

Eyeglasses for Global Development: Bridging the Visual Divide

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EYElliance

EYElliance is a coalition of multisector public, private and non-governmental organization (NGO) partners and stakeholders that collaborate to address the world's unmet need for eyeglasses. EYElliance will call attention to the importance of this issue and ensure it is appropriately prioritized by the international donor community, national governments and private sector, with the goal of mobilizing new resources to solve the problem at scale. EYElliance does not deliver eyeglasses directly, but instead promotes increased coordination among NGOs and facilitates collaboration across sectors to accelerate market-led development and support school eye health initiatives.

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Preface

We are pleased to present *Eyeglasses for Global Development: Bridging the Visual Divide*, a jointly authored report of collective findings on the urgent need for national governments, the private sector and development partners to substantially increase investment in providing eyeglasses to improve educational outcomes, increase productivity and stimulate the global economy.

We fully endorse the recommendations contained herein, and are committed to building cross-sector support to broaden access to eyeglasses. This report delineates the strong case for investing to improve their provision, along with recommendations that, if implemented, will address barriers to solving this problem on a global scale. A pair of eyeglasses could correct the vision of 2.5 billion individuals living with poor vision. Of these, 624 million need corrective lenses so strong that they are classified as visually impaired or blind without glasses.

The need is great, but the problem is solvable. This report presents a rare opportunity to help address a massive global health problem by harnessing market forces to deliver a solution that can potentially generate significant gains in socio-economic development. In addition, it makes a compelling case that providing glasses for school-age children is a high-impact investment and should be appropriately prioritized by both government leaders and development agencies.

To advance these recommendations, we will collaborate with existing efforts – for example, the International Agency for the Prevention of Blindness and Our Children's Vision Campaign – and work with a broad coalition of public- and private-sector partners. We believe that doing so will improve future educational and employment opportunities for hundreds of millions of children and adults throughout the world.

27 June 2016

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Executive Summary

Correcting people's vision with eyeglasses advances socio-economic development. Vision correction for children, for example, has been proven to lead to better test scores and improved academic performance in primary school for those affected,¹ thereby increasing the chance of having a better-educated populace. For adults, correcting vision represents an even more immediate economic return by supporting increased productivity of the working poor. This also allows adults to remain in the workforce for a longer period of time and can help overcome illiteracy.

Today, 2.5 billion people live with poor vision unnecessarily because they need yet do not have eyeglasses. Of these, 624 million require corrective lenses so strong that they are classified as visually impaired or blind without glasses; and, 80% of those with poor vision live in less developed countries. In 2015, non-governmental organizations (NGOs) and inclusive businesses collectively distributed less than 8 million pairs of eyeglasses in those countries. Those with the fewest opportunities in the world are further disadvantaged by persistently poor vision. This is today's world; it does not have to be tomorrow's.

Without glasses, children with poor vision are at a major disadvantage in school because 80% of all learning occurs through vision. Today, a pair of eyeglasses could correct the poor vision of 239 million children. Myopia, or short-sightedness, is commonly diagnosed at 8 to 12 years of age; if current trends continue, an estimated 4.8 billion people, or about half the world's population, will have myopia by 2050.² Research shows that correcting myopia and poor vision with properly prescribed glasses results in a greater impact on academic performance than any other health intervention. In addition, correcting vision has the potential to improve learning environments for all children in the classroom and decrease non-completion rates due to underperformance. School-based eye health interventions are a cost-effective approach to identifying children with vision problems. Therefore, providing glasses for school-age children is a high-impact educational and economic investment. National governments should collaborate with development partners to fund school eye health initiatives.

The global economy loses \$227 billion every year from lost productivity among adults who need eyeglasses.³ Providing affordable access to reading glasses alone would boost productivity by up to 34%. Illiteracy costs the global economy \$1.19 trillion each year; in fact, research reveals that 74% of illiterate adults failed one or more parts of a vision screening.⁴ Secondary benefits of correcting vision in adults include safer drivers and safer roads, as well as increased participation in the digital economy. Fortunately,

market-based approaches to eye care in less developed countries have emerged and demonstrated the viability of cost recovery models and sustainable solutions. To fully realize the potential for market-led development, finance institutions, foundations and development banks should offer financing options, including impact investment and social impact bonds, to de-risk the optical private sector's entry into less mature markets.

New developments in technology could accelerate the ability to reach consumers at a significantly lower cost and on a larger scale. Coupled with burgeoning momentum within the eye care community to align efforts, this means the time is now to collaborate across sectors to bring better vision to the world.

Political will, investment and the engagement of private-sector actors can overcome barriers to solving the problem at scale. In 2015, only \$37 million, or 2 cents per person affected, was spent to solve this problem.⁵ That amount is less than 1% of the resources allocated to address other global health and development problems, such as river blindness, malaria and access to clean water and energy. An infusion of philanthropic investment could stimulate government investment in school eye health and attract capital investment for market-based solutions. Such efforts would serve base-of-the-pyramid consumers and yield exponential returns in socio-economic gain.

Solving this problem is within society's grasp, but it needs to seize the opportunity to harness market forces for accomplishing the task. Although eyeglasses have existed for hundreds of years, scalable distribution models have now emerged and new technologies are being tested to accelerate access. In a year marked by a renewed commitment worldwide to reduce inequalities, shouldn't this achievable and highly impactful goal be added to the global development agenda?

Equitable access to eyeglasses is in the best interest of governments and businesses. Accordingly, both sectors should work with development partners to ensure that providing glasses is appropriately prioritized as a key part of global development. Helping all individuals live up to their potential is a great justice, but great injustice occurs when neglect hinders them from reaching their full potential. The time to pay attention and solve this problem is now.

Moving to Action

This report not only lays out the evidence that correcting vision with glasses has a profound impact on socio-economic development, but also highlights validated, scalable models. The challenge is: how can the concerned actors work together to address the barriers to systemic change, take these models to scale and close the global gap for those needing eyeglasses? The report's advisory panel recommends engaging multiple sectors to dismantle the primary supply-and-demand barriers, and create new opportunities for collaboration across sectors to solve the problem at scale.

Evidence of Impact

The benefits of improving children's vision

- A review of 60 trials of health interventions conducted in primary schools showed that the impact on learning outcomes from correcting vision with glasses was 10 times higher than from deworming, and three times higher than from nutrition.
- New research has proven that correcting vision in primary school students has a significant impact on test scores, in some cases the equivalent of a third to a half year of additional schooling.
- This evidence suggests that the provision of eyeglasses could be associated with an increase in personal earnings and annual growth of gross domestic product (GDP) per capita.

The socio-economic benefits of improving adults' vision

- Correcting near-vision loss with glasses yields an immediate increase in productivity of up to 34%.
- New research shows that drivers with poor vision, correctable with glasses, have an up to 30-percentage-point higher incidence of road accidents.
- Among adults with literacy problems, 74% have failed one or more parts of a vision screening.
- Clear vision is necessary to maximize use of application-based technology tools that are becoming increasingly accessible with the spread of affordable smartphones in less developed countries.

Validated Models

- School eye health
- Sustainable optical shops and vision centres
- A new eye health workforce to deliver reading glasses

Multisector Engagement Required to Address Barriers and Scale

Supply barriers

- Inadequate number of eye health workers
- Regulatory challenges
- Insufficient investment

Demand barriers

- Lack of awareness about vision problems, misperceptions and culturally based stigmas
- Limited affordable eye care options
- Value proposition not adequately conveyed to consumers

Cross-sector partnerships

- Opportunity to scale through partnerships with adjacent sectors

photo credit: Esther Havens



Recommendations

Supply Barriers

Policy

For ministers of health, education and finance: Collaborate to support the integration of school eye health programmes into existing school health initiatives; partner with international donor and finance communities to fund eye exams and free or subsidized glasses for children

For government authorities that regulate customs: Help ensure eyeglasses are affordable for base-of-the-pyramid⁶ (BoP) consumers; add eyeglasses to the list of essential assistive products, and eliminate import duties on glasses that have values of \$2 or less, freight on board

For government leaders: Develop targets for providing eyeglasses (recognizing that 48% of all vision impairment is due to uncorrected refractive errors) as part of their plan to meet the World Health Organization's (WHO) goal of reducing vision impairment by 25% by 2019

Financing

For multilateral, bilateral and regional development banks, finance institutions and foundations: Offer impact investment and creative financing options to global, regional and local private-sector optical companies to de-risk their entry into less mature markets

Programmatic

For the global eye care community: Assemble a diverse group of experts to set and continually evaluate the minimal competencies needed to determine quality prescriptions and dispense appropriate eyeglasses, based on the capacity of the local eye health workforce (competencies to be reassessed as technologies improve and costs are driven down)

Demand Barriers

Financing

For the international donor and eye care communities: Fund large-scale awareness and behavioural change campaigns that lead to increased demand for eyeglasses, informed by best practices related to creating demand in key geographies

Cross-Sector Partnerships

Private sector

For business leaders: Ensure that those manufacturing, delivering and consuming a business's products collaborate with optical companies and NGOs to receive quality vision care and access to eyeglasses, which will increase their productivity and safety on the road, and optimize use of their products

Research

For institutions funding and administering research: Conduct a comparative analysis to determine the most cost-effective approach for implementing school eye health programmes and the delivery of glasses, and research the correlation between poor vision and road accidents, productivity, and mobile device and smartphone usage



Introduction: The Need and the Opportunity

Background

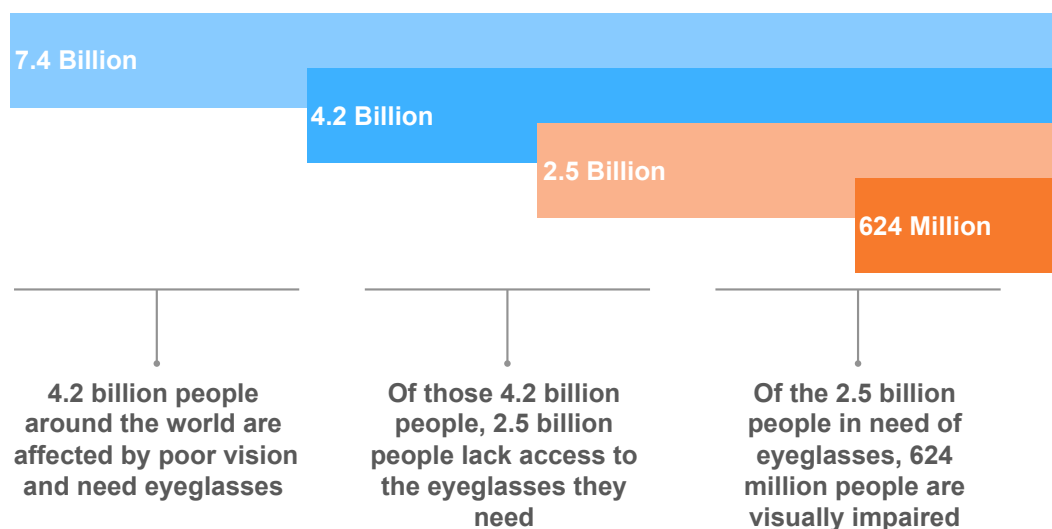
People cannot realize their potential without clear vision. Proper vision is essential for full participation in educational and economic opportunities, as well as for personal well-being, self-sufficiency and productivity. Yet today, 2.5 billion people unnecessarily live with poor vision⁷ because they need and do not have eyeglasses. Of these individuals, 624 million need corrective lenses so strong that they are classified as visually impaired or blind without glasses (Figure 1).

While poor vision will affect half the global population during their lifetime, access to the solution is far from equitable. In more developed countries, most of those whose vision could be improved with a pair of glasses are able to obtain an eye exam and affordable glasses either through public health systems or private-sector optical shops and online optical companies (or at pharmacies and retail outlets if they only need a pair of reading glasses). With a pair of glasses obtained relatively easily, their vision is restored and the problem solved, thus eliminating negative outcomes associated with persistently poor vision. The vast majority

(80%) of those without access to affordable, properly prescribed glasses live in less developed countries (Figure 2) with limited qualitative and affordable eye care options. Unlike other public health problems, however, unequal access to the solution is not the result of costly medical treatment. In fact, the cost of sourcing new frames and lenses for glasses is only \$0.60-2.50 per pair.⁸

Rather, the current unmet need for glasses in less developed countries stems from a long history of neglect. For many years, a lack of epidemiological data resulted in inaccurate sizing of the affected population. Without data and statistics, governments face a challenge in allocating the necessary resources to address such a problem. Prior to 2008, the WHO was collecting data only on the number of individuals whose vision could be restored with medical interventions. As a result, governments and the global health community had robust data on how many people needed surgery and medical treatment, but no information on the number of people in need of a pair of glasses. Without clarity on the scope of the problem, governments did not commit adequate resources to train eye health workers, or fully integrate the identification of poor vision and correction of vision with glasses into public health systems.

