Visual Impairment and Sustainable Development:

Demand for and Impacts of Surgical Cataract Extraction in Sub-Saharan Africa

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ABSTRACT

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This dissertation is divided into three chapters, all originating from original fieldwork. Chapter One explores the impacts of blindness on blind subjects, their caretakers and their households in Amhara Region, Ethiopia, and demand for cataract surgery among those eligible for surgery. Chapter Two explores the impacts of cataract surgery taken up by the eligible: on the subjects themselves as well as their caretakers and households. Chapter Three explores demand for and impacts of cataract surgery among visually impaired members of the Mbola Millennium Village, located outside of Tabora, Tanzania.

Variables of interest include, for the blind subjects and their caretakers, activities of daily living and time spent in productive activities, social participation, physical and mental health, and, for the blind subjects, vision-related quality of life and food insecurity. At the household level, we explore transfers and assistance, asset index, consumption, and food insecurity.

In Chapter One, we find the blind subjects, their caretakers and households are indeed worse off along many of the above dimensions when compared with matched, non-blind subjects and their households. Among those eligible for cataract surgery in the Ethiopia sample, 76% report for surgery, and we find that gender, age and physical condition are key determinants. In Chapter Two, we find that those who do report for and receive surgery improve along a number

of the dimensions listed above, though rarely to a point equal to their non-blind counterparts. Further, evidence of economic impacts at the household level is mixed. Chapter Three reinforces many of the findings from Chapters One and Two, including gender dimensions to uptake, improved quality of life for visually impaired individuals, and mixed results on economic impacts for subjects and their households.

TABLE OF CONTENTS

LIST OF TABLES

ACKNOWLEDGEMENTS

The first two chapters of this dissertation are drawn from co-authored work conducted in conjunction with Drs. Peter Glick and Jill Luoto of the RAND Corporation, as part of a report prepared with RAND Health for the Himalayan Cataract Project, entitled *The Costs of Blindness and the Impacts of Cataract Surgery*, submitted in October of 2014. I would first like to thank Peter and Jill for their wonderful support and collaboration, before detailing the roles of each author in the first two chapters, which follows below. This work builds upon the work of the third chapter, which was entirely my own work and pre-dated the above study, which itself followed a qualitative study also sponsored by the Himalayan Cataract Project and conducted entirely by myself in the Mwandama Millennium Village, located outside of Zomba, Malawi, the results of which are not reported here.

Though Dr. Peter Glick was the project lead, I helped to conceive the study from which the first two chapters emerge, oversaw most of the fieldwork (including exploratory research, screening, training, implementation, data entry and the intervention itself), contributed to questionnaire development, conducted most of the data cleaning and analysis presented here, and made significant contributions to the writing, particularly the uptake sections. Jill Luoto contributed to questionnaire development and data analysis, focusing primarily on analysis of individual data (e.g. data collected directly from blind subjects and their caretakers), while I handled all other data analysis (including household datasets and any other data collected). Additionally, any analysis related to uptake was entirely my own, from conception, to questionnaire development, to implementation and data analysis to writing. I also reorganized and restructured all of the report into the first two chapters presented here, including revisions and re-writing as necessary, and added all Propensity Score Matching analysis and write-up.

In addition to the work outlined above, Professor Tefera Belachew (Jimma University, Ethiopia) participated in the formative research and contributed to questionnaire design and analysis for the baseline. Dr. Alemu Kerie MD (Woldiya Hospital) participated in formative research, oversaw the vision screening, trained enumerators in medical aspects of the interviews, and participated in the formative research. Seifu Tedesse (JaRco consulting) participated in the formative research and managed all aspect of the baseline survey implementation for JarCo. He and Mengistu Kefale managed the follow-up survey. The team has received substantial guidance from Drs. Geoffrey Tabin and Matt Oliva of the Himalayan Cataract Project.

Indeed, we would like to thank Drs. Geoffrey Tabin and Matt Oliva of the Himalayan Cataract Project (HCP) for guiding this study and providing many important insights into its design. We are grateful for the financial as well as logistical support provided by HCP for the survey, and thank Job Heintz and Emily Newick of HCP for their support. Dr. Alemu Kerie of Woldiya Hospital provided expert advice as well as substantial time on this project and was integral to its success. We thank the expert staff of JaRco consulting for their work in carrying out the survey and would especially like to recognize the work of Seifu Tedesse who managed the survey implementation and Mengistu Kefale, who also worked on implementation for the follow-up as well as managing data entry.

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DEDICATION

To WZR

INTRODUCTION

Surgical cataract extraction has long been recognized among the most cost-effective public health interventions available (e.g. World Development Report, 1993). Previous studies have demonstrated cost-effectiveness in developing countries as low as $90 per DALY averted (Lansingh et al., 2007), while numerous studies have also documented positive impacts on quality of life in various different settings (Ellwein et al, 1995; Fletcher et al., 1997; Brown et al., 2001; Leplege & Schemann, 2010; Polack et al., 2010). Meanwhile, a handful of more recent studies have sought to measure effects on other outcomes such as time use (Polack et al., 2010), activities of daily living (West et al., 2002) and poverty (Kuper et al, 2010).

Despite these widely recognized positive impacts, there remains an undersupply of cataract surgeries worldwide, especially in low-income countries where health systems are underdeveloped and patients oftentimes cannot afford even the most subsidized of interventions., due to both individual and household poverty as well as general issues of access to persons living in these low-income settings, with their infrastructural deficits. In these same regions, still others do not take up the surgery even when it is offered free of charge, including when indirect costs and opportunity costs are carefully minimized. The result is a persistent and growing backlog of approximately 20 million individuals needlessly blind from cataracts, representing fully half of the total number of blind worldwide (Pascolini & Mariotti, 2011) – a nontrivial portion of the overall global burden of disease.

The largest of its kind, this study sheds increased light on the myriad positive impacts of cataract surgery on a population of blind individuals who are a part of this backlog, and expands the range and power of impacts examined on both the blind patients who undergo the surgery and also their caretakers and other household members at large. Variables examined include

time allocation and activities of daily living, social and economic indicators, food security and quality of life, and mental and chronic health indicators, among others. First, though, the study seeks to estimate the cumulative impacts of blindness on individuals and households through a separate comparison with randomly selected, similar households unaffected by blindness. Then, it builds upon existing research on the demand for cataract surgery, re-visiting households when blind members referred for surgery did not present to the surgical eye camp and conducting an interview to examine their reasons, before offering a second opportunity to receive surgery in a satellite eye camp location. Finally, an additional study is added examining all levels of visual impairment in the Mbola Millennium Village in Tanzania, and the demand for and impact of cataract surgery there as well.

This dissertation tests for impacts of cataract surgery by comparing outcomes across individuals eligible for cataract surgery with those who are not, using approaches from Difference-in-Differences (DID), Instrumental Variable (IV), and Propensity Score Matching (PSM) modeling, providing estimates for both the actual effect of the treatment on the treated (TOT) as well as on intention to treat (ITT).

Background

Blindness is defined by the World Health Organization as having best corrected visual acuity (BCVA) in the better eye worse than 3/60 (20/400). Vision this poor is severely limiting, resulting in a disability weight of 0.570 for blindness due to cataracts and up to 0.600 from other causes such as glaucoma (WHO 2004). According to the latest estimates (Pascolini & Mariotti, 2011), over 39 million persons suffered from blindness worldwide in 2010, comprising

approximately 0.5% of the total world population in that year, with cataracts as the leading cause by far at 51% (the 2nd-leading known cause is Glaucoma at 8%).

A cataract is a clouding and opacification of the eye's lens. The exact causes and mechanisms for cataract development are not fully known, but the key risk factor is age. In fact, everyone will develop cataract if they live long enough, though the exact timing of onset varies somewhat for unknown reasons. Blindness from cataracts, however, is both preventable and reversible. In more developed regions with better access to healthcare systems, cataracts are detected early and removed before achieving much visual impairment using modern surgical approaches such as phacoemulsification and laser surgery. While these techniques tend to be cost-prohibitive and not readily available in many developing regions, alternatives such as Manual Small-Incision Cataract Surgery (M-SICS) reduce these costs tremendously, offer similar results under best circumstances, and can be performed by local ophthalmologists or even specially trained cataract surgeons without full medical skills or certifications.

Nevertheless, there are still great disparities in blindness worldwide based on access to eye care and quality of cataract surgeries available. In the African region, for instance, the percentage blind is 0.7%, among the highest worldwide (Pascolini & Mariotti, 2011). The national prevalence of blindness for Ethiopia, meanwhile, is over double this African average, coming in at 1.6% nationwide (49.9% due to cataracts), with an estimated 1.4% blind in Amhara (Berhane et al 2006), the region in which this study takes place.

Uptake rates for cataract surgery vary widely in low resource settings, oftentimes depending on direct and indirect costs associated with access to the surgery. Numerous studies have identified direct costs of medical services as a major barrier to cataract uptake in developing countries (Dean et al 2001, Gyasi et al 2007, Johnson et al 1998, Melese et al 2004,

Rabiu 2001), though Kessy & Lewallen found that 40% who stated poverty actually had other reasons for not accepting surgery. Other studies have emphasized the importance of indirect costs such as transport, food and/or lodging (Johnson et al 1998, Melese et al 2004, Rabiu 2001, Razafinimpanana et al 2012), as well as the lack of an escort to accompany patients to the hospital (Gyasi et al 2007, Johnson et al 1998, Melese et al 2004). As a result, some studies have demonstrated that those living further from hospital are less likely to take up surgery, at least when transport is not provided (Courtright et al 1995, Razafinimpanana et al 2012).

Even when these costs are minimized, however, numerous patients still fail to take up the opportunity for surgery, and acceptance rates rarely approach full participation. One common reason is fear (Dean et al 2001, Gyasi et al 2007, Johnson et al 1998, Rotchford et al 2002), which seems to be counter-acted when the subject already knows someone else who had a successful outcome (Courtright et al 1995), though even rumors to the contrary can be enough to keep still others from presenting (Briesen et al 2010a). Usually those whose vision is worse (binocular, blind, worse VA, etc.) are more likely to present (Melese et al 2004), or their vision-related quality of life (Briesen et al 2010b). That said, sometimes patients simply do not want the surgery, or it opposes sociocultural beliefs they may hold (Chibuga et al 2008, Gyasi et al 2007, Rotchford et al 2002). Finally, it is important to note that women and elderly have been found in some instances to be less likely to take up surgery than their male or younger counterparts, which will be looked at more closely below in the pages to come.

CHAPTER ONE:

Impacts of Blindness and Demand for Cataract Surgery Among Rural Blind in Amhara, Ethiopia

This chapter introduces the study that will be covered in the first two chapters, and focuses on the effects of cumulative blindness of any kind across a variety of factors, at both individual and household levels, in poor rural settings. It concludes by examining demand for free cataract surgery for those whose blindness can be cost-effectively reversed.

Section 1.1: Background

Of the approximately 39 million blind people in the world--the vast majority of whom live in developing countries--half or more are blind due to curable cataracts (WHO 2010; Resnikoff 2004). Blindness and visual impairment in poor countries can have enormous negative impacts on the quality of life, as well as reducing life expectancy. Research indicates an association of blindness and poverty (Kuper et. al. 2010), due to poverty itself and issues of access to healthcare correlated with poverty. Further, research on disability suggests that blindness may lead to an individual's loss of social standing and isolation from the community, as is found in developed economies (Vale et al. 2004). Blindness also clearly imposes costs on others beside the blind person. In most poor countries social services for the blind are limited or non-existent, so the burden of care falls solely on other family members or the community. The individual responsible for helping a blind family member may be another adult or possibly a child—meaning that an additional individual is less able to work or possibly, that a child is unable to attend school. In extreme circumstances, illness has even been shown to increase risk of death of the caregiving partner for the ill individual, which could result in increased likelihood of widowhood for the disabled (Christakis & Allison, 2006).

Although the great majority of cataract blindness cases can be cured by simple surgical procedures with very high success rates in developing country contexts, sight restoring surgery remains significantly underfunded, with a backlog of millions of curable cataract blindness cases globally, including over 3 million in Africa alone. Contributing at least partially to the relative lack of attention and resources allocated to vision impairment and cataract blindness in developing countries is a lack of comprehensive information on the costs of blindness to individuals, families, and communities—and consequently, on the true societal benefits to interventions to restore sight. There is very little direct information on these costs. Research in developing countries has also failed to systematically consider the broader, non-economic impacts of blindness on individuals. These may include significant impacts on other aspects of physical health, operating through blindness-related poverty or neglect, as suggested by associations of blindness and earlier mortality in poor environments (Pion et. al. 2002; Taylor et, al 1991). Nor do we understand the impacts of blindness on an individual's emotional well-being, social status and social exclusion.

When it comes to impacts on families, the information gaps are even greater. No prior research in developing countries, to our knowledge, has attempted to directly measure how blindness affects families through the impacts on the time and productivity of other adults in the family or through impacts on emotional health and social isolation of family caregivers—who in poor countries with few social services often bear the full burden of providing care to the blind.

It follows that there is also very little information on how cataract surgery can change these outcomes, both at the individual and family level. This information is important since it can be used by policymakers to assess appropriate investments in resources to provide cataract

surgery in low-income countries, given resource constraints and other health care needs of their populations.

Study Objectives

In light of the information gaps just described, the Himalayan Cataract Project sought to carry out research to gain a better understanding of the costs of blindness in the developing world and the effectiveness of surgical interventions to restore sight. The specific study objectives are to:

1. Understand the economic impacts of blindness on households from lost productivity in income generating and other productive activities, of the blind as well as of their caregivers.
2. Estimate the effects of blindness on the health and nutrition, performance of activities of daily living, and subjective quality of life and mental health of blind individuals and caregivers.
3. Investigate the burden of blindness among family members, including spouses and adult children (who may sacrifice work or leisure time), and children (who may sacrifice schooling).
4. Understand the reasons why many blind adults do not utilize available screening or cataract surgery services.
5. Provide reliable estimates of the impact of sight restoring surgery on these outcomes and the economic impacts of such surgery in a resource poor setting, and why among those getting surgery, some benefit more or less than others in terms of the above outcomes.

This chapter will focus on the first four study objectives listed above, while the next chapter will examine the fifth study objective.

The baseline survey, carried out in April-May 2012 as noted above, itself forms a unique source of information on the situation of the blind and their households. The survey targeted 1298 blind older adults, of whom 698 were cataract blind, as well as an additional 500 non-blind older adults. A range of information was collected, including on physical and emotional health, social participation and time use, household livelihoods and food security, community support, caregiver well-being, and self-perceived impacts of vision loss on the individual and family. The survey was implemented just prior to the surgery intervention, which operated on about 480 eligible study participants. Few if any other studies in the developing world have gathered such rich, relatively large scale, survey data on the lives and well-being of older vision-impaired adults as is provided by the baseline survey for this evaluation. Further, the collection of information on a random sample of non-blind older adults and their households in the same communities permits comparisons of blind and similar non-blind individuals and families, shedding direct light on the impacts of vision loss and the needs of the blind. This chapter examines in detail the findings from the baseline study, including the impacts of blindness and the demand for cataract surgery.

Section 1.2: Data

The study followed a sample of older blind adults in North Wollo Zone, Amhara Region, Ethiopia over a period of one year. In the baseline survey, carried out in April/May 2012, blind individuals aged over 40 and their families in randomly selected communities in two districts in North Wollo were interviewed in their homes. In a prior home-based screening conducted shortly before the survey, approximately half (698) were diagnosed with cataracts, while the rest were

blind from other causes such as glaucoma or trachoma. After the interview, individuals with cataracts were informed of a surgical intervention to be held in the regional center, Woldiya, and offered free transportation to surgery. 523 of 698 screened cataract cases came for surgery. Upon further examination 484 were deemed operable and given surgery during the intervention, conducted by the Himalayan Cataract Project. The survey work was carried out by JarCo Consulting, a survey firm based in Addis Ababa.

The baseline survey also targeted a group of 500 comparable *non-blindness affected* households randomly selected from the same locations. Comparison of the blind with this group provides a picture of the cumulative impacts of blindness.

Questionnaire Design

To help our understanding of the situation of the blind in the region and to inform the development of the survey questionnaire, semi-structured interviews were carried out with blind older adults and their family caregivers in rural areas around Woldiya in December 2011. Blind individuals and their family members spoke openly about their situations. These interviews suggested deep emotional stress and social isolation, significant loss of family income, and heavy burdens on caregivers. Following the formative research phase we began the process of designing the survey instruments and devising the sampling procedures for the survey. Each is described in turn below.

Survey Instruments

The baseline and follow-up surveys were for the most part the same, and consisted of a household questionnaire, a blind person (BP) questionnaire, and a caregiver questionnaire. The

following describes the baseline questionnaires; changes for the follow-up are noted in Chapter Two.

The Household Questionnaire was administered to the household head and spouse (one of whom was often the blind person). It contains demographic, education and work information of household members. Detailed time allocation information is collected, including time caring for the BP. It includes an asset questionnaire, a detailed consumption module and a shortened version of the 9-item Household Food Insecurity Access Scale or FIAS (Coates et al. 2007). Information on transfers of labor and resources from other households and the local government was collected.

The Blind Person Questionnaire gathers information on:

- Physical health: chronic disabilities/illness and recent illness and care-seeking; ability to carry out activities of daily living; objective data on nutritional status (height, weight, arm span)
- Activities: including work, frequency of various social activities, membership in church and other community organizations
- Emotional well-being, using the 20 question Center for Epidemiologic Studies Depression Scale (CES-D), adapted for the setting after piloting.
- Food security, using an adaptation of the FIAS to measure individual food insecurity (which may differ from household level food security due for example to discrimination against the blind in resource allocation within the household)
- Impacts of vision loss, using self-rated vision status as well as the 20 question Vision Related Quality of Life Scale (VRQOL; WHO), adjusted for the population based on piloting. This module also asks the blind person how his or her blindness has affected him

or her and the household in different dimensions, including social participation, assistance to the family from other households, feelings of physical security, respect from others, and changes in assets of the household.

The Caregiver Questionnaire was given to the individual who is most responsible for looking after the BP, typically a spouse or a daughter, and usually female. The questionnaire consisted of two modules. The first collected information on physical health, activities and social interaction, and emotional well-being like those given to the BP, with necessary adjustments. The second asks the caregiver directly about various potential impacts of the blind person's disability on the caregivers' own life and on the family: level of work and social participation, impacts on other family members, and effects on physical security and overall household well being

In the BP interview, questions about physical and emotional health were asked before discussing the impacts of poor vision. Earlier studies (Polack & Kuper, 2009) tend to ask instead how vision has affected these outcomes. This is potentially suggestive, leading respondents to attribute to vision loss outcomes such as isolation or inactivity that may be caused by other age-related health problems. Asking general questions about physical and emotional well-being before asking how vision loss has affected the respondent's life will allow, in the statistical analysis, a more reliable assessment of differences in these outcomes between blind and non-blind people, and between pre- and post-surgery situations of operated cataract cases.

For the non-blindness affected households in the baseline survey, it was decided to randomly select one older adult to be given the same modules as the blind person, with necessary adjustments and deletions (in particular the question on vision loss and its impacts are dropped unless the targeted respondent has some vision impairment). This sample would provide the

comparison group to the blind study participants. Similarly, it was decided to ask who in such households would take care of the selected older adult if he or she became blind or otherwise disabled. This individual, referred to in the report as a 'potential caregiver', would be given the caregiver module, again with appropriate changes.

Finally, to understand community perceptions about blindness, a short (19 question) module was designed to be given to a randomly selected adult 15 or older in each non-blindness affected household. The questions ask about, among other topics, their understanding of the causes of blindness, whether the blind should be helped and by whom (family, community, government), whether more should be done to help them, if they personally know a blind person, and whether they are comfortable around blind people.

The field test of the questionnaire took place in one village (not part of the final sample) that had been visited as part of the screening in the first week of March. The field test involved fifteen households and was carried out using four survey supervisors as enumerators. The field test suggested the need for a number of revisions to the questionnaire. A general finding was that the mostly old and illiterate blind respondents had trouble understanding many questions, even those that had been designed for use with other poor populations. This necessitated considerable rephrasing of questions for the revision of the instruments, and in some cases questions were dropped. For example, some of the items in CES-D depression scale—which has been used in many environments including among adolescents in Ethiopia—were dropped and others rephrased. Ultimately 13 of the 20 questions of the scale were retained. While we were concerned about the effects of this on the psychometric properties of the scale, this was preferable to leaving in questions that were simply not well understood and would hence have rendered the overall scale much less reliable.

It also sometimes proved difficult to talk to the blind person (and their caregiver) privately. Privacy is desirable because a few of the questions are sensitive, such as whether your family respects you and whether you get enough to eat. As in many survey situations, other family members as well as neighbors wanted to observe the interview. Appropriate and courteous requests generally proved sufficient to obtain the desired privacy and these were incorporated in the training. However, we added a question to the blind person and caregiver modules for the interviewer to indicate whether the respondent was interviewed alone. Further, in several cases, the blind person was unwell and not able to answer the questions for him or herself. We created a space for the interviewer to note this as well. The field test also made clear the need for interviewers to be patient with this study population and explain questions clearly. The questionnaires were revised based on the above findings.

Sampling and Screening Procedures

Finding a large, representative sample of blind individuals is challenging. Even in high prevalence setting such as North Wollo, blindness is relatively rare (estimated to be 1% of the overall population and perhaps 3% of older adults, based on various surveys). A small community may have at most a few older blind adults, and these communities and the households in them are widely dispersed geographically in this part of the country. Initial power calculations, based on prior estimates of blindness and cataract prevalence among rural older Ethiopians, indicated that we would need to interview at baseline a sample of about 1,400 blind adults, on the assumptions that about half would be cataract blind and that of this group 80% would be operated during the intervention. This implied the need to sample over an area encompassing a total population of slightly less than 200,000 people, or, based on estimate average kebele (village) size, about 40 kebeles.

The sampling strategy for the baseline survey had to locate this number of dispersed blind individuals cost-effectively, which ruled out a household-based sampling strategy whereby enumerators would canvass door-to-door all domiciles in a given kebele and test the vision of their household older members. Rather, we employed community detection methods, whereby knowledgeable informants in each visited goth (sub-village, with about 150 households each) were used to locate blind adults.

We randomly selected 24 kebeles in Meket district and 16 in adjacent Wadla district. Trained ophthalmologic nurses under the direction of Dr. Alemu Kerie carried out the screening, which took place over a period of about one month starting in mid-February, with logistics and oversight from JaRco. Blind individuals were asked to participate in the survey and given a preliminary vision screening and asked a few questions about their condition, and told that they would be revisited soon by someone who would discuss the screening results with them. Screening personnel reported that there were no more than a small handful of refusals. Ultimately 1,526 blind adults were found in these 40 kebeles, of which 698 had cataracts according to the preliminary screening diagnosis. GPS coordinates were taken to facilitate re-contact by the survey. The results of the screening were entered into an Excel database by JaRco.

Sampling non-blindness affected Households:

Procedures were also devised for sampling the 500 comparison households without a blind adult, as follows. The number of non-blind households for each kebele was chosen in proportion to the share of the blind sample to be interviewed from the same kebele. In each kebele, not all goth or sub villages had a blind person, as revealed by the systematic screening of the kebele. Therefore the non-blind households in the kebele were drawn only from the goths

that the teams were going to visit to interview blind participants. This was helpful logistically, since it minimized travel by foot between goths, which were often quite far apart. A lottery method was used to choose the non-blind households in each goth (usually only 1 or 2), under which the team supervisor would work with a local informant to list all the families in the goth, and then randomly choose the number needed. The interviewers would go to each selected house and establish if there was an individual over age 65 living in the household; if not, they would move on the nearest domicile and ask the same question of the residents of that household, and so on until an older adult was found.

Once a non-blind household was selected in this manner, the interviewer would list the household members. If there was more than one individual over age 65, the individual to be interviewed was randomly selected from this group using a lottery. The names of the individuals over 65 were written on sheets of paper, folded, and put on a plate, and then one sheet was picked up, which be the 'older adult' to be interviewed. Next the interviewer asked which person in the household would take care of the designated older adult if he or she was disabled; this individual was given the caregiver questionnaire, as noted above.

Finally, for the attitudes toward the blind module, we interviewed one randomly selected adult from each non-blind household. To choose this person the lottery method was used again, this time selecting the person from all individuals 15 or older in the household.

Baseline Survey Implementation and Surgery Intervention

Just prior to the main fieldwork, the 25 interviewers underwent training in Meket under the direction of Seifu Tedesse from JaRco and the survey supervisors. The fieldwork began on April 7 and lasted through May 4th. Attempts were made to revisit and interview all of the 698 cataract blind and their households, and 600 other blind individuals and their households

randomly selected from the non-cataract blind participating in the screening. However, not all of these individuals could be interviewed, for several reasons, including that the household or blind person was no longer willing to be interviewed, could not be found, or, as in 11 cases, was reported to have died (the advanced age of the participants—average over 70 years—should be kept in mind). Since the screening covered more non-cataract blind than were selected for the survey, it was possible to replace 21 such households that were not available for interview. Ultimately, the interviewed blind sample consisted of 1234 individuals, of whom 666 were cataract blind and 568 non-cataract blind. The non-blind sample consisted of 490 individuals.

After the interview, those who had been diagnosed with cataracts were advised of the surgical intervention and told that free transportation, from the nearest paved road or the center of the kebele, would be provided. The non-operable were advised of their condition and told about other kinds of care, if any, they might receive at the eye hospital in Woldiya[1].

Two changes to procedures for selecting the non-blind sample were made during the survey. First, the minimum age for selection was raised from 65 to 70 to better match the mean age of the blind sample (73). Second, it appeared initially that the gender balance of older adult non-blind respondents was heavily tilted toward men. Therefore stratification on gender was used: in each kebele, the non-blind households were selected to alternately have an older male and older female interviewed.

