Effective Altruism

DISTRIBUTING EYEGLASSES

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Abstract

Presbyopia is a near vision impairment from increasing age. Globally, there are 1.8 billion people affected, and for 826 million people, their condition has yet to be addressed. This causes an estimated US $25 billion in global productivity loss. The problem persists since the market and the government fail to provide affordable eyeglasses, eye care services, funding, proficient ophthalmic personnel, and the correct knowledge. There are several solutions to tackle this issue such as subsidizing the cost of eyeglasses, providing eye care services to people in poverty, and educating people about the benefits of obtaining corrective eyeglasses. Evidence from research shows that with presbyopia, there is a 26% productivity decrease whilst distributing corrective glasses can produce a 20 % productivity increase while remaining low-cost. Thus, it is a cost-effective charitable program and is estimated to be 14x as effective as GiveDirectly. We recommend donating to Visionspring, given their strong emphasis on cost-effectiveness, focus on distributing corrective glasses, and potential to utilize further funding.

What is presbyopia?

Presbyopia, also known as near vision impairment, is “an age-related visual impairment that results from the gradual decrease in accommodation expected with age and may affect the quality of vision and quality of life” (Goertz et al 2014). The major cause of this problem is age however, medications, trauma, and disease can affect people as well. Since aging is the primary risk of this disease, many people can have this problem and the population growth will increase the number of people with this problem in the future.

According to the World Health Organization, the number of people affected globally is 1.8 billion, and 826 million people have yet to be addressed (2019). This indicates that around half of the people affected by presbyopia are not cured. Moreover, “ownership of glasses to cure presbyopia in low-income and middle-income countries is 10%” (Reddy et al 2018). This percentage is significantly lower than in high-income countries and demonstrates that most people in poverty don’t own glasses. Additionally, WHO states that “the rates of unaddressed near vision impairment are estimated to be greater than 80% in western, eastern and central sub-Saharan Africa, while comparative rates in high-income regions of North America, Australasia, Western Europe, and of Asia-Pacific are reported to be lower than 10%” (2019). Figures 1 and 2 also demonstrate that Africa and South Asia are regions that have a high number of people and a percentage of unmet needs for presbyopia correction.

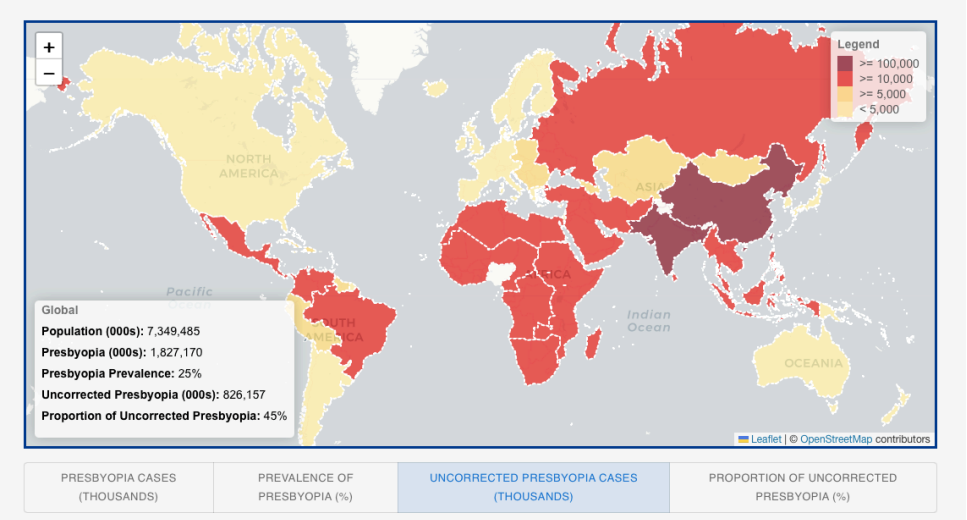

Figure 1: Uncorrected Presbyopia Cases (Thousands)