Figure 1: The Global Need for Eyeglasses (Number of People)

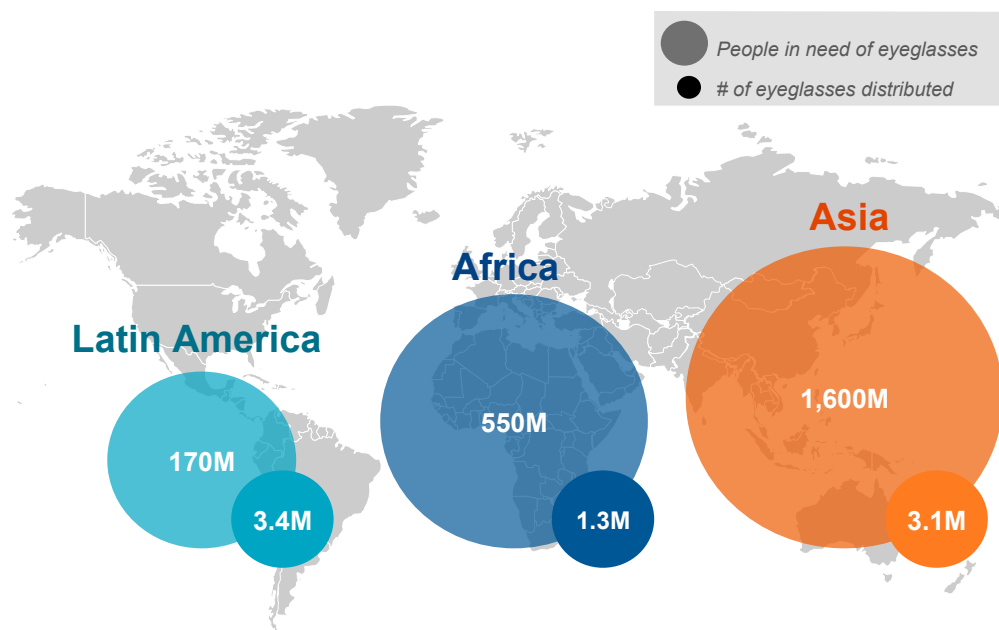


Sources: Essilor Estimates, 2015; Bourne et al., 2014; WHO, 2014.

2.5 billion includes individuals presenting visual acuity <6/9, including all levels of poor vision.

624 million are individuals presenting visual acuity <6/18, this only includes vision impairment and blindness that could be corrected with glasses.

Figure 2: Eyeglass Need vs Distribution in Latin America, Africa and Asia (2015, in millions)



Note: Eyeglass distribution includes surveyed organizations (primarily International NGOs). Data does not include local private sector, health systems or individual donations.

Source: 2015 eyeglass distribution derived from FSG Survey Analysis: Question 3: Roughly what percentage of eyeglasses/spectacles is delivered to the following service regions?; Organization Websites and Annual Reports. 2015 people in need of eyeglasses derived from Essilor Estimates, 2015.

In addition, optical companies in less developed countries have traditionally been concentrated in major cities and marketing primarily to high-income consumers. Furthermore, because of a widespread lack of eye doctors, skilled professionals are in high demand and frequently migrate to major cities where they can earn a higher income. For example, in Sub-Saharan Africa, 67% of ophthalmologists and 66% of optometrists are more likely to be employed in capital cities, and many leave their countries altogether for opportunities overseas.⁹ With so few eye doctors and a lack of competition, private optical companies have opted to focus on a small segment of urban populations that can afford to buy higher-priced glasses. This business environment offers little hope or incentive for such companies in less developed countries to expand into less mature markets. By contrast, more developed countries benefit from mature markets for eyeglasses, with adequate numbers of eye care professionals and private optical companies that market to high-, middle- and low-income consumers.

The historical lack of attention and resources allocated by the public and private sectors to address poor vision led NGOs to innovate and implement new eye care delivery models to meet the need for vision care. Despite new approaches and models, international NGOs and inclusive businesses collectively address only 0.3% of the global need for glasses in less developed countries. Without further intervention, this gap will only widen (Figure 3), as the prevalence rates of poor vision in children are expected to rise dramatically over the next three decades (see Chapter 2).

The lost productivity from not addressing this need has been calculated to cost the global economy at least \$227 billion annually, with less developed countries disproportionately affected.¹⁰ However, this is still a conservative estimate, according to Kevin Frick, Vice-Dean for Education at the John Hopkins Carey Business School (USA).

“The \$227 billion annual loss is derived from a narrowly defined age group and does not account for loss associated with missed educational opportunities, nor is it measuring the full impact on quality of life.

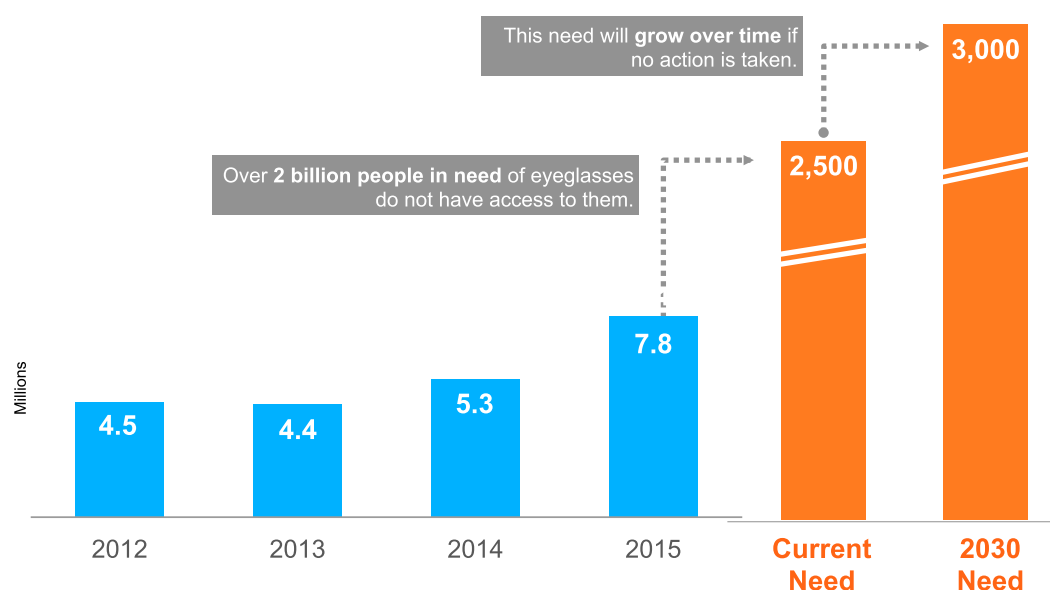
“

Recognizing the availability of an inexpensive solution (glasses), there is a compelling case to be made that increased investment in the identification of vision problems and distribution models would likely yield a substantial return on investment.

”

Kevin Frick, Vice-Dean for Education at the John Hopkins Carey Business School (USA)

Figure 3: Eyeglass Distribution in Latin America, Africa and Asia (2012-2015, in millions)



Note: Eyeglass distribution includes surveyed organizations (primarily International NGOs). Data does not include local private sector, health systems or individual donations.

Source: Past eyeglass distribution estimates derived from FSG Survey Analysis: Question 1: How many eyeglass/spectacles did your organization distribute over the last four years?; Organization Websites and Annual Reports. Current need and 2030 projected need derived from Essilor Estimates, 2015.

Achieving the United Nations Global Goals for Sustainable Development

In September 2015, the United Nations launched the Global Goals for Sustainable Development, a series of ambitious targets intended to drive action and investment to end poverty, combat climate change and fight injustice and inequality by 2030. This report makes the case for how proper vision serves as a critical input to achieving a number of the global goals. For example, to achieve goal 8 (“Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all”), an obvious course of action would be to stem the unnecessary loss to global GDP from lost productivity among adults with persistently poor vision.

Poor vision also limits children’s ability and motivation to learn; as a result, their academic performance often suffers.¹¹ Despite strong growth in primary school enrolments over the last several years, completion rates still remain low in many less developed countries. Increasingly, global education initiatives are emphasizing equal access to education beyond enrolment to include measuring learning outcomes. One of the targets for goal 4 is: “By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes”. Providing eyeglasses is a simple intervention that affords children with poor vision an equal opportunity to succeed in school. This report highlights research demonstrating that correcting the vision of primary school students has a significant impact on test scores, equivalent to a third to a half year of additional schooling.¹²

Ensuring equal access to eyeglasses has the potential to increase productivity levels for the working poor, promote inclusive economies, decrease premature retirement, enable children to perform at a higher level in school, increase literacy rates and make roads safer. Few global health problems, if addressed, could generate such significant cross-cutting impact across multiple global development priorities.

Insufficient Investment

The Brien Holden Vision Institute, an international eye care NGO, assessed the cost of solving the problem at scale. The institute concluded that a one-time investment of \$28 billion would ensure that the 624 million individuals living with correctable vision impairment or blindness could receive appropriate care and glasses. This investment assumes the cost of training 47,000 new eye health workers, as well as 18,000 opticians to dispense glasses, the creation of new facilities where needed, and five-year operating costs.¹³ However, the institute’s estimated total figure could be reduced by integrating market-based solutions and strategies that deploy a lower-skilled workforce to identify vision problems.

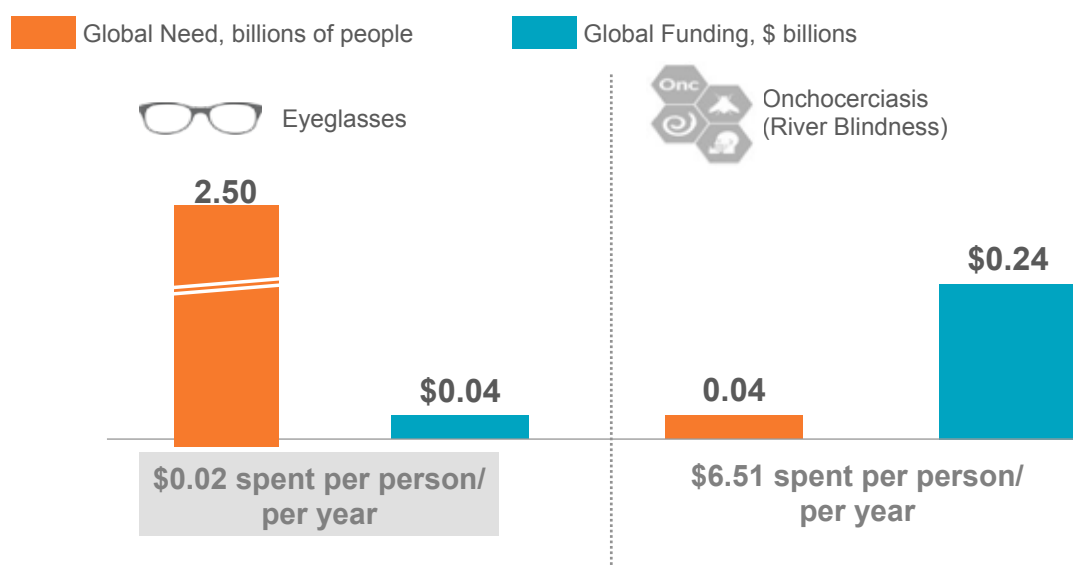
Despite a well-defined scope of the problem and an initial valuation of the economic drain to the global economy due to the unmet need for glasses, approximately \$37 million was committed in 2015 to close the gap in access to glasses.¹⁴ Individual contributions and foundations make up 49% of the funding that international NGOs receive in support of correcting poor vision, with bilateral and multilateral institutions combined accounting for only 10% of the resources dedicated to meeting the need for eyeglasses.¹⁵

A Multistakeholder Initiative to Mobilize New Resources

Over the past few decades, global health problems, including blinding eye conditions, have benefited from significant official development assistance, increased coordination to eradicate neglected tropical diseases, and large-scale in-kind donations from the pharmaceutical industry. The Bill & Melinda Gates Foundation's 2015 annual letter, *Our Big Bets for the Future*, states: "[By 2030] we'll also see the last of diseases like elephantiasis, river blindness, and blinding trachoma, which disable tens of millions of people in poor countries." This ambitious goal to eradicate river blindness and trachoma by 2030 would be inconceivable without substantial investment and long-term commitments from global health donors and global development agencies.