The high volume cataract surgery intervention was carried out in Woldiya Hospital during May 4-10, 2012 by the Himalayan Cataract Project team, working with Dr. Kerie and his staff. Screened patients from rural Meket and Wadla districts were transported to Woldiya for free by bus. Local administrators in the kebeles were notified ahead of time when the transport

[1] The non-cataract blind who were not selected for the interview were also visited by the teams to be informed about their diagnosis.

would arrive and were requested to notify the operable participants of the date and time to assemble for pickup.

The intervention carried out more than 1,100 manual small incision cataract surgeries (MSICS) over a one-week period. The surgeries were open to all clinically-eligible patients, not just those in the study. Of 698 cataract study patients in our baseline who were offered surgery, 438 initially reported to Woldiya for surgery (63%), of which approximately 400 received surgery. Reports from post-operative exams suggested very high success rates in terms of restored good vision.

A 63% uptake rate is not low by the standards of such interventions. However, this left many potentially operable individuals without treatment that could dramatically improve their lives. Therefore even while the main surgery intervention was still going on, it was decided to make additional efforts to reach out to 'decliners' (those who for one reason or another did not come to be picked up for transport to Woldiya at the appointed time) and offer a second opportunity for surgery. This time the surgeries were carried out at a smaller satellite eye camp more centrally located to Meket and Wadla districts, in the town of Flakit, where a makeshift eye hospital was set up in a health clinic. Screeners attempted to visit all referred participants who had missed the transport to Woldiya. Although transport was not directly provided for the second opportunity for surgery, participants were told that they would receive a travel subsidy at the clinic. This process began within days of the start of the intervention. A number of challenges were faced in Flakit, including in particular lack of reliability of electricity.[2] These are common problems in such environments and demonstrate why the main, intensive surgery intervention was located in more distant but developed Woldiya.

[2] Based on discussion with Dr. Alemu Kerie, who oversaw the camp.

We used this opportunity of these revisits to explore the reasons for non-take up. The problem of low take-up of cataract surgery has long been noted (Rotchford et al 2002, Dean et al 2011, Gyasi et al 2007). Therefore a short questionnaire was quickly developed for the screeners to administer that gathered information on reasons for not coming to the meeting place for surgery transport (which could be an hour's walk or more from the home). The questionnaire is described and the results analyzed below.

Ultimately screeners were able to visit the homes of and conduct the short survey with 192 of the referred baseline participants who missed the initial transport to surgery. Of this group, 42 agreed to come to surgery and all were operated on. This means that in total 523 of our eligible baseline sample came for surgery, of which 484 were deemed operable on further examination and given surgery. Hence the ultimate rate of uptake was 76% (defining 'uptake' as coming in for further examination and surgery). The experience also suggests that having follow-up eye surgery camps is a potentially valuable option for increasing uptake following an initial intervention, despite infrastructural and logistical challenges.

Section 1.3: General Characteristics of the Baseline Sample

We begin the discussion of survey results by describing the characteristics of the individuals in the sample and their households, distinguishing between blind and non-blind, as well as between the cataract and non-cataract blind. Before discussing the results, we note a few general aspects of the presentation in what follows. The analysis throughout compares both blind to non-blind and, within the group of blind, cataract to non-cataract blind, testing statistically for differences in means or distributions of variables across these groups. Men and women are also usually compared. To avoid cluttering the presentation with an excess number of results, for many of the tables we only present blind and non-blind comparisons, typically by

gender. Important differences between cataract and non-cataract blind are noted in the text, however. Also to avoid clutter, we show only the point estimates (means or proportions) in the tables, not standard errors. However, we report in the text results of statistical tests of differences across groups.[3]

As noted above, one objective in comparing outcomes for blind and non-blind individuals and households (for example, work, social participation, and food security) is to understand the cumulative effects of blindness. Since blind and non-blind samples differ along some dimensions—notably age—that may also affect these outcomes, simple comparisons of means may be reflecting these differences in characteristics, not simply blindness. Therefore we also report blind-non-blind differences estimated in probit or linear regression models[4] with controls for age, having any formal education, number of living sons and daughters, and location (kebele). We also note differences between cataract and non-cataract blind controlling for these characteristics where they occur. Finally, we also utilize Propensity Score Matching (PSM) techniques to provide an additional check to the data and results.[5]

Table 1.1 displays basic characteristics of the blind older adults in the sample and their non-blind counterparts in comparison households. The sample is slightly disproportionately

[3] The tables also include sample sizes for the subgroups presented. These vary slightly over different tables or surveys questions due to missing or implausible values for some questions.

[4] Probit is used for binary outcomes such as work participation while linear regression is used for continuous outcomes such as the depressions scale. In the case of probits, we report the effect of blindness as the difference in the probability of the outcome (e.g., working) between blind and non-blind, calculated at the means for the control variables. The control variables indicated in the text are pre-determined characteristics that may affect the outcomes but are not themselves determined by blindness. Hence they do not include factors such household composition or assets, which may be affected by blindness.

[5] PSM variables and modeling is conducted according to Austin (2011). After many trials, variables included for PSM are as follows: gender, age (including higher order age interactions), education (including higher order education interactions), whether subject is head of household, religion, and living number of children and siblings. The psmatch2 command was then used in STATA, with nearest neighbor matching (without replacement). Common support for the variables in this model and specification provided the desired results for a matched sample according to Rubin (2001), including a Rubin's B value <25% and Rubin's R between 0.5 and 2.0, and standardized bias for each variable at or under 5%, except for the living siblings variable, which was at a still acceptable level of 12%.

female for both blind and non-blind subgroups. The average age of participants is about 76 years for cataract blind and 70 for those blind for other causes, and about 70 for the non-blind. The age difference between cataract and non-cataract blind is what one would expect to observe in an essentially randomly selected sample of blind adults over 40 (which is what the community detection method for the sampling should achieve).

Table 1.1 – Characteristics of the Sample (Blind Individuals and Comparisons)

	Cataract Blind	Non-Cataract Blind	Non-Blind
Female (share)	0.57	0.55	0.57
Age (mean years)	75.7	70.4	70.8
Education (mean years)	0.06	0.10	0.10
Any formal education (share)	0.02	0.02	0.02
Married (share)	0.30	0.37	0.61
Household size	5.19	4.96	4.36
Years bilaterally vision impaired (median)[a]	2.00	7.00	_
Consulted formal health care provider (share)	0.17	0.34	_
Household is engaged in farming (share)	0.98	0.97	0.98
Household has an enterprise (share)	0.08	0.08	0.06
Household owns land (share)	0.98	0.98	0.98
Household owns large animals (share)	0.83	0.76	0.88
# of large animals	5.17	4.34	5.66
Asset Index	0.036	-0.084	0.044
N	653	564	479

[a] Years since vision become impaired in the most recently affected eye

Cataracts are very highly age-related while other sources of blindness include age-related causes as well as others that are less tied to age, such as trauma or infection.

Respondents were asked in the initial screening when they first had trouble seeing out of each eye. The table shows median years since vision become impaired in the most recently affected eye. Given that the screened individuals were all bilaterally blind, this marks the date

when vision in both eyes had become impaired, so serves as an approximate measure of the onset of significant functional impairment from bad vision. The median time is much longer for non-cataracts—7 years as opposed to 2 years for cataract cases. This too may be explained by the very strong correlation of age and cataract, or conversely, that some cases of blindness from other causes started earlier in life.

Relatively few individuals reported seeking help from a formal medical provider for their condition. However, the share is twice as high for non-cataract blind than for cataract blind (34% vs. 17%), possibly because the former suffered from pain or irritation, e.g., from infection, or because they have been afflicted longer. Overall, the figures point to a lack of accessible services in the region before the opening of the eye hospital in Woldiya, and possibly, lack of information about surgery for cataracts.

This sample of older, poor rural adults is essentially uneducated: only 2 percent have any formal schooling, so mean years of schooling (in the preceding row) are close to zero. Larger shares, though still 10% or less, have had some form of instruction, including church or mosque schooling or literacy training. With respect to demographic factors, a significant difference between blind and non-blind is that a much higher share of the latter are married—61% as opposed to 30% and 37% for cataract and non-cataract blind, respectively. Households are somewhat larger for blind adults, which is likely due to a significant share of the blind moving into other households, e.g., of their children, to be better cared for.

Other household characteristics in Table 1.1 capture livelihoods and assets. Virtually all households, blindness-affected or not, are engaged in farming, which is the overwhelming source of production or income in the area. Almost all own some farmland and most households own ‘large’ livestock (defined here as animals other than chickens, and including cattle, goats, and

oxen). The share, however, is somewhat smaller for the blind, and especially the non-cataract blind; the latter have been vision impaired, hence less able to manage livestock or make ends meet, longer, and thus more likely to have sold off animals. Overall, however, households with blind older adults are generally engaged in economic activity, even if, as we will see below, the blind themselves are not.

Finally, the asset index is a measure of household wealth based on information on assets owned by the household. Specifically, following the methodology of Sahn and Stifel (2003), we use factor analysis to construct an asset index using information on ownership of durable goods such as radio, furniture, cell phone, and bicycle, as well as the source of drinking water (if the household has access to a shared or private tap) and toilet facilities (if household has access to a latrine), and materials used in the construction of the domicile.[6] By construction, the index has a mean of zero so can be negative or positive. As seen in Table 1.1, the index is comparable for cataract blind and non-blind households (about 0.04 in both cases), but slightly lower for non-cataract blind households (-0.08.) Put another way, households with blind older adults from non-cataract causes have lower consumption related assets just as they have somewhat fewer livestock, which again may reflect the effects of a longer duration of vision impairment. We should note, however, that the mean difference in assets between non-cataract blind and other households is quite small, amounting to only 0.15 standard deviations of the index.

Table 1.2 presents characteristics of caregivers of the blind person and potential caregivers of the comparison older adults in the non-blind households. Recall from above that a

[6] The survey also detailed data on consumption of and expenditures on food and non-food items, which can be used to construct a consumption-based measure of household welfare (expenditures per capita). Due to the complexity of data cleaning for the consumption data, this was not done for the baseline survey report. However, it will be done for the planned follow-up to allow measurement of changes in household consumption as a result of cataract surgery.

potential caregiver is the person in non-blindness affected households who would take care of the sampled older adult in that household should that person become blind or disabled. Caregivers of the blind (i.e., actual caregivers) are disproportionately female, with just one quarter of them men. They are much younger on average than the blind individuals they care for: in both cataract and non-cataract blind households, caregivers are about 40 years old on average. This is not surprising as many caregivers are the children of the blind individual, in particular, daughters. Also reflecting their younger age, caregivers are somewhat better educated than the older blind persons, though still largely uneducated: only about 14% have some formal education.

Table 1.2 – Characteristics of Caregivers and Potential Caregivers

	Caregivers to Cataract Blind	Caregivers to non-Cataract Blind	Caregivers - all Blind	Potential Caregivers in non-Blindness affected Households
Female (share)	0.76	0.72	0.74	0.67
Age (years)	40.4	39.3	39.9	39.7
Any formal education (share)	0.13	0.15	0.14	0.26
Married (share)	0.69	0.65	0.67	0.58
N	661	573	1234	479

Potential caregivers are also 40 years old on average, though are less disproportionately female than actual caregivers for the blind (67% vs. 74%) and less likely to be married (58% vs. 67%). A larger share (26%) has been to school. Overall, however, caregivers and potential caregivers are reasonably similar, indicating that the latter should fairly well represent the situation of the caregivers had they not been living in a blindness-affected household.

Section 1.4: Results

Situation of and Impacts of Vision Loss on Blind Individuals

Living Situation of Blind Older Adults

We first examine the living situation of the blind compared to non-blind older adults. Table 1.3 shows that blind respondents are much less likely to be married and more likely to be widowed than the non-blind. Among men, 57% of the blind are married compared to 88% of their non-blind counterparts, and 25% are widowed compared with only 6% of non-blind men.

Table 1.3– Living Situation of the Blind and Comparisons (shares)

	Blind		Non-Blind	
	Male	Female	Male	Female
Marital status:				
Married	0.57	0.14	0.88	0.41
Widowed	0.25	0.63	0.06	0.42
Divorced	0.11	0.17	0.03	0.12
Separated	0.05	0.04	0.01	0.03
Single	0.02	0.02	0.00	0.01
Living with an adult child	0.62	0.65	0.65	0.63
Marital status changed due blindness	0.30	0.41	__	__
Moved due to blindness	0.31	0.45	__	__
Others moved in or out of blind person's household due to blindness	0.11	0.11	__	__
N	541	699	204	275

Among women, only 14% of the blind are married compared to 41% of the non-blind, while 63% of blind women are widowed compared with 42% of non-blind.

These differences between blind and non-blind in marriage and widowhood, for both sexes, are very large. After adjustment for age and other covariates (see previous section), blind older males and females are still each about 25% less likely to be married than their non-blind comparisons (p=0.00). Widowhood differences fall after adjustment, to about 13% for men and

19% for women ((p=0.00). PSM analysis does bridge this gap a little as well, but still over 40% of the blind matched sample remains widowed, compared to just 26.7% of their non-blind counterparts. This adds further support for the possibility of increased widowhood as an outcome of blindness, as suggested by Christakis and Allison (2006).

With respect to the share married, part of the difference between blind and non-blind is accounted for by the higher share of divorced or separated individuals among the former. For example, 16% of blind men are divorced or separated compared to 4% of non-blind men; the corresponding figures for women are 21% and 15%. This is consistent with responses to a direct question about changes in marital status due to one's blindness: a substantial share of blind respondents (30% of men, 41% of women) said that their marital status changed as a result of blindness. Nevertheless, it is possible that the sampling of non-blind households tended to select households with intact older couples, though we see no basis of or evidence for this.

Potentially related to the higher rates of divorce and separation among the blind, some 31% of blind men and 41% of blind women reported that they had changed households due to their bad vision. It is possible that an older blind person must leave his or her wife or husband to be cared for by a different household, say of an adult child, hence reports that they are 'separated'. In contrast, relatively few blind respondents had other family members move into (or out of) their households as a consequence of their vision problem. Roughly two-thirds of blind men and women live with an adult child, though this is the same for non-blind, hence reflects a general pattern among the elderly in this population.

Economic Activities and Time Use

Information was collected on income generating work and other activities for all household members age 5 and older. As Table 1.4 shows, older blind adults in the sample are almost universally not active economically: no women and just 2% of the men did any work in the last week.

Table 1.4 – Time in Productive Activities of the Blind and Comparisons

	Blind			Non-Blind		
	Male	Female	All	Male	Female	All
Worked in last week (share)	0.02	0.00	0.01	0.39	0.02	0.18
Worked in last week or past year (share)	0.04	0.01	0.02	0.55	0.05	0.26
Hours worked last week for those who worked (mean)	19.75	24.00	20.10	21.11	27.50	21.60
Household has someone who worked in last week (share)	0.42	0.43	0.42	0.48	0.39	0.43
Hours in household work in previous day (mean)	0.16	0.46	0.33	0.38	2.50	1.60
N	541	699	1240	204	275	479

Notes: 'Work' is any productive activity in agriculture, enterprises, or for wages
'Household work' includes food preparation, cleaning, shopping, fetching wood or water, childcare and care of disabled/ill family members

A broader definition of being economically active would include those who say they are not working because it is 'off-season'—a potentially important consideration given the overwhelming importance of agriculture in the area and the fact that the survey (in April-May) took place during a slack season just before the major rainfall. These individuals presumably did work in the past year. However, including them in the definition increases only slightly increases the share of blind men who are economically active, as the table shows.

In contrast, a significant share of the non-blind—at least among men—are still economically active. 39% of the non-blind older men worked in the last week, and 55% worked

in the last year. Adjusting for age and other factors, the difference in mean participation over the last year between blind and non blind men remains at 50% (significant at 99%).

Non-blind women, on the other hand, were generally no more likely to be working than blind women; the adjusted mean difference in participation is 4% (significant at 95%). The table also shows the share of households in which someone (the blind person or others) worked in the last week. This is about the same for blind and non-blind households, indicating that the households in which the blind person lives, though not the blind person him or herself, are as likely to be involved in productive activities as other households with older adults.

Hours in household work in the previous day, also shown in the table, includes time spent preparing food and cleaning house, going to market, fetching wood and water, and caring for children as well as disabled or ill individuals (including the blind person in blindness affected households). As in almost all cultures, women spend substantially more time performing these tasks than men do. Even blind women report a small amount of time per day on average (slightly less than half an hour) in household work, but this is far less than their non-blind counterparts (2.5 hours). Blind men report an average of just 0.16 hours per day in these activities, compared with about 0.40 hours for their non-blind counterparts.

In sum, the data indicate, not surprisingly, that participation in productive activities is substantially, indeed almost completely, compromised by loss of vision. Examination of samples matched by PSM support this analysis, with no significant changes to the results presented above when comparing the matched samples. While somewhat more than half of older sighted men continue to do some income generating or other productive work, almost no blind men do. Women's time in domestic activities is very sharply curtailed by the loss of vision.

Social Participation

A range of survey questions gathered information on the types and frequency of social interactions of blind and comparison older adults. 'Mahiber' and 'Senbetie' are central to rural Ethiopian social life; the former are monthly meetings of the members of the Orthodox Christian church, and the latter are weekly religious gatherings. The survey asks how often the respondent attends such meeting, or equivalent gatherings at mosques for Muslims. While virtually all non-blind older adults attend such gatherings, only 49% of the blind 'ever' go (Table 1.5). There are also significant gender differences among the blind, with females substantially less likely to attend than men (37% compared with 53% for men for attending monthly or more). Controlling for age and other covariates, men who are blind are 40% less likely than non-blind counterparts to ever attend church or mosque (p=0.00), while blind women are more than 50% less likely (p=0.00). The source of blindness makes a difference, with cataract blind men and women 11% and 20% more likely (p=0.006, p=0.00) to ever attend than those blind from other causes. Those with cataract blindness are on average more recently blind, so they may still be attempting to retain previous social activities despite the challenges to doing so.

The other measures shown in Table 1.5 further illustrate the low participation of the blind in various other social activities. Less than a quarter ever attend weddings or funerals, go to market, or visit friends and relatives. Here too, blind women are general less likely than blind men to do these activities (though the differences are statistically significant only for weddings and funerals). For both men and women, mean differences between blind and non blind groups are similar to those in the table after adjusting for age and other covariates.

Table 1.5 – Social Activities of the Blind and Comparisons (shares)

	Blind			Non-Blind		
	Male	Female	All	Male	Female	All
Attends Mahiber or Senbetie or other Church/mosque meetings once a month or more	0.53	0.37	0.44	0.96	0.95	0.96
Ever attends church/mosque	0.56	0.43	0.49	0.98	0.97	0.97
Ever has friends/relatives visit	0.68	0.63	0.65	0.93	0.87	0.90
Ever visit friends/relatives	0.26	0.23	0.24	0.86	0.76	0.80
Ever go to market	0.09	0.10	0.10	0.80	0.61	0.69
Ever attend weddings	0.23	0.17	0.20	0.82	0.71	0.76
Ever attend funerals	0.27	0.17	0.21	0.89	0.83	0.85
N	539	690	1229	202	270	472

Note: "Ever" means at least once in a year.

While PSM does bridge the gap somewhat between blind and non-blind across all measures, it does so only marginally. For example, the percentage of those ever attending funerals increases from 21% to 34% for the matched blind sample, but this is still considerably lower than the non-blind. This represents the largest gains to any of the categories above, with all others increasing between 7 and 10 percentage points at most; the exception is the variable for going to market, which only increases by 3 additional percentage points (to 13%) for the matched blind sample when using PSM.

The data thus suggest that older blind adults have very limited participation in the social life of their communities. Of course, these are mostly elderly individuals whom we might not expect to be very socially active even if sighted, but almost all non-blind comparisons attend church functions and two-thirds or more participate in the other activities discussed. About two-thirds of the blind do report that friends or relatives visit their households (three-quarters using the matched samples), though this also is lower than for non-blind (90%).

Physical Health

The physical health of blind and non-blind older adults was captured through a range of measures, reported in Table 1.6. First, the survey administered standardized questions on the functioning in terms of an individual's ability to perform unaided a range of Activities of Daily Living (ADLs) including personal hygiene and grooming, dressing and undressing, going to the toilet, and feeding. Some ADLs, including those just mentioned, are strictly speaking not dependent on having good vision, hence can be used to measure overall physical health apart from vision disability. The questions were adjusted to make this distinction clear, for example by asking the blind person if they could dress themselves "if clothes were placed nearby" or if they could walk a kilometer "if guided by someone". Other standard ADLs are more dependent on having some level of visual acuity in addition to purely physical capability, for example, tending animals and repairing one's house. In these cases it is not possible to distinguish the difficulty doing the activity that is caused by other disability as opposed to simply lack of sight; there items therefore were not asked of blind participants. Eight of the ADLs in the survey are in the first group (not requiring good vision), and 12 are in the second group (requiring vision). For this analysis we focus on the first group of ADLs, as this permits direct comparison of the physical status of blind and non-blind older adults.

Table 1.6 – Physical Health Status of the Blind and Comparisons

	Blind			Non-Blind		
	Male	Female	All	Male	Female	All
Has trouble performing 1 or more Activities of Daily Living (share)	0.80	0.85	0.83	0.17	0.24	0.21
Activities of Daily Living Index (mean)	0.71	0.65	0.67	0.96	0.95	0.96
Body Mass Index (mean)	18.51	17.87	18.16	19.52	18.86	19.14
Share with BMI < 18.0	0.42	0.54	0.49	0.34	0.36	0.35
Middle Arm Circumference (cm) (mean)	21.59	21.15	21.34	22.47	22.12	22.27
Has 1 or more non-vision related chronic health problem (share)	0.69	0.67	0.68	0.57	0.59	0.58
Number of chronic health problems	1.61	1.62	1.61	1.33	1.40	1.37
N	541	699	1240	204	275	479

To create an index for ADLs we coded the responses for each activity as either: can do it easily (a value of 1), can do it with difficulty (3), or unable to do it (5). We summed the scores across the eight ADLs and then normalized the ADL index so that it takes the value of 1 if the individual can perform all ADLs without difficulty and zero if the individual cannot perform any ADLs. Mean values of the index are reported in Table 1.6 (2nd row). The table also shows a simpler measure, the share of individuals who report having difficulty or being unable to do one or more of the activities.

Considering the second measure first, there are very large and statistically significant differences between blind and non-blind. Among blind adults, 83% report being unable to do one or more ADL without difficulty, compared with only 21% for non-blind; this gap is unchanged after adjustment for age and other covariates (0.62; p=0.00). Patterns for the ADL index are similar (0.67 for blind and 0.96 for non-blind). A slightly higher share of blind women than men report difficulty with ADLs (significant at 95%), a pattern also seen for non-blind men and women. There were no significant differences between cataract and non-cataract blind.

These figures suggest that blind older adults are in worse physical health than non-blind adults. It is possible, however, that the differences to some extent are capturing direct impacts of vision impairment, despite the attempt to word the questions to avoid this ambiguity.

The table also shows a direct (as opposed to self-reported) measure of health status, body mass index or BMI.[7] Calculated as the ratio of weight in kilograms squared over height in centimeters, BMI is a commonly used measure of nutritional status. Specifically, very low values of BMI (below thresholds of 18.0 or 18.5) are associated with chronic energy deficiency. Overall, BMI is quite low in this environment: even for non-blind older men and women it is 19.5 and 18.9, respectively.[8] For the blind, the means for BMI are markedly (and statistically significantly) lower than for the non-blind: 18.5 for men and 17.5 for women, in both cases close to or below the usual thresholds for under nutrition (adjusted mean blind/non-blind differences for men are 0.92 for men and 0.71 for women, significant at 99% in both cases). About half of the blind older adults have BMI<18.0 hence can be considered significantly undernourished, compared with 35% of the non-blind.

There are also statistically significant gender differences. BMI of blind men is greater than that of blind women, and the share of blind women with BMI<18.0 is 54% compared to only 42% for men. In contrast, among non-blind the shares are similar (and lower overall) for men and women. This suggests that blind women may have particular difficulties getting adequate quantities of food.

[7] In common with other studies of older adults, we use armspan as an approximation of height rather than attempting to measure height directly. With older adults, direct measurement may be inaccurate due to changes in body composition, posture and mobility (De Lucia et al., 2001).

[8] This is low relative to other developing countries, not just the developed world. However, these figures are in the range of other studies of adults in Ethiopia (Bitew and Telake 2010, De Lucia et al 2001). It bears keeping in mind that this is a poor rural region in one of the poorest countries in Africa.

The survey also collected an alternative anthropometric measure of adult nutrition, middle upper arm circumference (MUAC), measured in centimeters. FAO/WHO recommended MUAC cut-off points for under nutrition are 23 cm for males and 22 cm for females, although there is uncertainty as to the appropriate threshold values in older adults due to changes in body composition with aging. For this measure too we see both low values overall and (statistically significant) differences by vision status, with a mean of 21.3 cm for blind compared with 22.3 for non-blind.

Finally we consider chronic illness and disability other than poor vision. As with the other health indicators, there are statistically significant differences across blind and non-blind respondents in the incidence of chronic conditions or disabilities. 68% of blind adults report having at least one condition compared with 58% for non-blind (adjusted difference 11%, significant at 99%); the mean number of conditions is 1.61 for blind and 1.37 for non-blind. In this older population, the most commonly cited conditions are arthritis, migraines, heart disease/chest pain, poor hearing, and serious dental problems. For each of these conditions, very few—usually well under 10%—actually were diagnosed by a doctor or nurse. The cataract blind appear to suffer somewhat more than the non-cataract blind from chronic conditions (the number of conditions is 1.69 for the former vs. 1.52 for the latter) but the difference falls short of statistical significance at the 90% level. With regard to the incidence of specific conditions, migraines and hearing problems are significantly more common among the blind than non-blind.

