to the Commonwealth Eye Health Consortium which is a network of fellowships, research and technology which strengthens eye health capacity across the Commonwealth. An overview of each of these investments follows.

For **Blinding Trachoma**, the Trust is working with members of the International Coalition for Trachoma Control to make significant advances towards the elimination of blinding trachoma in 12 Commonwealth countries. It is supporting the implementation of the World Health Organization endorsed SAFE strategy to fight the disease.

For **Diabetic Retinopathy**, the Trust invests in programmes in 13 countries across the Commonwealth, spanning the Caribbean, South Asia and the Pacific. The Trust's partners are piloting different methods of screening, treatment and awareness raising, in addition to bringing together health professionals and governments from all of these countries to share learning and find new solutions. The goal of these programmes is to create practical, effective and replicable models of care that can be used to prevent diabetic retinopathy throughout the Commonwealth.

For **Retinopathy of Prematurity**, the Trust is working with the Government of India, the Public Health Foundation of India and the London School of Hygiene & Tropical Medicine to increase awareness of the condition across India and develop programmes to detect and treat retinopathy of prematurity, and so prevent more young children from needlessly going blind.

The goal of the retinopathy of prematurity programme in India is to establish sustainable and scalable services for the detection and treatment of severe retinopathy of prematurity which are integrated into the national health system.

And finally, with a commitment to the promotion of capacity development across and between member countries, the Trust established the **Commonwealth Eye Health Consortium**, to tap into expertise that exists across the Commonwealth and deliver a programme of fellowships, research and technology to strengthen eye care. Its aim is to bring quality eye care to all who need it, and the consortium is being coordinated by the International Centre for Eye Health at the London School of Hygiene & Tropical Medicine.

The investments in programmes specific to a type of avoidable blindness (trachoma, diabetic retinopathy and retinopathy of prematurity) were analysed via a return on investment model that follows the methodology outlined in Appendix A. These results are discussed in detail in section 5.2, followed by a discussion in Section 5.3 on the augmentation of impact through investment in capacity via the Trust's Commonwealth Eye Consortium.

5.2 Investments have generated a positive economic return

At an overall level, across all of the programming areas, analysis shows a return on investment of £12 for every £1 invested by the Trust. It is important to note though that analysis has not taken into account other potential investments that may have been required from country governments or other organisations to support the programmes and the outputs that arose from them. The Trust's investments have been advantaged from being able to capitalise on experiences and approaches that had demonstrated effectiveness and with a track record of impact.

Trust return on investment results across the programming areas are outlined in Table 3.

Table 3: Results summary – Trust programme impact (2014-2017)

Results summary	Trachoma	Diabetic Retinopathy	Retinopathy of Prematurity	Overall
RoI (for every £1 invested, £x in economic benefit is returned)	13.2	6.5	6.0	12.0*
Total investment (GBP)	21.0 mil	3.8 mil	0.8 mil	25.6 mil
Total benefit to visually impaired (GBP)	215.9 mil	14.7 mil	4.1 mil	234.7 mil
Total benefit to carers (GBP)	60.9 mil	9.8 mil	0.8 mil	71.5 mil
Total averted productivity loss (GBP)	276.8 mil	24.5 mil	4.9 mil	306.2 mil

*Rounded up from 11.96 to nearest whole number

Key takeaways from the results include:

- The Trust's investments have resulted in averted productivity loss of more than £300 million split across both the individuals with blindness/vision impairment and their carers
- The high ROI for trachoma relates to significant investments in prevention and education in line with the SAFE strategy, and targeting countries with high prevalence of trachoma in Africa and the Pacific from 2014-17
- Diabetic Retinopathy programmes across a number of Commonwealth countries with varying levels of health system readiness achieve an average ROI of 6.5
- India as the pilot country for the Retinopathy of Prematurity programme generates £6 of returned economic benefit for every £1 spent through targeted surgical and training activities.