Although river blindness still requires and deserves significant investment to meet this goal, the potential to eradicate the condition clearly demonstrates the possibilities when multiple stakeholders coordinate among themselves and prioritize issues. Correcting vision with glasses merits comparable investment and will require a similar approach to galvanize support. Currently, \$0.02 is spent for every person whose vision could be corrected with glasses, or less than 1% of the spending per person affected by river blindness (Figure 4). Yet, poor vision resulting from eye disorders is the number-one cause of vision impairment (48%), as opposed to river blindness, which accounts for less than 1% of all vision impairment.

Figure 4: Global Need and Funding by Eye Condition



Note: Funding only includes official development assistance. It does not include significant additional funding from national governments. All funding investments are calculated as an average per year investment.

Eyeglasses: Need derived from Essilor estimates, 2015. Funding is the sum of survey respondents' % of 2015 revenue allocated to URE programs (FSG Survey, 2016)

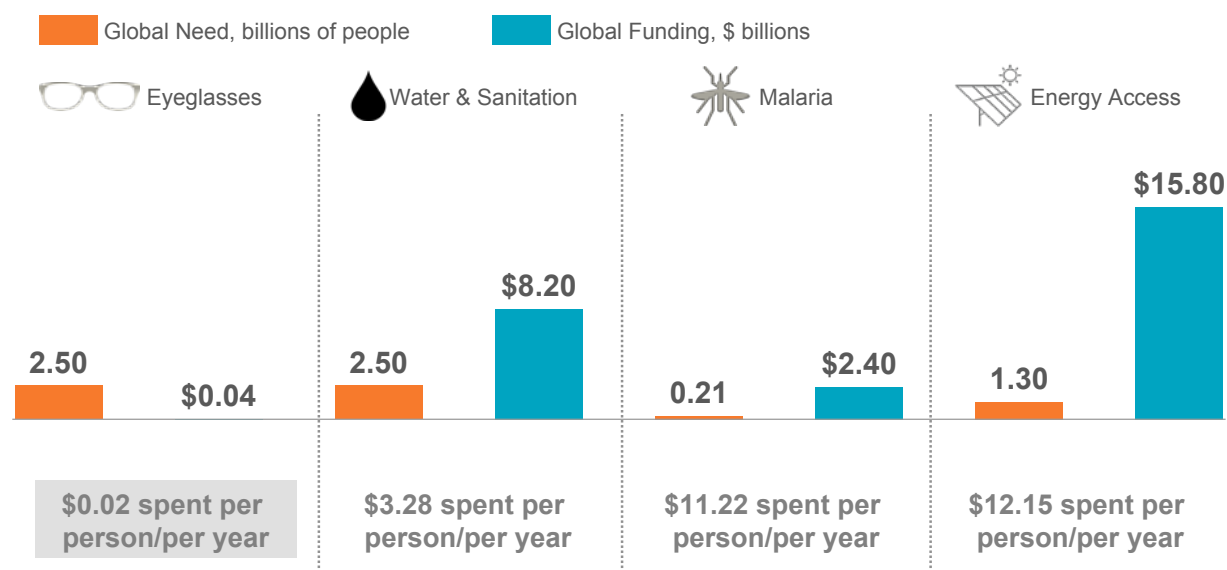
Onchocerciasis: Need based on CDC assessment of 37M people infected with Onchocerciasis, not only those that are visually impaired or blind due to the condition. Funding derived from Bundy et al. "Investing in Onchocerciasis Control: Financial Management of the African Programme for Onchocerciasis Control (APOC)" 2015. This paper estimates that the annual funding distributed by the APOC trust from 1995-2015 = ~\$13M/year. APOC's ~\$13M/year investment represents 55% of total annual investments. 45% (\$10.6M) comes from NGDO's and Governments. Thus, the average annual investment (excluding gift in kind) is \$13M+\$10.6M= **\$23.6M**. Additionally, each tablet of Merck donated Mectizan is priced at ~\$1.50/tablet. Each treatment includes ~2.8 tablets (although there is some variation between countries and ethnic groups). Therefore, each treatment costs \$1.5 X 2.8 tablets or \$4.2/treatment. 2 billion treatments have been delivered since 1987, with approximately 1.5 billion going directly to treating Onchocerciasis. This equates to approximately 52M treatments/year. 52M treatments x \$4.2/treatment equates to total in-kind support of **\$217.2M/year**. **Total = \$217.2M (in-kind) + \$23.6M (APOC)= \$240.8M/year**

Source: FSG Survey and Analysis; Essilor Estimates, 2015; WHO, 2014; CDC, 2014; Merck, 2016; Bundy, et al. 2015.

Compared to other issue areas affecting a population of similar size, such as access to clean water and sanitation or energy, the annual investment per person to provide glasses is also dramatically less (Figure 5); specifically, it is 0.2% of the annual investment per person in malaria and 0.16% of the investment in access to energy. Yet equitable access to eyeglasses has a cross-cutting impact on health, economies and education, comparable to that of increasing access to energy, clean water and sanitation.

The issue areas of malaria, access to energy and to clean water and sanitation have benefited from cross-sector collaborations or multistakeholder initiatives. These efforts have successfully increased coordination among existing organizations and mobilized significant official development assistance to address the problem at scale.

Figure 5: Global Need and Funding by Issue Area



Note: Funding only includes official development assistance. It does not include significant additional funding from national governments. All funding investments are calculated as an average per year investment.

Eyeglasses: Need derived from Essilor estimates, 2015. Funding is the sum of survey respondents % of 2015 revenue allocated to URE programs (FSG Survey, 2016)

Malaria: Need derived from December, 2015 global WHO estimate of 214M individuals infected with Malaria. Funding derived from IHME DAH, 2014.

Energy Access: Need derived from Sustainable Energy for All 2015 calculations of the total number of individuals without access to electricity. Funding is derived from OECD DAC CRS 2014 total ODA flows to energy.

Water and Sanitation: Need derived from UN Global Analysis and Assessment of Sanitation and Drinking Water Report 2014 which uses WHO, UNICEF 2014 data. 2.5 billion people lack access to improved sanitation and 748Mpeople lack access to improved drinking sources. We use the 2.5 billion sanitation number with the assumption that it captures the 748 million individuals who lack access to water as well. Funding derived from OECD DAC CRS 2014 total ODA flows to water supply and sanitation.

Source: FSG Survey and Analysis; Essilor Estimates, 2015; OECD DAC CRS, 2014; IHME, 2014; WHO, 2014, 2015; UNICEF 2014; Sustainable Energy for All Website, 2015; UN Global Analysis and Assessment of Sanitation and Drinking Water Report, 2014.

Multistakeholder partnerships are an effective means of addressing systemic problems. Goal 17 of the UN global goals for sustainable development covers strengthening the means of implementation; one of its targets is to “enhance the global partnership for sustainable development, complemented by multistakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the sustainable development goals in all countries, in particular developing countries”.¹⁶

Equitable access to eyeglasses is an issue area well positioned to benefit from a multistakeholder initiative, given the history of neglect, as well as the systematized lack of prioritization and absence of cohesive coordination among existing actors. With some supply-chain barriers already resolved (glasses are a low-cost, easily obtained product), the simplicity of the intervention provides a rare opportunity for the global development community to gain a quick win.

“
There is no doubt that taking a multistakeholder, collaborative approach to solving the problem of poor access to eyeglasses is the best way to tackle this problem.

”
Ray Chambers, the UN Secretary-General’s Special Envoy for Health in Agenda 2030 and for Malaria

Building Momentum

In addition to a low-cost, mass-produced solution, a burgeoning movement within the sector seeks to scale up validated distribution models and identify opportunities for collaboration. The International Agency for Blindness Prevention has established a working group dedicated to providing leadership on advocacy efforts that engage health policy-makers in the importance of correcting vision with glasses.

Within the last year, NGO and private-sector actors launched two new initiatives aimed at increasing coordination among NGOs, strengthening relationships with government ministries in support of school eye health initiatives, and funding the development of new business models. In 2015, Essilor, the world's largest manufacturer of ophthalmic lenses, established Vision For Life™, a \$33 million fund to accelerate initiatives that combat poor vision by improving access to vision screening, vision correction and protection. In April 2016, the Brien Holden Vision Institute and the Vision for Life™ fund launched Our Children's Vision, a coalition of 38 NGOs, professional organizations and businesses. The campaign seeks to ensure that effective, sustainable eye health initiatives for children and adolescents are included in appropriate health programmes and are integrated into regional, national and global education and health policy. To generate support for this policy change, the campaign aims to reach 50 million children by 2020, and develop and disseminate best practices for school eye health.

Building on momentum from within the sector, an opportunity exists to drive meaningful change by connecting and aligning the “bottom up” action agenda with international donor and financing communities, global development agencies, and multilateral and bilateral institutions. The EYElliance is a multistakeholder initiative partnering with Vision For Life™ and Our Children's Vision, and will collaborate with global, regional, and country-level actors to:

1. Signal attention about the issue area's importance, and ensure that the international donor community, national governments and private sector prioritize it appropriately, with the goal of mobilizing new resources to solve the problem at scale
2. Promote increased coordination among NGOs and facilitate collaboration across sectors to accelerate market-led development and support school eye health initiatives

Chris Jurgens, Director of the Center for Transformational Partnerships, U.S. Agency of International Development (USAID), states:

“A key objective of USAID's Global Development Lab is to help proven, cost-effective innovations that deliver development impact get to scale. We believe partnerships that mobilize stakeholders across the public, private and non-profit sectors around a common vision and goal and that leverage diverse partners' respective strengths and resources are essential to achieve the ‘systems change’ that is so frequently needed to reach scale. The EYElliance is a promising venture that takes just this approach on an issue – access to eyeglasses – for which there is strong evidence of impact and cost-effectiveness, but which has not received the attention it warrants in the development sector. We see the EYElliance playing a critical role to shine a light on an important cross-cutting issue that can contribute to positive development outcomes in education, economic growth and other sectors, and in building the evidence base that can help inform how the international development community, host country governments and others can work together to increase access to eyeglasses most effectively.”

Providing glasses for the 2.5 billion people who need them represents an unprecedented opportunity for global development and business communities to make an impact. Research shows that correcting vision with glasses yields an immediate and up to 34% economic gain from increased worker productivity, as well as long-term benefits associated with improved educational outcomes for children. Working together, society can solve a problem that slows economic growth and affects children's ability to succeed in school. The solution is in hand: successful multistakeholder initiatives have proven that scale is achievable through collaboration, and the global eye care community is working together to promote effective models. It is time to make clear vision – a universally valued sense – equally accessible for all who need a pair of glasses, so they can live up to their full potential.

photo credit: OneSight



Advancing Equitable Quality Education through School Eye Health

The Case for Action and Investment

Without glasses, children with poor vision are at a major disadvantage in school. Poor vision limits children's ability and their motivation to learn;¹⁷ as a result, their academic performance often suffers. Hundreds of millions of children who need glasses do not have a pair, and many of them have not received a vision screening because they live in communities with limited eye care options. Fortunately, school-based interventions have been proven to be a cost-effective¹⁸ approach for identifying children with vision problems. From Latin America to Sub-Saharan Africa, to East and South-East Asia, school eye health initiatives demonstrate that appropriately trained teachers can safely and accurately identify children with vision problems.

Research has proven that correcting vision in primary school students has a significant impact on test scores, in some cases the equivalent of a third to a half year of additional schooling.¹⁹ Compared to data from 60 trials of health interventions conducted in primary schools, the impact on math test scores from corrected vision with glasses was 10 times higher than from deworming, and three times higher than from nutrition. This outcome is particularly powerful given that interventions for deworming and nutrition have been demonstrated to improve learning.

“

Based on my 25 years of research experience, correcting vision with glasses is the single most effective health intervention when it comes to improving academic performance.