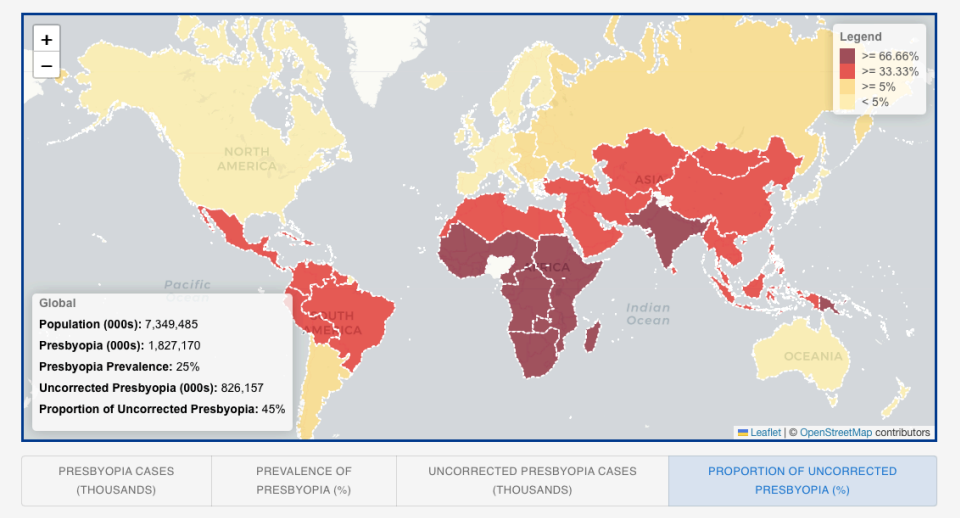

Figure 2: Proportion of Uncorrected Presbyopia

From 826 million people not being addressed to cure presbyopia, it is estimated that there is US $25 billion in global productivity loss. Additionally, not only productivity is being affected, but presbyopia is also affecting the quality of life among adults. Thus, the problem can have a severe lasting effect both on global productivity and the quality of life for individuals.

Why is presbyopia still an issue?

There are several causes for this problem such as affordability, lack of eye care services, funding, proficient ophthalmic personnel, and eye care literacy of the population. The problem persists since the market and the government fail to provide these services. One study stated that “31 percent of the people surveyed were unable to afford eyeglasses at a price that covered the cost and shipping of the spectacles” (Karnani et al 2011). Another article indicates that nearly two-thirds of people have difficulty affording glasses (Gupta et al 2020). Thus, presbyopia remains an issue since the market fails to sell glasses to people in low-income and middle-income regions since people would need to pay the transportation cost, doctor fees,

and eyeglasses, which are costly. Additionally, the market also has the responsibility since the market lacks sufficiently trained ophthalmic support personnel such as assistants and technicians. Since the number of ophthalmologists is limited, the lack of assistants and technicians will reduce the number of people who can access eye care services.

Moreover, the government is partially responsible for the low percentage of people with unaddressed presbyopia in rural areas. It is stated that “eye screening centers are sparse, especially in rural areas, because of lack of funding. As a result, primary eye care is largely unavailable where governments lack the willingness to pay for the services” (Karnani et al 2011). Thus, one can say that governments fail to provide the appropriate eye care services and funding. In addition, people in poverty both lack knowledge of proper eye care and hold bias against seeking it. A study indicated that some people are unwilling to wear glasses from appearance and embarrassment whilst others believe that eyeglasses deteriorate eyesight further. Furthermore, some people do not know the existence of eyeglasses whilst others do not understand the advantages of seeking them. Thus, the lack of knowledge and the biases that people in poverty hold are also causing this problem to persist.

What is the solution to uncorrected presbyopia?

As mentioned prior, treatment for presbyopia is available and common in developed countries, the most common treatment being corrective eyeglasses. The focus of the solution must then be on how to make this treatment accessible for people with low income. Many programs can help achieve this goal, it depends from region to region whether a particular program will be useful. Nevertheless, we will list some notable programs and some comments

about where they would be most effective. The comments below are mainly of interest to organizations and agencies with the resources to implement these programs, for individual donors, we suggest skipping ahead where we discuss existing organizations that already work on this issue.

One of the most direct options is to subsidize the cost of glasses or provide it for free. However, this method is only effective if there is a gap between what people are willing to pay for glasses and the market price for glasses. For example, in a randomized control trial (RCT) on distributing correction glasses to tea pickers in India with presbyopia, a follow-up survey reports that 98.3% of the participants find glasses useful to very useful. However, with their given income, they are willing to pay only $5.57 to $6.64 for a pair of glasses, which is below the $10.20 cost (glasses including delivery) reported in the research. However, this is not always the case. In another RCT on distributing correction glasses for Rwandan women who produce woven handicraft items, 87% of the participants who were given glasses reported being willing to pay at least 2,000 Rwandan francs (Rwf), which is more than the cost of 1,300Rwf.