In sum, the data show that blind older adults are worse off than the non-blind along each of the measures of physical health collected in the survey. The PSM analysis confirms these findings for all variables above within the matched group. The differences are not due merely to the somewhat older average age of the blind in the sample. This suggests that severe vision

impairment may have indirect impacts on physical health via, for example, reduced nutritional intake (especially for women) or reduced access to health care.

Food Insecurity

Potentially related to poorer nutrition of blind adults is greater food insecurity, examined in Table 1.7. We measure food security at both the household and individual (blind person) level employing adaptations of the Household Food Insecurity Index (Coates et al. 2007). The HFIAS questionnaire consists of a list of questions about different aspects of food availability for the household during the previous 30 days. For example, the first question is, "In the past four weeks, did you worry about your household not having enough food?" The standard procedure for scoring each item was used: zero was attributed if the event described by the question never occurred, 1 point if it occurred rarely (1 or 2 times during the previous 30 days), 2 points if it occurred sometimes (3–10 times), and 3 points if it occurred often (more than10 times). This was done for each question, and the results summed up for each household. We use a shortened version of the questionnaire consisting of five questions. Therefore the household index can range from zero (no food insecurity) to 15 (maximum insecurity). For the individual index we use just 4 questions from the scale, so the index can range from zero to 12.

Table 1.7 – Household and Individual Food Security, Blind and Comparisons

	Blind Household/ Individual			Non-Blind Household/ Individual		
	Male	Female	All	Male	Female	All
Household Food Security Index (mean)	--	--	3.07	--	--	2.49
Individual Food Security Index (mean)	2.36	2.22	2.28	1.90	1.97	1.94
Individual has any Food Insecurity (share)	0.61	0.59	0.6	0.55	0.51	0.53
N	538	694	1232	204	275	479

Notes: Household Food Security Index is a 5-item adaptation of the HFIAS scale, with higher values indicating more food insecurity (see text). Individual Food Security Index is a 4-item adaptation of the HFIAS scale, with higher values indicating more food insecurity (see text).

As shown in the table, food insecurity, while not very high overall in view of the possible maximum, is markedly higher for blindness-affected households. The mean of the index is 2.49 for non-blind households and 3.07 for blind households (difference significant at 99% level). The difference depends heavily on gender of the blind person. Controlling for age and other covariates, the mean blind/non-blind difference in the household food insecurity index is 0.94 (p=0.001) for men while no significant difference exists for females. PSM results actually present an even more dramatic disparity, with the matched blind households having an index score of almost 3.4. A similar pattern is seen for blind and comparison individuals in individual food insecurity measures (bottom two rows). Again, the matched sample shows even higher levels of food insecurity. The mean adjusted difference in the individual index between blind and non-blind men is 0.67 (p=0.00) while for women is it 0.28 and not significant.

These differences by gender may reflect the division of roles within the household. With men being more responsible for income generation, we might expect a greater impact on food consumption from a man being blind. It is also of note from the regressions with controls that having more adult sons (defined as all sons whether living with the blind person or not) consistently reduces food insecurity, while impacts for adult daughters are less consistent and

smaller. This too would appear to be due to men's greater role in income generation, though it also may be that daughters living in other households have less power to provide resources in cash or kind to a blind parent.

Because the household and individual scales are different in terms of both the number and content of questions (for example, the household index asks if any household member ate fewer meals than usual or went to bed hungry in the last four weeks while the individual index asks only about one person, the respondent), the household and individual indexes are not directly comparable. We can, however, compare the ratios of the household and individual food indexes across blind and non-blind households, to assess whether the blind are treated relatively poorly or better within the household with respect to access to food compared with non-blind older adults in their households. That is, a higher ratio of individual to household food insecurity would suggest that being blind makes one likely to have less access to food, for a given level of overall household food access. In fact the ratios are similar: 0.74 for blind and 0.78 for non-blind, suggesting an absence of 'discrimination' against the blind within their households. Put another way, blind older adults do suffer from greater food insecurity than comparison non-blind adults—consistent with their lower nutritional status—but this appears to come through effects on overall household livelihoods, incomes, and access to food.[9]

Mental Health

As noted above, the survey measured mental health using a 13 question adaptation of the CES-D depression scale. The questions are both positive and negative (e.g., Do you feel hopeful

[9] This is an admittedly indirect and crude way to measure food allocations within the households. Some surveys (not focusing on the blind or disabled) have measured the actual amount of food going to different household members at mealtimes over an observation period. This approach is quite expensive and prone to bias through households adjusting their behavior in the presence of an observer.

about the future; Do you feel sad? Do you not feel like eating much because of the mood you are in?), with four potential responses to indicate how often this feeling occurs. We create the depression index using the standard approach, which is to score a negative item with 0 for Never or almost never, 1 for "some of the time/not too often", 2 for "a lot of the time", and 3 for "all or almost all of the time". Positive items are scored the same way but in reverse (3, 2,1,and 0). Adding the scores over the 13 items, the index thus can vary for an individual from 0 to 39, with higher values indicating more depression symptomology.

Not surprisingly, blind older adults have higher depression scores than non-blind older adults and the difference is significant at the 99% level (Table 1.8). The difference is slightly over 2 points, hence is perhaps surprisingly modest given the potential range of the scale, but is larger (5 points, p=0.00) with adjustment for age and other covariates. There are no significant differences across gender but depression among non-cataract blind appears slightly higher than among those with cataracts (significant at 90%).

Table 1.8 – Mental Health Status and Life Satisfaction of the Blind and Comparisons

	Blind			Non-Blind		
	Male	Female	All	Male	Female	All
Modified CES-D Depression scale	17.16	17.40	16.61	14.41	15.13	14.82
Life Satisfaction (percent):						
Very good or excellent	1.62	1.93	1.79	9.95	6.15	7.76
Mostly good	37.12	31.62	34.05	59.16	51.54	54.77
Neither good nor bad	36.31	40.29	38.53	26.18	35.00	31.26
Mostly bad	22.31	21.51	21.86	3.66	5.77	4.88
Very bad	2.64	4.65	3.76	1.05	1.54	1.33
N	493	623	1116	191	260	451

Respondents were also asked a simpler, standard question on overall life satisfaction ("Overall, how is your life these days?"). A much larger share of blind than non-blind individuals indicated that their lives were either "mostly bad" or "very bad"': 26% as compared

with 6%. Only 36% of the blind rated their current live situation as “mostly good” or “very good or excellent” compared with 63% of the non-blind (adjusted mean difference 29%; p=0.00).

Overall then, the data confirm poorer mental health among blind older adults. Note that the above analysis infers these impacts through a comparison of blind and non-blind individuals’ responses about their overall emotional situation; it does not ask the blind person to make a judgment of the effect of bad vision on their emotional health. As argued above, the latter approach, while common, is highly subjective. Still, this approach is also of interest and so the survey also posed a series of such questions to the blind person (as well as to caregivers). These responses (Table 1.9) confirm the significant emotional toll of loss of vision. A large majority of blind men and women (over 80%) say that because of their poor vision they are hesitant to participate in social functions. 65% of women and 60% of men say they are ashamed or embarrassed by their condition, and more than two-thirds say they feel like a burden on others. Somewhat over half of blind respondents say they because of their vision problem, their families respect them “a fair amount” or “a lot” less, and a similar share say they have less respect from the community. These shares are similar for men and women.

Table 1.9 – Self-reported Impacts of Blindness on the Individual

Because of your vision problem:	Never/Rarely	Sometimes	Often/ Very Often
Are you…	*Share responding 'Yes'*		
Hesitant to participate in social functions?			
Female	**0.07**	**0.10**	**0.83**
Male	**0.07**	**0.11**	**0.81**
Ashamed or embarrassed?			
Female	**0.22**	**0.14**	**0.65**
Male	**0.23**	**0.16**	**0.60**
Do you…	**Not at all/ a little**	**A fair amount**	**A lot/ completely**
Feel like a burden to others?			
Female	**0.18**	**0.15**	**0.67**
Male	**0.17**	**0.13**	**0.70**
Have less respect within your family?			
Female	**0.45**	**0.20**	**0.35**
Male	**0.42**	**0.23**	**0.35**
Have less respect from the community?			
Female	**0.43**	**0.20**	**0.37**
Male	**0.44**	**0.19**	**0.37**

Impacts of Blindness on the Household and Sources of Support

Impacts on the Household

Several findings above already provided insight into the household level impacts of blindness. Households with an older blind person have somewhat fewer livestock, and (for non-cataract caused blindness) fewer assets, and blindness-affected households are also more food-insecure. We continue to consider impacts of blindness on households in this section as well as considering support from outside the household.[10] As noted, the survey was designed to address

[10] It bears keeping in mind that in a significant share of cases, the household in question is one that the blind person moved into as a result of his or her impairment.

this and other questions of impacts using two approaches: an inferential approach whereby we compare the situation of households with and without a blind older adult, and a direct but subjective approach, whereby we asked individuals about the effects of blindness on them or their families. The results just cited take the first approach.

Findings from survey items taking the second approach are shown in Table 1.10. About half of blind respondents said that as a result of their vision problem, their household's income or farm production was reduced "a lot". Blind men were substantially more likely to say this, perhaps reflecting men's greater role in farm production and income generation: as seen earlier, more than half of the non-blind older male adults worked in the last year, suggesting that loss of vision even of an elderly male household member can significantly impact household incomes. However, relatively few blind persons indicated that the family sold assets or livestock to make ends meet. Particularly striking is how few blind respondents—just 10%—said that they or their households received help from others in the village as a result of being blind.

Table 1.10 – Impacts of Blindness on the Household (share)

	Reported by		
	Male Blind	Female Blind	All
Significant reduction in income or production	0.43	0.62	0.52
Household sold livestock	0.16	0.21	0.18
Household sold assets	0.08	0.10	0.09
Others in village help you or your household	0.11	0.08	0.10
N	690	540	1230

Table 1.11 shows findings for questions on impacts that were posed to caregivers. 27% of female caregivers and 34% of male caregivers agreed with the statement that the blind

person's poor vision "has had a big effect on our household's well-being". The higher share for male caregivers may reflect different perceptions of men and women of the same impacts, differential willingness to admit negative impacts, or that the implications for household well-being are indeed different when a man is the caregiver (for which the blind person is more often a woman, say a wife) as opposed to when a woman is caregiver (often for a husband). Regarding the last possibility, men may keenly feel the loss of a wife's ability to manage the household or prepare food, and the burden of having to take on these tasks themselves.

Table 1.11 – Impacts of Blindness Reported by Caregivers

	Female Caregivers	Male Caregivers
Share agreeing with the statement:		
The blind person's poor vision has had a big effect on our household's well being	0.27	0.34
Because of [blind person]'s eyesight, our household is more likely be the victim of theft	0.58	0.61
Because of [blind person]'s eyesight, I am less likely to participate in village social functions	0.77	0.72
Because of [blind person's] eyesight, I am less likely to visit friends or family outside of my home	0.76	0.73

A majority of caregivers (58% for women, 61% for men) agreed that the loss of vision of the blind individual made their households more vulnerable to theft. Roughly three-quarters of caregivers of both sexes indicated that they are less likely to participate in village social activities and visit socially outside the home as a result of the blind person's loss of vision.

All caregivers were asked what the most important impacts of blindness on their household have been. Of the 61% who cited one or more impacts, the most important one--consistent with what was reported by blind individuals themselves--was loss of income; this was mentioned in 54% of cataract blind cases and 61% non-cataract cases. Reduced food security, which is related to changes in income, was cited by 36% of caregivers with no significant

difference between cataract and non-cataract blind cases. 39% cited reduced involvement in the community, and 36% cited an increased time burden on others in the household.

As just noted, about three-fifths (61%) of the caregiver sample mentioned one or more important impact of blindness on the household. The remaining 39% who said there were no significant impacts were asked why this was the case. The overwhelmingly dominant response (62%) was that the blind individual had already stopped working when their vision became bad. The advanced age of the blind should be kept in mind; most of the sample's cataract cases, at least, were already old when they became bilaterally blind. Far fewer caregivers cited as the reason for no major impact that the household had adequate assets (14%) or gets a lot of help from others (11%)—the latter confirming other findings from the survey of a lack of assistance from the community.

Transfers and Assistance

In Table 1.12 we explore the levels of support given to the household from the government and the community. These questions were posed to the household head or most informed individual in both blind and non-blind households. With respect to government sources, Ethiopia has an extensive social transfer program to relieve extreme poverty and food insecurity. The Productive Safety Net Program has two main components. The first is Direct Support, an unconditional transfer to households that are food insecure or have no other source of income because their members are elderly, disabled/ill, orphaned or pregnant or lactating. The second and much larger component is the public works (conditional) transfer, whereby members of the household contribute labor on public projects in exchange for cash or food.

Table 1.12 – Transfers and Assistance to Blind and non-Blindness Affected Households

	Blind	Non-Blind
Share of households:		
Receiving Direct Support from government in last year	0.60	0.46
Participating in Public works / food for work programs in last year	0.32	0.30
Receiving cash as a gift from others in last year	0.07	0.10
Receiving food grains or other food items from others as a gift in last year	0.02	0.03
Receiving transfer in cash or kind from a community organization in last year	0.02	0.02
Receiving labor contributions from others to work on its farm in last year	0.13	0.13
Receiving help in housework from others (last week)	0.09	0.10
Receiving help caring for blind person (last week)	0.14	0.08

Blindness-affected households are more likely to have received direct support than non-blind households—60% vs. 46% (p=0.00). PSM analysis only decreases this to 57% for the matched blind sample. The relatively high share even for non-blind households is not surprising given the extent of poverty in this region and the fact that the households contain elderly individuals. In contrast to direct support, similar shares of blind and non-blind households—about one-third—participated in public works employment in the past year.

Responses to a range of questions on types of assistance from other households in the community suggest that blindness-affected households get little support from the community. They are actually slightly less likely than non-blind households to report receiving a gift of cash from others —10% vs. 7% (p=0.03), though the share is very small in either case. Similar small shares (13%) of blind and non-blind households received contributions of labor to work on the farm of the household over the last year, and about 10% in each case report getting help in housework in the last week.[11] Finally, respondents were asked if, in the last week, someone from

[11] Note that help from 'other households' can include assistance from relatives in the community, including children living in other households.

outside the household helped care for the blind person (if there was one) or for anyone else in the household who was sick or disabled. The share was higher for households with a blind person than households without one, but still low 14% vs. 8% (p=.002).

These findings indicate that while a majority of blindness-affected households receive some transfer support from the government, and many participate in public works programs, support from the community is very limited. This conclusion, which is based on a comparison of the situation of blind and non-blind households, is consistent with responses to direct questions about whether others in the community help as a result of the blindness of oneself or a family member. As seen, very few of the blind indicated that such help was provided, and of caregivers who said that blindness did not have major impacts on their families, few said this was because of help provided by others.

Impacts of Blindness on Caregivers

Other than the blind person, the individual primarily responsible for taking care of the blind person bears the heaviest burden of blindness, at least in terms of their time. As seen earlier, the burden of care falls primarily on women, who make up three quarters of the caregivers in the sample. In this section we examine measures of caregivers' activities, social participation, and emotional health. In what follows, it should be recalled that 'potential caregivers' in non-blind households refers to the person who was identified as most likely to take care of the selected older adult in that household if he or she become disabled.

Caregiver Time Use

A substantial portion of male caregivers are engaged in income generating work—some 42% in the last week, and over 50% in the past year as defined earlier (Table 1.13). This is actually more than the share of male potential caregivers working (33% and 48%). The difference may reflect greater income stress (hence need to work) in blind households, though it should also be kept in mind that despite being the same age on average, caregivers are somewhat different demographically from potential caregivers in that they are more likely to be married and somewhat less educated, which may affect labor supply behavior. In contrast, female caregivers and potential caregivers alike generally do not engage in these work activities, replicating the pattern of gender differentiation in work seen for older adults above.

Table 1.13 – Time in Productive Activities of Caregivers and Potential Caregivers

	Caregivers			Potential Caregivers		
	Male	Female	All	Male	Female	All
Worked in last week (share)	0.42	0.06	0.14	0.33	0.04	0.13
Worked in last week or past year (share)	0.54	0.08	0.18	0.48	0.06	0.19
Hours worked last week for those who worked	22.8	19	21.7	22.7	20.6	22.1
Hours in household work in previous day	3.31	7.04	6.22	2.08	4.62	3.85
N	254	903	1157	140	322	462

Turning to domestic work, female caregivers in particular report a very significant amount of time spent in household work activities—an average of 7 hours in the previous day. This compares to the lower (but still substantial) 4.6 hours for female potential caregivers.[12] Among actual caregivers of both genders, the reported time spent specifically caring for the blind person is quite substantial: 2.7 hours per day for female caregivers and 2.9 hours per day for

[12] It may be noticed that this is higher than the mean of 2.5 hours in household work for females in the same households who are the 'non-blind comparisons' (Table 1.4). The latter group, however, is older on average than potential caregivers so the means are not directly comparable.

male caregivers (the two are statistically equivalent). Some caution in interpretation is necessary, since it is possible that some of the activities the survey collects information on may be done concurrently, for example, cleaning house and helping the blind person. While the questions were worded to minimize this problem, there still may be some double counting of hours in these activities. Nevertheless, these data suggest that looking after the blind person imposes a significant burden of time on family caregivers, and for women (who make up the majority of caregivers) it adds to an already very large daily domestic workload.

Male caregivers and potential caregivers spend about half the time in domestic work as their female counterparts: 3.3 hours for male caregivers and 2 hours for potential caregivers. These figures therefore also suggest an impact on the domestic work burden of men who are caregivers of the blind, if smaller than for women.

Caregiver Social Participation

Caregivers and potential caregivers were asked the same questions about social activities as the blind and comparison respondents. While when asked directly, most caregivers said they reduced their social activities as a result of the blindness of the person they cared for (see Table 1.10 above), the data on frequency of various activities of caregivers and their comparisons in non-blind households show few differences between the two (Table 1.14). Generally, the large majority of caregivers and potential caregivers engage in each of the activities shown. More refined comparisons considering the shares attending at different frequencies revealed very few statistically significant differences across the two groups. This is in contrast to the very large differences in levels of social activity between the blind themselves and their comparison sample.

Table 1.14 – Social Activities of Caregivers and Potential Caregivers (shares)

	Caregivers			Potential Caregivers		
	Male	Female	All	Male	Female	All
Attends Mahiber or Senbetie or other Church/mosque meetings once a month or more	0.91	0.93	0.92	0.88	0.93	0.91
Ever attends church/mosque	0.95	0.95	0.95	0.92	0.95	0.94
Ever has friends/relatives visit	0.88	0.87	0.87	0.85	0.90	0.88
Ever visit friends/relatives	0.84	0.81	0.81	0.86	0.85	0.86
Ever go to market	0.89	0.89	0.89	0.92	0.92	0.92
Ever attend weddings	0.77	0.79	0.78	0.85	0.81	0.82
Ever attend funerals	0.72	0.85	0.82	0.69	0.79	0.76

Note: "Ever" means at least once in a year.

Caregiver Mental Health

Caregivers and potential caregivers were administered the same mental health module as the blind and non-blind comparison individuals. Results are shown in Table 1.15. First, it is noteworthy that irrespective of blindness, depression appears to increase somewhat with age. Just considering the non-blind households, for example, we see that potential caregivers (mean age 39 years) have a mean score of 13.5, lower than the 14.8 seen in Table 1.8 above for the non-blind older adults (mean age 71 years). Comparing caregivers and potential caregivers (whose mean ages are very similar), caregivers have statistically significant higher CES-D depression scores than their counterparts in non-blind households, though the difference is not very large (1.24 points). 56% of caregivers rated their current life situation as "very good or excellent" or "mostly" good", substantially lower than for potential caregivers (73%). Only 9% of caregivers indicated that their lives were either 'mostly bad' or 'very bad', though this was still larger than for potential caregivers (3%).

Table 1.15 – Mental Health Status and Life Satisfaction of Caregivers and Potential Caregivers

	Caregivers			Potential Caregivers		
	Male	Female	All	Male	Female	All
Modified CES-D Depression scale	13.88	15.54	15.16	12.11	14.04	13.45
Life Satisfaction (percent):						
Very good or excellent	5.2	6.2	5.9	23.7	9.2	13.6
mostly good	55.2	49.1	50.5	57.0	59.9	59.0
neither good nor bad	30.7	36.2	34.9	16.3	27.7	24.3
mostly bad	7.8	7.3	7.4	2.2	2.2	2.2
Very bad	1.1	1.3	1.3	0.7	1.0	0.9
N	270	910	1180	157	322	479

Overall then, the data suggest that being a caregiver has negative impacts on emotional well-being, which may come through a variety of pathways: witnessing the suffering of a close family member; additional homework or market work burden, financial strain, or possibly, reduced social participation. As we might expect, these mental health impacts seem smaller than the impacts of vision loss on the mental well-being of the blind themselves.

Section 1.5: Findings on the Demand for Surgery

Poor take-up of cataract surgery has long been noted as a problem in the literature (e.g. Rotchford et al 2002, Dean et al 2011, Gyasi et al 2007). Indeed, the surgery intervention for the present study achieved only about 76% uptake among surgery-eligible blind. Even this level partly reflects the attempts made to revisit eligible individuals who did not appear for transport to surgery at Woldiya hospital and offer them a second opportunity for surgery. As described earlier, the second round of surgeries were carried out at a smaller, satellite eye camp more centrally located to Meket and Wadla districts, in the town of Flakit, where a makeshift eye hospital was set up in a health clinic. The process of revisiting households was able to increase the number of individuals coming to surgery by 42, and all of these were operated on.

In this section, we investigate the issue of uptake in several ways. First, during the visits to those who did not come to Woldiya, we administered a short questionnaire to these surgery 'decliners' to understand the reasons for not coming to the meeting place for surgery. As is typical in such interventions in rural areas, this could be an hour's walk or more from the home. Blind households were an average of 3.6 km—in geodesic or "as the crow flies" terms—from the nearest road, and an average of 6.0 km from the main paved road leading to Woldiya.

The visits to the homes and the interviews were carried out by screeners drawn from the team of nurses who carried out the initial vision screening before the baseline survey. This process began within days of the start of the surgery intervention. Ultimately, 212 referred blind individuals did not report to Woldiya for surgery, of whom 13 were reported to have died and 7 had re-located outside the region by the time of the surgery. Of the remaining 192 eligible baseline participants who missed the initial transport to surgery, screeners were able to visit the homes of, and conduct the short survey with, 185 of them. From this group, as noted above, 42 came to the second round of surgery and had the surgery.

The questionnaire gathered information on a range of possible reasons for not having the surgery, including lack of belief in benefit of surgery, not having information about the meeting times or arriving too late, lacking a family member willing to accompany them, and the family not believing the respondent should have the surgery. We are aware of no similar survey administered following a cataract surgery campaign. Further, the survey was given to the surgery-referred study participants in their homes within several days of the missed appointment for transportation. This ensures that reasons are not lost in memory or confusion, and possibly avoids later *ex post* rationalizations (e.g., respondents 'forgetting' that their family was not willing to bring them in).

Second, in addition to the direct questioning of those who initially declined surgery, we use the whole baseline sample of referred individuals (surgery accepters and decliners) to explore the correlates of not coming to surgery, including gender, age, assets, family structure, geographic location, and other factors. We estimate the importance of these factors for uptake using a multivariate probit model.

Finally, as noted, on the return visits to households of those not appearing for surgery, these individuals were (after being interviewed) offered additional encouragement to come for surgery, In this case, transport was not arranged, but individuals were told they would be reimbursed for the costs of their travel at the clinic. We examine who among the decliners was most likely to respond to this further outreach, which has implications for who would benefit the most from more intensive outreach efforts to increase surgery coverage.

Results from a Survey of Individuals Declining Surgery

Descriptive findings are shown in Table 1.16. The sample consists of the referred cataract blind who did not show up for transport to surgery after the first visit to the household (hence the sample includes those who were induced to come for surgery after the return visit). One thing to note is the striking difference in the numbers of men and women in this group—135 women compared to only 50 men. This is in accord with the higher share of cataract blind men than women receiving surgery noted earlier. However, the initial gender gap in accessing transport to Woldiya for surgery was larger than the ultimate gap in surgery rates, since the revisits and offer of a second chance at surgery helped to reduce the gap.

Table 1.16 – Survey of Surgery Decliners-Selected Results

	Men	Women	All
Of those *not wanting* surgery after diagnosis, reasons given (up to 3 reasons listed per individual):			
N (number of individuals)	10	24	34
Didn't think it would help me	10	20	30
Afraid of the surgery	0	3	3
Too sick/tired	9	23	32
Too sad/depressed	0	0	0
No one would take me	0	1	1
Too old/not economically active, so no point	5	15	20
Family does not want me to have the surgery	4	6	10
Other	1	1	2
Of those *wanting* surgery after diagnosis:			
N	37	106	143
Was informed about pickup time/location (share)	0.84	0.70	0.74
Attempted to meet bus transport, if informed (share)	0.32	0.41	0.38
Of those *wanting* surgery after diagnosis but *not attempting to meet the transport*, reason given (#)			
N	21	44	65
Location too far	5	6	11
Too disabled	2	2	4
Too sick/tired	8	19	27
Too sad/depressed	0	0	0
Conflicted with other event	0	1	1
No one would take me	4	14	18
Family does not want me to have surgery	1	1	2
Decided I not want surgery after all	0	0	0
Other	1	1	2
Of those *attempting/planning* to meet the transport, reasons for failing to do so:			
N	10	30	40
Location too far	0	5	5
Too disabled	2	0	2
Too sick/tired	5	10	15
Too sad/depressed	0	0	0
No one would take me	0	6	6
Arrived late	0	2	2
Had wrong date/time/location	2	1	3
Transport never arrived	0	4	4
Other	1	2	3
All revisited surgery decliners:			
N	50	135	185
Believes Surgery would make vision better (share)	0.94	0.96	0.96
Believes Surgery could make vision worse (share)	0.06	0.04	0.04
Believes People could die from the surgery (share)	0.02	0.10	0.08

Virtually all the respondents recalled the visit by the screeners and the interview for the baseline survey (which had taken place not long before). Almost all remembered their diagnosis of cataracts and being told that surgery potentially could restore their vision. Similarly, almost all remembered being told that the surgery and the transportation to it would be provided for free. The table shows that about a fifth of these individuals—18% of women and 20% of men—said that they nonetheless did not want to have the surgery. The most important reasons given by far were that they were "too sick/tired" and "did not think it would help me."