”

Scott Rozelle, Helen F. Farnsworth Senior Fellow, FSI, Stanford University (USA)

Providing glasses to children who need them is a simple intervention that ensures children with poor vision have an equal opportunity to succeed in school – a condition critical for attaining goal 4 of the UN global goals for sustainable development: “Ensure inclusive and equitable quality education for all and promote lifelong learning”.

Furthermore, providing this equal opportunity to children with poor vision has far-reaching benefits when considering the widely recognized impact of improved educational outcomes on personal income and GDP. In fact, one extra year of schooling increases earnings by as much as 10%.²⁰ Given that correcting vision in primary school students equates to a benefit equal to up to half a year of additional schooling, correcting vision, it can be reasonably assumed, could increase earnings by as much as 5%.

A World Bank policy research working paper noted that an increase of one standard deviation in test scores of international literacy and math assessments is associated with a 2% increase in annual growth of GDP per capita.²¹ Research demonstrates that correcting children's vision yields an increase in test scores by at least 0.1 standard deviation,²² and suggests that providing eyeglasses could be associated with a 0.2% increase in annual growth of GDP per capita. These findings support the conclusion that providing properly prescribed glasses for children could potentially increase personal earnings by 5% and raise GDP by 0.2%.

Providing glasses for school-age children is an investment with high impact on health, education and the economy. Therefore, ministers of health, education and finance must collaborate to support integrating school eye health programmes into existing school health initiatives, and to partner with international donor and finance communities to build viable programmes – those that ensure free or subsidized glasses for children from low-income families.

The problem

Today, 239 million children around the world live with poor vision – children who could have their vision corrected with a pair of eyeglasses.²³ Of those, 12 million need corrective lenses so strong that, without them, they are classified as visually impaired or blind.²⁴ They live unnecessarily with poor vision for a variety of reasons, including a lack of affordable high-quality vision care in their communities, prevailing misperceptions about the safety and effectiveness of glasses, lack of ever having had an eye exam, or being unaware of their condition or that it is correctable with glasses. According to the American Optometric Association, during the formative first 12 years of a child's life, an estimated 80% of all learning occurs through vision, in activities such as looking at blackboards, reading books and viewing other educational materials. Children with

uncorrected poor vision are at a major disadvantage in school and not afforded the same opportunity to succeed as their peers with good vision.

The most common cause of poor vision in children is myopia. With this condition, children can see nearby objects clearly, but objects farther way, such as a classroom blackboard, are blurry. Myopia can affect children as young as six years of age, but is commonly diagnosed between

8 and 12 years of age and may worsen during teenage years, presumably because of the visual demands of school. Unfortunately, rates of myopia are increasing. Over the last 40 years, many East Asian countries have seen myopia rates double and even triple.²⁵ New research has found that this increase is not limited to Asian countries; myopia's prevalence in North America has increased from 28% in 2000 to 35% in 2010.

Table: Estimated Prevalence of Myopia for Each Global Burden of Disease Region (2000-2050)

	Prevalence (%)		
	2000	2020	2050
Andean Latin America	15.2	28.1	50.7
Asia-Pacific, high income	46.1	53.4	66.4
Australasia	19.7	36	55.1
Caribbean	15.7	29	51.7
Central Africa	5.1	9.8	27.9
Central Asia	11.2	24.3	47.4
Central Europe	20.5	34.6	54.1
Central Latin America	22.1	34.2	54.9
East Africa	3.2	8.4	22.7
East Asia	38.8	51.6	65.3
Eastern Europe	18	32.2	50.4
North Africa and Middle East	14.6	30.5	52.2
North America, high income	28.3	42.1	58.4
Oceania	5	9.1	23.8
South Asia	14.4	28.6	53
Southeast Asia	33.8	46.1	62
Southern Africa	5.1	12.1	30.2
Southern Latin America	15.6	32.4	53.4
Tropical Latin America	14.5	27.7	50.7
West Africa	5.2	9.6	26.8
Western Europe	21.9	36.7	56.2

Source: Adapted from Holden, Brien A. et al. 2016. "Global Prevalence of Myopia and High Myopia and Temporal Trends from 2000 through 2050". *Ophthalmology* 123(5):1036-42

Projections indicate the condition will affect 58% of the North American population by 2050. Moreover, in East and West Africa, where individuals have the least access to high-quality eye care, myopia prevalence is expected to increase sevenfold and fivefold, respectively, from 2000 to 2050 (Table). If current trends continue, about half of the world's population, or 4.8 billion people, will have myopia by 2050.²⁶

Yet, a properly prescribed pair of glasses can easily, safely and immediately correct myopia and slow its progression.²⁷ Less common vision problems in children include astigmatism, which can cause objects at any distance to appear blurry, and hyperopia, a condition that causes up-close objects to appear out of focus. Uncorrected hyperopia in four- and five-year-old children enrolled in preschool or kindergarten has been found to be associated with significantly worse performance on early literacy tests.²⁸

“Ensuring that children are healthy and able to learn is an essential component of an effective education system. Visual screening and provision of eye glasses to those who need [them] can be a cost-effective intervention to support learning outcomes and student achievement, particularly for the poorest and most disadvantaged children.”

”

Amit Dar, Director of Education Global Practice, World Bank Group

The Benefits of Improving Children's Vision

In more developed countries, schools usually offer a wide variety of educational tools, such as textbooks and computers. However, for the vast majority of children in less developed countries, schoolwork focuses around teachers and information written on blackboards, which puts children with myopia at a disadvantage.

In rural Kenya, for example, a 2009 study found that, on average, most classrooms had less than one English, math or science textbook for every 20 students.²⁹ In the absence of other educational materials, particularly in rural areas, the blackboard is a teacher's only tool. Yet in some rural areas of less developed countries, as few as one in six school-age children who need glasses have them,³⁰ affecting their ability to see the blackboard clearly. In addition, even children with minor vision problems can have difficulty seeing the blackboard clearly because many classrooms in less developed countries do not have electricity or adequate lighting, and dark rooms can exacerbate the problem. Children with this vision difficulty have trouble taking notes and do not absorb the same amount of information as their peers without vision problems, or are doing so more slowly and laboriously.

Raising test scores

Strong evidence links the adoption of corrective measures for poor vision and poor academic performance with a positive impact on academic achievement.³¹ A cluster-randomized controlled trial conducted in China in 2012-2013 proved that providing glasses to primary school students who needed them resulted in an increase in math test scores by 0.11 standard deviation.³² This impact increased in direct correlation to the frequency with which teachers used their classrooms' blackboard. Similarly, a working paper looking at the effect of providing free vision exams and glasses to primary school children in the United States found that this intervention led to improvement in math and reading skills in Grade 5.³³

Promoting educational opportunity

Up to 85% of US children aged 8-18 who are academically and behaviourally at risk have been found to have either undetected or untreated vision problems.³⁴ Children with poor vision that is undetected or untreated tend to underperform academically relative to their peers, which significantly impacts their educational opportunities. For example, Helen Keller International (HKI) has been conducting school eye health programmes in high-poverty communities in the United States for 20 years. According to Nick Kourgialis, HKI's Vice-President for Eye Health, children with poor vision that is correctable with glasses tend to underperform in school, are often falsely identified as having a learning disability, and are placed in specialized classes. Once children receive glasses and their vision is corrected, they can be reintegrated into mainstream classes and succeed academically. Similarly, in China, the Smart Focus programme (see Case in Point, p.21) found that students with uncorrected vision are often diverted into a

slow academic track in Grade 7, which frequently leads to their attending less academically challenging vocational secondary schools.

These outcomes are not uncommon for children with uncorrected poor vision in countries that offer a secondary track of education. In countries without such a track, it would follow that children underperforming due to poor vision are at increased risk of discontinuing their education.

Within the context of the UN global goals for sustainable development, two of the targets for quality education (goal 4) refer to eliminating disparities in education for children with disabilities, and providing inclusive and effective learning environments for all. Ensuring universal access to assistive technology products, such as glasses, is a simple, cost-effective way to increase equitable access to educational opportunity and include children who are visually impaired. Properly prescribed glasses could transform the lives of the 239 million children with poor vision, affording them equal opportunity to succeed in school and beyond.

Enhancing learning environments

In addition to the impact that correcting vision has on children with poor vision, evidence suggests that positive spillover often affects their classroom peers. Various factors may cause this: the class may be benefiting from joint attention and joint referencing; a teacher may be devoting less time to assisting children with poor vision; and children with corrected vision may be less reliant on their peers for help, thus allowing all children to focus on their assignments.³⁵

photo credit: OneSight



Validated Model: School Eye Health

Guiding principles

The guiding principles of successful school eye health initiatives include (1) engagement of school leadership and teachers, (2) close collaboration between ministries of health and education, (3) an educational component on eye health and treatment, and (4) referral systems to connect children to more advanced care.

1. Engage teachers to prescreen and increase use of glasses

It is widely accepted that teachers can safely and effectively prescreen children for vision problems on-site in schools. A project supported by the World Bank confirmed this, training school teachers to screen 13,000 children. A rescreening with eye doctors conducted six months later confirmed that the teachers' prescreening for vision problems was 100% accurate (see Case in Point, p.21). In addition, teachers can play a key role in increasing usage of glasses in the classroom. One study found that by providing incentives to teachers to encourage children to wear their new glasses, usage in the classroom tripled over the course of a full school year.³⁶ In that study, teachers were given tablets if their students wore glasses during an unannounced visit. However, other interventions have found that mobile phone time for teachers is an equally effective incentive.

2. Encourage collaboration between ministries of health and education

A key learning of the International Council of Ophthalmology's Task Force on Uncorrected Refractive Errors and School Eye Health is that successful school eye health initiatives benefit from effective collaboration between ministries of health and education. These initiatives require that ministers of health approve the use of eye health practitioners, who may not be eye doctors, to prescribe and dispense glasses in schools. In addition, teachers must be granted leave by the minister of education for training. In Cambodia, the joint effort between the health and education ministries to support the launch of a school eye health programme inspired the development of a memorandum of understanding between the two ministries to facilitate ongoing collaboration.

3. Include education, awareness and behavioural change

Children often refuse to wear glasses for a variety of reasons, including no perceived benefit,³⁷ parental disapproval^{38,39} and fear of being teased.^{40,41,42,43} Improved communication strategies targeting students, teachers and parents about eye conditions, management and treatment options are critical to maximizing procurement of glasses and, ultimately, to their appropriate usage. Educating parents about the importance of proper eye care has also been shown to benefit the entire family, as it increases the likelihood that other family members will access appropriate eye care.

4. Create referral networks

Screenings conducted in schools have an ancillary benefit of identifying children with more complex eye conditions that need advanced care. Assuming that surrounding communities have adequate vision care facilities, the opportunity now exists to establish referral networks to treat advanced eye disorders that might otherwise have gone undetected.

Maximizing cost-effectiveness at scale

Several approaches can make school eye health initiatives more cost-effective: (1) recovering costs in the early phases of a child's using eyeglasses, (2) making eye health part of overall school health programmes, and (3) incorporating ready-made and ready-to-assemble glasses.

1. Integrate cost recovery

Studies show that offering a child's first pair of glasses for free does not affect the overall market for glasses. In a study designed to determine how free eyeglasses might affect a family's willingness to purchase them for their children, approximately 20% of parents bought glasses for their children when offered attractive "upgrade" glasses, even when they were also offered a free pair. The study concluded that the same proportion of families purchased glasses regardless of whether a free pair was offered.⁴⁴ Moreover, providing glasses to school-age children increases the likelihood of future purchases, because once the need is identified and children experience the benefits associated with corrected vision, most will continue to wear glasses throughout their lives.



2. Integrate school eye health into school health

To date, school health initiatives have primarily emphasized malaria prevention and control, HIV/AIDS education and nutrition interventions. The School Health Integrated Programme (SHIP), supported by the Global Partnership for Education, has determined that the most cost-effective approach to scaling school eye health initiatives is to integrate screenings for vision and the provision of glasses into school health plans. Specifically, teacher training for vision screening could be incorporated with training programmes for other health interventions, thereby reducing costs and optimizing teachers' time in training. A new SHIP initiative that combines deworming and school eye health interventions in Senegal, Ghana and Ethiopia will seek to prove this concept. An additional benefit of integrating school eye health into active school health initiatives is the increased likelihood of effectively identifying children with vision problems through annual screenings before those problems negatively affect their academic performance.