But providing subsidized or free glasses to low-income patients might not be enough if they cannot afford the cost of getting a diagnostic in the first place. As a result, another program would be to provide eye care services to low-income families or to increase eye care capacity in the region. This could involve temporary eye-care centers with volunteer doctors and nurses or investment in permanent infrastructure or eye-care centers. Of course, this program is most effective in regions where people have no easy access to eye care centers.

Lastly, in some cases, it could be that people aren't aware of the existing treatment of presbyopia, or there exists some stigma for the treatment. For these regions, we recommend

running awareness campaigns to educate people about eye-care treatments as well as counteract the social stigma against seeking out treatment.

For individuals interested in donating to this cause, we have listed two organizations that have successfully tackled this issue. These are Visionspring founded in 2001 and Sightsavers founded in 1950.

Visionspring is a charity organization that focuses on providing affordable and quality glasses to 2.5 billion people that need them. So far, they have provided 8.7 million glasses to people in need in around 24 countries and created $1.8 billion of economic impact.

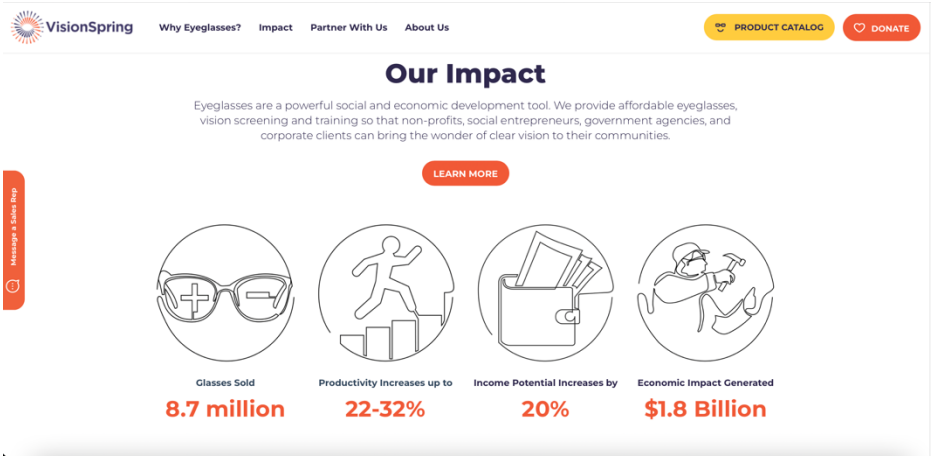

Figure 3: Visionspring website

Sightsavers works with 30 countries, focusing especially on Africa and Asia. Unlike Visionspring which focuses primarily on distributing glasses, Sightsavers have various programs related to vision aid. Some of these programs include treating refractive errors, cataract

surgeries, and prevention of neglected tropical diseases that could lead to blindness. In addition, they also have programs that campaign for disability rights.

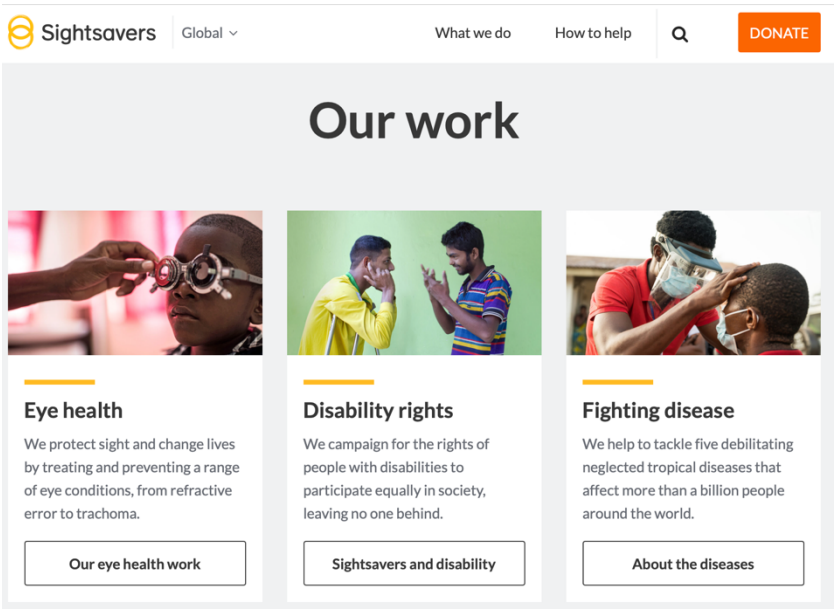

Figure 4: Sightsavers website

How effective are these programs?