One concern during the intervention was that information about the pickup time and location, which was given to locale (kebele) administrators, might not be properly relayed to the family. This may have been a factor in some cases of not having surgery: about 26% said no one informed them of the pickup details.

Of those who said they were informed about the transportation timing, 38% said they attempted to avail themselves of the ride to the hospital. Of those who did not, the main reason (27 of 65 cases) was that they were too sick or tired. Some 18 others reported that no one would take them to the meeting place, and 11 said the meeting location was too far.

Of the 40 respondents who said they tried but failed to meet the transportation, 4 said the bus never arrived, while 5 said that they either arrived late for the pickup or had the wrong date, time or location. Taken together with the significant share saying they were never informed about the pickup, this points to inadequate communication about the transportation as an obstacle, though it is not possible to confirm if families were actually given incorrect information (or were not informed at all), or instead did not understand or remember what they were told.

The questionnaire also asked respondents about their perceptions of the value and risks of surgery. Almost 30% of respondents knew of someone who had had cataract (or perhaps, other

eye) surgery, and the vast majority of these respondents said they through that that surgery was successful. Almost all believed that if they had surgery it would improve their own vision, and fears of side effects or of vision getting worse from the surgery were held by few respondents. Indeed, 70%, or 130 individuals, indicated that they were willing to try to have the surgery (as indicated, 42 did end up having surgery in Flakit).

Considering these findings overall, two factors seem most important in leading to non-uptake. One is the physical condition of these elderly blind individuals, as being 'sick or tired' was the most common reason given for not wanting the surgery and for not trying to make the pickup to the hospital if they did want it. The second is inadequate information about when and where the pickup would be, whether this is because the families were not properly informed, or because they did not understand the instructions despite efforts by local leaders to inform them.

Determinants of the Demand for Surgery

Table 1.17 presents the results of a probit model for reporting to Woldiya for surgery, estimated on the sample of individuals who were referred for surgery (eligible) and included in the baseline. It should be noted that a small share (8.1%) of those reporting for surgery were deemed not eligible for surgery upon closer examination. Therefore this is a model of the demand for surgery, not of having surgery. For understanding uptake behavior, this approach is more appropriate.

Table 1.17 – Determinants of Reporting for Surgery in Woldiya—Probit Results

Variable	Marginal Effect	Z-statistic	P-Value
Married	0.046	0.80	0.422
Years blind	-0.003	-0.71	0.477
Female	-0.189	-3.83	0.000***
Age	-0.013	-3.80	0.00***
Ever attended school	0.095	1.37	0.170
Asset Index	0.016	0.79	0.432
Orthodox religion (Muslim excluded)	0.069	0.90	0.371
No. HH members <15	-0.002	-0.15	0.855
No. HH members 15-65	-0.000	-0.01	0.993
Has 1 or more chronic health condition	-0.096	-2.43	0.015**
Mid-upper arm circumference	0.022	2.50	0.012**
Distance to nearest primary road	0.010	1.65	0.100*
Difference in elevation from primary road	0.000	-1.03	0.302
Distance from Woldiya	-0.002	-2.70	0.007***
Number of observations	641		

Note: Marginal effects show changes in probability of surgery from unit change in the independent variable, based on probit model for having surgery (for binary regressors, shows the difference in probabilities when the variable is zero and 1). Sample is all blind referred for surgery at baseline.. * p<0.1; ** p<0.05; *** p<0.01.

Several variables in the model are significant. Physical condition is an important factor: those with chronic health problems are less likely to come for surgery, as are older individuals and those with lower mid-upper arm circumference readings.[13] These results are in accord with the interviews of surgery decliners, where as seen physical condition was the most common reason given for not wanting the surgery and for not trying to make the pickup to the hospital. As for age, it is not possible to tell if this is a result of increased difficulty to attend for surgery, or because benefits of surgery may be considered lower (less remaining time, less productive,

[13] The probit model initially included BMI as well as caregiver gender, but neither was significant. Since there were some missing values for these covariates, including them necessitated a sample reduction, so they were dropped from the final model.

etc.); this may be a question for future research. Also consistent with the analysis above, females who have cataract blindness are clearly at a disadvantage relative to males in obtaining surgery; the estimate indicates that they were almost 19% less likely to get the transportation to the surgery site. As noted earlier, this gender disparity has been seen elsewhere, as has the pattern of women making up a disproportionate share of those blind from cataract.

Finally, in examining the role of geographic location of the household, we find that the farther the households are from Woldiya, the less likely they were to report for surgery. However, there is no such negative effect of distance from primary road (where the transportation pickup was located) or elevation differences to primary road did not have an impact; in fact the estimate for distance to road is positive and marginally significant. This shows that individuals or their families were not inhibited by the distance to the relatively local place to meet the transportation, but if their location was far from Woldiya, they were less likely to report for surgery. This finding suggests that families perceive an opportunity cost to longer travel or being further from home. In fact, the expectation that this would be a factor motivated the idea to set up a satellite surgical camp in Flakit, which is closer to the households, for those who did not come to surgery in Woldiya. We examine this next.

Who was most responsive to additional outreach?

As indicated, a total of 42 study subjects received surgery at Flakit as a result of the follow-up visit and additional offer of surgery plus expenses for travel. Mean values of characteristics (those used in the probit model above) were generally not significantly different for these 42 individuals and the remaining 143 who were revisited but did not subsequently come in, though the small sample sizes should be kept in mind. However, a higher share of revisited

females reported to Flakit than did males (21.6% vs 15.5%) as Table 1.18 shows. This contrasts sharply with the higher rate among men for initially reporting to surgery in Woldiya (first row of the table).

Table 1.18 –Share of referred subjects reporting for surgery, by gender

	Male	Female	Total
Reported to Woldiya (as share of referred)	0.794	0.628	0.695
Reported to Flakit (as share of those not reporting to Woldiya)	0.155	0.216	0.199
Reported to either Woldiya or Flakit (as share of referred)	0.826	0.708	

Hence when we combine those reporting to Flakit with those who reported to Woldiya (last row), we see that while females are overall still less likely to come for surgery than men, the proportion of referred females increases from 62.8% to 70.8%, and narrows the gap between men and women. This finding suggests that it is indeed possible to address, through more intensive outreach, the sharp inequity caused by the combination of women's higher rate of cataracts and their lower rate of surgery. The closer location of the follow-up surgery intervention may also have played a role in this outcome, even though in this case, transport was not directly provided, only reimbursed.

Summary

This intervention studied in this evaluation went to substantial lengths to overcome as many barriers to surgery uptake as possible, including removing or reducing previously identified barriers such as the direct costs of surgery itself and the indirect costs of transportation, food and overnight lodging, for both the blind person and an escort, as well as other opportunity costs. For an intervention of this size in this extreme environment, both geographically and

socioeconomically, 76% uptake should be considered a successful outcome. Still, approximately one quarter of the individuals who may have benefited greatly did not come for the offered surgery. Two main factors leading to non-uptake are the poor physical condition of some of these elderly individuals, and inadequate (or poorly understood) information about when and where the pickup would be. Both the negative effect of physical condition—and of being female—on uptake are confirmed by multivariate modeling. The experience of this study also shows, however, that additional encouragement and re-offering of surgery (possibly at a satellite camp closer to these peoples' homes) may overcome these obstacles, and in addition to increasing overall coverage, may reduce the gender disparity in access to cataract surgery.

Section 1.6: Discussion and Conclusions

Summary of Baseline Survey Results

The main findings of the baseline survey can be summarized as follows:

The sample of blind rural adults is elderly and generally uneducated

- The mean age is 76 years for cataract blind, 70 for blind from other causes, and 70 for the non-blind comparisons. The vast majority have no education, and live in households that rely overwhelmingly on agriculture for their livelihoods. The cataract blind, in addition to being somewhat older than the non-cataract blind, lost their sight much more recently in general (median 2 vs. 7 years since having vision problems in the second affected eye).

Blindness has significant negative impacts on individual well-being across a number of dimensions:

- Blind older adults do not work. While somewhat more than half of older sighted men continue to do some income-generating work, almost no blind men do. Older women's time in domestic activities is very sharply curtailed by loss of vision.
- The data on participation in church-related and other social activities suggest that older blind adults have only very limited participation in the social life of their communities.
- With respect to physical health, nutritional status as measured by body mass index is low in general for this poor sample but is worse for the blind. About 50% of blind older adults have BMI below the threshold for significant undernourishment, compared with 35% of the non-blind. Among the blind, women have worse nutritional status than men, suggesting that blind women may have particular difficulty getting enough food. The blind score significantly worse in terms of being able to perform basic activities of daily living that should not be affected by poor vision, and report more chronic illnesses than the non-blind.
- Mental health of the blind is significantly worse than that of non-blind comparisons, measured both by a modified CES-D depression scale and overall life satisfaction.

The data generally suggest negative impacts on households as well, though coping mechanisms such as the blind person moving into another household may mitigate these effects:

- Household food insecurity is higher among households with a blind older man than among similar non-blind households, but this difference is not seen for households where an older woman is blind. This pattern may reflect men's greater involvement in income generating work, so that the reduction in income or food consumption is greater when a man becomes blind.

- Households with an older blind person have somewhat fewer livestock, and (for non-cataract caused blindness) fewer assets; blindness-affected households are also more food-insecure. About half of blind respondents said that their loss of vision reduced their household's income or farm production significantly. This is consistent with the observation that many men of similar age who are sighted are still working.
- A smaller share of caregivers (27% of female caregivers and 34% of men) said that the blind person's poor vision had a big effect on the household's overall well-being. However, consistent with the responses of the blind, caregivers cited loss of income as an important household-level impact of blindness.
- Almost all households with older adults, whether blindness-affected or not, maintain their agricultural livelihoods, though the blind themselves do not participate.
- A significant share of the blind moved to a different household because of their bad vision, presumably to be cared for or supported by an adult child or others. About two thirds of the blind live with an adult child.

Assistance to blindness-affected households is limited:

- Most blind households (60%) benefit from the Ethiopian government's extensive program of unconditional transfers to the needy (compared to 46% for non-blind comparison households), and slightly less than a third participate in public works schemes.
- However, support from other households in the community is very limited, whether in terms of cash or labor support, gifts of food, or help specifically for caring for the blind person. This conclusion, which is based on a comparison of the support given to blind and non-blind households, is consistent with responses to direct questions about whether others in the community help as a result of the blindness of oneself or a family member.

Family caregivers to the blind bear a large time burden and suffer emotional impacts and possibly social ones as well:

- Caregivers are on average much younger than the blind themselves (average age about 40) and include many children of the blind as well as spouses. They are also disproportionately (about 75%) female. Care giving is a mostly female activity throughout the world; in the case of blindness in rural Ethiopia, this means that women bear a far higher burden of care than men.
- Both male and female caregivers spend between two and a half and three hours per day on average caring for the blind person. For female caregivers, the overall domestic workload including care giving and other household work, is very high—almost eight hours per day, more than two hours per day more than the workload of a comparison group of women in non-blind households. Male caregivers also do significantly more housework than their counterparts in non-blind households.
- Caregivers exhibit greater depression, and lower life satisfaction, than their counterparts in non-blind households.
- Caregivers also indicate that their social interactions have been curtailed by having to care for the blind person, though comparisons of the frequency of such activities with the comparison group do not reveal significant differences.

This analysis has some limitations that should be noted:

- The comparisons of blindness-affected households and non-affected but otherwise similar households along various dimensions (assets, employment, etc.) shows association; they do not establish causality from blindness to these outcomes. While blindness (and especially cataracts) is clearly an age-related phenomenon, it is also related to some extent to

environmental factors as well as to prior injury, disease, and nutrition. This means that unmeasured environmental or behavioral factors may to some degree be causing both loss of vision and observed levels of assets, employment, or mental health, rather than there being a purely causal link from the former to the latter. However, in lieu of the ideal of a natural experiment[14], the approach we take here, using a unique data set and comparing means adjusted for age and several other pre-determined covariates, provides the best approach to understanding the impacts of blindness on individuals and households.

Inadequate uptake remains a constraint to improvement in the lives of many cataract blind

- Poor take-up of cataract surgery has long been noted as a problem, and this issue emerged in this study as well. By making significant and unusual attempts at outreach (including home visits), the intervention achieved 76% uptake among the surgery-eligible blind in the sample. In comparative perspective this is not low but still many individuals who could have benefited from the surgery did not get it. Further, and replicating patterns elsewhere, while women make up a larger share of the cataract blind, the uptake rates were lower for them than for men (71% vs. 83%).

- The study investigated the issue of uptake in two ways. First, a short questionnaire was administered to these surgery 'decliners' to understand the reasons for not coming to the meeting place for transportation to the surgery site. Second, in addition to the direct questioning of those who initially declined surgery, the full sample of surgery-eligible individuals was used to explore the correlates of not having surgery, including gender, age, assets and family structure. Third, the analysis considered the impacts of the additional

[14] A natural experiment is an approach to estimating causal impacts that would take advantage of some event that essentially randomly created the disability in some individuals and not others. Natural experiments are sometimes possible in health research, but it is difficult to see how a natural experiment could occur in the case of blindness.

outreach to those who initially did not come to surgery, to understand who would benefit the most from more intensive efforts to improve uptake.

- From the follow-on interviews with those not coming to surgery, two factors are most important in leading to non-uptake. One is the physical condition of these elderly blind individuals, as being 'sick or tired' was the most common reason given for not wanting the surgery and for not trying to make the pickup to the hospital if they did want it. The second is inadequate information about when and where the pickup would be, whether this is because the families were not properly informed, or because they did not understand the instructions despite adequate efforts by local leaders to inform them.
- Multivariate probit analysis of the determinants of coming for further examination and surgery in Woldiya hospital confirms that physical health is an important factor. Those with chronic health problems are less likely to come for surgery, as are older individuals and those with lower nutrition as measured by mid-upper arm circumference readings. Women who have cataract blindness are clearly at a disadvantage relative to males in obtaining surgery: they were almost 19% less likely than referred men to get the transportation to the surgery site.
- Distance to the surgery site in Woldiya also reduces the likelihood of accessing surgery, even when free transportation was offered. This suggests that families perceive an opportunity cost to longer travel or being further from home.
- Additional outreach was conducted among households with referred individuals who did not meet the transportation to Woldiya hospital for surgery, with a second opportunity to get the surgery, this time in a makeshift eye camp in the closer town of Flakit. A higher share of revisited females reported to Flakit than did males (21.6% vs 15.5%)—in contrast

with the higher rate among men for initially reporting to surgery in Woldiya. Therefore the additional outreach served to reduce the disparity in the shares of eligible men and women accessing cataract surgery.

CHAPTER TWO:

Impacts of Cataract Surgery on Rural Blind in Amhara, Ethiopia

This chapter examines the impacts of and potential for restored sight from free cataract surgeries in potentially reversing the cumulative negative impacts from blindness in poor rural settings examined in the first chapter, across a variety of variables at both individual and household levels.

Section 2.1: Data

The follow-up survey, carried out in May-June 2013, targeted all blind individuals and their households from the baseline sample for re-interview. The combined baseline and follow-up data are used to measure the impacts of cataract surgery on the range of individual and household outcomes examined in Chapter One, using non-operated (non-cataract) blind as controls. The follow-up survey also collected information on self-perceived impacts of surgery on the individual and the family, and carried out a small number of qualitative interviews with surgery recipients as well (see Appendix).

By design, the non-blind sample was not followed up: the main purpose of the non-blind sample was to compare the situation of blind and non-blind individuals and their households to capture the impacts of blindness, as just noted. The survey teams re-located and re-interviewed 1026 individuals (83%) of the blind baseline sample; of the remainder, 113 were found to have died, 26 moved too far to be interviewed, and 69 were not located.

In this chapter, changes in outcomes for the two groups of operated and non-operated blind are compared in order to measure the impacts of surgery on individual and family well-being. As just noted, the non-operated blind serve as controls for those getting the surgery. This

is a quasi-experimental approach to estimating the impacts of surgery, which we carry out in lieu of a randomized controlled trial (RCT). Such a trial would have randomly assigned surgery to some cataract blind individuals and (at least at first) not to others. While RCTs are considered the optimal approach to impact evaluation, randomization of this surgery would have been very difficult due to cost, logistical and ethical considerations (the few previous non-clinical evaluations of eye surgery have also been non-randomized). The main obstacle was cost and logistics: if we were to divide the cataract blind sample into surgery and non-surgery (or late surgery) arms, to achieve the same statistical power obtained using our approach we would need twice the number of cataract blind, hence about twice the number of total blind screened (to identify the expected 50% or so with cataracts) and twice the number of communities included in the survey.

Further, the use of non-cataract blind as controls for cataract blind is reasonable in that older adults who are blind from other causes such as glaucoma should be similar to cataract blind in terms of psychological status, physical health, and activity levels, hence provide a reasonable counterfactual for the evaluation. Baseline analysis presented in Chapter One reveals that the two groups do differ in some ways, notably age: the cataract blind on average are about four years older than non-cataract blind. As discussed below, the study instead uses a difference-in-difference and instrumental variable hybrid approach to estimate the impacts of surgery, which controls for different baseline values in the outcomes as well as allowing controls for factors such as age.

Changes to Questionnaire for the Follow-up:

As noted in Chapter One, the survey instruments were for the most part the same for the follow-up. This facilitates accurate measurement of changes in outcomes between surveys.

However, some changes or additions were made to enable a better understanding of the impacts of the intervention:

- Vision assessment: A detailed test of vision was administered by a nurse to those who had surgery (procedures are described below).
- Self-reported impacts of surgery module: For individuals who had surgery, this module is asked in place of the baseline module that asked about impacts of blindness on the individual and family. The first section of this module repeats the self-assessed vision questions and the Vision Related Quality of Life Scale (VRQOL) from the baseline module. The next portion contains questions on whether surgery has led to changes in social participation, work, security, respect from family and community, and income and assets.
- Impact of surgery on caregiver and family module: This module replaced the second caregiver module described in Chapter One. Now the caregiver is asked about impacts of the blind person's surgery on his or her own activities and well-being, as well as that of other family members. This was administered only in households where the blind person had surgery.

The follow-up survey was piloted in May 2013, in the same kebele used for the pilot study for the baseline questionnaire. Given that the instrument was largely the same as that used in the baseline, this field test was brief and served largely to get new interviewers acquainted with the survey and field procedures.

Qualitative Interviews

In addition to the main follow-up survey, semi-structured interviews were carried out with 13 cataract surgery recipients (drawn from the main sample) to gather in-depth information on the impacts of surgery on themselves and their families. The objective of these interviewers was to provide a fuller portrait of the wide-ranging impacts of surgery beyond the quantitative measurement enabled by our survey. The results of these interviews are presented in the Appendix.

Follow-up Survey Implementation

The follow-up survey, which like the baseline was carried out by JaRco, was organized along similar lines as the baseline. The survey supervisors and many of the interviewers were the same as for the baseline. Training took place on May 8-12, 2013, and was followed by a day of field testing and a day of review. As noted, given that the instrument was largely the same as that used in the baseline, this field test was brief and served largely to get new interviewers acquainted with the survey and field procedures. The review did not reveal that any changes were needed to the new or revised sections of the questionnaires. The actual fieldwork for the follow-up survey began on May 17th and continued through June 10. As indicated earlier, the survey teams relocated and re-interviewed 1026 individuals (83%) of the blind baseline sample. Further details on the sample and on attrition and mortality are provided below.

Vision Examination

The arrival of the JarCo survey teams in each kebele was preceded by the activities of the same ophthalmic nurses whose responsibility it was to test the vision of and diagnose all those

who from the pre-baseline screening. The four nurses were hired by HCP and trained and initially directed by Dr. Alemu Kerie, but the training and their field activities were carefully coordinated with JaRco's survey fieldwork. The examinations were intended to provide clinical data on vision for those who had surgery, but also were used to clearly identify those who had surgery. The system implemented at the baseline survey of giving vouchers to participants to bring to surgery did not work perfectly, so in a number of cases there was uncertainty over whether an individual had gone for surgery. The form filled in by the nurses directly asked the individual if he or she had had surgery, and the vision exam was used to confirm this information as well as to measure visual acuity. The nurses were given location and identification information for the households they were to visit (those containing surgery eligible individuals as determined at baseline), and after visiting the indicated households in a kebele, they submitted the forms to JaRco.

Because the vision testing form was only finalized and printed once the fieldwork had started, the nurses were not able to administer the test to all eligible individuals. Of the 553 surgery eligible blind who were re-located, 503 were given the vision test, of whom 371 had been operated and 132 were surgery eligible but were not operated. Information on whether the individual had surgery was collected for all, however.[15]

[15] The nurses only visited households where the blind person had been referred (judged eligible for surgery) at baseline. The JaRco teams visited all households: they followed up with the households visited by the nurses to conduct the main interview, searched for surgery-eligible blind participants that nurses could not locate, and visited all the non-eligible blind as well. All eligible blind were asked by JaRco if they had had surgery in the last year, whether it was a result of this study, where it was done, and on which eye (repeating the questions asked by the nurses). These questions are detailed enough so that it is clear whether or not an eligible person actually had cataract surgery, even if the nurses did not visit the household to carry out the exam.

Section 2.2: Follow-up Survey: Sample Characteristics and Attrition

For the follow-up survey the study attempted to re-contact and interview 1234 blind individuals from baseline, comprising the blind who were diagnosed as having cataract and eligible for surgery and those who were not referred for surgery, and for whom we had complete data from the baseline survey. As shown in Table 2.1, 83% of the sample (85% of the eligible group and 82% of the non-eligible group) were found and re-interviewed. About 9 percent of the sample had died between baseline and follow-up, a not surprising outcome in view of the age of the sample. The mortality rate is higher among the surgery eligible (11%) than the non-eligible (7%) but this is likely a reflection of the overall higher average age of the former group (76 vs. 70 years). A very small share of both groups (2%) were found to have moved outside of the community and were too distant to visit for re-interview, and the remaining individuals could not be found or matched to baseline.

Table 2.1– Re-interview Rates at Follow-up, Surgery Eligible and Non-Eligible Blind

	Eligible for Surgery		Not eligible for Surgery		All	
	number	share	number	share	number	share
Re-interviewed	559	0.85	471	0.82	1030	0.83
Died	74	0.11	39	0.07	113	0.09
Moved, not re-interviewed	14	0.02	12	0.02	26	0.02
Not found/not matched	14	0.02	51	0.09	65	0.05
Total	661	1.00	573	1.00	1234	1.00

Next we look at the baseline characteristics of those who were re-interviewed and those who were lost to follow-up for whatever reason (Table 2.2). For both the surgery eligible and non-eligible groups, attriters are older, less likely to be married, and were in larger households at baseline. The higher mean age of attriters compared with those who were re-interviewed is not surprising since mortality explains some of the loss of sample over time and is, of course, age-related. The lower rate of being married among attriters is likely related to their higher age, since

older individuals are more likely to be widowed. The somewhat larger household size is more difficult to interpret but may also be related to age, since older adults, as they advance further in years, may be more likely to have moved to the larger households of their adult children. The differences in some variables between those who are in the follow-up and those who are lost to follow-up should be kept in mind when interpreting the estimates of the impacts of surgery. For example, age may condition the response to the surgery. That said, in the models discussed below, we deal with this by including controls for the variables shown in the table, as well interactions of having surgery with these variables.

Table 2.2 – Characteristics of Re-interviewed Blind and Attriters, by Surgery Eligibility

	Eligible Re-interviewed	Eligible, not Re-interviewed	Non-eligible, Re-interviewed	Non-eligible, Not Re-interviewed
Female (share)	0.60	.58	.56	.60
Age (mean years)	75.45	79.03	69.62	74.05
Any formal education (share)	.06	.03	.10	.09
Married (share)	.31	.23	.38	.32
Household size	5.1	5.7	4.9	5.2
Years bilaterally vision impaired (median)[a]	3.42	3.35	11.09	10.86
Asset Index	.04	.10	-.10	.14
N	559	102	471	102

Finally, within the group of eligible for surgery cataract blind who were re-interviewed, Table 2.3 compares the characteristics of those who got the surgery and those who did not. We should note first that among all eligible (referred) individuals, substantially more are women (60% are female), while the surgery rate was lower for women: 72% of referred women vs. 82% of referred men. Comparing operated and non-operated of both genders, the table shows that those accepting the surgery were younger by 3.9 years on average, had been bilaterally blind slightly less long, and most strikingly, were substantially more likely to be married (33% vs.

22%). It is possible that a spouse (who is likely the caregiver) plays an important role in encouraging acceptance of the surgery as well as accompanying the individual to surgery.