3. Correct vision with ready-made glasses or those assembled on-site

The cost of glasses themselves represents another area for improving cost-effectiveness. While some children require fully customized glasses, a significant portion could have their vision corrected with either ready-made or ready-to-assemble glasses. Ready-made glasses are appropriate to dispense when the corrective lenses are the same for both eyes and no astigmatism is present. Quality, ready-made glasses can be produced in high volume at an extremely low cost. Ready-to-assemble glasses can also be procured at a low cost and can address vision problems where no astigmatism is present, but where each eye requires a different corrective lens. Dispensing ready-to-assemble glasses requires stocking a range of lenses and frames that can be assembled on-site to provide a customizable, low-cost alternative to individually made glasses from optical laboratories.

Barriers to Scale

Demand-side barriers

Affordable eye care options are limited in less developed countries. Moreover, a general lack of awareness about proper vision care leads to few parents proactively seeking eye exams for their children. In addition, parents are often unaware that their children have poor vision, and misperceptions about using glasses persist. Both parents and students have reported uncertainty about whether a vision problem actually exists even after it was determined the students needed glasses.⁴⁵ Parents and teachers have a commonly held but false belief that wearing glasses will worsen vision or be harmful to the eyes.⁴⁶ The opposite is true, in fact, as research shows that early correction of myopia slows its progress.⁴⁷ Smart Focus, an NGO in China, has found that even among those parents who know their child has a vision problem correctable with glasses, only about 60% will procure glasses for their child. Better understanding is required of why parents do

not get eyeglasses for their children, what role prevailing misconceptions and sociocultural barriers play in using glasses, and what the most effective strategies are to overcome these barriers.

This report's advisory panel recommends that ministers of health, education and finance collaborate to support integrating school eye health programmes into existing school health initiatives, and partner with international donor and finance communities to fund eye exams and free or subsidized glasses for children.

This report's advisory panel recommends that the international donor and eye care communities fund large-scale awareness and behavioural change campaigns that lead to increased demand for eyeglasses, informed by best practices related to creating demand in key geographies.

Supply-side barriers

From a programmatic perspective, NGOs may find it prohibitively expensive to retain eye doctors on staff because of the concentration of eye health workers in urban areas and a reluctance of eye doctors to travel to more remote locations (where interventions are conducted in schools). Accordingly, many organizations opt to train their own eye health workforce to provide eye exams for children who fail teacher-conducted vision screenings. While possibly a functional solution for some organizations, the approach is not optimal for the widespread scaling-up of school eye health initiatives. The cost of training procedures can vary depending on the laws governing the level of certification required for a practitioner to prescribe and dispense glasses. Therefore, any approach that involves training eye health workers on a large scale requires collaboration with national governments to maximize cost effectiveness while ensuring compliance with the health ministry.

This report's advisory panel recommends that the global eye care community assemble a diverse group of experts to set and continually evaluate the minimal competencies needed to determine quality prescriptions and dispense appropriate eyeglasses in schools, based on the capacity of the local eye health workforce. These competencies should be reassessed as technologies improve and costs are driven down.



Smart Focus has a goal of developing a nationally supported system that could reach 100% of the 18 million children in rural China who will suffer from poor vision during the early 2020s.

Case in Point: Smart Focus

Franchising a sustainable approach for school eye health in China

The Rural Education Action Program (REAP), an impact-evaluation organization, aims to inform sound education, health and nutrition policy in China. Since 2011, REAP's five randomized controlled trials have shown that quality vision care is the most cost-effective intervention for improving child welfare, and leads to large and sustainable increases in learning and school performance, along with positive spillovers to children who don't have poor vision.

REAP is now establishing a network of for-profit vision centres based at county hospitals through an initiative called Smart Focus. Those centres partner with schools to deliver high-quality vision care. Optometrists administer six hours of training for classroom teachers, enabling the latter to conduct initial vision screenings and refer students needing more advanced care through a highly structured referral system. The teachers are provided free mobile-phone time as an incentive, and the vision centres earn revenue from urban consumers in a cross-subsidization scheme that supports providing care for poorer rural consumers whose unmet need is greatest. To date, REAP has provided access to free or affordable glasses for over 30,000 primary school students and screened an additional 120,000 children.

In addition to screening children and supervising their wearing glasses, teachers play a vital role in communicating with parents. Once a teacher's screening indicates a child needs glasses, the teacher often spends significant time convincing parents that (a) the child's condition requires attention, (b) the problem is correctable, and (c) taking the child to the vision centre to get glasses is highly advisable.

Vision centres dispense "first pair free" or very low-cost glasses to rural elementary- and middle-school students, while providing part of the urban market with refraction and eyewear on a fee-for-service basis. Giving away the first pair of glasses is not "just charity"; rather, it provides access to the huge untapped rural market. To build confidence, vision centres unconditionally guarantee the frames for three months and lenses for six months, something that no private optician does. (A noteworthy challenge arises, however, with parents who believe that low-cost or free services must also be of low quality; usage rates and eyeglass prices have been shown to rise in tandem.)

Smart Focus provides county hospitals with management, retail expertise, training and equipment. Critically, the programme assigns a Smart Focus staff member at each vision centre to coordinate construction and staff training, and to manage operations and logistics, including relationship-building with schools, hospitals and optical suppliers. To date, REAP has built four vision centres with full approval from the county education and health bureaus. As revenues rise, Smart Focus is committed to expanding the network of vision centres to new counties that lack appropriate care.

In addition, and in collaboration with Zhongshan Ophthalmic Center, Smart Focus arranges training in optometry and vision-centre management for three staff members from each centre. Smart Focus also trains nurses as optometrists through classroom instruction and an in-the-field training and mentoring programme. By the end of their training, nurses are certified to refract patients and make glasses, as well as identify more complex but common eye disorders for referral to ophthalmology departments. Further, Smart Focus pays vision centre staff salaries for the first six months during training and mentoring, and facilitates the centres' purchasing of frames and lenses. Across China, 2,000 county hospitals each serve 400,000 people annually.

Case in Point: A Collaborative Initiative to Integrate School Eye Health into School Health Programs

Supporting school eye health through evidence-based policies in Cambodia

A collaboration in Cambodia of NGOs with the country's ministry of education on a school eye health pilot has led to integrating eye care into the ministry's comprehensive school-based child health programme and a scaling-up of the pilot model.

The Global Partnership for Education (GPE) recognized the opportunity for school-based eye care delivery following completion of a national prevalence study on disabilities and impairment among children. That study, conducted by the ministry of education with technical assistance from Handicap International Belgium and GPE's support, found that many children who dropped out of school – or who never enrolled – suffered from poor vision.

GPE launched the pilot in 2012 in partnership with ministry of education, the World Bank, Sightsavers, the Partnership for Child Development (PCD) of Imperial College London, and The Fred Hollows Foundation. In conjunction with the ministry's existing school health interventions, the pilot ran in 56 schools in Siem Reap province, in both urban and rural settings, and gave teachers one full day of training to conduct basic vision screenings. A team of visiting eye health workers saw children identified with poor vision and provided those who did not need fully customized glasses with an immediate, ready-made pair. Children who required fully customized eyeglasses received them within days following their exam. While 13,000 students and out-of-school children aged 11-15 were screened, some teachers also asked to be screened during this process. Although this was not part of the original programme design, the project aimed to improve the quality of education, with the teachers' vision being critical for an effective learning environment. In addition, teachers wearing glasses serve as role models and thus encourage students to wear their glasses, too. The pilot therefore incorporated screenings for teachers, with a recommendation to add this component to any future school-based vision screening interventions.

A six-month follow-up to evaluate accuracy found that teacher prescreenings were 100% aligned with those of trained eye health workers, demonstrating the method's effectiveness and safety. Evaluators also found that getting eyeglasses to children within a matter of days was an effective approach for maximizing adoption and usage.

The pilot provided data on vision health that helped the ministry of education to plan and budget for appropriate interventions. In the year after the pilot ended, the ministry incorporated the model into its new five-year national Education Strategic Plan and hired The Fred Hollows Foundation to provide technical assistance in implementing vision screening in three provinces. In addition, in February

2016, the ministry launched national operational guidelines for school vision screenings, in collaboration with the ministry of health, the National Program for Eye Health, the Brien Holden Vision Institute and The Fred Hollows Foundation.

Looking ahead with a view towards affordability, scalability and impact, GPE is supporting the launch of SHIP, a project of Sightsavers and the PCD that will assist the ministry of education in scaling up its vision screening activities in Cambodia. GPE will also support the ministry on how to integrate different school health interventions, such as vision screening and deworming, in a holistic and cost-effective manner. The SHIP initiative will be replicated in Ghana, Ethiopia and Senegal. SHIP's methodology, which holds that a programme's sustainability requires an enabling policy environment, involves catalytic training and learning as a precursor for any on-the-ground action. Informed by the successful Cambodian pilot that demonstrated the potential impact of government ownership, GPE, through the World Bank, has engaged multisector stakeholders, including local donor groups, from 15 countries in Africa and Asia in workshops to promote and increase government ownership.





A Ver Bien study found that over 90% of teachers saw improved reading skills among children who needed and received eyeglasses. In addition, over 80% of teachers indicated these students were following lessons more closely, and 87% noted overall improvement in student grades.

Case in Point: Ver Bien Para Aprender Mejor, See Well to Learn Better

Generating impact from a government-led initiative in Mexico

In 1997, Mexico's ministry of education conducted a survey that showed approximately 12.7% of children in public primary schools suffered from visual acuity problems. In response, the ministry invited entrepreneurs, NGOs and business leaders to design a programme to address the issue; the result was the creation of Fundación Ver Bien Para Aprender Mejor (Ver Bien; or, "See Well to Learn Better Foundation").

Working in close partnership with the ministry of education, Ver Bien establishes school eye health programmes across Mexico. The Mexican government provides both financial and logistical support, subsidizing 66% of the operational costs and thereby enabling Ver Bien to provide glasses to children free of charge.

Ver Bien's intervention begins with training teachers to conduct initial vision screenings for their students. Children identified with poor vision are then examined by an optometrist (Mexican law stipulates that an optometrist with

a four-year optometry degree can prescribe eyeglasses). To examine students at their schools, Ver Bien's team of 60 optometrists travels nationwide, returning exam results electronically. The foundation gives children choices from among its own line of colourful, virtually unbreakable and locally manufactured frames to complete their glasses, which are shipped to the local ministry of education office for distribution to students at their schools. Optometrists revisit schools every three years.

The screening programme also identifies eye diseases and other needs for advanced care, and refers children to the local hospital. Alliances with paediatric hospitals have also enabled Ver Bien to extend its reach to help preschool children (0 to 6 years old).

Until Ver Bien arrives at a school, 95% of students have never had an eye exam. From September 2013 through July 2015, Ver Bien's coverage reached every Mexican state, including visits to more than 1,100 municipalities and 32,000 schools, vision screenings for more than 9 million schoolchildren, and delivery of 731,735 pairs of glasses. With Ver Bien screening 4.5 million school children annually and providing 400,000 pairs of glasses per year, the foundation is an impressive example of the possibilities when government takes the lead to establish a school eye health initiative fully integrated into the national school system.

Market-Led Development

The Case for Action and Investment

Correcting vision in adults is a high-impact social investment that supports equitable growth and inclusive economies. It increases productivity among the working poor, improves literacy rates and decreases premature retirement. In addition, equitable access to eyeglasses promotes the socio-economic gains associated with increased access to the digital economy, and has an ancillary benefit of contributing to safer drivers and safer roads.

Two eye care distribution strategies that emerged over the last decade demonstrate the viability of cost recovery and market-based solutions. Free-standing optical shops and vision centres located in hospitals – from Latin America to Sub-Saharan Africa, to East and South-East Asia – are selling low-cost glasses to base-of-the-pyramid (BoP) consumers, with some cross-subsidizing to reach the very poor with free eye care and glasses. Expanding the eye health workforce through task shifting and training lower-skilled workers represents another model for cost recovery, as these workers can conduct vision screenings and dispense reading glasses in remote communities with no access to healthcare.

If addressed worldwide, vision correction would increase global GDP by \$227 billion annually.⁴⁸ Stemming the current loss to the global economy from persistently poor vision among those lacking a pair of glasses is an easy first step towards achieving goal 8 of the UN global goals for sustainable development, which states: “Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all”.