We found two randomized control trials (RCT) that were concerned with distributing glasses to manual workers with presbyopia. To our knowledge, there is no other RCT on this topic. Despite the lack of quantity in our evidence, the evidence that we do have are high quality. This section will discuss two papers separately, before joining their finding together to piece together a general picture.

The first paper is by Glewwe and Schaffner (2014), focusing on Rwandan women and their productivity in weaving baskets, earrings, and other handicraft objects. The study was designed to measure the loss of productivity due to presbyopia as well as the productivity increase by distributing corrective glasses. It is structured by dividing the participant randomly into two

groups and giving one group glasses at the beginning of the experiment (treatment group) and the other group at the end of the experiment (control group). The researcher used various metrics to measure productivity, including the number of products created in 8 hours, the percentage of high-quality products, the percentage of medium and high-quality products, and the average value created per minute. However, the experiment did not filter out participants without presbyopia in both the treatment and control group and opted to use the "triple difference" estimation (the first difference is between before and after treatment, and the second difference is between the treatment group and control group, and the third difference is between participants with and without presbyopia). We believe that the researcher did it this way due to the small size of the population (N=239).

However, this allows the researcher to measure the difference in productivity for people with presbyopia and without presbyopia before treatment. Across all metrics, we see a decline in productivity for workers with presbyopia, notably up to a 26% decrease in value created per minute (1.6Rwf decrease of the average 6.2 for workers without presbyopia) When they differentiate between different levels of presbyopia, the decrease in productivity is larger for higher levels of presbyopia.

A. Farsighted vs. Not Farsighted				
VARIABLES	(1) Sets Complete in 8 Hours	(2) Percent High	(3) Percent Medium	(4) Average Value per Minute
Presbyopic	-0.805**	-5.867	-24.74***	-1.610***
	(0.276)	(3.241)	(6.093)	(0.391)
Age	-0.0479**	-0.289	0.317	-0.0453
	(0.0193)	(0.291)	(0.503)	(0.0357)
Azizi	-0.681*	-9.539	-23.78	-1.710*
	(0.345)	(9.382)	(13.36)	(0.891)
Constant	8.217***	39.61**	62.30**	8.478***
	(0.714)	(14.26)	(21.54)	(1.560)
Observations	238	238	238	238
R-squared	0.311	0.062	0.148	0.237

Table 1: Impact of Presbyopia on Productivity

However, when it comes to measuring the productivity increase by distributing corrective glasses, the study falls short of showing a significant effect. One of the reasons for this is due to participant lack of motivation to create high-quality products during the study. Even though all metrics (except one) account for the quality of the product made by workers, the compensation scheme of the study rewards based solely on the number of products made, not on the quality of each product. As such the participants have incentives to produce goods as fast as possible, regardless of the quality. The researcher advises coming up with a better compensation scheme to motivate participants to pursue high quantity as well as high quality. Secondly, as mentioned before, the limited sample size has made it harder to find a statistically significant effect. Follow-up calculations made by the researcher suggest that the population will need to be increased by 10-fold to be satisfactory.