5.3 Increasing impact through investment in capacity

To support to the targeted investment that the Trust provides to avoidable blindness programmes across the Commonwealth, the Trust funded a universal eye health systems strengthening platform – the Commonwealth Eye Health Consortium (the Consortium) which increases economic impacts through investment in capacity.

The Trust has invested strategically for a period of five years (June 2014 to May 2019) in the Consortium) – an integrated programme of Fellowships, Research and Technology³⁸.

The Consortium is a group of 15 training institutions and four national/international Colleges of Ophthalmology from around the Commonwealth working together in partnership to deliver a coherent programme of:

- human capacity development for health systems strengthening
- knowledge generation and sharing, and
- development and deployment of new affordable and accessible technology for eye care.

The Consortium's aim is to strengthen eye health systems and quality of eye care throughout the Commonwealth. Its key components include:

- **Public Health Masters** (MSc) programmes in South Africa and the UK, which help to equip ophthalmologists and eye care managers with the skills and knowledge they need to implement effective, sustainable strategies to prevent and treat blindness across the Commonwealth
- Long-term (one-year) and short-term (three-month) **Clinical Fellowships**, which support ophthalmologists and related cadre from low and middle-income Commonwealth countries to enhance sub-specialty knowledge and skills and the delivery of high quality eye care
- **The Diabetic Retinopathy Network**, which aims to build a network to combat diabetic retinopathy across the Commonwealth
- **Clinical Research Fellowships**, which support the development of eye research capacity across the Commonwealth by providing a number of clinical research fellowships at PhDs and postdoctoral level, to applicants from low- and middle- income Commonwealth countries where there is a demonstrable need and the least opportunity for advancement
- **Portable Eye Examination Kit** (Peek), which supports the development of high quality low-cost tools that will transform the provision and quality of eye health care services for millions across the Commonwealth
- **Open Educational Resources**, to support public health training for eye care across the Commonwealth with Open Access learning resources.

The Consortium is playing a major role in connecting eye health professionals across the Commonwealth, which is leading to shared learning, the strengthening of eye health systems

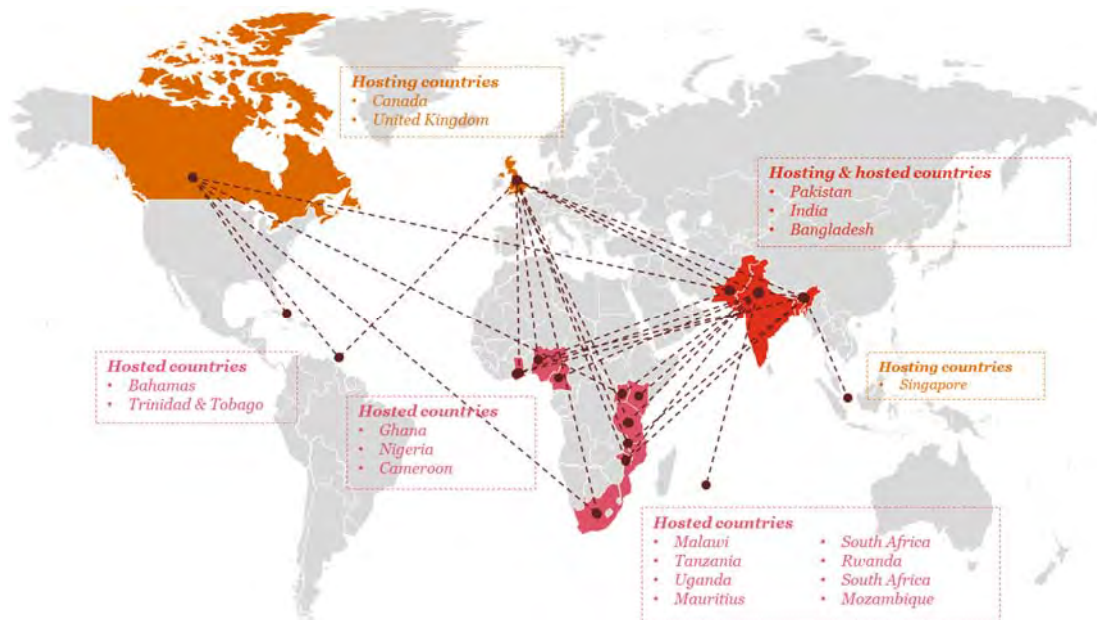
³⁸ Commonwealth Eye Health Consortium. Mid term evaluation January 2017. Undertaken by Lucy A Lee, London School of Hygiene and Tropical Medicine

and improved integration with the wider health sector. Some of the key results of the Consortium's work include:

- completion of free on-line training courses that have been developed and/or supported by the Consortium by 13,000 people, 6,000 of whom are from Commonwealth. This platform makes high quality topic-focused eye health training widely available
- the development of 'Peek', utilising smartphone based tools, public health methods and incentive-based financing to identify and organise the treatment of populations with visual impairment. The Peek School Eye Health System is now being taken to a national level programme in a partnership between the Government of Botswana and Peek Vision (see Section 3.2)
- the establishment of new interdisciplinary networks in 15 Commonwealth countries that have developed national or regional frameworks and programmes for the detection and treatment of diabetic retinopathy, integrated into the wider health system
- the development of a nascent eye health research network in the African region. This is leading to an approximate doubling of the number of research active clinicians trained to PhD level from the African region, who are conducting contextually relevant, public health orientated eye health research
- supporting the development of a curriculum for a national ophthalmology training for Papua New Guinea.

Further to these results, Figure 3 illustrates the significant reach and breadth of the network that has supported capacity development and professional learning opportunities for eye health professionals across the Commonwealth. This collaboration has fostered expertise across specialty areas including paediatrics, cornea, glaucoma, oculoplasty, diabetic retinopathy and others.

Figure 3 Commonwealth Eye Health Consortium – countries involved





Appendices

Appendices

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Appendix A Methodology

This section details the methodology used to calculate:

- The return on investment of avoidable blindness programmes funded by the Trust
- The potential return on investment across the Commonwealth given investment in vision
- An estimation and assessment of health system impact and maturity as a result of diabetic retinopathy programmes with four selected countries.

Measuring the Trust's impact

The Trust has provided targeted investments to avoidable blindness programmes across a number of Commonwealth countries to support improvement in Trachoma, Diabetic Retinopathy and Retinopathy of Prematurity outcomes in targeted countries.

From an analysis standpoint, PwC developed a return on investment calculation to quantify the averted productivity loss attributable to the population whose sight has been saved or improved (as well as their carers) as a result of Trust funded programmes. At a high level this is illustrated in Figure 4 and detailed further below.

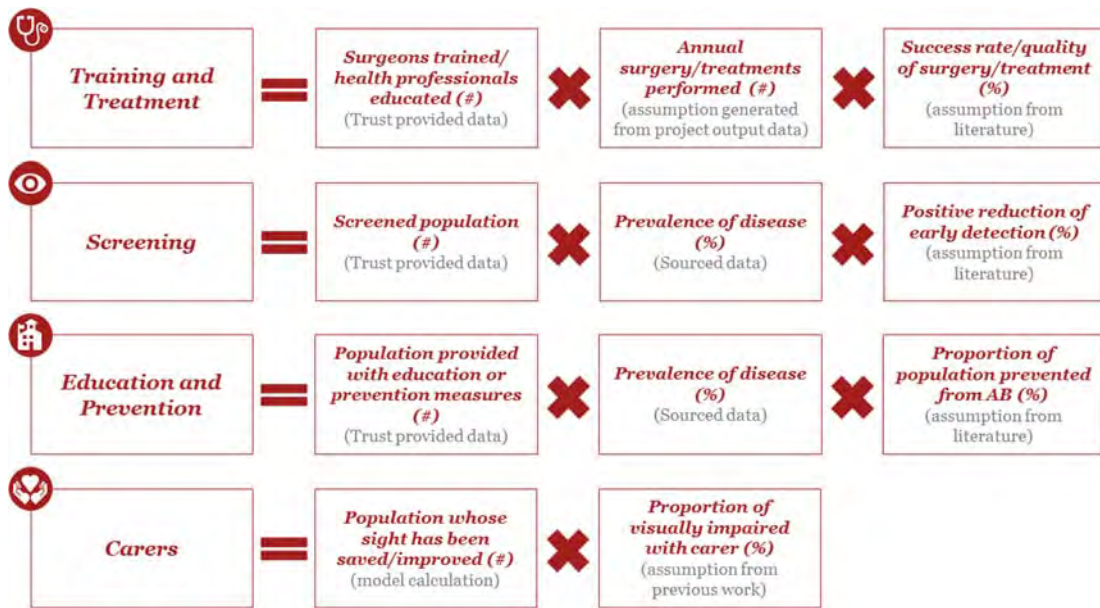
Figure 4: Overall return on investment calculation