Unleashing market forces will largely address and help solve this massive global health problem. To fully realize the potential for market-led development, governments must eliminate barriers to market entry, such as high import duties on glasses. The international financing community should offer impact investment and creative financing options to global, regional and local private-sector optical companies to de-risk their entry into less mature markets.

The problem

The poor vision of 2.5 billion individuals worldwide could be corrected by providing each with a pair of eyeglasses. Of this population, 624 million need corrective lenses so strong that they are classified as visually impaired or blind without glasses. The majority of these people are affected by near-vision loss due to presbyopia, meaning they are unable to see nearby objects clearly and need to use reading glasses. Presbyopia usually develops when adults are in the prime of their careers, affecting a vast range of activities and professions, from agriculture and food production, such as coffee- and cocoa-bean sorting, to garment and textile work. If left untreated, presbyopia causes gradual vision loss that can reduce productivity and lead to premature retirement. However, rates of correcting presbyopia are as low as 6% in Africa, compared to 96% in Europe.⁴⁹ Evidence suggests that environmental conditions, including hot climates, high levels of ultraviolet radiation and chronic deficiency of essential amino acids, may play a major role in causing early-onset presbyopia.⁵⁰ Indeed, countries in the Global South experience significant rates of early-onset presbyopia, with vision loss beginning as early as the mid-30s, as opposed to typical onset in the mid-40s in the Global North.

The Socio-Economic Benefits of Improving Adults' Vision

Productivity

Studies demonstrate that poor vision negatively affects productivity, whether the result of near-vision loss or the inability to see distant objects clearly. A University of Michigan (USA) working paper found that correcting near-vision loss with glasses yields an immediate increase in productivity of up to 34%. An impact assessment conducted by BRAC, the world's largest NGO in number of staff, concluded that 90% of individuals experiencing near-vision loss encountered problems with their daily work; and, on average, 23% reported that their income was compromised. In Rwanda, Lifetime Consulting & Partners found that workers with poor vision and not wearing glasses were three times more likely to be asked by supervisors to repeat their work of sorting coffee beans than after receiving

and wearing glasses. Furthermore, a Dalberg Global Development Advisors study of adults in India who had their vision corrected with glasses found that 65% reported an increase in independence in movement and travel, and 59% reported an increase in work productivity.⁵¹

Literacy

Adult literacy is widely recognized as critical to achieving continuous and rapid economic growth. Illiteracy costs the global economy \$1.19 trillion each year, and research has shown that 74% of illiterate adults⁵² failed one or more parts of a vision screening. Yet, hundreds of millions of individuals in less developed countries live with near-vision loss that prevents them from reading or learning to read, when all they need is a \$1 pair of glasses.

Participation in the digital economy

The socio-economic benefits associated with internet connectivity, access to mobile technology and mobile money are well documented. For example, according to a 2012 report released by the United Nations Development Programme, mobile technologies increase productivity by facilitating information flow among African farmers.⁵³ Moreover, mobile money's convenience, affordability and security have brought financial inclusion to millions who were previously unbanked. However, these new tools risk being underutilized in the future with the spread of affordable smartphones. Clear vision is necessary to maximize application-based technology and, without access to reading glasses, ageing populations will have difficulty

clearly seeing the screens of their mobile devices as their near vision deteriorates. A UN World Population prospectus estimates that, within 15 years, 1.3 billion people will be over the age of 60, and more than 60% of them will live in low- and middle-income countries.⁵⁴ Without greater access to reading glasses, today's digital divide could grow among older adults, resulting in a "visual divide" that would deny individuals with near-vision loss access to the digital economy through mobile technology.

Road safety

Road traffic accidents are a leading cause of death worldwide, accounting for over 1.2 million fatalities every year. According to the WHO's *Global Status Report on Road Safety 2015*, road traffic deaths lead to an estimated 3% loss of global GDP. In fact, the economic burden of road traffic injuries and deaths in low- and middle-income countries can mean losses of up to 5% of GDP. As a result, interest is growing in the correlation between road accidents and poor vision. One study conducted by the Road Safety Observatory estimates that in 2012, 2,048 drivers in the United Kingdom were involved in road accidents due to poor vision, causing an estimated 2,874 casualties and costing over \$50 million. Another study showed that in India, drivers with poor vision correctable with glasses have a higher incidence of road accidents – as much as 30 percentage points higher than those with clear vision.⁵⁵



In addition, studies in West Africa revealed that large numbers of commercial drivers on the road have vision that fails to meet the minimum standards required by law. In Ghana, a study found that over 12% of commercial drivers were on the road with vision below the minimum standards required by law, and 6.8% were visually impaired.⁵⁶ Another study conducted in Nigeria showed that, while 98% of commercial drivers in Northern Nigeria possessed a licence, less than 28% received an eye test before obtaining their licence. Drivers must have clear vision not only to make roads generally safer, but to meet a target of UN global goal 3 for sustainable development: to halve the number of global deaths and injuries from road traffic accidents by 2020.

Validated Model: Sustainable Optical Shops and Vision Centres

For many years, the dominant approach to providing glasses involved collecting used, donated glasses, often sourced from more developed countries, for distribution through mission work in communities with limited access to eye care. The significant decrease in the cost of eyeglasses over the last decade, however, has allowed NGOs and inclusive businesses to pioneer models for selling and delivering low-cost, attractive new glasses to BoP consumers. Selling or distributing new glasses is also a more cost-effective delivery model compared to those that distribute recycled glasses. In fact, research shows that the practice of recycling donated glasses and delivering them to less developed countries costs \$20.49 per pair, and that only 7% of all donated glasses are in adequate condition to be distributed.⁵⁷ In contrast, VisionSpring, an NGO that sells subsidized glasses and has established optical shops serving BoP consumers, has demonstrated it is possible to penetrate less mature markets with a philanthropic subsidy as low as \$2.70 per pair of glasses sold. In addition to cost-effectiveness, permanent optical shops also create benefits through developing local workforces and enhance the prospects of creating referral networks.

Best practices for sustainable optical shops and vision centres

Over the years, the public and private sectors' failure to meet the needs of those with poor vision led to innovative solutions by NGOs that established new distribution models for providing BoP consumers with glasses. These models have demonstrated that (1) the BoP is a viable market, (2) a cross-subsidy approach can reach those who cannot pay for glasses, (3) training eye health workers creates new income-generating opportunities and builds the professional base, and (4) optical shops and vision centres can be leveraged to identify individuals who need more advanced eye care.

1. *The BoP as a viable market*

Research conducted by the NGO OneSight showed that half the population of The Gambia was unaware that vision correction was an option for them. After learning about the possibility, 96% said they would be willing to pay \$8.50 for an eye exam and glasses, even though most live on less than \$2.50 per day. Similarly, other NGOs have found that low-income consumers in Vietnam, El Salvador and India are willing to pay up to 10% of their monthly income for a pair of glasses.

2. *The cross-subsidy for maximizing reach*

Aravind Eye Hospitals, founded in 1976, pioneered a cross-subsidy model to provide eye surgery and eye health services in India, with price points based on a patient's income. Upon expanding its services to include vision correction with glasses, Aravind Eye Hospitals incorporated the successful cross-subsidy approach into the cost of an eye exam and sale of eyeglasses. The Brien Holden Vision Institute also employs a cross-subsidy model in many of its vision centres located across Sub-Saharan Africa and parts of Asia. Many Brien Holden Vision Institute vision centres include cost-recovery mechanisms that allow the centres to conduct outreach campaigns to educate rural and low-income communities about proper vision care, and to provide free glasses to those who cannot afford them (see Case in Point, p.28).

3. *Opportunities to generate income*

To establish permanently viable optical shops and vision centres, new eye health workers must be trained or upskilled. Building the eye health workforce provides less skilled workers with new job opportunities, while also meeting the need for eye care services in communities with no affordable eye care options. For example, Essilor's Eye Mitra programme trains unemployed and underemployed youth to become eye care providers, and equips newly trained practitioners with the skills required to establish an optical shop. Of the 1,274 Eye Mitra opticians, 64% have reported an increase in earnings as a result of their training, and 15% have left cities and returned to their home communities to open an optical shop (see Case in Point that follows).

4. *Referral pathways*

Optical shops and vision centres enhance health systems by identifying individuals in need of advanced vision care, such as cataract surgery or treatment for glaucoma. Optical shops and vision centres have the ancillary benefit of promoting proper vision care, and can serve as efficient triage points to connect individuals (those who might not have otherwise received proper vision care) to the appropriate facility for treatment.

Base-of-the-pyramid market segmentation: a growth opportunity

While the optical shop and vision centre model has variations, most cost recovery models are based on marketing to consumers who have never owned a pair of glasses. Once individuals experience vision correction with properly prescribed glasses, they are highly likely to continue

purchasing affordable glasses throughout their lives. As a result, organizations that offer subsidized glasses to a new consumer base effectively increase market penetration for glasses and, over time, support the development of a viable market for them. Data collected by VisionSpring on the behaviour of consumers purchasing glasses for the first time in India and El Salvador indicates that most individuals had not procured glasses before because they never had an eye exam or did not know their problem could be easily solved. Other reasons for not purchasing glasses include a lack of public or affordable private eye care options in their community or surrounding areas. In general, the BoP consumer's purchase behaviour is informed by a favourable past experience with the product, the product's durability, peer recommendation of the product, and the reputation of the business or organization that provides glasses in the community.

Individuals living on \$2 a day or less, who are sometimes included in the definition of a BoP consumer, spend most of their income on food, energy, housing and transportation. This segment of the population will likely continue to benefit from free eye care and glasses. However, according to a report by the International Labour Organization (ILO), 42% of workers in less developed countries are now classified as either "middle class" or "above middle class". Middle class is defined as workers earning incomes sufficient enough for their families to consume between \$4 and \$13 a day per person. This population segment is growing quickly: between 2001 and 2011, the number of middle class workers doubled from 399 million to 800 million.⁵⁹ The ILO also forecasts that by 2017, the number of middle-class workers in developing countries will grow by an additional 390 million. This would represent a tremendous expansion of the eyeglasses market, with implications for cost recovery and inclusive business models that serve this growing consumer base.

Case in Point: Essilor's Eye Mitra Programme

Using new business models for vision care in underserved communities of India

About 550 million people need vision correction in India, and 90% of them are living in rural areas. In rural and peri-urban India, Eye Mitra (Sanskrit for "friend of the eyes") addresses unmet needs for vision care by recruiting, training and supporting unemployed and underemployed young people to become eye care providers. They can bring affordable primary vision care and, as micro-entrepreneurs, vital socio-economic stimulation to their local communities.

The Eye Mitra Optician (EMO) training programme leads to government-recognized certification to provide eye care. The year-long course consists of two months of classroom study and 10 months of on-the-job training. The programme actively recruits women, who comprise about 12% of EMOs working today. In less than three years since its founding, the programme has trained 2,100 youth, with more than half working with Eye Mitra and two-thirds earning a higher living than previously, thus helping to avert a small portion of the nation's urban migration.

In addition to refraction, edging and mounting of glasses, and primary vision care (including a hospital-referral protocol for customers needing advanced eye care), EMO students learn about entrepreneurship, products and sales. They pay an enrolment fee, which they receive back at the end of training as seed stock (an initial supply of product). It usually takes less than a year for a new EMO shop to break even operationally.

After completing their training and certification, EMOs sign a franchise agreement with Eye Mitra's parent organization, 2.5 New Vision Generation (2.5 NVG), a division of global vision care leader Essilor, that explores methods of building sustainable eye care business models in areas with no or minimal vision care infrastructure. Essilor's earlier work in India involved mobile optical units to provide secondary eye care for those with eye illnesses. While these mobile units still operate, Essilor launched Eye Mitra with the goal of validating a sustainable, scalable business model for providing primary eye care.

New EMOs receive hands-on support from 2.5 NVG to set up a shop in their village, develop their business on a sound foundation, and organize local outreach activities. To deliver stock directly to EMO shops, 2.5 NVG created stock points via master distributors in each state, and is working on a system for real-time ordering and dispatch.