Table 2.3 – Characteristics of Individuals Having Cataract Surgery and Not Having Surgery (Surgery-Eligible Sample)

	Had Surgery	Did not have Surgery
Female (share)	.57	.66
Age (mean years)	74.93	78.80
Any formal education (share)	.07	.03
Married (share)	.33	.22
Household size	5.13	5.39
Years bilaterally vision impaired (median)[a]	3.18	4.00
Asset Index	.05	.02
N	478	183

Caregivers

Attrition of caregivers was somewhat higher than for the blind survey participants themselves. This is not surprising as caregivers are generally not disabled so are more able to move; there may fluidity in caregiver roles within the family; and since many blind individuals regained their vision, their caregivers may no longer be constrained from moving. Also, unlike with the blind participants, the survey did not attempt to re-interview caregivers who had moved (unless they moved with the blind person). Table 2.4 shows the number of caregivers who were re-interviewed and the number lost to follow-up, distinguishing caregivers for non-eligible and surgery eligible individuals, and also presents baseline characteristics for each group.[16] 83% of the baseline caregivers of the non-eligible blind were re-interviewed compared with only 76% of

[16] At follow-up, the caregiver to be interviewed was defined as the person who was identified as the caregiver and interviewed at baseline. This was the case even if the individual was no longer the primary caregiver, since our focus is on the changes in activities and well-being of this group of individuals since baseline. Also note that for blind who underwent successful surgery and had no other major disabilities, the caregiver will likely no longer play that role at follow up as it is no longer required. Again, 'caregiver' refers to the person identified as such as baseline, even if no longer carrying out those activities at the time of follow-up.

caregivers for those eligible for surgery, confirming that those in the latter group were more likely to leave.

Table 2.4– Characteristics of Re-interviewed Caregivers and Attriters, by Surgery Eligibility of the Blind Person

	Eligible Re-interviewed	Eligible, not Re-interviewed	Non-eligible, Re-interviewed	Non-eligible, Not Re-interviewed
Blind person Female (share)	0.57	0.56	0.55	0.59
Blind Person Age (mean years)	73.74	74.64	70.96	68.76
Caregiver Female (share)	0.76	0.58	0.78	0.53
Caregiver Age (years)	39.78	37.03	40.10	35.74
Asset Index	-0.01	0.03	-0.04	-0.27
N	496	119	340	59

Two other patterns stand out. First, female caregivers are substantially less likely to attrite. Second, as we might expect, older caregivers are also less likely to be lost to follow-up. Since moving and being lost to follow-up is selective—on gender and age and mostly likely as well on other, unmeasured characteristics—the findings discussed below for changes in caregiver activities and well-being should be interpreted somewhat cautiously.

Section 2.3: Estimation

This study considers a wide range of potential impacts of cataract surgery on individuals, caregivers, and households, ranging from effects on daily activities to mental and physical health to household consumption and food security. For all these outcomes we follow the distinction in the impact evaluation literature between two basic kinds of estimates of the impacts of interventions: *Intention to Treat (ITT)* and *Effect of Treatment on the Treated (TOT*). The latter

conforms to what we might normally consider the 'impact' of the intervention, particularly from a clinical perspective though by no means limited to clinical (medical) outcomes. It measures the average effect of surgery on the patients who receive surgery. This would measure, for example, the mean effect on depression among patients getting the surgery.

In contrast, Intention to Treat measures the mean effect of the intervention not just on those getting the surgery but on all those who were eligible for it, whether they actually accepted surgery or declined it. This is the target group for the intervention, which in the present case are the cataract blind who in the baseline screening were referred for further examination and likely surgery at the hospital in Woldiya. Continuing the example from above, ITT would measure the mean effect on depression among all surgery eligible individuals. ITT and TOT will differ because uptake is less than compete. In the present case uptake was significantly less than complete, as more than a quarter of the referred did not have surgery. Of these, the vast majority did not come in for the additional exam and surgery, though a small number came in and were judged to not be candidates for surgery on further, more detailed, examination. ITT is important for understanding the overall impact of the intervention on the group it is supposed to benefit. An intervention may have strong benefits for those who participate, but if participation is very low, the overall benefit for the targeted group is also low. This has obvious implications for cost effectiveness of the intervention. Therefore we estimate both ITT and TOT below.

Quasi-experimental Approaches

The intervention was offered to all blind in the sample who had cataracts and were deemed at the baseline screening to be medically eligible for surgery. Our intended control group is the non-cataract blind, who are not eligible for surgery. This group is used to represent the counterfactual, that is, what would have been the outcomes of the cataract blind one year

after baseline had they not been offered or had surgery. This is not an experimental design, in which surgery is randomly assigned to one group of cataract blind and not to another. However, the setup would approach an experimental design if the cataract and non-cataract blind were essentially identical in all other respects, that is, if whether an older adult had cataracts or another source of blindness was itself effectively random. This in turn would require that there exist no differences between the groups in behaviors, nutrition or other factors that affect both the cause of blindness and the outcomes we are measuring (depression, activities, physical health, etc.).[17] This is not guaranteed. While cataract is generally age rather than behaviorally related (Robman & Taylor, 2005), there is a risk that some cases of non-cataract blindness such as corneal scarring are the result of behaviors that might be associated with being (for example) less risk-averse. Still, this concern is likely not very significant, in that behavior is at most only relevant to some non-cataract cases of blindness and because its relation to changes in the main outcomes of interest in the absence in surgery is likely to be remote. In lieu of a true experiment, non cataract blind older adults comprise a reasonable control or comparison group for this evaluation.

Quasi-experimental approaches in fact do not rest on the assumption that the groups being compared are equivalent, though they rely on other assumptions that are not required in a true experiment. For this analysis we first apply the method known as *difference in difference (DinD)*. DinD essentially compare changes in outcomes in treatment and control groups; because it compares changes between baseline and follow-up rather than levels, it does not require the two groups to be equivalent at baseline. It does require that, in the absence of the

[17] Assignment to surgery accrues to being in the cataract blind group, so if belonging to that group rather than being blind from other causes is random, assignment to surgery is also random.

intervention, the changes in outcomes (trend) would be the same for the two groups.[18] The approach is applied to intention to treat estimation for this study.

Formerly, in a regression framework, the basic DinD model for ITT using baseline (t=0) and follow-up (t=1) data is:

$$Y_{it}=b_0 + b_1*Time_t + b_2*Eligible_i + b_3*Eligible_i*Time_t + b_4*X_i + e_{it}, \quad t=0,1$$

where 'eligible' is a binary indicator of whether the individual has cataract and was recommended for surgery, and Y is any of the outcome variables described above for household or individual *i* at time *t*. The effects of the intervention are captured by b_3, the coefficient on the interaction of being eligible and measured in the follow-up survey. X_i represents various household and demographic covariates such as age, sex, and assets to control for other differences across groups. The models also have controls for kebele fixed effects, that is, they estimate differences across individuals within each kebele to eliminate the influence of unmeasured kebele-level factors that may affect both eligibility for surgery (being cataract blind) and the outcomes. e_{it} is an individual-level disturbance term, assumed to be correlated across periods for an individual due to the presence of unmeasured individual characteristics.

Using this regression framework, the DinD assumptions can be phrased in a different way: that conditional on its effect on surgery and other included covariates, eligibility (cataract blindness) is not associated with (is exogenous to) the change in the outcome Y.

For estimating TOT, we use a different quasi-experimental approach, instrumental variable (IV) analysis, which accounts for selectivity into treatment. IV methods estimate the

[18] The Cataract Impact Study (Polack and Kuper (2009) also applied a DinD approach, but rather than non-operable blind, used non-blind households as a control group. This is somewhat less plausible than using the non-operable blind, because it is more likely that changes over time in the absence of the intervention would be different between non-blind and cataract blind than between non-cataract blind and cataract blind. For example, blind individuals may have compromised physical health that affects trends in outcomes (as they age another year). This would imply a similar trend for cataract and non cataract blind (as required for the validity of DinD in our set-up), but may imply differential trends for non-blind and cataract blind.

causal effect of some variable *x* on an outcome *y*, using a third variable, or instrument, that is assumed to affect *y* only through its effect on *x*. In the present case, we need for an instrumental variable a factor that affects selection into surgery but has no direct effect on the outcomes of interest, controlling for other measured factors. In experimental designs where eligibility or access to the intervention is randomly assigned but where participation in the intervention among the eligible is not complete, eligibility itself is used as an instrument for participation: it is strongly correlated with actual participation, but given random assignment of eligibility, it is not correlated with the outcomes conditional on its effect on participation (see e.g., Banerjee et al. 2005).

We apply this approach in our estimate of the effect of treatment on the treated, using eligibility for surgery as an instrument for uptake of the surgery. Clearly eligibility—being cataract blind—is a strong determinant of actually getting surgery, as required for the approach. However, the assumption that conditional on this impact, eligibility is not related to the outcomes may be a strong one. As noted, eligibility—being operable cataract blind—is not randomly assigned as in an experiment. The assumption made here is that, conditional on controls for age, sex and other factors that are included in the model, eligibility is uncorrelated with the outcomes other than through its effect on take-up. This remains a potentially strong assumption.

For most of the outcomes we also explored differences by gender and age in the effect of surgery, as these may be important in some cases. For example, impacts on participation in market work might be greater for younger surgery patients, since many older ones may no longer have been working even if they had not been severely visually impaired. Generally, we approached this in the analysis by estimating separate models for men and women and adding interactions terms of the treatment variable with age, specifically, a dummy variable for being

under 70. The choice of this relatively high age threshold was driven by the fact that relatively few surgery recipients, particularly among men, were found in younger categories.[19] To this, we again add Propensity Score Matching (PSM) analysis[20], comparing subjects who received surgery with matched, non-referred counterparts; these results are presented in the text.

The estimations were done using STATA. The models calculate standard errors adjusted for clustering at the kebele level.[21] Further, data used for the DinD model use repeated measurement of individuals or households (baseline and follow-up), leading to correlation over time in error terms for individuals or households, as noted above. This correlation can be modeled as an individual or household random effect and we take this approach, using STATA's XTMIXED command.

Presentation of Results

The general presentation of results in subsequent sections is as follows. First we present descriptive results, comparing means for the outcome at baseline and follow-up for (1) those who had surgery, (2) those who did not have surgery (non-eligible controls) and (3) those who were recommended for surgery but did not have it (eligible but declined surgery). This is followed by the impact evaluation estimates, starting with the DinD estimate of intention to treat and followed by the IV estimates of treatment on the treated. As discussed below, for groups of

[19] To estimate the age and treatment interaction for the ITT model (for example), (1) is extended by interacting the treatment effect $Referral*Time_t$ with age, specifically, a dummy variable for being under 70. The coefficient on this term captures how age modifies the intervention effect. In addition, controls for *age*time* and *age*referral* are included.

[20] Using the same variables as above, which again achieved the same desired appropriate levels of common support.

[21] Since our sampling strategy is a two stage approach in which kebele were randomly selected within each Woreda and then households were sampled within these kebele, the data are clustered at the kebele level. As individuals within a kebele are more likely to be similar than those across kebeles, we expect standard errors to be correlated within kebeles, which increases the variances of the estimates.

related outcomes specified above, the regressions combine the measures into an index of average effects for the estimation. Even where we use this approach, we still begin by presenting descriptive findings on changes for each specific outcome within a group, e.g., different types of social participation, as readers may find these of interest as well as somewhat more intuitive.

Section 2.4: Results

Impacts of Surgery on Blind Individuals

Economic Activities and Time Use

We begin by considering changes in market work and household work activities, defining these variables in the same way as done above in Chapter One. Table 2.5 shows the share reporting working in the last week and in the last year, and hours in household work in the previous day, for individuals who had surgery, for those who were not eligible (non-cataract blind controls) and for those who were eligible but did not have the surgery. Work in the last year was defined as either working in the last week or if not, reporting "off season" as the reason for not working.

Among surgery recipients, the shares of men and women working in the past week or year were generally higher at follow-up than at baseline. The increases were small: the vast majority did not work either before or after surgery. For example, 10% of men worked in the previous year as of follow-up compared with 4% at baseline. Still, these modest increases contrast with the lack of statistically significant changes in work activity for either group of non-operated blind. With regard to domestic work, no statistically significant changes were seen in hours in domestic labor in the previous day for men and women in any group, although the point estimates were higher at follow-up for the operated group.

Table 2.5 – Time in Productive Activities at Baseline and Follow-up, by Gender and Group (Had Surgery, Non-Eligible Controls, Eligible but Declined Surgery)

		Men			Women		
		Baseline	**Follow-Up**	**Change**	**Baseline**	**Follow-Up**	**Change**
Had surgery	Worked in last week (share)	0.022	0.092	0.071***	0.004	0.025	0.021*
	Worked in last week or past year (share)	0.038	0.102	0.065***	0.017	0.029	0.012
	Hours in household work in previous day (mean)	0.136	0.185	0.049	0.603	0.773	0169
N		184	184		242	242	
Did not have surgery (non-eligible controls)	Worked in last week (share)	0.024	0.029	0.005	0.00	0.004	0.004
	Worked in last week or past year (share)	0.044	0.054	0.010	0.004	0.004	0.000
	Hours in household work in previous day (mean)	0.185	0.098	-0.088	0.444	0.414	0.030
N		205	205		266	266	
Did not have surgery (eligible but declined)	Worked in last week (share)	0.00	0.00	0.00	0.011	0.011	0.00
	Worked in last week or past year (share)	0.00	0.00	0.00	0.022	0.011	0.011
	Hours in household work in previous day (mean)	0.293	0.146	-0.146	0.587	0.337	-0.25
N		41	41		92	92	

The small magnitude of changes in work among operated individuals likely reflects above all the age of the sample. Cataract surgery patients are close to 75 years old on average (77.5 years for men, 72.3 for women), so their ability to work and their productivity if they do work once sight is regained may be significantly diminished. To explore this we break up the sample by age, distinguishing between those under 70 and those 70 and older. As shown in

Table 2.5a, the point estimate for the increase in participation in the last week is larger for the younger male patients than for older ones (0.10 vs. 0.6), though the change for the younger group is not significant, which may reflect the small sample (just 29 men in this group). Among the few male surgery patients under 65 (n=12), participant in work in the last week rose from zero to 25%. Although the size of the subsamples means that the findings by age can only be considered suggestive, they do point to a substantially stronger work response among younger male patients.

Table 2.5a – Surgery Recipients: Time in Productive Activities at Baseline and Follow-up, by Gender and Age

	Under 70			70 and over		
Men	**Baseline**	**Follow-Up**	**Change**	**Baseline**	**Follow-Up**	**Change**
Worked in last week (share)	0.07	0.17	0.10	0.01	0.08	0.06***
Worked in last week or past year (share)	0.14	0.21	0.07	0.02	0.08	0.06**
Hours in household work in previous day (mean)	0.07	0.03	-0.03	0.15	0.21	0.06
N	29	29		155	155	
Women						
Worked in last week (share)	0.01	0.01	0.00	0.00	0.03	0.03**
Worked in last week or past year (share)	0.01	0.01	0.00	0.02	0.04	0.02
Hours in household work in previous day (mean)	0.91	1.04	0.13	0.46	0.65	0.19
N	77	77		165	165	

Table 2.6 presents the regression estimates for impacts of surgery.[22] First we briefly explain the setup of these tables with reference to the methodological description presented earlier. The first column shows the results of the Difference in Difference estimation of Intention to Treat (mean effect of the surgery on all surgery eligible individuals); the second column shows TOT estimates using the instrumental variables approach. Among the

[22] Although the dependent variable (worked in last week) is binary, suggesting probit or logit model be used, we instead use a simple linear probability model, in part to facilitate the use of Kebele fixed effects. However, probit and linear models gave very similar results for common specifications.

independent variables, *Time period 2* is an indicator for year 2, and captures differences in outcomes between baseline and follow-up, that is, a common time trend for the whole sample. *Eligible for surgery* is an indicator for having been referred for surgery and controls for baseline differences in eligible and non-eligible groups in the ITT DinD model. The coefficient on the interaction of eligibility and period 2, *Time 2 X Eligible*, measures the impact of the intervention on the outcome in this model. Finally, for the IV model, the TOT impact is measured by *Had Surgery (IV).* All the models also include controls for age, duration of blindness, being married, and other characteristics as well as kebele dummies.

The estimates in Table 2.6 show that the intervention led to an increase in participation in income-generating work among surgery patients relative to controls. The Difference in Difference ITT model shows a small but statistically significant increase in the probability of work of 3%, while in the IV TOT model the change is about 4%. We would expect, all things equal, a larger impact in the TOT models given that they only consider changes in the treated (operated), not all surgery-eligible blind. The propensity score matching analysis reinforces these findings, though the gap is slightly (but insignificantly) narrowed to 0.032.

Table 2.6– Estimates of impact of Surgery Intervention on Participation in Market Work

	DinD(ITT)	IV (TOT)
Time period 2 (T1 excluded)	0.0042	
	(0.0074)	
Eligible for surgery	0.0017	
	(0.0064)	
Time 2 X Referred (Eligible)	0.0299	
	(0.0120)**	
Married (from baseline)	0.0144	0.0265
	(0.0076)*	(0.0123)**
Years of blindness	-0.0007	-0.0007
	(0.0003)**	(0.0005)
Female	-0.0240	-0.0282
	(0.0086)***	(0.0153)*
Age in years	-0.0009	-0.0007
	(0.0004)**	(0.0006)
Number of adult sons	-0.0031	-0.0031
	(0.0021)	(0.0032)
Number of adult daughters	0.0034	0.0040
	(0.0024)	(0.0044)
Ever attended school	0.0100	0.0002
	(0.0145)	(0.0248)
Orthodox religion dummy (Muslim excluded)	-0.0114	-0.0249
	(0.0139)	(0.0241)
Had surgery (IV)		0.0402
		(0.0126)***
Constant	0.0906	
	(0.0308)***	
Number of Observations	1,027	1,026
R^2	0.05	0.03

Note: dependent variable is work in the last week.: ITT=Intention to Treat; TOT=Effect of Treatment on Treated; DinD= Difference in Difference; IV=Instrumental Variables. The intervention impact is measured by Time 2 X Eligible for DinD/ITT and Had surgery (IV) for the IV model.
* p<0.1; ** p<0.05; *** p<0.01. All estimations include Kebele Fixed Effects. Standard errors are adjusted for clustering at Kebele level. For DinD models, correlations across repeated measures for individuals are modeled using random effects.

Since the descriptive statistics in Table 2.5a suggest divergent responses by gender as well as age, we also present the Difference in Difference model for men and women separately, with and without interactions with a dummy variable for being under 70. Results are shown in Table 2.6a; only the coefficients for intervention impacts are presented. For men overall, a significant impact on the probability of market work in the last seven days is confirmed. The interactions with age under 70 are positively signed but not significant. However, models using an interaction with age under 65 do find a large positive effect of being under 65, pointing to

differential effects by age, though as already noted for the descriptive analysis, the small number of men under 65 in the sample needs to be taken into account.

Table 2.6a– Estimates of impact of Surgery Intervention on Participation in Market Work by Gender and Age

	DinD (ITT)	DinD (ITT)
Men		
Time 2 X Eligible	0.0579	0.0452
	(0.0256)**	(0.0237)*
Time 2 X Eligible X Under 70		0.0798
		(0.0812)
R^2	0.10	0.10
Number Individuals	856	856
Women		
Time 2 X Eligible	0.0113	0.0207
	(0.0102)	(0.0127)
Time 2 X Eligible X Under 70		-0.0284
		(0.0235)
R^2	0.05	0.05
Number Individuals	1,198	1,198

Returning to the issue of work in the last week vs. the last year, we consider the responses to two additional questions in the follow-up survey that were designed to elicit more specific information about work in the year since the baseline. These questions asked if the respondent worked at all during the previous planting season and during the last harvest season. Since the questions were only added to the follow-up survey, the Difference in Difference method to estimate impacts on these measures, but descriptive comparisons are informative. Among those having surgery, 7% reported working during planting and 8% during harvest. This is higher than the non-eligible controls (5% for planting, 6% for harvest) and the eligible group not having surgery (only 0.6% during planting and 2% during harvest). Still, the shares of the operated patients reporting this activity remain very low, confirming the impression of limited participation in income generating activities following surgery.

The estimates in Table 2.6 show that a number of factors affect participation in market work activities. Individuals are more likely to have worked in the last week if they are married, and, reflecting differences in gender roles, women are less likely to do market-oriented work. Participation declines both with age and the number of years a person has been blind. Interestingly, having more adult sons (but not daughters) is associated with working, perhaps because sons may have land hence a use for a parent's labor.

To save space we do not present the regression results for hours in household work. Only the IV (TOT) model shows a statistically significant positive effect of surgery on time in these activities, and the implied effect is relatively small (about 18 minutes more per day).

Social Participation

In Chapter One we saw that blindness was associated with very large reductions in various forms of social participation of older adults, based on comparison of blind and non-blind samples. To what extent is this reversed by cataract surgery? Table 2.7 indicates that there were across the board generally statistically significant increases in participation in a range of activities among surgery patients, including attending church or mosque, visiting friends, and attending weddings and funerals. No such changes were reported either by non-eligible controls or surgery decliners. In fact, there are several statistically significant reductions in activities for these groups, perhaps reflecting normal aspects of aging in the sample overall.

Table 2.7 – Participation in Social Activities at Baseline and Follow-up, by Group (shares)

		Baseline	Follow-Up	Change
Had Surgery	Attends Mahiber or Senbetie or other Church/mosque meetings once a month or more	0.45	0.59	0.141***
	Ever attends church/mosque	0.51	0.65	0.144***
	Ever have friends/relatives visit	0.68	0.73	0.049
	Ever visit friends/relatives	0.27	0.40	0.128***
	Ever go to market	0.13	0.16	0.030
	Ever attend weddings	0.23	0.32	0.086***
	Ever attend funerals	0.24	0.43	0.189***
	N	423	425	
Did not have surgery (non-eligible controls)	Attends Mahiber or Senbetie or other Church/mosque meetings once a month or more	0.52	0.40	-0.115***
	Ever attends church/mosque	0.56	0.46	-0.103***
	Ever have friends/relatives visit	0.66	0.67	0.011
	Ever visit friends/relatives	0.25	0.22	-0.028
	Ever go to market	0.10	0.06	-0.046***
	Ever attend weddings	0.21	0.21	0.004
	Ever attend funerals	0.23	0.23	0.000
	N	466	470	
Did not have surgery (eligible but declined)	Attends Mahiber or Senbetie or other Church/mosque meetings once a month or more	0.33	0.25	-0.076
	Ever attends church/mosque	0.36	0.27	-0.083
	Ever have friends/relatives visit	0.64	0.64	-0.000
	Ever visit friends/relatives	0.23	0.14	-0.083*
	Ever go to market	0.05	0.03	-0.015
	Ever attend weddings	0.11	0.11	-0.000
	Ever attend funerals	0.12	0.12	-0.000
N		132	132	

Notes: * $p<0.1$; ** $p<0.05$; *** $p<0.01$.

For the regression analysis of impacts, given the presence of multiple related participation outcomes we estimate the average effect for all the outcomes. We follow Clingingsmith, *et al.* (2009) and Kling and Liebman (2004) in constructing mean standardized treatment effect estimates for this group of outcomes. These estimates yield the normalized treatment effect obtained from a seemingly unrelated regression (SUR) where each dependent variable is one of these individual measures of participation.[23] The estimates show shifts of the

[23] This test is preferable to a joint F-test across related outcomes because it is unidirectional and has improved power (Duflo *et al.* 2007).

mean effect in standard deviations of the mean. The results, presented in Table 2.8, confirm the descriptive findings of benefits in terms of greater participation in social activities. In the ITT difference in difference model, there is an effect of the intervention on the eligible group equal to 0.23 s.d. of the mean of the average participation (as noted above the impact is measured by the coefficient on the interaction of eligibility and time period 2). Finally, the IV model for TOT indicates a smaller effect of 0.17 s.d. of the mean. Both of these estimates are statistically significant at the 99% level.

Table 2.8 – Estimates of Impact of Surgery Intervention on Participation in Social Activities

	DinD(ITT)	IV (TOT)
Time period 2 (T1 excluded)	-0.0679	
	(0.0472)	
Eligible for surgery	0.0772	
	(0.0619)	
Time 2 X Eligible	0.2324	
	(0.0548)***	
Constant	1.5987	
	(0.1600)***	
Had surgery (IV)		0.1725
		(0.0319)***
Married (from baseline)		0.0667
		(0.0241)***
Years of blindness		-0.0004
		(0.0011)
Female		-0.0841
		(0.0190)***
Age in years		-0.0074
		(0.0008)***
Number of adult sons		0.0130
		(0.0067)*
Number of adult daughters		0.0055
		(0.0070)
Ever attended school		0.0293
		(0.0315)
Orthodox religion dummy (Muslim excluded)		0.0647
		(0.0318)**
Number of Observations	1,027	1,023

Notes : Estimates standardized mean effect of participation in different activities using seemingly unrelated regression. Coefficient values indicate the standard deviations change in the mean associated with the variable. * $p<0.1$; ** $p<0.05$; *** $p<0.01$. All estimations include Kebele Fixed Effects. Standard errors adjusted for clustering at the level of Kebeles. For DinD models, correlations across repeated measures for individuals are modeled using random effects.

Overall, the impacts of surgery on these activities, while highly significant statistically, seem to be fairly modest in size. For example, as seen in Table 2.7, the share of operated individuals ever attending church or mosque rose from 0.45 to 0.59. 'Ever attending funerals' increases more, from 0.24 to 0.43. These are not trivial increases, but levels of social participation remain well below those of the non-blind older adults recorded as baseline (reported in Table II.5). For example, as seen in Chapter One, almost all of the non-blind reported attending church or mosque, and 83% of women and 89% of men attended funerals. Also as reported in Chapter One, after adjustment for age and other covariates, there is a 40% gap between non-blind and blind men in the probability of ever attending church or mosque, and a 50% gap for women. Therefore surgery appears to significantly improve measures of social participation, but without restoring them to pre-blindness levels.