Triple Difference Estimates of Provision of Glasses on Weaving Productivity

VARIABLES	(1) Sets Complete in 8 Hours	(2) Percent High	(3) Percent Medium	(4) Average Value per Minute
Follow-up	2.053**	0.742	-1.059	1.986**
	(0.860)	(4.753)	(2.618)	(0.809)
Treatment	-0.272	-13.00	-9.767	-1.078
	(0.500)	(10.10)	(13.99)	(0.977)
Presbyopic	-0.513	-18.80*	-40.91**	-2.573**
	(0.667)	(8.981)	(13.72)	(1.021)
Follow-up x Treatment	0.823	-4.815	-14.57	-1.034
	(1.108)	(8.198)	(8.919)	(0.952)
Follow-up x Presbyopic	0.0275	-1.057	9.162	-0.215*
	(0.219)	(8.350)	(6.210)	(0.104)
Treatment x Presbyopic	-0.235	15.22	22.02*	1.183
	(0.709)	(8.608)	(11.35)	(1.119)
Follow-up x Treatment x Presbyopic	-1.103***	12.57	13.74	1.090
	(0.275)	(10.29)	(10.86)	(0.733)
Age	-0.0527*	0.0595	0.628	-0.0160
	(0.0251)	(0.256)	(0.514)	(0.0370)
Azizi	-1.662***	-8.675	-21.36*	-2.528**
	(0.451)	(7.783)	(10.72)	(0.819)
Constant	8.973***	33.83***	55.49**	8.408***
	(0.780)	(8.847)	(17.15)	(1.243)
Observations	473	473	473	473
R-squared	0.468	0.076	0.138	0.303

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2: Triple Difference Estimates, the parameter of focus is Follow-up x Treatment x Presbyopic

The second paper is by Reddy et al. (2018) which focuses on tea pickers aged 40 years or older in India with uncorrected presbyopia. Unlike Glewwe and Schaffner (2014), this study focuses only on worker with presbyopia that can be corrected using corrective glasses and use the difference in difference analysis to estimate the effect of distributing corrective glasses. The researcher measured productivity by the weight of tea leaves picked by participants, measurement was made by masked inspectors. The population size was also more sizable, with 376 in the treatment group and 375 in the control group. Measurement on the baseline also indicates that the two groups are comparable in all observed factors.

	Baseline mean daily productivity over 4 weeks, kg per day (SD)	Post-intervention mean daily productivity over 11 weeks, kg per day (SD)	Change in productivity, kg per day (95% CI)	Between-group difference in change in productivity, kg per day (95% CI)
Control group (n=375)	26·0 (3·48)	30·6 (4·77)	4·59 (4·10–5·07)	..
Intervention group (n=376)	25·0 (4·25)	34·8 (5·11)	9·84 (9·27–10·4)	5·25 (4·50–5·99); p<0·0001

Figure 5: Difference-in-difference Analysis

The result from the difference-in-difference shows that giving corrective glasses to worker increase their yield by 5.25 kg per day of leaves or roughly an increase of 20% in productivity. In addition, their further analysis shows that the increase is stronger as age increases.