- **Return on investment** – averted productivity loss attributable to the population whose sight has been saved and improved, and their carers, as a result of Trust funded initiatives, as compared with the cost required to provide that gain
- **Potential contribution** – the potential contribution that could be gained through capacity release and considers the salary foregone by a person and/or their carer, as a result of visual impairment
- **Cost of investment** – programme costs resulting in prevention or treatment of the visually impaired population that has been targeted.

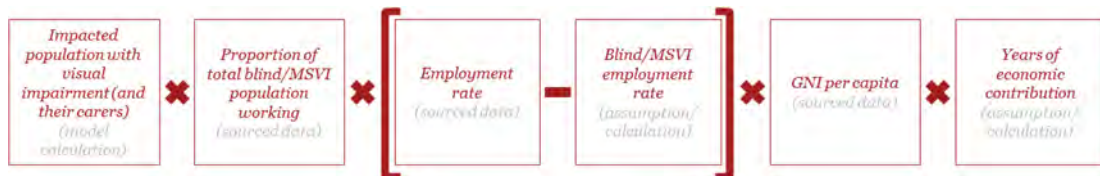
In order to calculate the potential contribution a view of **the impacted population with improved vision** was estimated within the model. The elements involved within this calculation were broken down into individual programme pillar calculations which are illustrated in Figure 5.

Figure 5: Calculating the impacted population



Following the estimation of the impacted population as a result of Trust funded initiatives, the **potential contribution** could be calculated, and is illustrated in Figure 6.

Figure 6: Calculating the potential contribution of the impacted population



This calculation, when divided by the **cost of investment** provided by the Trust, allows for **return on investment** calculations at the country, disease and aggregate level.

Measuring the potential impact across the Commonwealth

Similar to the return on investment calculation developed to determine the impact of the Trust's funding, modelling was undertaken to estimate the potential impact across the Commonwealth given future investment in vision.

Certain avoidable blindness types were modelled where external data was most available and where previous PwC work had been undertaken. The avoidable blindness types included Trachoma, Diabetic Retinopathy, Cataract, Age-Related Macular Degeneration and Glaucoma.

Estimating the potential return on investment across the Commonwealth involved the following

1 Calculate the potential impacted population with visual impairment, and their carers

Based on low, medium and high annual AB prevalence estimates, the potential impacted population can be calculated for all AB types modelled at the country level. This number forms the basis for a potential investor's targeted population.

2 Estimate the unit cost required to save/improve one visually impaired person's sight

A unit cost per person for each AB type was calculated utilising the data that was provided from Trust programmes (Trachoma and diabetic retinopathy), and overlaid with avoidable blindness cost data from previous PwC work for other disease types (Cataract, Glaucoma, AMD) as well as Trachoma and diabetic retinopathy. Figure 7 illustrates this calculation for Trachoma and diabetic retinopathy using Trust programmed data.