To increase public awareness of vision care, 2.5 NVG encourages EMOs to conduct a large-scale vision screening event every month and a smaller one every week. The organization supports EMOs' outreach through customized point-of-sale materials in local languages and targeted rural marketing campaigns, such as street theatre and roadshows, with messaging about the benefits of eye care services available at the local EMO shop. Eye Mitra also supports EMOs through its standardized approaches to service delivery, branding and shop signage. Moreover, EMOs benefit from ongoing educational opportunities through 2.5 NVG, and from financial assistance if they want to purchase additional optical equipment. In this way, 2.5 NVG supports professional development and enables EMOs to grow both their business and their skill set over time.

In 2015, Dalberg Global Development Advisors evaluated the impact of the EMO programme in India. They found Eye Mitra to be successful in creating access to both vision care and employment opportunities: 75% of eyeglass customers were first-time wearers of glasses, 91% of EMOs felt they were better respected by their community, and 64% of them reported an increase in income. Overall, the study showed customers were highly satisfied with EMO services and product quality, with more than 90% rating these as "good" or "excellent".

As of April 2016, Eye Mitra had 17 training centres dedicated exclusively to the EMO programme, serving 85 districts in 13 of India's 29 states. Regarding the EMO shops, 1,389 were operational, a number expected to rise to 6,600 by 2018 and 10,000 by 2020.

Case in Point: Brien Holden Vision Institute

Enhancing public-sector vision care through a cross-subsidy approach in Vietnam

Over the last 14 years, the Brien Holden Vision Institute has delivered sustainable eye care services in 54 countries, training over 139,000 eye health workers and providing glasses to over 2.5 million children and adults at 429 vision centres and eye care sites.

In 2011, the institute partnered with the government health service in Vietnam's Ba Ria-Vung Tau province on a three-year project to develop a sustainable local delivery model for identifying individuals with poor vision and correcting vision with glasses. Prior to the project, eyeglasses were not available through Vietnam's public health system.

Working with the Ba Ria Vung Tau Provincial Eye Hospital (PEH), the project established five local vision centres, one at PEH and the others at district hospitals across the province. Over the course of the project, the institute trained 37 eye health workers to prescribe and dispense glasses, and an additional 100 community eye health workers to promote proper eye care in their communities. Importantly, training and mentoring on vision centre management skills was provided, including financial management, inventory control and customer service training.

In an effort to ensure long-term sustainability, the institute invested in advocacy efforts to promote a better understanding of the problem among policy-makers and stakeholders, and engaged in educational and promotional campaigns through multimedia messaging, including television and radio broadcasts. Today, the vision centres yield an average monthly profit of approximately \$6,000, which supports outreach efforts and enables the centres to provide free glasses for those who cannot afford them. In 2015, the PEH began to manage the centres as the institute's staff transitioned out of their roles.

During the project's first four years, the vision centres welcomed more than 90,500 patients (almost half were children, and the majority were women), and dispensed more than 26,000 pairs of glasses. Integrating the vision centres into existing provincial public-health services has made for an effective and sustainable approach to providing affordable eye care to local communities. The institute has established vision centres in Ghana, Tanzania, Papua New Guinea, Solomon Islands, Cambodia, Sri Lanka and Nigeria, with variations of the model used to meet communities' needs.

Validated Model: New Eye Health Workforce to Dispense Reading Glasses

Less developed countries offer few opportunities to obtain reading glasses outside of healthcare facilities. In an attempt to meet the enormous need for reading glasses, some organizations have begun training lower-skilled workers to conduct basic vision screenings and dispense or sell reading glasses for about \$1 per pair. With proper training, lower-skilled workers are also able to identify more advanced vision disorders, such as cataracts and glaucoma, and connect individuals who might not have otherwise received proper vision care to the appropriate facility for treatment. Models that engage lower-skilled workforces can be replicated in countries with active community health worker programmes, thus creating an opportunity for thousands of low-skilled workers. For example, estimates are that Sub-Saharan Africa has 300,000 community health workers, Nepal 50,000 female community health volunteers, and India 700,000 accredited social health activists servicing its rural communities (as of 2015). Training lower-skilled workers to reach people in remote communities with basic vision screenings can potentially create significant impact by delivering reading glasses at the point of care and establishing referral networks that increase the odds of having access to eye care.





RGIL has dramatically changed the lives of people like Dipali Rani Pal for the better. A middle-aged potter in the village of Tangail, Bangladesh, she says that wearing her first pair of eyeglasses has helped her increase her output from one or two clay pots per workday to 10-12 pots, and work is easier and more enjoyable. Her newfound success was made possible after she heard from a BRAC member that help was available.

Case in Point: VisionSpring and BRAC

Building a village-based eye health workforce in Bangladesh

With 111,000 employees and a history of serving 138 million people, BRAC is the world's largest NGO. But this status could scarcely have been foreseen in 1972, when BRAC was founded to fight poverty in the newly sovereign nation of Bangladesh.

One of BRAC's signature successes has been its "bottom up" approach to economic development, perhaps best demonstrated by the 117,000 women it has trained to serve as community health workers (CHWs, or "Shasthya Shebikas") in their villages.

As women living in rural communities that lack access to basic healthcare, Shasthya Shebikas are trained to diagnose, treat and provide health education on diarrhoea, dysentery, fever, common cold, anaemia, worm infection, gastric ulcer, allergic reaction and ringworm infection. They also sell such products as clean birthing kits, aspirin and oral rehydration salts, retaining a small profit from their sales.

Of the products that Shasthya Shebikas currently sell, eyeglasses have the highest profit margin, thanks to BRAC's partnership with VisionSpring. The collaboration has led to the Reading Glasses for Improved Livelihoods (RGIL) project, launched in 2007, that equips Shasthya Shebikas to lead informational vision campaigns in their communities, conduct vision screenings, teach proper eye care, dispense reading glasses and refer individuals needing advanced eye care to healthcare facilities. RGIL provides a framework for expanding Shasthya Shebikas' access to economic opportunities while offering a valuable, often first-time health service to their underserved communities. In this way, VisionSpring and BRAC deliver high-quality, affordable and economically sustainable vision care to some of the world's poorest consumers.

By the end of 2016, a million pairs of glasses will have been sold. And by 2020, 38,000 Shasthya Shebikas will have been trained to screen for presbyopia and dispense reading glasses, reaching 150 million people who otherwise would not have access to glasses to correct near-vision loss.



Mukamanzi Gerodide, a tailor, purchased her glasses for just \$1.50, which generates revenue for the ministry's primary eye care programme (the glasses are distributed free of charge to the poorest 20% of Rwandans), and says: "Before, I had trouble. I was always calling my children to help put a thread into the machine, which would bother them. But after getting the glasses, I'm independent and no longer rely on them."

Case in Point: Vision for a Nation in Rwanda

Nurses Deliver Primary Eye Care to Local Communities

A nation of 10.5 million people, Rwanda has 1.1 million requiring vision care. To begin addressing this problem, the Vision for a Nation (VFAN) foundation, a UK charity, partnered with the Rwandan government's ministry of health to build a comprehensive primary eye care programme as a fully integrated part of the nation's universal healthcare system.

Key innovations of this work include:

1. Training government-employed nurses using a curriculum developed by leading Rwandan ophthalmologists that is now embedded in all eight of Rwanda's nursing schools
2. Developing a supply chain to provide eyeglasses and medication on the spot at each of the nation's 502 health centres
3. Linking with the nation's 42 district hospitals to help people with severe vision problems
4. Covering the cost of vision screenings and hospital referrals with government-sponsored health insurance
5. Mobilizing the public nationwide to access local eye care service
6. Institutionalizing a central fund administered by the ministry of health, where all revenue from the sale of eyeglasses is solely dedicated to the primary eye care programme's ongoing self-sustainability

To date, nearly 2,000 of Rwanda's nurses have received primary eye care training. All future nursing school graduates will be certified to provide the same level of care. The health ministry and VFAN are now executing an unprecedented outreach programme to 100% of Rwanda's 15,000 communities over 28 months, district by district. Teams of VFAN- trained nurses based at the nation's local healthcare centres are visiting each community to screen, treat or refer people for more advanced care. In addition to addressing the backlog of eye care needs, the outreach programme maximizes public awareness of current and future eye care services available at local health centres. No other emerging nation has successfully achieved this critical healthcare goal. Significant further improvements for Rwanda should come from the benefits to individuals, their families and friends, and to the entire nation from worker productivity, career longevity, enhanced scholastic achievement for both children and adults, and social interaction.

During the programme's first 27 months, Rwandan nurses not only prescribed medication for 225,000 individuals, eyeglasses for 65,000 and referrals for 80,000, but screened over 500,000 people, a number forecast to triple by December 2017 upon completion of the community outreach programme. At that time, after having helped build a financially self-sustaining national eye care service in under five years, VFAN will discontinue its direct involvement in Rwanda and turn over management of the service to the Rwandan ministry of health.

Agnes Binagwaho, Minister of Health of Rwanda, says: "By helping Rwanda to provide nationwide access to primary eye care, Vision for a Nation has changed the lives of many people, empowering them to contribute to our nation's economic progress and fight against poverty."

Barriers to Scale

The 2014 report, *Beyond the Pioneer: Getting Inclusive Industries to Scale*, examines the obstacles to scaling market-based solutions for alleviating poverty. It identifies scaling barriers that are not at the level of the firm pioneering new inclusive business models, but rather in the environment around it. “We need to expand our focus from just building inclusive firms, to building inclusive industries”, the report states. Addressing key scaling barriers for organizations serving the BoP consumer therefore benefits all firms in the industry, not just one or two.

Demand barriers

Although glasses are not new – they were invented nearly 700 years ago – they still remain a “push” product in many less developed countries. With push products, consumers typically do not fully understand the problem or the value in solving it, or that a product exists to solve that problem. Potential consumers of eyeglasses, in particular, are frequently unaware that they have a correctable vision problem. Others do not know that an existing simple solution can help them see clearly, increase their productivity and improve their quality of life. Culturally based stigmas only exacerbate this barrier to procuring glasses, as misperceptions persist about their benefits, i.e. the fear that wearing glasses will worsen vision. Unlike a “pull” product, which consumers readily desire and demand, a “push” product requires establishing a loyal following and convincing consumers of its value. In contrast to solar lights, clean cookstoves and mobile phones, the value of glasses has not been adequately conveyed to low-income consumers with limited disposable income. Furthermore, if consumers cannot easily assess a product’s benefits or reliability before buying it, the challenges to adoption become even greater. Thus, for interventions focusing only on issuing prescriptions for eyeglasses, procurement rates are far lower than for those interventions that can deliver glasses at the point of care.

An additional barrier to adopting or purchasing glasses is the indirect cost associated with procuring glasses, including travel and opportunity costs. With few eye care options outside of urban areas, even those who seek care often have to take significant time away from work or caregiving to travel to the nearest facility or affordable optical shop. Depending on geography, the indirect costs of obtaining a prescription for glasses is estimated to be \$5-8.

This report’s advisory panel recommends that the international donor and eye care communities fund large-scale awareness and behavioural change campaigns that lead to increased demand for eyeglasses, informed by best practices related to creating demand in key geographies.

Supply barriers

The shortage of eye health workers represents a key barrier to adequately addressing the unmet need for glasses, coupled with local laws that govern the level of certification required for a practitioner to prescribe and dispense glasses. Despite

a widespread shortage of eye doctors, many countries have policies that require practitioners to obtain professional degrees before being permitted to prescribe and dispense either distance vision glasses or reading glasses. To respond to this challenge, NGOs have developed new training curricula that focus on providing the skills required to perform quality refraction and determine prescriptions, yet require significantly less time than obtaining a professional degree. To scale these new training methodologies and ensure the highest quality of service, the sector would benefit from creating a set of minimum core competencies required to prescribe glasses. These competencies would vary depending on the capacity of the existing eye care infrastructure in a particular country.

This report’s advisory panel recommends that the global eye care community assemble a diverse group of experts to set and continually evaluate the minimal competencies needed to determine quality prescriptions and dispense appropriate eyeglasses, based on the capacity of the local eye health workforce. These competencies should be reassessed as technologies improve and costs are driven down.

Regulatory barriers are similarly challenging market-based solutions. Laws and policies are often created to regulate mainstream models and favour the established industry. Some countries impose unnecessarily high import duties on glasses. In Bangladesh, for example, the rate of import duties levied on eyeglasses is 93%. High import duties inhibit entrepreneurship and hinder optical companies’ efforts to provide glasses at a price point appropriate for the average BoP consumer.