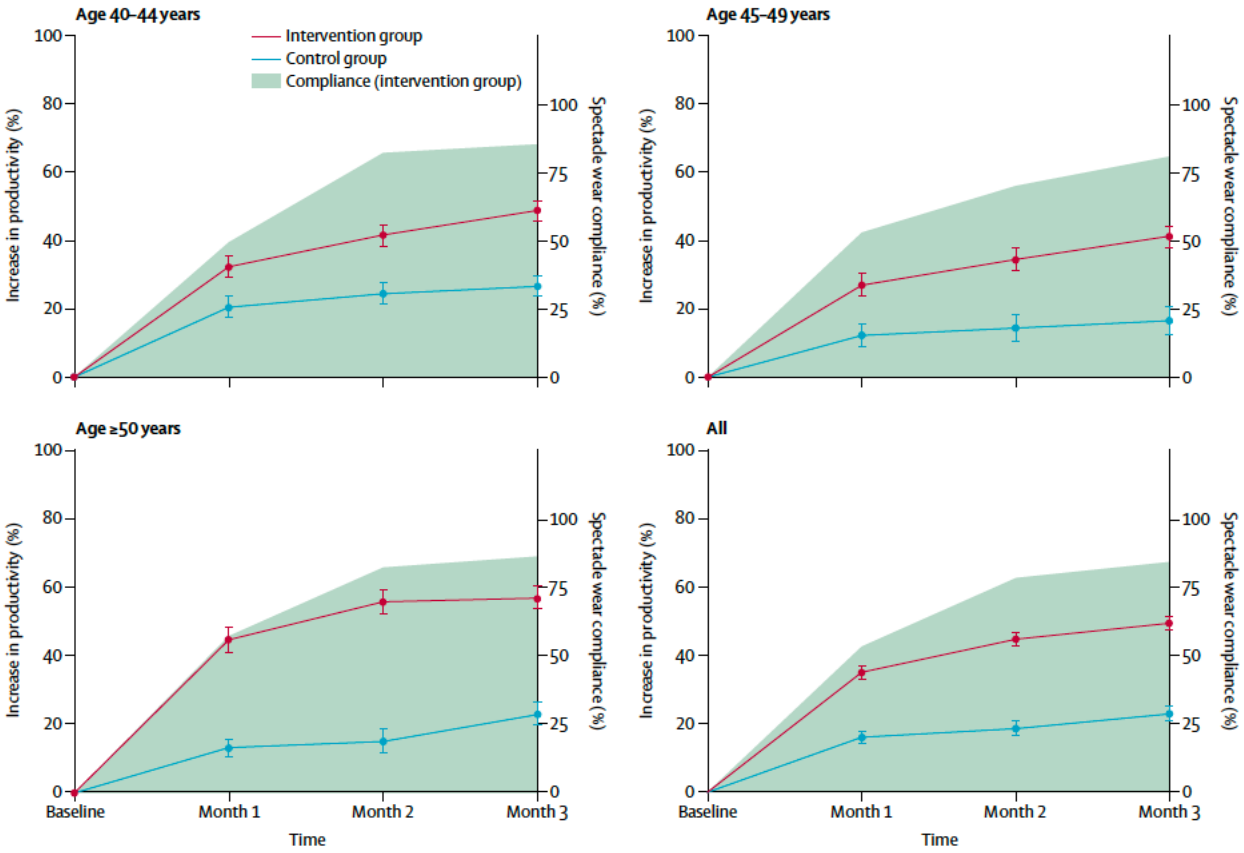

Figure 6: Productivity increase for different age groups

With these two papers, we can conclude two things, one is that there is an observed difference in productivity between people with presbyopia and people without presbyopia around a 26% decrease in productivity, and two is that the decrease can be significantly mitigated by providing correction glasses by around 20%.[1] As noted in the previous section, participants from both types of research almost always find the glasses useful and increased their productivity in follow-up surveys.

To better understand the cost-effectiveness of the program, GiveWell has given us a tool to compare the cost-effectiveness between programs. We will follow the steps of their calculation but draw our own assumptions along the way. We will aim to estimate the general effect of distributing glasses to workers across different regions and occupations.

First, we start with the result from Reddy et al that the distribution of eyeglasses will increase by 21.9% of worker productivity.

The next step is to translate this into an annual increase in income. GiveWell adjusted that the tea pickers only work seasonally 20 out of 52 weeks of the year and adjusted this accordingly. Given that we are trying to calculate the universal effect for all occupations, we will not assume that the occupation is seasonal and that the annual increase in income is 21.9%.

The next step is to measure the impact of the increase in income per household. We share the same assumption with GiveWell that a house on average has two earners. GiveWell makes a further assumption that on average the earner with presbyopia and the earner without presbyopia earn the same amount, however, we relax the assumption to two earners on average

[1] Note that a 26% decrease and then a 20% increase does not mean that the net decrease is 4%. The net decrease is 12.2%

have the same income if they both don't suffer from presbyopia. Then, there are two situations: The other earner also suffers from presbyopia, or they are not[2]. Given the global prevalence of presbyopia is 25% we have the following equation to estimate the percentage increase in income per household.

$$0.75 * \frac{1 + 0.74 * 1.2}{1 + 0.74} + 0.25 * \frac{0.74 + 0.74 * 1.2}{0.74 + 0.74}$$ [3]

Calculate this to give us an increase of 8.88% percent in household income. And this converts to a 0.085 increase in log income per household.

Next, we will calculate the value created per year from the increased income. Using GiveWell's definition a one-unit increase in log income per person per year is 1.44 value. Using the assumption from GiveWell that an average household is 4.7 people, the value created per year is 0.575. At this point, GiveWell uses a set of weight adjustments to modify the value created from the increase in income. The first weight is internal validity, which is 100% if we strongly believe the income effect is accurately reflected by current evidence and below 100% if we believe the current evidence overestimates the income effect. GiveWell gives a score of 70%, however, we give a score of 90%, believing that the current evidence presented by Reddy et al (2018) is strong while acknowledging that further evidence is needed. The second weight is external validity, which is 100% if the effect measured in current evidence can be perfectly generalized to a population outside of the research sample and below 100% if we believe the effect cannot be perfectly generalized. GiveWell gives this weight 60%, and we agree with this,

[2] Technically we can entertain another case where the other earner suffered from presbyopia and got treatment, but we will avoid that case for simplicity.