Figure 7: Estimating unit costs where data is available

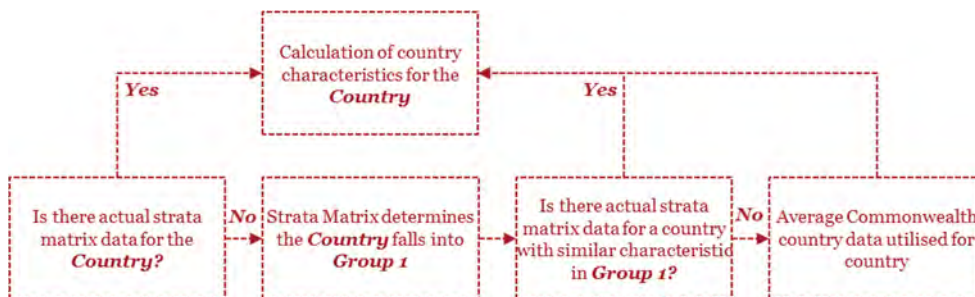


3 Utilise a strata matrix to generate unit costs per avoidable blindness type for all Commonwealth countries

For countries where unit costs were not available from model calculations and through Trust/previous PwC data, calculated unit costs were placed in the model's built-in strata matrix to determine subsequent unit costs for all Commonwealth countries. Figure 8 illustrates the process undertaken by the strata matrix to determine country level unit costs for all Commonwealth countries.

At a high the strata matrix groups similar countries based on a number of criteria to appropriately allocate AB unit costs where there is no data available.

Figure 8 Estimating unit costs for all Commonwealth countries using the strata matrix



4 Calculate averted productivity loss and corresponding potential return on investment across the Commonwealth

Following the derivation of country and AB level unit costs, return on investments are calculated for low, medium and high AB prevalence estimates and corresponding investment requirements.

Assumptions used in return on investment calculations

The following table details key assumptions that have been made where limited data or literature is available, and to help inform the ROI calculations for the Trust and broader Commonwealth.

Table 4: Assumptions used for return on investment calculations

Model assumption	Assumption description	Assumption value	Source(s)
Success rate/quality of treatments	Not all treatments/eye procedures administered will result in a successful outcome for a person with visual impairment. As limited data is available on these rates a global proportion is applied to all impact calculations in order to not overestimate economic contribution.	Sources range from 60-85% for varying disease types	Various – including RAABs, IAPB and WHO, previous PwC SAFE, cost/benefit and impact work
Positive reduction of early screening, prevention, and education measures	There is very limited available data and information surrounding the impact (in terms of the reduction of eye health disease) as a result of early screening, prevention and education measures.	A global estimate of approximately 80% reduction of prevalence given early screening, prevention, and education has been utilized	Previous PwC cost/benefit and impact work
Blind/MSVI employment rate	A proportion of the population already working prior to improving/having their sight saved. This assumption takes into account the blind/MSVI employment rate in order to not overestimate economic contribution.	Blind/MSVI employment rates are approximately 50% of country employment rates (where data is available)	Literature – a recent economic paper suggests ~50% of country employment is a good estimate of blindness employment rates
Years of economic contribution	Economic gain (or potential contribution for a return on future investment has been modelled to a selected year – until approximately 2030 which is in line with international WHO AB elimination targets.	Model calculated through to 2030	N/A
Average age at treatment	Different AB types are treated during different age bands. The number of years of economic contribution is directly related to treatment/prevention age and thus it is important for educated estimates.	<ul style="list-style-type: none"> • Trachoma – early-mid life • Retinopathy of prematurity – early life • diabetic retinopathy – mid life • Cataract – late life • AMD – late life 	Miscellaneous data sources – bands have been used as educated estimates for all disease types to limit potential inaccuracies

Model assumption	Assumption description	Assumption value	Source(s)
		<ul style="list-style-type: none"> • Glaucoma – mid-late life 	
Retirement age	A retirement age needs to be considered in order to limit impact calculations to only the working years in which an impacted person, and/or their carer, is contributing economically.	<ul style="list-style-type: none"> • 65 years of age 	Multiple sources all confirming average global retirement age is approximately 65 years of age

Approach to case studies

The Trust selected four focus countries for case study development. The following criteria were used to select one country from each region (i.e. Africa, Asia, Caribbean and Pacific):

- Prevalence of diabetes
- Income/development level of the country
- Population size
- Perception of how ‘representative’ the country is of its region
- Access to information/relationships with organisations in-country
- Likelihood of the country being able to act on the study findings.