Additional regressions with age interactions found no significant differences in the impact of surgery on social participation for patients under 70 and 70 or older. Among other covariates in the models, several factors influence social participation, in generally expected ways. Married individuals are more socially active while older individuals are less active. Women have lower social participation, a reflection of differing social roles, and consistent with differences seen in the baseline descriptive data.

Food Insecurity

Table 2.9 shows increases in our measures of food insecurity between baseline and follow-up both for operated blind and ineligible controls. For blind individuals who had surgery, the index increases from 2.10 to 2.60, and the share reporting at least one measure of food insecurity in the last month rose from 0.58 to 0.75. Increases in similar magnitude were reported by controls, while for the eligible but declining group, there was essentially no change.

Table 2.9 – Individual Food Security at Baseline and Follow-up, by Group

		Baseline	Follow-Up	Change
Had Surgery	Individual food insecurity index (range 0-12)	2.10	2.60	0.500***
	Any individual food insecurity?	0.58	0.75	0.164***
	N	424	426	
Did not have surgery (non-eligible controls)	Individual food insecurity index (range 0-12)	2. 42	2.87	0.452***
	Any individual food insecurity?	0.62	0.77	0.145***
	N	468	471	
Did not have surgery (eligible but declined)	Individual food insecurity index (range 0-12)	2.53	2.19	0.346
	Any individual food insecurity?	0.58	0.62	0.0439
	N	131	133	
Total	Individual food insecurity index (range 0-12)	2.30	2.67	0.369***
	Any individual food insecurity?	0.60	0.74	0.140***
N		1023	1030	2053

As shown below, these findings are mirrored by a similar general worsening of food security at the household level as well as apparent very large declines in household per capita expenditures. The most likely explanation for these patterns is the timing of the follow-up survey in late May-early June, compared with April-May for the baseline. Household food availability varies significantly by month in the rural region of the study. An additional month means households are further away from the time of the last harvest, and food stocks as well as cash reserves are further depleted. Therefore it is not surprising that food security for both controls and treatment groups fell relative to the baseline (investigations also established that there was nothing exceptional about either year such as a particularly poor harvest, so seasonal patterns best explain the result).

The DinD estimate as well as IV model (Table 2.10) confirm that there were no significant differences in changes in food security across groups. PSM analysis adds further evidence, with a point estimate close to the IV model (0.027) but also not significant. The results

thus indicate that surgery did not lead to improvements in individual or household food security relative to other individuals or households, though caution should be exercised here, since it is possible that improvements were simply swamped by the overall negative trend. Household level measures are considered below.

Table 2.10 – Estimates of impact of Surgery Intervention on Food Insecurity

	DinD(ITT)	IV(TOT)
Time period 2 (T1 excluded)	0.4513	
	(0.2239)**	
Eligible for surgery	0.0722	
	(0.1662)	
Time 2 X Referred (Eligible)	-0.1624	
	(0.1880)	
Married (from baseline)	-0.1675	-0.0490
	(0.1634)	(0.2074)
Years of blindness	0.0053	0.0122
	(0.0069)	(0.0091)
Female	-0.2640	-0.2603
	(0.1391)*	(0.1957)
Age in years	-0.0284	-0.0275
	(0.0048)***	(0.0076)***
Number of adult sons	-0.1127	-0.1339
	(0.0379)***	(0.0455)***
Number of adult daughters	-0.1316	-0.1385
	(0.0342)***	(0.0459)***
Ever attended school	0.3645	0.2103
	(0.1721)**	(0.2664)
Orthodox religion dummy (Muslim excluded)	-0.4359	-0.5848
	(0.2670)	(0.4834)
Had surgery (IV)		0.0300
		(0.1698)
	(0.0312)***	
Constant	5.0966	
	(0.5188)***	
R^2	0.09	0.05
Observations	1,027	1,026

Note: dependent variable is the Food Insecurity Index. : ITT=Intention to Treat; TOT=Effect of Treatment on Treated; DinD= Difference in Difference; IV=Instrumental Variables. * p<0.1; ** p<0.05; *** p<0.01. All estimations include kebele fixed effects. Standard errors are adjusted for clustering at the kebele level. For DinD models, correlations across repeated measures for individuals are modeled using random effects.

We saw above that there was some evidence that surgery has larger impacts on participation in income generating activity for younger patients as at least among men (though

these of course are still older adults). As we would expect working to be positively linked to food security, all things equal, we also considered whether there were differential impacts of surgery by age as well as gender. Model estimates are presented in Table 2.10a. Unexpectedly, the results indicate a negative effect of the intervention on male surgery patients' food security (base models in columns 1 and 2) and a positive effect on women's food security. On the other hand, the interactions with age under 70 in the men's models are negative, very large, and statistically significant. This is consistent with the findings of larger increases in work for younger male patients.

The reasons for the difference in mean impacts of surgery on food security for men and women are not clear. This finding seems inconsistent with baseline survey analysis showing significant food insecurity differences between blind men and non-blind men, with less difference between blind and non-blind women; this would suggest recovery of sight would have stronger and positive impacts on men's food security than women's, not the reverse as we find here.

Table 2.10a– Estimates of impact of Surgery Intervention on Food Insecurity by Gender and Age

	DinD(ITT)	DinD (ITT)
Men		
Time 2 X Eligible	0.5852	0.7244
	(0.2912)**	(0.3052)**
Time 2 X Eligible X Under 70		-1.3686
		(0.6786)**
R^2	0.14	0.14
Number of Individuals	854	854
Women		
Time 2 X Eligible	-0.7108	-0.4861
	(0.2297)***	(0.2890)*
Time 2 X Eligible X Under 70		-0.3322
		(0.4788)
R^2	0.12	0.12
Number of Individuals	1,193	1,193

Notes: see notes to Table 11.10.

Physical Health

Changes in different measures of physical health are shown in Table 2.11. Among those getting surgery, there were statistically significant improvements in most measures between baseline and follow-up. Recall from Chapter One that our index of activities of daily living is limited to activities that are (in principle) independent of visual acuity. The share of operated persons reporting having trouble performing one or more of these activities fell by more than 25%, from 0.80 to 0.53, and the ADL index itself rose from 0.71 to .83. Although this change may still in part capture the effects of better vision, as noted earlier the questions were framed to capture better health, e.g., having more strength.24 No such improvements were recorded for non-eligible controls; in fact, the activities of daily living index fell from .69 to .60 (significant at 1%).

[24] As discussed in Chapter One, these measures capture general functioning like dressing, bathing, and going to the toilet, and the questions were worded in such a way that purely vision disability as a cause of difficulty is eliminated or minimized, for example by asking if the individual could go to toilet without difficulty if they were guided.

Table 2.11 – Activities of Daily Living and Physical Health Status at Baseline and Follow-up, by Group

		Baseline	Follow-Up	Change
Had Surgery	Has trouble performing one or more ADLs	0.80	0.53	-0.268***
	Activities of Daily Living Index	0.71	0.83	0.118***
	Body Mass Index (BMI)	18.21	18.52	0.312*
	Share with BMI < 18.0	0.48	0.42	-0.052
	Has 1 or more non-vision-related chronic health problem	0.66	0.66	0.000
	Number of chronic health problems (out of 20)	1.57	1.34	-0.239**
	# Observations	426	426	
Did not have surgery (non-eligible controls)	Has trouble performing one or more ADLs	0.82	0.81	-0.015
	Activities of Daily Living Index	0.69	0.60	-0.094***
	Body Mass Index (BMI)	18.48	18.82	0.340*
	Share with BMI < 18.0	0.43	0.40	0.023
	Has 1 or more non-vision-related chronic health problem	0.65	0.64	0.004
	Number of chronic health problems (out of 20)	1.450	1.28	--0.221**
	# Observations	471	471	
Did not have surgery (eligible but declined)	Has trouble performing one or more ADLs	0.88	0.85	-0.030
	Activities of Daily Living Index	0.63	0.59	-0.040
	Body Mass Index (BMI)	17.28	18.60	1.314***
	Share with BMI < 18.0	0.54	0.43	-0.113*
	Has 1 or more non-vision-related chronic health problem	0.77	0.68	-0.097*
	Number of chronic health problems (out of 20)	1.89	1.43	-0.466**
	# Observations	133	133	

With regard to general health indicators, we observe overall improvement across all groups both in Body Mass Index and the mean number of reported (non-vision related) chronic health problems. The BMI improvements are noteworthy given that this occurred in spite of the fact that the follow-up survey was conducted during a month when households were relatively vulnerable to food insecurity as discussed above (as well as lower consumption, presented below). At the time of the survey, BMI, which is considered a medium term indicator of nutrition, may not yet have responded to recent reductions in food availability. It is not likely

that the change in BMI reflects differences in the way subjects were measured across survey rounds. The across the board reduction in the number of chronic health problems is more difficult to understand but this measure would be more susceptible to changes in interviewer approach.[25]

Difference in Difference and IV results for the ADL index are shown in Table 2.12. In the ITT framework (first column), the coefficient on the interaction of 2nd period and eligibility indicates a 17 point improvement in the index relative to non-eligible controls. The IV estimate suggests an even larger 26 point improvement relative to those not getting surgery. Both of these estimates are highly significant. Although as noted these questions were intended to capture physical health changes, not direct vision-related changes, in light of the findings for other measures of physical health, it is possible that the ADL index is mostly picking up the effects of improved vision. If it was capturing general physical health improvements, we would expect some change in all groups for this measure as well, since other measures of physical health improved for all groups.

[25] For example, if interviewers in the follow-up tended to rush through the list of questions on chronic health problems, it is likely that fewer would be reported.

Table 2.12 – Estimates of Impact of Surgery Intervention on Activities of Daily Living Index

	DinD(ITT)	IV (TOT)
Time period dummy	-0.0940	
	(0.0266)***	
Referred for surgery (Eligible)	0.0228	
	(0.0204)	
Time 2 X Referred (Eligible)	0.1740	
	(0.0291)***	
Married dummy (from baseline)	0.0151	0.0080
	(0.0169)	(0.0214)
Years of blindness	-0.0013	-0.0016
	(0.0009)	(0.0013)
Female	-0.0652	-0.0650
	(0.0144)***	(0.0201)***
Age in years	-0.0058	-0.0063
	(0.0006)***	(0.0008)***
Number of adult sons	0.0042	0.0049
	(0.0052)	(0.0061)
Number of adult daughters	0.0006	-0.0041
	(0.0039)	(0.0056)
Ever attended school	0.0501	0.0264
	(0.0284)*	(0.0380)
Orthodox religion dummy (Muslim excluded)	0.0248	0.0060
	(0.0301)	(0.0332)
Had surgery (IV)		0.2596
		(0.0304)***
Constant	1.1486	
	(0.0569)***	
Number of Observations	1027	1,021
R^2	0.17	0.19

Note: ITT=Intention to Treat; TOT=Effect of Treatment on Treated; DinD= Difference in Difference; IV=Instrumental Variables * p<0.1; ** p<0.05; *** p<0.01. All estimations include kebele fixed effects. Standard errors are adjusted for clustering at the kebele level. For DinD models, correlations across repeated measures for individuals are modeled using random effects.

Mental Health

As discussed in Chapter One, mental health was measured through the modified CES depression scale as well as a Likert question on overall current life satisfaction. On both measures, as shown in Table 2.13, those who had surgery registered a strong improvement. The value of the CES-D scale fell from 18.9 to 15.4, a highly statistically significant decline. Life satisfaction also increased, with the share saying their life was 'very good' or 'mostly good' rising from 39% to 47% and the share for 'mostly bad' or 'very bad' falling from 22% to 14%.

For both controls and eligible surgery decliners, point estimates for the CES-D scale also suggest a decline in depression, but these are much smaller and not significant at conventional levels. In both of these groups, the shares reporting their lives as 'very good' or 'mostly good' appears to stay the same or fall slightly.

Table 2.13 – Mental Health Status and Life Satisfaction at Baseline and Follow-up, by Group

		Baseline	Follow-Up	Change
Had Surgery	Modified CES-D Depression scale	18.93	15.38	-3.55***
	Life Satisfaction (percent):			0.019***
	Very good or excellent	0.03	0.05	
	Mostly good	0.36	0.42	
	Neither good nor bad	0.40	0.39	
	Mostly bad	0.19	0.12	
	Very bad	0.03	0.02	
	N	384	408	
Did not have surgery (non-eligible controls)	Modified CES-D Depression scale	19.78	19.08	-0.70*
	Life Satisfaction (percent):			0.011
	Very good or excellent	0.01	0.02	
	Mostly good	0.32	0.28	
	Neither good nor bad	0.39	0.44	
	Mostly bad	0.26	0.22	
	Very bad	0.03	0.05	
	N	436	448	
Did not have surgery (eligible but declined)	Modified CES-D Depression scale	19.41	18.70	-0.70
	Life Satisfaction (percent):			0.030
	Very good or excellent	0.01	0.01	
	Mostly good	0.35	0.31	
	Neither good nor bad	0.38	0.46	
	Mostly bad	0.20	0.18	
	Very bad	0.06	0.04	
	N	116	122	

Note: For Life Satisfaction the Change column reports the p-value for a chis-square test for change in proportions in the response categories from baseline to follow-up

The DinD and IV models (Table 2.14) confirm that the intervention resulted in improvements in mental well-being. The ITT model indicates a 2.3 point, highly statistically significant decline in the depression scale. The impact among those both eligible and getting surgery was a larger 4 percentage points in the IV model. It is noteworthy that these estimated

impacts are all larger than the initial difference in the scale at baseline between blind and non-blind older adults seen in Chapter One (14.8 vs. 16.6, or 1.8 points). These beneficial impacts of the intervention on mental health are therefore large.

Table 2.14 – Estimates of impact of Surgery Intervention on Mental Health Status

	DinD(ITT)	IV (TOT)
Time period 2 (T1 excluded)	-0.7076	
	(0.4582)	
Eligible for surgery	-0.6747	
	(0.3619)*	
Time 2 X Eligible	-2.2803	
	(0.5523)***	
Married (from baseline)	-0.3518	-0.1201
	(0.3473)	(0.5457)
Years of blindness	0.0069	0.0454
	(0.0165)	(0.0189)**
Female	0.5354	1.2453
	(0.3953)	(0.5771)**
Age in years	0.0156	0.0472
	(0.0147)	(0.0239)**
Number of adult sons	-0.3319	-0.3946
	(0.0886)***	(0.1336)***
Number of adult daughters	-0.2229	-0.0925
	(0.0954)**	(0.1574)
Ever attended school	-0.5068	-0.7173
	(0.5612)	(0.8240)
Orthodox religion dummy (Muslim excluded)	0.4539	0.0525
	(0.5823)	(0.7979)
Had surgery (IV)		-4.0658
		(0.5453)***
Constant	18.4460	
	(0.8778)***	
Number of Observations	1,021	974
R^2	0.13	0.12

* Note: dependent variable is modified CES-D Depression scale. ITT=Intention to Treat; TOT=Effect of Treatment on Treated; DinD= Difference in Difference; IV=Instrumental Variables. * p<0.1; ** p<0.05; *** p<0.01. All estimations include kebele fixed effects. Standard errors are adjusted for clustering at the kebele level. For DinD models, correlations across repeated measures for individuals are modeled using random effects.

Self-reported Impacts of Surgery

The survey also took a more subjective approach to assessing the impacts of cataract surgery, directly asking individuals who had surgery how it changed their own situation and that

of their households. These questions began with the patient's vision, starting with the question, Overall, how would you rate your eyesight when you use both your eyes?[26] As shown in Table 2.15, there were dramatic improvements in self-rated vision since baseline, with some 86% of patients at follow-up saying their vision was now 'moderate' or better than moderate compared with 24% at baseline (and 37% reporting good or very good vision compared with 3.4% at baseline). The share reporting 'bad' or 'very bad' vision fell from three quarters of the sample to just 14%.

The surgery recipients were also asked if they were currently experiencing any pain or discomfort from their eyes. There was a modest reduction in the incidence of pain or discomfort, with the share reporting none or 'just a little' rising from 0.68 to 0.77, and the share reporting 'a fair amount', 'quite a lot' or 'extreme' falling from 32% to 24%. It should be noted that many of these bilaterally blind patients had only one eye operated so remained with very poor vision in the other eye; for such cases current vision would be unlikely to be self-rated as 'very good' even with a completely successful surgery on the operated eye. Therefore it is the overall, quite dramatic, change over time rather than current level that is of most interest.

Subjects were also given the Visual Related Quality of Life questionnaire, which asks how vision problems affect one's ability to do various activities or perceive things (e.g., recognize faces, see objects in the road). While at follow-up surgery patients were given all 20 items, at baseline, blind participants were only administered the first four items of the scale which ask questions about how vision may affect basic functioning (carrying out daily activities on your own; finding your way around indoors; doing work up to your usual standard; going to the toilet). Most of the later questions focused on specific activities such as seeing the level in a

[26] As indicated, all surgery eligible (at baseline) participants were also given vision tests by nurses before the follow-up interview. These data are being analyzed separately.

container when pouring. These were not asked at baseline of blind people as it was felt there would be very little variation in responses and that repeated questions of this type would unnecessarily tire or irritate the respondent.

Table 2.15 – Self-reported Impacts of Cataract Surgery on Vision

		Baseline	Follow-Up	Change
Overall, how would you rate your eyesight when you use both your eyes?				
	Very Good	1.2	6.4	5.2
	Good	2.2	34	31.8
	Moderate	20.9	45.8	24.9
	Bad	58	12.3	-45.7
	Very Bad	17.4	1.5	-16.0
	N	407	406	
	Pearson chi-2 for difference between Baseline and Follow-up			341.91(0.000***)
Because of your eyesight, how much difficulty do you have in…..		Baseline	Follow-Up	Change
Carrying out daily activities on your own?	None	0.7	18.2	17.4
	Mild of a little bit	4.9	25.3	20.4
	Moderate or a fair amount	12.3	32.4	20.1
	Severe or a lot	58.7	18.7	-40.1
	Extreme/cannot do	23.1	5.4	-17.7
Finding your way indoors?	None	3.4	27.3	23.8
	Mild of a little bit	9.1	27.3	18.2
	Moderate or a fair amount	22.6	25.1	2.5
	Severe or a lot	47.7	14.7	-32.9
	Extreme/cannot do	16.7	5.7	-11.1
Doing your work up to your usual standard?	None	0.7	18.9	18.2
	Mild of a little bit	3.9	24.3	20.4
	Moderate or a fair amount	13.0	27.8	14.7
	Severe or a lot	50.1	21.9	-28.3
	Extreme/cannot do	31.0	7.1	-23.8
Going to the toilet on your own?	None	6.4	38.1	31.7
	Mild of a little bit	12.3	23.8	11.5
	Moderate or a fair amount	20.4	19.7	-0.7
	Severe or a lot	40.3	13.8	-26.5
	Extreme/cannot do	19.7	4.7	-15.0
Vision Quality of Life Subscale Scores (scale 1-25, 25 is best)	Women	9.31	16.1	6.7***
	N	230	231	
	Men	10.10	16.33	6.23***
	N	176	176	

Therefore we examine the change from baseline to follow-up for the four common items. Each has five possible responses to the question of how much difficulty one has in performing the activity due to vision problems (none/mild or a little/moderate or a fair amount/severe or a lot/extreme or cannot do the activity). As shown in Table 2.15, vision-associated difficulties in these tasks diminished dramatically. For example, at baseline, 82% said that due to their vision problem they could not carry out their daily activities on their own or could do so only with severe or a lot of difficulty. This fell to 24% one year after surgery. The share saying their vision caused either 'none' or only 'a little bit' of difficulty in carrying out these activities increased from 6% to 44%. We also created a score for an index formed from the four items. Each item was scored with 5 representing the best category of no difficulty and 1 assigned to the worst category. The item scores were summed to yield a subscale score with can range from 1 for inability to do every activity to 21 for being able to do all with no difficulty. These scores are shown in the table for surgery recipients at baseline and follow-up. The mean scores increased from 9.3 to 16.1 for men and 10.1 to 16.3 for women ($p=0.00$ in both cases). Clearly, the cataract surgery led to very significant improvements in vision and large reductions in vision-related difficulties in carrying out basic functions, as reported by patients.

The second set of questions on impacts of surgery asked about a range of individual and family outcomes, presented in Table 2.16. About two-thirds of men and women said they participated more in social activities as a result of the surgery, with 39% of men and 36% of women saying they increased their participation by 'a fair amount' or 'a lot'. 53% of the men and 55% of the women reported working more as a result of surgery; about 30% of men and 25% of women reported working a fair amount or a lot more. Hence participation in social activities as well as work activities overall increased, but substantial shares did not report increases in

social participation (about one third of surgery patients) or work (close to half), and another 25% for each activity increased their participation by only ‘a little’. The changes in work reported this way seem somewhat greater than in the comparisons of baseline and follow-up data seen earlier but are still rather modest. Overall these findings accord with the scope of changes in social and work activities seen earlier that were based on comparing baseline and follow-up data.

Those who responded that there were no increases in their social participation or work were asked why this was the case. The most commonly cited reason was age: 47% of those reporting no change in social participation gave this as the reason, as did 53% of those not increasing work activities. Continued poor vision was cited by 39% of those who did not increase social participation and by 34% of those who did not increase work. Significantly smaller shares cited having other disabilities or not having engaged in the activities even before blindness as reasons.

As Table 2.16 also shows, the vast majority of respondents said that they now feel safer in their homes, with almost 60% saying they feel ‘a fair amount’ or ‘a lot’ safer; the proportions for men and women are similar. Equally large changes are seen in the level of self-perceived respect both from one’s family and the community. 62% of women and 63% of men said they have a fair amount more or a lot more respect within their families, with only 12% and 13%, respectively, saying there was no change. More than half of the respondents said that respect from the community increased a fair amount or a lot as a result of their surgery.

Table 2.16 – Self-reported Impacts of Cataract Surgery on Non-Vision Outcomes

Because of the surgery for your vision, do you….	Not at all	A little	A fair amount	A lot
participate in social activities more than you did before? (All, N=402)	0.31	0.28	0.34	0.06
Female (N=229)	0.33	0.29	0.33	0.5
Male (N=173)	0.29	0.27	0.36	0.08
work more than you did before (that is, in farming or an enterprise)?	0.46	0.27	0.23	0.05
Female	0.45	0.30	0.21	0.04
Male	0.47	0.22	0.25	0.06
feel safer in your house?	0.13	0.29	0.47	0.11
Female	0.12	0.31	0.46	0.10
Male	0.14	0.25	0.47	0.13
feel you have more respect within your family?	0.13	0.25	0.51	0.12
Female	0.12	0.26	0.48	0.14
Male	0.13	0.23	0.54	0.09
feel you have more respect from others in the community?	0.14	0.32	0.45	0.09
Female	0.14	0.32	0.44	0.09
Male	0.13	0.32	0.46	0.09

In sum, the findings from self-reported changes due to surgery suggest large improvements in vision and functioning, modest but non-trivial overall increases in social participation and work activities, and significantly enhanced feelings of security as well as respect from others.

Impacts of Surgery on the Household

In this section we consider the impacts of cataract surgery on the household along a number of dimensions, using baseline and follow-up survey comparisons as well as survey results from direct questioning of blind individuals and their caregivers (or former blind and their caregivers as the case may be) on these impacts. We first consider changes in three indicators of

household well-being: levels of assets, food security, and per capita household consumption. For this analysis we dropped a small number of cases where the individual moved to a different household between baseline and follow-up, as changes in household measures for these cases would be difficult to interpret in terms of changes in household level well-being.

Pre and post changes in these outcomes are presented in Table 2.17. The asset index was created using the methodology described in Chapter One, this time recalculated using the pooled two year sample of households to ensure comparability across years. As shown, there were no significant changes in household wealth as measured by the asset index for the households of surgery patients and of surgery ineligible controls, though perhaps surprisingly, a marginally significant increase for the eligible but declined group is seen. Generally, we would not expect major changes in assets as they are discrete ('lumpy') and thus tend to change slowly relative to flows of income or consumption. The models estimates in Table 2.18 indicate no change in wealth from the intervention, and propensity score matching finds a slightly larger point estimate (0.13) that is closer to significance, but ultimately also falls short.

We look next at a consumption measure, food insecurity. Food insecurity, measured by the index and by an indicator for experiencing one or more component of food insecurity, appears to have increased for both the surgery and ineligible groups. In contrast, the index fell among surgery declining households, consistent with the positive change in assets for this group. The DinD Intention to Treat model in Table 2.18 indicates a negative impact of the intervention on household food insecurity (that is, a positive impact on food security). No effect is detected for the IV model (since the latter compares to eligible but declining households, who as seen experienced no worsening of food insecurity, this is not surprising), or the PSM model.