[3] Assume income without presbyopia is 1, with presbyopia is 26% less (0.74), and treatment is 20% increase (multiply by 1.2)

given that our sample population is very narrow - tea pickers in India. The last weight is productivity gain retention, which is 100% if we believe the productivity gains will translate perfectly to an increase in income of the person and below 100% if we believe some other party could take away the benefits (for example, employers or local officials). GiveWell gives this weight 100%, however, we aren't so optimistic. Although in both of our references, workers are compensated directly for the product they produced, in other occupations, especially those that involve services, it is harder to justify a perfect transfer from productivity to income. As such we will give this a weight of 80%. With these three weights, the value from increased income per person per year is 0.249.

In addition, we must also count the value created solely from increasing the QoL of the patient. GiveWell assigns the treatment of presbyopia as increasing 0.003 DALYs and the value of each DALY is 2.3. Thus, the total value created per year is 0.255.

Given the assumption that glasses last for 2 years, and the discount rate of 4% (GiveWell), the total value created per intervention is $0.255 + \frac{0.255}{1+0.04} = 0.5$. And the total cost per person, given by Reddy et al (2018), is $10.20 so the total value created per $100,000 is 4901.96. GiveWell, based on their own set of assumptions arrive at the value of 2865 per $100,000 donated.

Compared to GiveDirectly's estimated value per $100,000 donated of 344, our estimate indicates that distributing corrective glasses is 14 times as effective, and GiveWell's estimate is 8 times as effective, as GiveDirectly.

Note that our estimation is not robust and still relies on many assumptions. Notably, our calculation is not country-specific, where the price of corrective glasses could fluctuate. In

addition, it would be better if we can identify each occupation that corrective glasses could be helping and calculate the benefits separately. Finally, the $10.20 cost per person was taken from Reddy et al. which only includes the cost of making and delivering glasses, additional cost of diagnosing presbyopia was not included and may be different from region to region. However, we believe that these estimates can still be helpful, but urge the reader to make their judgment call.

Final recommendation

For our policy recommendation, we have suggestions for different target groups, from researchers, policymakers, charity organizations, and donating individuals. Regardless of the group, we determine that this is an area that deserves more research to determine the cost-effectiveness of distributing correction glasses to workers with presbyopia in a more general setting - in different regions as well as with people in a different occupations. However, given a potential 20% increase in productivity, we strongly believe that this is a charity because that is cost-effective and there is a large funding gap. These all point to the fact that distributing corrective glasses could be yet another low-hanging fruit for effective altruism.

For researchers, we recommend conducting additional RCTs to determine the cost-effectiveness of distributing corrective glasses to workers. Procedure-wise and sample size we see that Reddy et al. provide a good example of how a successful study would look like. Glewwe and Schaffner provide us with a good example that researchers should ensure participants' motivation aligns with the metric the study uses to determine productivity. Additional research conducted in different regions as well as with workers in different occupations would help show

the generality of the productivity increase. Finally, we would like to see a more in-depth account of the total cost of getting corrective glasses (from eye exams to delivery of glasses), as well as a survey on why workers did not acquire glasses by themselves.

For policymakers and charity organizations, we recommend prioritizing distributing corrective glasses at a subsidized rate or for free over other vision-health programs. We emphasize focusing resources where uncorrected presbyopia is prevalent and regions with low income. If it is suitable, we also recommend programs that aim to provide eye-care services, vision impairment diagnostics, and awareness campaigns for presbyopia.

For individual donors, we recommend two charity organizations, Visionspring and Sightsavers. Both are organizations with a focus on vision impairment and have significant room for further funding. Visionspring has a stronger focus on distributing corrective glasses for low-income people and made most of its impact through the QoL gained with corrected glasses as well as the productivity increase because of better vision. On the other hand, Sightsavers has a spread in different programs, and while this allows them to work on multiple issues, at the same time it is harder to quantify their effectiveness. If we must recommend a single charity organization, we will choose Visionspring, due to its focus on the programs that we know will be effective.

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