On this basis Zambia was selected for Africa, Bangladesh was selected for Asia, Jamaica was selected for the Caribbean and the Solomon Islands was selected for the Pacific region.

Data collection and analysis

The development of these case studies was informed by two rounds of consultations with programme stakeholders in each of the four countries and a desk based review of WHO country profiles.

The main objective initial consultations was to develop a high level understanding of the programme itself. To get an understanding of how:

- the programme interacts with the health system and health service delivery – e.g. are the diabetic retinopathy services delivered in a vertical programme or embedded in the health system? Do patients incur out of pocket expenditure? Is there a clear referral pathway?
- a diabetic retinopathy patient interacts with the programme itself as well as with the health system of the country more broadly – i.e. the pathway from education, through to screening and prevention, and direct treatment.
- These consultations were also used to explore the nature of available data and request that which is appropriate to our assessment.

Building on the information gathered through initial consultations and data analysis, the objective of the second round of consultations was to develop a more detailed understanding of the programmes and the context they are operating in. These consultations were used to:

- explore the particular strengths of each country programme in more detail

Methodology

- understand the relative importance of contributing factors
- find out more about the national context within which the programmes operate.

Appendix B Quantifying the ROI of the Trust's investments

Table 5 Return on the Trust's investments by programmatic area and country

Country	Region	ROI – Trachoma	ROI – Diabetic Retinopathy	ROI – Retinopathy of prematurity	ROI – Aggregate	Total Investment (GBP)	Total benefit to visually impaired (GBP)	Total benefit to carers (GBP)	Total averted productivity loss (GBP)
Bangladesh	South Asia	-	5.3	-	5.3	250,000	800,000	500,000	1,300,000
Fiji	Oceania	-	12.4	-	12.4	250,000	1,800,000	1,200,000	3,100,000
India	South Asia	-	8.0	6.0	7.3	2,400,000	11,500,000	5,800,000	17,300,000
Jamaica	Caribbean	-	7.9	-	7.9	250,000	1,200,000	800,000	2,000,000
Kenya	Eastern Sub-Saharan Africa	14.4	-	-	14.4	7,800,000	82,800,000	30,100,000	112,900,000
Kiribati	Oceania	-	3.7	-	3.7	250,000	600,000	400,000	900,000
Malawi	Eastern Sub-Saharan Africa	17.2	-	-	17.2	4,500,000	72,400,000	5,500,000	77,900,000
Mozambique	Eastern Sub-Saharan Africa	1.7	-	-	1.7	1,000,000	600,000	1,200,000	1,700,000
Nigeria	Western Sub-Saharan Africa	4.2	-	-	4.2	2,400,000	3,400,000	6,600,000	10,000,000
Samoa	Oceania	-	4.4	-	4.4	250,000	700,000	400,000	1,100,000
Solomon Islands	Oceania	-	2.5	-	2.5	250,000	400,000	300,000	600,000
Tonga	Oceania	-	5.9	-	5.9	250,000	900,000	600,000	1,500,000
Tanzania	Eastern Sub-Saharan Africa	5.2	-	-	5.2	1,600,000	2,800,000	5,500,000	8,200,000

Country	Region	ROI – Trachoma	ROI – Diabetic Retinopathy	ROI – Retinopathy of prematurity	ROI – Aggregate	Total Investment (GBP)	Total benefit to visually impaired (GBP)	Total benefit to carers (GBP)	Total averted productivity loss (GBP)
Uganda	Eastern Sub-Saharan Africa	17.9	-	-	17.9	3,700,000	54,000,000	11,900,000	65,900,000
Vanuatu	Oceania	-	1.2	-	1.2	250,000	200,000	100,000	300,000
Zambia	Eastern Sub-Saharan Africa	-	5.3	-	5.3	250,000	800,000	500,000	1,300,000
Total		13.2	6.5	6.0	12.0	25,600,000	234,700,000	71,500,000	306,200,000

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