Table 2.17– Household Consumption, Assets, and Food Insecurity at Baseline and Follow-up, by Group (Patient Had Surgery, Non-Eligible Controls, Eligible but Declined Surgery)

		Baseline	Follow-Up	Change
Blind Person Had Surgery	Asset Index (mean)	0.05	0.06	0.0193
	Food Insecurity Index (mean)	2.92	3.02	0.1011
	Any food insecurity (share)	0.64	0.71	0.0753***
	Per Capita Consumption (Mean 1000 Birr/mo.)	82.24	49.86	-32.34***
Did not have surgery (non-eligible controls)	Asset Index (mean)	-0.10	-0.09	0.0116
	Food Insecurity Index (mean)	3.14	3.50	0.360**
	Any food insecurity (share)	0.65	0.75	0.100***
	Per Capita Consumption (Mean 1000 Birr/mo.)	83.36	47.28	-36.08***
Did not have surgery (eligible but declined)	Asset Index (mean)	0.018	0.16	0.144*
	Food Insecurity Index (mean)	3.36	2.72	-0.639**
	Any food insecurity (share)	0.68	0.71	0.0301
	Per Capita Consumption (Mean Birr/mo.)	84.48	43.56	-40.92***

Finally, our measure of per capita household consumption is derived from the detailed consumption module of the survey, which gathered information on household consumption (though purchases, own production, or gifts) of 32 food items in the last week as well as non-food purchases in the last month. For each item, unit prices were derived from the survey information on units, quantity purchased, and expenditures. Median unit prices were calculated at the Woreda (district) level and these prices were used to value food consumed out of the household's own production as well as from gifts, for which no prices (only units and quantities) were provided. Outlier values for household expenditures or value of consumption per item per capita were replaced by district median values. Values of consumption on each food and non-food item were added to get the value of total household per person consumption. Year 2

(follow-up) expenditures were deflated using WFP estimates of food price inflation from June 2102 to June 2103.[27]

Table 2.17 indicates that there were very large reductions in household per capita consumption from baseline to follow-up, across groups, but with the smallest reduction in the surgery group. The reductions range in magnitude from 32% to 41% of baseline levels. While a decline in consumption is in line with the patterns of lower food security just discussed, these declines seem implausibly large, given that many of the households in the sample are close to subsistence so presumably could not sustain large reductions in consumption. Detailed checks of the data and imputation of prices and expenditures did not reveal anomalies that might explain these results; one possibility is that the inflation index we use overstates inflation in the area of the study, hence over-deflates year 2 consumption. We conclude that household consumption was lower at follow-up, but advise caution with respect to the magnitude of the recorded changes.

In the regressions in Table 2.18, the overall decline is captured by the very large and significant coefficient on the period 2 dummy variable. The coefficients on the variables capturing impacts of the intervention are positive in each regression (including PSM), in line with the smaller reductions for the surgery group seen in Table 2.17, but these impacts are not significant. Other models (not presented) added interactions of the intervention and gender of the patient. We found no differential by gender in the intervention impact. For household food insecurity this may seem at odds with the finding of differential effects by gender for individual food security, but the individual level outcomes may capture intra-household dynamics or other behavioral

[27] http://documents.wfp.org/stellent/groups/public/documents/ena/wfp258436.pdf

factors associated with regaining sight. Interactions of the intervention with age (being under 70) were not significant in separate models for men and women.

Several other covariates in these household regressions, not shown in the table to save space, are of interest. The number of years the individual has been blind at baseline is significantly negatively associated with the household's level of assets, indicating that households with a blind person sell assets or accumulate fewer assets over time, due to the need for income or the inability to use productive assets any longer. Households where the blind person is married (at baseline) and where the blind person is older suffer less from food insecurity.

Potential Economic Impacts of Surgery

We have seen, first, that participation, especially of men, in income-generating work increases after surgery, but the mean changes are small. This is reflected in a general lack of clear improvement in household per capita consumption and food security relative to controls (in a context where the consumption and food measures were declining overall). Direct questions for surgery patients and their caregivers about economic impacts on the household also suggest limited changes, despite major improvements in other dimensions such as the burden on caregivers and social participation. These findings are not very surprising in view of the fact that most surgery patients—and especially men—were quite old: the average age for men was 77.5 and for women was 72.3. Hence most of these individuals were past the age where they would

be highly productive in the agricultural work that is the source of livelihood for virtually all families in this low income rural area.[28]

Table 2.18 – Estimates of impact of Surgery Intervention on Household Consumption, Assets, and Food Security

	Asset Index		Food Insecurity Index		Per Capita Consumption	
	DID(ITT)	**IV(TOT)**	**DID(ITT)**	**IV(TOT)**	**DID(ITT)**	**IV(TOT)**
Eligible for surgery	0.0016		0.0760		3.7686	
	(0.0517)		(0.1678)		(3.6560)	
Time 2 X Eligible	0.0621		-0.4384		1.7185	
	(0.0378)		(0.1990)**		(3.9104)	
Time period 2 (T1 excluded)	-0.0100		0.3218		-35.9435	
	(0.0364)		(0.2524)		(4.7948)***	
Had surgery (IV)		0.0905		-0.1536		3.0919
		(0.0575)		(0.2179)		(2.4944)
R2	0.25	0.131	0.12	0.098	0.22	0.026

Note: ITT=Intention to Treat; TOT=Effect of Treatment on Treated; DinD= Difference in Difference; IV=Instrumental Variables. * $p<0.1$; ** $p<0.05$; *** $p<0.01$. All estimations include kebele fixed effects. Standard errors are adjusted for clustering at the kebele level. For DinD models, correlations across repeated measures for individuals are modeled using random effects. Models also include controls for: married, years blind, female blind, age of blind person, number of adult men, number of adult women, and number of children under 15.

Our overall findings contrast with those of the three-country Cataract Impact Study (Kuper 2010), which found larger mean impacts on work and substantial overall improvement in per capita expenditures in the households of operated individuals relative to non-operated, non-blind controls (though they also found, unexpectedly, improvements in non-operated cataract cases). However, in addition to differences in country settings, the samples in that study were significantly younger than in the present case. The mean age of cataract surgery patients was 69 years in both Bangladesh and Philippines compared to 75 here. This reflects the fact that rather

[28] The qualitative interviews discussed later in this chapter suggest a stronger impact on economic activities of surgery recipients, though the sample was only 12 individuals,

than sampling only blind, study cases were individuals aged 50 or older with Best Corrected Visual Acuity <6/24 due to cataract. This will include many persons with low vision, and these will tend to be younger individuals whose cataract impairment has not progressed to bilateral blindness.

Among younger patients and their households in the present sample, potential economic impacts appear stronger. The analysis by age is constrained by the fact that there are few surgery recipients who are relatively young: for example, re-interviewed surgery patients include just 12 men under age 65 and 29 under 70. However, it is noteworthy that male surgery patients in these younger categories increased work participation more than older patients. Although these changes are not reflected in differential improvements (or smaller reductions) in household consumption, the age-disaggregated findings for work nonetheless suggest possibly significant economic gains for younger, hence also more able-bodied, cataract patients. For someone who returns to a significant level of work participation, household income or consumption per capita has the potential to rise significantly. Households of older adults in this setting are not very large averaging about 5 persons so additional labor from one member can mean significant increases in production and household income.

It should be noted that the cataract surgery intervention in Woldiya, as elsewhere, was not restricted to completely blind patients, so would have included a greater share of younger and potentially economically productive adults than the study sample. The impacts on work and household consumption would be expected to be larger for these patients, though this would depend in part on the extent to which work was impaired for such partially sighted individuals prior to having surgery. Therefore the overall economic impact of such an intervention may be significantly larger than implied by the outcomes for the study sample.

Impacts on the Household Reported by Patients and Caregivers

Perceptions of impacts of the surgery on different aspect of household well-being were also elicited directly from the individual who had surgery, in the same module asking about impacts on the person himself or herself. Questions about household impacts were also posed to caregivers. Table 2.19 reports the responses of patients. In line with the results presented above, responses to questions about economic impacts suggest relatively little change. 59% of surgery patients indicated there was no change at all in household income or production. The share was higher for women than men (0.64 vs. 53), reflecting the fact that men would be more likely to engage in income earning activities than women upon regaining their sight. An additional 36% indicated that household income or production had increased a little, while very few reported 'a lot' (almost none reported a reduction). Few respondents (12%) reported that their household bought (or bought back) livestock or new assets.

Table 2.19 – Impacts of Surgery on the Household Reported by Patient

Because of the surgery for your vision….				
	no change	**increase a little**	**increase, a lot**	**Reduced**
has your household's income or farm/livestock or other production changed?	0.59	0.36	0.05	0.00
Female	0.64	0.31	0.05	0.00
Male	0.53	0.41	0.05	0.00
			Yes	**No**
did your household take back any of its animals or buy new animals?			0.12	0.88
Female			0.10	0.90
Male			0.15	0.85
did your household buy any new assets?			0.12	0.88
Female			0.09	0.91
Male			0.15	0.85

Table 2.20 shows responses of caregivers of those who had surgery. Three fourths of the caregivers agreed with the statement that the blind person's surgery had a big effect on the household's well-being (as discussed in the next section, 81% also agreed with the statement that their own lives had become much better). 60% off caregivers cited lower time burdens of other household members in caring for the blind person as an important impact of the surgery on the household overall, and about half cited more involvement in or greater respect from the community as a household impact. Improvements in household income or production were less important, mentioned by only 22% of respondents. Therefore, there are important individual impacts noted by both surgery recipients and caregivers (the latter discussed below), and household impacts such as reduction in burden of care. On the other hand, improvements to household income do not appear to be among the more significant outcomes of surgery.

Table 2.20 – Impacts of Surgery on the Household Reported by Caregivers

Overall, what would you say are the main impacts of [NAME]'s surgery on your household?			
Share of caregivers mentioning the following:			
More income/production	0.22		
Lower time burden on other household members	0.60		
More food security	0.13		
More involvement/respect in the community	0.51		
No major impacts	0.15		
Share agreeing with the statement:	**Female Caregivers**	**Male Caregivers**	**All**
[NAME]'s surgery has had a big effect on our household's well being	0.74	0.77	0.74
Because of [NAME]'s surgery, our household is less likely be the victim of theft (because [NAME] can now keep watch over things).	0.75	0.79	0.75
Note: N= 387 (295 women, 77 men)			

Impacts of Surgery on Caregivers

In this section we examine impacts of cataract surgery on the activities and well-being of the family caregivers of older blind persons. We use objective survey responses at baseline and follow-up regarding the caregivers' activities and health, as well as direct questions at follow-up to caregivers about the impacts of surgery. There were several complications in the analysis of the sample of caregivers from baseline to follow-up. Unlike the blind person himself or herself, the identity of the caregiver could change, if for example another relative took over these duties. Or in the case of someone getting successful surgery, the caregiver may no longer be present in the household as he or she may no longer be needed. In other cases the blind person may have moved after surgery and so become separated from the caregiver in that fashion. While the survey teams made substantial effort to relocate blind participants from baseline, including finding them in new (local) residences if they had moved, this effort was not made for caregivers.

Care was taken in the data analysis to ensure that our caregiver sample for the analysis of changes was a properly matched baseline to follow-up sample. Caretaker matches were assumed to occur when the personal ID number and sex was the same across surveys, and age difference was less than 10 years. If at least one but not all of these conditions were met we examined the case by hand to see if names matched. This procedure ensured an appropriately matched sample of caregivers for the analysis, so that we can be assured of having the same group of people in both rounds and can therefore measure changes in individual caregiver outcomes. Still, this sample excludes by construction cases where the caregiver changed or left, and these individuals may be different from those who remained in the sample with respect to the outcomes we are

measuring. Therefore the sample, hence also measures of change within it, may not be fully representative of all caregivers.

Economic Activities and Time Use

Table 2.21 shows market work participation and hours in homework for male and female caregivers by the eligibility and surgery status of the blind person. Some changes are seen in market work: for both male and female caregivers the share working in the last week increased. However, similar changes are seen for male and female caregivers in the non-eligible controls, suggesting that the changes reflect factors other than surgery, such as the fact that the follow-up interview was one month later in the year than the baseline.

Table 2.21 – Caregiver Time in Productive Activities at Baseline and Follow-up, by Gender and Group

			Male Caregivers			Female Caregivers	
		Baseline	Follow-Up	Change	Baseline	Follow-Up	Change
Blind person had surgery	Worked in last week (share)	0.40	0.57	0.17*	0.05	0.10	0.056**
	Worked in last week or past year (share)	0.51	0.60	0.09	0.08	0.11	0.028
	Hours in household work in previous day (mean)	3.02	2.68	-0.34	7.19	6.97	-0.218
N		53	53		248	248	
Blind person did not have surgery (non-eligible controls)	Worked in last week (share)	0.43	0.6	0.17**	0.06	0.11	0.05**
	Worked in last week or past year (share)	0.57	0.64	0.07	0.07	0.12	0.05**
	Hours in household work in previous day (mean)	3.13	2.91	-0.23	6.92	7.07	0.153
N		75	75		281	281	
Blind person did not have surgery (eligible but declined)	Worked in last week (share)	0.44	0.31	-0.125	0.05	0.09	0.04
	Worked in last week or past year (share)	0.50	0.44	-0.06	0.07	0.09	0.01
	Hours in household work in previous day (mean)	4.13	3.00	-1.125	6.90	7.27	0.37
N		16	16		81	81	

The findings with respect to domestic work for caregivers, which show no reduction for the surgery group from baseline to follow-up, are somewhat unexpected, especially for female caregivers. In Table 1.13 from Chapter One we saw that female caregivers to the blind worked several hours more a day in housework (including care of the blind person) than their

counterparts in non-blindness affected households, which would lead one to expect a reduction in this time once the vision of the blind person was significantly improved. Further, this finding is at odds with direct questioning about impacts on changes in caregiver time use as well as qualitative interviews reported in the appendix. These women may therefore be substituting other domestic work for time in care of the (no-longer) blind family member, leaving overall hours in domestic work unchanged.[29]

[29] The data bear this out, to an extent. Time specifically in the care of the patient fell by about 30 minutes per day between baseline and follow-up. On the other hand, the caregivers still reported spending about 1.5 hours a day attending to the individual (out of about 7 hours per day domestic work overall), so there may have been some problems in interpretation of this question.

Social Participation

Table 2.22 suggests that there was relatively little change in the social participation for caregivers in any of the groups.

Table 2.22 – Caregiver Participation in Social Activities at Baseline and Follow-up, by Group

		Baseline	Follow-Up	Change
Blind person had surgery	Attends Mahiber or Senbetie or other Church/mosque meetings once a month or more	0.94	0.94	-0.003
	Ever attends church/mosque	0.96	0.96	0.003
	Ever have friends/relatives visit	0.88	0.92	0.043*
	Ever visit friends/relatives	0.81	0.85	0.037
	Ever go to market	0.87	0.89	0.016
	Ever attend weddings	0.80	0.75	-0.047
	Ever attend funerals	0.82	0.83	0.012
	N	301	301	
Blind person did not have surgery (non-eligible controls)	Attends Mahiber or Senbetie or other Church/mosque meetings once a month or more	0.92	0.95	0.029
	Ever attends church/mosque	0.96	0.98	0.023*
	Ever have friends/relatives visit	0.86	0.91	0.049**
	Ever visit friends/relatives	0.83	0.85	0.017
	Ever go to market	0.91	0.93	0.017
	Ever attend weddings	0.80	0.82	-0.023
	Ever attend funerals	0.84	0.87	-0.023
	N	352	353	
Blind person did not have surgery (eligible but declined)	Attends Mahiber or Senbetie or other Church/mosque meetings once a month or more	0.93	0.97	0.0243
	Ever attends church/mosque	0.94	0.98	0.043
	Ever have friends/relatives visit	0.85	0.92	0.065
	Ever visit friends/relatives	0.81	0.86	0.045
	Ever go to market	0.92	0.88	0.040
	Ever attend weddings	0.78	0.77	0.005
	Ever attend funerals	0.83	0.984	0.013
	N	95	97	

This general finding is confirmed in the SUR analysis in Table 2.23, which shows no significant impact on average social participation among caregivers (there is in fact a small negative effect in the IV model though this is only marginally significant). This result is not surprising in view of the baseline findings discussed in Chapter One, which showed (Table 1.14) a lack of differences in social participation measures for caregivers of the blind and their

counterparts in non-blindness affected households, and overall high levels of participation for both.

Table 2.23 – Estimates of Impact of Surgery Intervention on Caregiver Participation in Social Activities

	DinD(ITT)	IV (TOT)
Time period 2 (T1 excluded)	0.0813	
	(0.0447)*	
Eligible for surgery	-0.0264	
	(0.0503)	
Time 2 X Eligible	-0.0431	
	(0.0542)	
Constant	2.7713	
	(0.1218)***	
Had surgery (IV)		-0.0411
		(0.0217)*
Years of blindness		-0.0007
		(0.0009)
Caregiver female		-0.0201
		(0.0190)
Caregiver age		-0.0001
		(0.0004)
Number of adult sons		0.0050
		(0.0054)
Number of adult daughters		-0.0031
		(0.0054)
Orthodox religion dummy (Muslim excluded)		0.0410
		(0.0391)
Number of Observations		742

Notes : Estimates standardized mean effect of participation in different activities using seemingly unrelated regression. Coefficient values indicate the standard deviations change in the mean associated with the variable. ITT=Intention to Treat; TOT=Effect of Treatment on Treated; DinD= Difference in Difference; IV=Instrumental Variables.. * $p<0.1$; ** $p<0.05$; *** $p<0.01$. All estimations include Kebele Fixed Effects and are clustered at the level of Kebeles. For DinD models, correlations across repeated measures for individuals are modeled using random effects.

Caregiver Mental Health

We consider caregiver mental health impacts in Tables 2.24 and 2.25. Here we observe statistically significant improvements among caregivers of surgery recipients, both in terms of a reduction in the depression scale and overall life satisfaction. However, statistically significant reduction in the depression index also occurred among caregivers in the other groups. Nonetheless, the estimates of intervention impact show that controlling for other factors, surgery

has a positive though modest impact on caregiver mental health (Table 2.25). It is associated with a 0.94 point decline relative to controls in the ITT model and a 0.8 decline in the other model. In sum, our estimates indicate that direct impacts of the intervention on caregivers in terms of work and social activities are limited, but there is measurable impact on mental health.

Several of the other covariates in the regressions have strongly significant effects on the depression scale. Female caregivers score significantly lower on the scale (are less depressed) while older caregivers have greater depression. In contrast, years of blindness of the individual in their care has no effect on depression.

Table 2.24– Caregiver Mental Health and Life Satisfaction at Baseline and Follow-up, by Group

		Baseline	Follow-Up	Change
Had Surgery	Modified CES-D Depression scale	12.40	10.79	-1.612***
	Life Satisfaction (percent):			0.004***
	Very good or excellent	0.05	0.12	
	Mostly good	0.49	0.55	
	Neither good nor bad	0.39	0.28	
	Mostly bad	0.05	0.05	
	Very bad	0.01	0.00	
	N	302	303	
Did not have surgery (non-eligible controls)	Modified CES-D Depression scale	12.15	11.47	-0.685**
	Life Satisfaction (percent):			0.039**
	Very good or excellent	0.05	0.11	
	Mostly good	0.49	0.47	
	Neither good nor bad	0.35	0.33	
	Mostly bad	0.09	0.07	
	Very bad	0.01	0.01	
	N	354	355	
Did not have surgery (eligible but declined)	Modified CES-D Depression scale	13.03	11.45	-1.578***
	Life Satisfaction (percent):			0.133
	Very good or excellent	0.03	0.09	
	Mostly good	0.46	0.55	
	Neither good nor bad	0.41	0.32	
	Mostly bad	0.08	0.04	
	Very bad	0.01	0.00	
	N	95	97	

Table 2.25 – Estimates of Impact of Surgery Intervention on Caregiver Mental Health Status

	DinD(ITT)	IV (TOT)
Time period 2 (T1 excluded)	-0.6987	
	(0.3483)**	
Eligible for surgery	0.3625	
	(0.3270)	
Time 2 X Eligible	-0.9400	
	(0.3643)***	
Years of blindness	0.0135	0.0282
	(0.0142)	(0.0180)
Caregiver female	0.8719	1.1358
	(0.2682)***	(0.2685)***
Caregiver age	0.0516	0.0504
	(0.0081)***	(0.0097)***
Number of adult sons	-0.0629	-0.0315
	(0.0660)	(0.0798)
Number of adult daughters	-0.0588	0.0051
	(0.0617)	(0.0996)
Orthodox religion dummy (Muslim excluded)	0.1451	0.6190
	(0.3465)	(0.4909)
Had surgery (IV)		-0.8000
		(0.3931)**
Constant	9.0435	
	(0.6231)***	
Number of Observations	751	746
R^2	0.17	0.10

Note: dependent variable is modified CES-D Depression scale. ITT=Intention to Treat; TOT=Effect of Treatment on Treated; DinD= Difference in Difference; IV=Instrumental Variables. * p<0.1; ** p<0.05; *** p<0.01. All estimations include Kebele Fixed Effects. Standard errors are clustered at the level of Kebele. For DinD models, correlations across repeated measures for individuals are modeled using random effects.

Caregiver Self-reported Impacts of Surgery

As with the blind persons themselves, the survey asked caregivers of surgery recipients directly about impacts of surgery on themselves and their households.[30] Asked to name the most important effects on their own life, the most common response was simply that they were happy because the blind person was no longer suffering from blindness. This was mentioned by just under half of the respondents (Table 2.26; note that the percentages sum to more than 1.0 since respondents could name up to three impacts). Almost as many (45%) mentioned being able to

[30] It should be kept in mind that 'caregiver' refers to the person identified as such at baseline, even if not carrying out those activities by the time of follow-up-which will be the case for of this sample of caregivers to individual who had surgery, since most of these patients regained adequate vision and presumably no longer need a caregiver.

start to work or work more. Some 21% named the opposite effect—able to work less because the patient is able to work again. The third most common response, noted by 39% of the sample, was being able to socialize or leave the house more.

Table 2.26 – Caregiver Self-reported Impacts of Cataract Surgery

Since [NAME]'s surgery for his/her vision, how has your own life changed?			
Share mentioning the following:			
No change in my life		0.18	
Went back to school		0.03	
Started to work (or work more) outside		0.45	
Can work less since [NAME] is working again		0.21	
Able to get married/plan to get married		0.04	
Able to start/resume having children		0.06	
Socialize more /leave the house more		0.39	
More leisure time		0.14	
Able to move back to my own home/able to move		0.06	
Happy because Blind Person no longer suffering		0.49	
Share agreeing with the statement:	**Female Caregivers**	**Male Caregivers**	**All**
As a result of [NAME]'s surgery my <u>own</u> life is much better.	0.81	0.84	0.82
Because of [NAME]'s surgery, I am more likely to participate in village social functions.	0.78	0.81	0.78
Because of [NAME]'s surgery, I am more likely to visit friends or family outside of my home.	0.79	0.83	0.80
Note: N= 388 (296 women, 77 men)			

81% of caregivers agreed with the statement that their own lives had become much better. About the same proportion also said they are more likely to participate in village social events and to visit friends or family as a result of the surgery on the blind person. These self-reports by caregivers suggest large beneficial impacts on surgery on themselves (as well as to the household, as discussed in the last section). The large number of caregivers citing increased work and social activities suggests stronger beneficial impacts in these areas than the baseline-follow-

up comparisons for these outcomes discussed above, suggesting that the survey questions may not have fully captured relevant variations in time devoted to these activities.

Section 2.5: Discussion and Conclusions

At one year follow-up, attempts were made to revisit and interview 1,234 blind individuals from baseline, comprising both the blind who were diagnosed as having cataract and eligible for surgery and those who were not referred for surgery, and for whom we had complete data from the baseline survey. About 84% of the sample was found and re-interviewed. About 9 percent of the sample had died between baseline and follow-up. Among those referred for cataract surgery at baseline and re-interviewed at follow-up, the share getting surgery was somewhat lower for women than men: 73% vs. 79%, consistent with a female disadvantage in access to cataract surgery noted in previous research.

Descriptive results for changes in each outcome were presented, followed by estimates of impacts making use of quasi-experimental approaches to evaluation. In addition, insights were drawn from direct questions about impacts posed both to patients and caregivers, as well as a series of qualitative follow-on interviews with a small number of patients and their caregivers (see Appendix).

We summarize the findings as follows:

Cataract surgery leads to dramatic improvements in vision, basic functioning, and mental health of patients

- Some 85% of operated patients at follow-up said their vision was now moderate or better compared with 24% at baseline (and 37% reported good to very good vision compared with 3% at baseline). Since many of these bilaterally blind patients had only one eye operated, hence remain with poor vision in the other eye, current vision will be unlikely to

be self-rated as ‘very good’ even with a completely successful surgery on the operated eye. Therefore the overall improvement since baseline is dramatic. The surgery also led to very significant reductions in vision-related difficulties in carrying out basic functions, as reported by patients.

- Surgery recipients experienced large improvements in mental health (reductions in depression scores) relative to blind non-operated controls. A measure of life satisfaction also increased significantly. The reduction in the depression score brought about by surgery was at least as large as the initial gap in the score between blind and comparable non-blind individuals at baseline. Qualitative interviews confirmed the large benefits to emotional well-being from restoration or improvement in vision (see Appendix).
- A sub-index of the activities of daily living index, capturing physical difficulty in performing basic tasks such as dressing (and for which the questions were adjusted to be independent of vision) improved sharply relative to controls. Body Mass Index and the number of self-reported chronic, non-vision related, physical disabilities also fell among surgery patients. However, improvement in these two health measures were also generally seen for non-operated blind (surgery eligible and not). Since we might expect ADL to move with these indicators, the dramatic improvements in ADL among surgery recipients may be capturing, in part, vision related improvements in functioning, not just physical health changes.
- The majority of surgery recipients said they felt significantly safer in their homes, and equally large changes were seen in the level of self-perceived respect both from one’s family and the community. 62% of women and 63% of men said they have a fair amount more or a lot more respect within their families, with only 12% and 13% for each saying

there was no increase. More than half of the respondents said that respect from the community increased a fair amount or a lot as a result of their surgery. Qualitative follow-on interviews reinforced the notion that status within the community rose substantially after surgery (see Appendix).

Participation in social activities among surgery recipients increases, but changes in work activity are limited.

- There were generally across the board statistically significant increases in participation in a range of social activities for surgery patients, including attending church or mosque, visiting friends, and attending weddings and funerals. No such changes were reported either by non-eligible controls or surgery decliners. Impact evaluation estimates confirm these changes in social participation as a result of surgery.
- The actual average increases in participation in different social activities were fairly modest, however, and after the surgery, patients were still less socially active than comparable non-blind individuals, if considerably more active than those who did not get surgery. These findings are in accord with direct responses about changes in social participation since surgery.
- Mean participation in income-generating activity increased modestly as a result of surgery. Estimates indicate increases of about 5-7% in the probability of working in the last week for men but little or no change for women (who normally participate less in these activities). Despite the increases among men, the vast majority did not work either before or after surgery. No statistically significant changes were seen in hours in domestic labor in the previous day for men or women. These findings are somewhat in contrast with direct questions about resumption of work after surgery. More than half of the surgery

patients of either gender reported working more as a result of surgery, though even here, only about 30% of men and 25% of women reporting working ‘a fair amount’ more or ‘a lot’ more.