“

In some countries, policies and laws are a bigger barrier than resources – either financial or eye health professionals.

”

Thulsi Ravilla, Executive Director of Aravind Eye Hospitals (India)

In addition, businesses that market to the BoP consumer need to sell lower-priced glasses with a lower profit margin and, hence, must compensate for lost revenue by increasing sales volumes. The potential BoP market is sizeable, but it is also less mature, and requires investing both time and resources in activities to generate demand. Therefore, private optical companies and NGOs pursuing market-based solutions would benefit from access to impact investment and creative financing options; this would help to offset the delayed return on the initial investment required to sustainably serve the BoP consumer base.

Accordingly, this report’s advisory panel recommends that multilateral, bilateral and regional development banks, finance institutions and foundations offer impact investment and creative financing options to global, regional and local private-sector optical companies to de-risk their entry into less mature markets.

Technology, Innovation and Areas for Additional Exploration

Closing the gap in access to eyeglasses for the 2.5 billion people needing them will require investment, engagement of new actors and innovative approaches to solving the problem. Such approaches include exploring the use of mobile technology to broaden access to affordable eyeglasses, incorporating new technologies to expand the eye health workforce and using preventive strategies to combat the rise in myopia.

Disruptive Technologies

Developing easy to use, affordable handheld technologies, including applications used with smartphones, could reduce the complexity and drive down the cost of providing eyeglasses. These new technologies perform two distinct functions: first, they enable low-skilled technicians to rapidly conduct visual acuity tests to determine who needs further evaluation; and second, they offer a fast and accurate way to determine prescriptions via handheld autorefractors, and at a fraction of the cost of table-top autorefractors. Use of either function could potentially increase cost-effectiveness and expedite identifying individuals with vision problems, thereby enabling low-skilled technicians to connect them to the appropriate care.

Peek Acuity is a mobile application that, when paired with a lens adapter, can turn a smartphone into a visual acuity testing device. Peek tested the accuracy of the device in a randomized control trial in rural areas of Kenya, where community health workers were trained to use it to conduct visual acuity tests. The results proved that a Peek Acuity smartphone test is capable of accurate and repeatable acuity measurements.⁶² Peek has also demonstrated the potential for increased efficiency in identifying vision problems in children: in 2015, 25 teachers across 50 schools used the device to screen 20,000 children, all in less than two weeks. In addition to these benefits, Peek's application can image the retina to diagnose diabetes and hypertension.

QuickSee is one example of a new handheld prescription determination device. It has been shown not only to be significantly more accurate than commercially available autorefractors, but also to produce results that agree with subjective prescription determination performed by a

trained refractionist. In a 700-patient study conducted at the Aravind Eye Hospital, 75% of prescriptions determined by using the device agreed with those issued by a trained refractionist. QuickSee will be offered at a price appropriate for adopting it in settings with limited resources, where it can be used by either low-skilled technicians to conduct outreach, or trained eye care professionals to increase access to eye care at primary care vision centres or more remotely located optical stores. Lenskart, an Indian optical company, currently uses another handheld autorefractor. The company has launched a training programme that equips individuals who have had no previous eye health education with the necessary skills to use this device for determining prescriptions.

These are select examples of companies that have developed technologies designed to respond to specific needs in less developed countries and emerging markets, or that have been tested in these regions. To encourage new solutions and pioneering technologies with the potential to accelerate delivery of glasses to those who need them, Adlens, a leading designer of adjustable eyeglasses, has launched Clearly, a year-long campaign. Clearly has issued a call for innovations and created the Vision Prize and Innovation Lab to inspire talented and creative minds to solve diagnosis, training and supply challenges.

See the Appendix for a more comprehensive list of all handheld autorefractors.



E-Commerce in Emerging Economies

To disrupt the established eyeglasses market, Lenskart uses new technology and e-commerce. Launched in 2010, Lenskart operates in 11 cities in India and has trained over 500 new eye health workers to meet the needs of middle-income and BoP consumers. Transforming how urban-dwelling Indians access eye care, it provides a system for consumers to obtain a prescription and order a pair of glasses from their homes.

Lenskart's first point of access with the consumer is through its website, where potential customers can indicate whether they already have a prescription or need to obtain one. If a customer needs a new prescription, one of the company's trained eye health workers travels to the customer's house by motorcycle and determines a prescription on-site with a handheld autorefractor. Once trial lenses have verified the prescription, customers choose from a variety of frames brought by the eye health worker. Each worker travels with 100 of Lenskart's most popular styles, placing orders on-site via mobile technology. In 2014, the company expanded its model to include optical shops located in over 50 cities and has plans to train an additional 1,000 eye health workers. In April 2016, the International Finance Corporation was the lead investor in a \$63 million series D round of financing for Lenskart.

Essilor, through its social business venture in Brazil, Instituto Ver e Viver (IVV), is pioneering another model that uses mobile technology to reach communities that lack access to affordable glasses. IVV trains individuals living in favelas (shanty towns) to become vision ambassadors and sell low-cost glasses in their communities. Predominantly women, vision ambassadors participate in a day-long training module that equips them with the necessary skills to conduct basic vision screenings, provide information on proper vision care, and use a mobile application to order glasses for those with a prescription. The ambassadors

identify potential customers through social media as well as word of mouth. They then conduct vision screening events in their communities and provide those in need of an eye exam with a voucher for affordable eye care services at a local clinic. When the vision ambassadors visit customers' homes, they bring sample frames and can place orders for glasses on-site via the mobile application. This high-impact model enables the ambassadors to earn supplemental income while simultaneously increasing access to glasses for those without affordable options.

Prevention Strategies

In addition to increased prevalence rates of myopia noted in Chapter 2, the number of cases of high myopia, a more severe form, are also increasing in children. Even if corrected with eyeglasses, high myopia ultimately increases the risk of serious eye conditions, such as myopic macular degeneration, cataracts, glaucoma and retinal detachment that can lead to permanent blindness. Thus, exploring the potential of integrating myopia prevention strategies into programmes that provide glasses becomes critically important.

Research in a number of settings has suggested that children who spend less time outdoors are at greater risk of developing myopia. Randomized controlled trials have recently strengthened the evidence, including one in China showing that an additional 40 minutes of daily outdoor activity resulted in reducing myopia by one-quarter.⁶³ Countries with high prevalence of myopia would benefit from supporting initiatives that encourage children to spend more time outdoors, ultimately slowing or even preventing its development. These efforts could yield the additional benefit of reducing obesity, diabetes and other public health problems on the rise among children globally. Chinese Taipei is one economy with a national programme encouraging children to spend two hours a day outdoors; these nations are documenting decreases in myopia prevalence with programmes of outdoor activity. Other promising approaches to slowing the progression of myopia involve using topical eye drops, such as low-dose atropine, and wearing specially designed contact lenses and glasses to reduce the amount of out-of-focus light at the peripheral retina.

Using new technologies, leveraging increased connectivity in emerging economies, and intervening to slow and prevent the development of myopia will likely gain momentum over the next few years. Each approach shows real promise in meeting the need for glasses more efficiently. However, additional work is needed to better understand how to effectively integrate these strategies and technologies into existing interventions and identify replicable models.



Appendix

Next Generation Devices for Determining Prescriptions

Features and Specifications	EyeNetra	Smart Vision Labs	LensKart Device	Opternative	The QuickSee	Quextra	2020 Now
An Official Rx in US?	N	Y	N	Y	N	N	Y
Time to Train on-Ground Person	1 Day	1 Day	1 Hr.	N/A	2 Mos.	1 Day	1 Day
Time to get a Consumer to Rx	4 Min	3 Min	10 Sec	20 Min	3 Min	3 Min	10-25 Min
Include Astigmatism?	Yes	Yes	Yes	Yes	Yes	No	Yes
Patient Effort Required to Get Rx?	Yes	Yes	No	Yes	Yes	Yes	Yes
Subjective or Objective?	Subjective	Objective	Objective	Subjective	Objective	Subjective	Both
Monocular or Binocular?	Binocular	Monocular	Binocular	Monocular	Monocular	Monocular	Monocular
Special Lighting Required?	Yes	Yes	No	No	Yes	No	No
Contact Lens Rx?	No	No	No	Yes	No	No	Yes
Device Cost	\$1,099	\$4,700 (by leasing equipment)	\$1,000	\$40/60 (online exam fee to consumer)	\$1,300	\$100	\$13k (software)
Quality of Vision Solution	High	High	High	High	High	Directional	H

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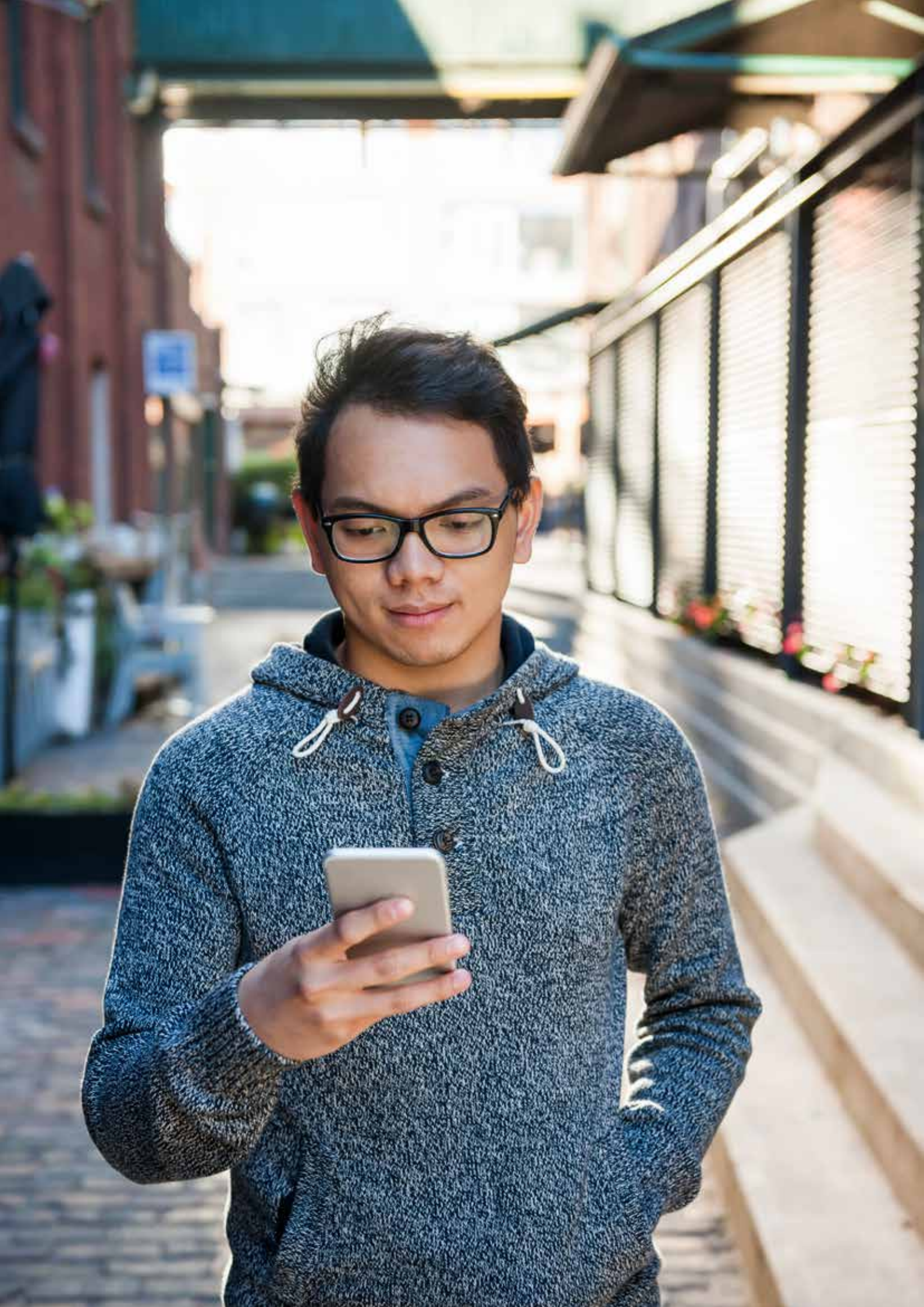
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