- The small changes in market work very likely reflect the advanced average age of cataract surgery patients in this study —77.5 years for men and 72.3 for women. Those who responded that there were no changes in their social participation or work after surgery most commonly cited age as the reason (this was the case for 47% of those reporting no change in social participation and 53% of those not increasing work activities). Further, years of inactivity and possibly, inadequate nutrition or medical care due to blindness may lead to cumulative health problems preventing a full resumption of prior activities; several of the follow on qualitative interviews suggest this as well (see Appendix). Our comparisons of the physical health status of blind and non-blind older adults in the baseline data is consistent with this hypothesis.
- The work activity of younger male patients, however, responded more strongly to the surgery. Though our ability to infer differences is limited by the small number of younger observations in the sample, descriptive analysis indicates a 10% increase in work in the last week for men under 70 compared to 6% for those 70 and over. Among the few male patients under 65, participation increased by 25%.

Households are impacted in a number of positive ways, but the evidence for impacts on income is weak, likely reflecting the advanced age of surgery recipients

- In direct questioning about impacts, both surgery patients and caregivers noted improvements to the household overall and to specific members. Most caregivers indicated that the surgery had resulted in major improvements to the household’s well-

being. Most cited lower time burden on other household members as an important impact of the surgery on the household overall—an impact reinforced strongly in the qualitative follow-on interviews (see Appendix)—and more than half cited more involvement in or greater respect from the community as a positive household impact.

- On the other hand, economic impacts on the household appear to be limited. 59% of surgery patients indicated there was no change in household income or production. An additional 36% indicated that household income or production had increased a little, while very few reported a big increase. Few households reported buying (or buying back) livestock or new assets as a result of having surgery.
- Statistical analysis of changes in household wealth or assets as a result of surgery also show no significant changes (for both treated and non-treated households). Consumption based measures—food security and per capita monthly household consumption—indicate an overall worsening in the situation for all households, operated and not. This likely reflects that the follow-up was conducted one month later in the year than the baseline survey, hence further from the previous harvest (individual level food insecurity of the operated individuals and controls also increased between baseline and follow-up). There is some evidence that reductions in food security and consumption were smaller for households where the blind person received surgery, but this is inconclusive.
- The overall lack of improvement in household economic well-being in the data is consistent with the limited increases in income earning work among surgery patients, which in turn likely reflects the average age of this sample. However, the cataract surgery intervention itself, as is generally the case, was not restricted to completely blind patients so would have included many persons with low vision, and these will tend to be younger

individuals whose cataract impairment has not progressed to bilateral blindness. Impacts on work and household consumption would be expected to be larger for these patients, though this would depend in part on the extent to which work was impaired for these partially sighted individuals before surgery. Therefore the overall economic impact of this and similar interventions may be significantly larger than implied by the mean outcomes for the study sample.

Evidence for impacts on caregivers is positive but mixed

- Evidence for benefits of surgery come largely from caregiver self-reports in the follow up survey on the impacts of surgery as well as qualitative follow-on interviews (see Appendix). 80% agreed with the statement that their own lives had become much better. About the same proportion also said they were more likely to participate in village social events and to visit friends or family as a result of the surgery on the blind person. A frequent theme in the qualitative interviews was the reduction in caregiver burden and their consequent ability to pursue other activities (see Appendix).
- These self-reports by caregivers suggest stronger impacts in these areas than the baseline-follow-up survey comparisons for these outcomes. The analysis of surgery impacts found relatively few effects on caregiver participation in income generating work, hours in domestic work, and social activities (though the last of these was already high before surgery). Mental health did improve among caregivers of surgery recipients, both in terms of a reduction in the depression scale and overall life satisfaction, but similar improvements occurred among caregivers in the eligible but not operated group.

Implications of the study

This analysis, using systematic survey approaches and rigorous evaluation techniques, confirms the strong benefits of cataract surgery to patients along numerous dimensions, including, in addition to improved vision, improved basic functioning, mental health, physical health, and social participation. Other benefits, elicited directly from surgery patients, include greater security, and more respect from family and community. Caregivers seemed to benefit in manifold ways as well, citing in particular the greater happiness of the patient and their own reduced care burden.

On the other hand, economic benefits at the household level appear small. The most likely reason is that the individuals whose sight has been restored are quite elderly. While there is some increase in participation in work on the part of these patients, it is small and unlikely to contribute greatly to household incomes—though importantly, among the fewer younger patients in the male sample, increases in participation were larger. Nor does it appear as if the reduction in caregiver burden led to sufficiently increased production from these individuals such as to raise household incomes or consumption. In addition to age, it is possible that the relatively weak labor supply response to surgery reflects cumulative impacts on health of spending years in blindness. Loss of productive assets after becoming blind could also be a factor, meaning that the individual has fewer opportunities to be productively engaged once he or she is sighted again. Both of these possibilities would argue for aggressive efforts to treat cataract before the individual has become bilaterally blind, so as to avoid cumulative and possibly irreversible changes in health and income generating capacity. Indeed, the comparisons of blindness affected and non-blindness affected households in Chapter One suggest significant cumulative negative impacts of blindness.

Similarly, as noted, work and economic impacts of surgery may be larger for younger and thus potentially more economically active patients than for the sample of older blind in this study. At the same time, younger individuals with cataract will on average have vision that has not deteriorated as far as the bilaterally blind subjects in this study. Therefore some are likely to still be working, if at reduced levels of productively, and this will tend to lessen the income gains among this group. However, the potential gains need to be viewed in dynamic perspective. Most of these individuals will need surgery eventually as their cataract progresses, and earlier surgery will ensure more years of high productive work for these individuals.

The analysis of uptake from Chapter One also provides important insights. One is the need to ensure gender parity in access to the benefits of cataract surgery. The interviews also highlight the difficulties of arranging transportation to surgery in this remote environment, and the need to have health staff and community leaders communicate clearly with families about the arrangements. Further revisiting of households with a second offer of surgery served to increase the number having surgery while also helping to reduce the disadvantage faced by women in accessing surgery. The strategy of follow-up outreach combined with smaller, local surgery interventions therefore may be a useful approach to improving cataract surgery coverage, especially for women. It is not clear if these outcomes derived simply from the additional encouragement, or also from the closer location of the follow-up surgery intervention (even though in this case, transport was not directly provided, only reimbursed). This would be a valuable topic for future research.

CHAPTER THREE:

Demand for and Impacts of Cataract Surgery Among Rural Blind and Visually Impaired in Tabora, Tanzania

This chapter explores topics similar to the first two chapters above, but with a reduced scope and for a smaller, different population of individuals from the Mbola Millennium Village, located just outside of Tabora, Tanzania.

Section 3.1: Background

The Millennium Villages Project is a project of The Earth Institute at Columbia University, the United Nations Development Programme, and Millennium Promise, which takes an integrated approach to rural sustainable development, working to address the root causes of extreme poverty through a holistic, community-driven package of low-cost interventions across a variety of sectors, including education, health, infrastructure, agriculture and more. The study for this final chapter takes place in the Mbola Millennium Village, which is a cluster of six villages containing a total population of approximately 40,000 individuals, located in the Uyui District of mid-western Tanzania, 36 kilometers west of Tabora, the nearest city center.

In July of 2010, the Mbola Millennium Village partnered with the Himalayan Cataract Project (HCP) and the eye department from Nkinga Mission Hospital, located just outside of Tabora, to offer community-based eye screenings open to all members from each of its villages. Based on the results of these screenings, all individuals suffering from visual impairment due to cataracts were provided with the opportunity to receive free surgical cataract extraction at Kitete Hospital in Tabora during a surgical eye camp that took place in August of 2010. Details of both the screening and surgical eye camp procedures are provided below. This study examines the

results of this screening and seeks to measure the demand for and impacts of surgery that followed for all visually impaired villagers identified through the screening.

Section 3.2: Data

Eye screening was conducted under the direction of Dr. Francis Kifutumo from Nkinga Mission Hospital, working in close coordination with staff from the Mbola Millennium Village, including the medical doctors overseeing its health interventions, Dr. Muhadili Shemsanga and Dr. Junias Mtobesya, as well as Jonathan Mwakabuku, director of monitoring and evaluation for the Mbola Millennium Village. Multiple different screening sites were selected by Mbola Millennium Village staff to get as close to as many villagers as possible, including local health clinics and schools, spanning the course of 10 days. Villagers were alerted to the screening days, times and locations in advance using multiple methods, including Community Health Workers, loudspeaker announcements via trucks traveling throughout the villages, flyers posted at clinics, word of mouth, and other approaches. At the end of the initial screenings, a number of additional opportunities were offered for screening at the main health clinics for those who may have missed the initial rounds.

At the screenings, Dr. Kifutumo and his staff measured visual acuity (VA) of all villagers in attendance using Snellen Tumbling E eye charts, and performed individual eye examinations on each villager to diagnose causes of visual impairment and to refer villagers likely to benefit from surgical cataract extraction to the surgical eye camp to be held a few weeks later. As each villager was screened, those with visual impairment (best corrected visual acuity (BCVA) worse

than 6/18) were invited to be a part of the present study[31], and their diagnoses and referral status for cataract surgery were also recorded, along with some basic demographic and identifying information. All recruited subjects gave full informed consent to participate in the study, and baseline interviews were scheduled to take place at each subject's household within the following days.

Six enumerators were hired especially to carry out this task, all of whom were local and had prior experience working as enumerators with the Mbola Millennium Village staff. Enumerators were trained for one week prior to the screenings and baseline interviews on how to administer the questionnaire and how to record responses using Open Data Kit, which had been uploaded to Android smart phones provided to each enumerator for this purpose.

The questionnaire consisted of several parts and took up to an hour or more to complete. The first part of the questionnaire consisted of a basic household roster, conducted with the head of household and any other informed members of the household, especially in the absence of the household head. Following the roster, modules intended for just the subject were conducted in private. This included additional demographic and socioeconomic information, as well as information on the subject's quality of life and activities of daily living. Finally, these modules were followed by household asset and consumption surveys, which were asked of the head of household and any other knowledgeable members of the household present.

The surgical eye camp took place in August at Kitete Hospital in Tabora, and free transport was arranged to take all referred patients (and personal escorts when needed) to the hospital for the surgeries. Multiple pickup locations were determined by Mbola Millennium Village staff in order to reach the maximum number of subjects as closely as feasibly possible,

[31] All individuals were clearly ensured they would receive access to treatment whether or not they chose to be part of the study; subjects under age 18 (n=1) and considered too old/frail for the interview (n=3) were excluded from the interviews.

and community health workers informed each of their referred households of the date, time and location of pickup. All referred subjects were informed of the free transport to and from Kitete, and also that free lodging and meals would be provided for them (and their escorts when needed). All subjects were re-screened at Kitete,[32] and surgeries were conducted by ophthalmologists from Himalayan Cataract Project along with Dr. Kifutumo, utilizing both manual small incision cataract surgeries (MSICS) as well as phacoemulsification procedures, using a phaco machine brought by HCP doctors specifically for this purpose. The eye camp was open to others from outside the village as well, and additional surgeries were performed.

Section 3.3: General Characteristics of the Baseline Sample

As a result of the screening, a total of 342 subjects were identified from within the Mbola Millennium Village cluster with visual impairment, defined as best corrected visual acuity of worse than 6/18. Baseline interviews were successfully carried out with 322 (94.2%) of these subjects, of whom 227 (70.5% of baseline sample) were eligible for cataract surgery in one or both eyes. We begin by comparing those who were diagnosed with cataracts and eligible for surgery with those who were not eligible along a wide variety of characteristics, as presented in Table 3.1 below.

The sample is disproportionately male for both eligible and ineligible sub-groups, with both groups being composed of approximately 40% women. This is contrary to the literature that generally shows women as having higher prevalence of visual impairment when compared to men (even after adjusting for age), with female/male prevalence ratios up to 1.5 to 2.2 (Resnikoff et al. 2004), though a Rapid Assessment of Avoidable Blindness in the Kilimanjaro

[32] Some (n=12) of these were determined to not be ideal candidates for surgery upon additional screening, and thus were not operated on; they are therefore excluded from results on the impact of surgery, but included in the results on demand for surgery, since they reported for surgery. This is discussed in more detail below.

Region of Tanzania found prevalence estimates to be similar for men and women (Habiyakire et al 2010). This suggests that the "open invitation" approach of the screening was biased against attracting women to the screening sites. This is in line with prior studies that generally show that while women have an equal or higher prevalence of visual impairment, they are less likely to be screened or treated for their visual impairment (in Tanzania, see Geneau et al 2005, Habiyakire et al 2010). These "missing women" should be kept in mind when analyzing the results below.

Table 3.1 – Characteristics of the Sample (Eligible and Ineligible)

	Eligible	Ineligible
Female (share)	0.40	0.41
Age (mean years)	70.87***	58.03***
Muslim (share)	0.749	0.758
Employed (share)	0.132	0.126
Education level (mean)	1.96***	3.20***
Any education (share)	.0436***	0.632***
Literate (share)	0.401**	0.558**
Married (share)	0.542	0.632
Household size (mean)	5.24	6.06
QoL (EQ5D mean)	0.725**	0.782**
Self-rated Eyesight (mean)	2.269**	2.063**
Hours in productive activity (mean)	2.304	2.217
Any assistance in ADLs (share)	0.172	0.137
Subject is HoHH (share)	0.665	0.632
Asset Index (mean)	-0.072*	0.161*
PCE (mean)	$19.31	$16.64
Owns large livestock (share)	0.167	0.137
Number of large livestock (mean)	2.98	2.96
Relative wealth rating (mean)	3.61	3.72
N	227	95

* $p<0.05$; ** $p<0.01$; *** $p<0.001$

While the eligible and ineligible samples are similar across other demographic characteristics, such as being Muslim (an even more important variable than usual given the timing of the campaign and interviews, which overlapped with Ramadan, and almost 75% of the population being Muslim), they are significantly different across a variety of important characteristics, many of which may be related to the large and significant (at the 99.9% level) difference in age, with the eligible sample almost 13 years older, on average, than their ineligible counterparts. This difference should not be surprising, given the age-related nature of the onset of cataracts, compared with other sources of visual impairment, but it does pose potential problems in comparing the outcomes of the groups. Not only is the ineligible group younger, with an average age of 58 that falls well below the typical "retirement" age, but they also differ across other variables that might be largely attributed to this difference in age. For instance, the younger ineligible group is also far more likely to not only have some kind of formal education (63.2% compared to 43.6%), but also to have stayed in school for more than an additional year longer, though overall schooling levels are still low, on the order of 2-3 years. Nevertheless, this additional year of schooling seems to translate into a more literate population than the older, eligible group, with 55.8% claiming to be able to read "A little" or "Well," compared to just 40.1% for the eligible group. The ineligible group is also more likely to be married (though only significant at the 90% level), again at least in part a result of the eligible group being older and therefore more likely to be widowed, as well as divorced or separated.

While these important and sizeable differences suggest the groups may not be entirely comparable across outcomes related to improvements in vision resulting from the surgical cataract intervention, it is somewhat surprising and noteworthy that the subjects do not differ across economic variables of interest considered below, such as being employed (defined as

having an outside job) or hours in productive activity.[33] In fact, while the differences are not significant, the eligible group reports being slightly more likely to be employed, though employment is more of an exception than a rule, incorporating approximately 13% of either population. Similarly, hours spent productively is limited to just over 2 hours the previous day on average. If these low levels of economic activity are a result of visual impairment, then any positive impact on productivity from having vision restored might be attenuated by the fact that this current intervention is only available to the older eligible population. If, on the other hand, this is just a sign of the low economic activity of the region, or the age and state of the subjects, then we might not expect to see large impacts on economic activities despite the restoration of sight. Either way, any economic impacts that might be found should only be all the more impressive given these differences and low initial levels of these two populations, especially givn their poverty, examined next.

Both groups are demonstrably poor, with the PCE values of $16-$19 representing the extreme poverty in which the village is located, as well as the average ownership of just 3 large livestock on average in this subsistence agriculture community. The eligible group has a significantly lower asset index score at the 95% level, so they are relatively worse off when it comes to accumulated assets when compared to their younger, ineligible household comparisons, despite being slightly more likely to own large livestock (cows, goats or sheep) and a marginally higher per capita expenditure (PCE) value, though the averages are not significantly different. Subjectively, the groups equally consider themselves worse off when compared to the surrounding community at large, as indicated in the subjective relative wealth rating, with a score

[33] Productive hours include household productivity (such as cooking, cleaning, washing clothes, shopping, etc), hours engaged in paid employment (including casual, formal and self-employed), and uncompensated work hours (farming, animal rearing, fetching water or firewood, etc.).

of 0 indicating much worse off than others in the community, 5 as about the same as others, and 10 as much better off than others.

Finally, the ineligible group reports slightly worse overall quality of life, as indicated in the significantly higher mean EQ5D index score, a variable we'll look at in greater detail below. Meanwhile, the eligible group reports slightly worse eyesight. This self-reported worse eyesight is not drawn out by the actual measurements of visual acuity, however, which are shown in Table 3.2 below. Here, we see the eligible group is more likely to experience lower levels of vision, though the difference is only statistically significant between moderate visual impairment (VA between 6/18 and 6/60) and severe visual impairment (VA between 6/60 and 3/60).

Table 3.2 – Visual Acuity of the Sample (Eligible and Ineligible)

	Eligible	Ineligible
Visually Impaired (6/18 < BCVA <= 6/60)	0.453**	0.611**
Severely Visually Impaired (6/60 < BCVA <= 3/60)	0.278*	0.158*
Blind (3/60 < BCVA)	0.269	0.232
N	227	95

* $p<0.05$; ** $p<0.01$; *** $p<0.001$

Section 3.4: Estimation

Similar to Chapter Two above, this study also makes use of quasi-experimental approaches to measure a variety of potential impacts of surgery on visually impaired subjects and their households, including overall quality of life, vision-related quality of life (general functioning and psychosocial factors), effects on individual level economic factors (employment and time spent in productive activities), and effects on household level economic factors (asset index, consumption as measured by per capita expenditure, and self-reported relative wealth

rating). To do so, we again look first Difference and Difference (DID) analysis for the Intention to Treat (ITT) followed by Instrumental Variable (IV) analysis for the impact of the Treatment on the Treated (TOT). As we have seen, uptake for this study is even less complete than in Chapter Two above (we examine uptake itself in greater detail in the last section of this chapter), with just over 50% of subjects receiving surgery. Therefore we estimate both ITT to capture the desired impact of the intervention on the entire target population, not just those who self-selected into receiving the treatment, and TOT to estimate effects on those who actually underwent the intervention. Given the significant differences in age and related factors between the eligible and ineligible populations, however, eligibility may prove a particularly inadequate instrument for this study, especially when considering sample size limitations.

Section 3.5: Results

Follow-up Survey: Sample Characteristics and Attrition

For the follow-up survey, we attempted to revisit all 322 subjects interviewed at baseline. As shown in Table 3.3 below, nearly 80% of all subjects were found and re-interviewed, with slightly higher success rates among those who were eligible for surgery (80.2%) versus those who were not (79.0%). The most common reason for attrition was that a subject was reported to have moved outside of the Mbola Millennium village, at a rate of 9.7% for eligible subjects and 14.7% for ineligible subjects. If accurate, this would represent a surprisingly high rate, though it should be kept in mind that this is a relatively densely settled rural region undergoing increasing urban migration. In most instances, enumerators listed the town to which the subject was reported to have moved, which supports the accuracy of some of the data, though in other cases it seemed less certain whether the subject had really moved or this was just some excuse. One explanation for the latter is that some subjects from baseline may not have actually been a part of

the Millennium Village, but were merely trying to take advantage of the free eye services by visiting a household with which they were acquainted. This is not an uncommon event in such an intervention. Only 3.7% of the sample was lost to death; this was higher for the eligible subjects, likely representing their older age on average. Finally, another 5% were simply not able to be tracked down, or the interviews could not be matched between baseline and follow-up for one reason or other.

Table 3.3 – Re-Interview Rates at Follow-up, Surgery Eligible and Ineligible

	Eligible for Surgery		Not eligible for Surgery		All	
	number	share	number	share	number	share
Re-interviewed	182	0.802	75	0.790	257	0.798
Died	10	0.044	2	0.021	12	0.037
Moved, not re-interviewed	22	0.097	14	0.147	36	0.112
Traveled or not found/matched	12	0.053	4	0.042	16	0.050
Refused follow-up	1	0.004	0	0.000	1	0.003
Total	227	1.000	95	1.000	322	1.000

Below we examine the characteristics of those who were re-interviewed compared with those who were not, again segregating by eligible and ineligible subjects. We see in Table 3.4 that women are less likely to be re-interviewed for both groups, though this difference is relatively small and not statistically significant, as is also the case for older subjects, though this may be explained at least in part due to attrition due to death. Only one variable, household size, is significantly different for both groups, and this works in different directions for each group, making interpretation somewhat difficult. Most other differences are small and oftentimes in different directions, leaving little room for interpretation. That said, it should be noted that literate subjects were more likely to be re-interviewed than their illiterate counterparts, and this difference was large (14%) and significant among the eligible group. Also, married subjects

were more likely to be re-interviewed across both groups, though not significantly so. These differences should be kept in mind when interpreting results below related to impacts of surgery, though we deal with this in part by including controls for the variables with greatest difference.

Table 3.4 – Characteristics of Re-interviewed Blind and Attriters, by Surgery Eligibility

	Eligible Re-interviewed	Eligible, not Re-interviewed	Non-eligible, Re-interviewed	Non-eligible, Not Re-interviewed
Female (share)	.396	0.400	0.400	.450
Age (mean years)	70.5	72.2	57.8	59.1
Muslim (share)	0.758	0.711	0.700	0.773
Employed (share)	0.126	0.156	0.147	0.050
Education level (mean)	1.92	2.11	3.24	3.05
Any education (share)	0.440	0.422	0.627	0.650
Literate (share)	0.429*	0.289*	0.560	0.550
Married (share)	0.555	0.489	0.667	0.500
Household size (mean)	5.03*	6.09*	6.45*	4.60*
QoL (EQ5D mean)	0.733	0.694	0.796	0.729
Self-rated Eyesight (mean)	2.24	2.38	1.97*	2.40*
Hours in productive activity (mean)	2.31	2.28	2.35	1.71
Any assistance in ADLs (share)	0.143**	0.289**	0.133	0.150
Subject is HoHH (share)	0.670	0.644	0.653	0.550
Asset Index (mean)	0.118	-0.118	0.238*	-0.130*
PCE (mean)	$19.72	$17.66	$16.30	$17.91
Owns large livestock (share)	0.148	0.244	0.147	0.100
Number of large livestock (mean)	2.73	4.00	3.60	0.55
Relative wealth rating (mean)	3.57	3.76	3.77	3.50
N	182	45	75	20

* $p<0.05$; ** $p<0.01$; *** $p<0.001$

In Table 3.5 below we compare those who had surgery versus those who did not, among all subjects for surgery. The largest and most significant difference between these two groups is that eligible women were far less likely to report for and receive surgery at the surgical eye camp, with only 33.6% of eligible women undergoing surgery compared with 45.0% of eligible women who did not report for surgery. This result is in line with prior literature cited above

demonstrating that women are far less likely to report for surgery compared with their male counterparts. This adds to the gender equity issues discussed earlier, where our eligible sample itself was comprised of just 40% women despite evidence that women generally suffer more than half the burden of visual impairment, particularly in these settings, and reinforces the importance of the limiting gender dimensions to these campaigns, and therefore the potential muted results of this study when it comes to the full impact possible for all visually impaired women.

Table 3.5 – Characteristics of Individuals Having Cataract Surgery and Not Having Surgery (Surgery-Eligible Sample)

	Eligible (all)	Eligible (had surgery)	Eligible (no surgery)
Female (share)	0.40	0.336*	0.450*
Age (mean years)	70.87	71.12	70.64
Muslim (share)	0.749	0.748	0.750
Employed (share)	0.132	0.084*	0.175*
Education level (mean)	1.96	1.88	2.03
Any education (share)	.0436	0.449	0.425
Literate (share)	0.401	0.402	0.400
Married (share)	0.542	0.561	0.525
Household size (mean)	5.24	5.67	4.85
QoL (EQ5D mean)	0.725	0.708	0.740
Self-rated Eyesight (mean)	2.269	2.33	2.22
Hours in productive activity (mean)	2.304	1.82	2.73
Any assistance in ADLs (share)	0.172	0.178	0.167
Subject is HoHH (share)	0.665	0.682	0.650
Asset Index (mean)	-0.072	-0.111	-0.037
PCE (mean)	$19.31	$20.62	$18.15
Owns large livestock (share)	0.167	0.187	0.150
Number of large livestock (mean)	2.98	2.73	3.21
Relative wealth rating (mean)	3.61	3.49	3.72
N	227	107	120

* $p<0.05$; ** $p<0.01$; *** $p<0.001$

The only other statistically significant difference is with respect to employment, where we see that those receiving surgery were half as likely to have an outside job compared with eligible subjects who did not undergo surgery (8.4% versus 17.5%). While this may seem counter-intuitive, since the employed might stand the most to gain from receiving restored visual acuity, it may also be capturing the opportunity cost of sacrificing a few days of employment in order to attend the surgical eye camp, especially for those with lower levels of visual impairment, who may feel they stand less to gain from the surgery.

Finally, we find in Table 3.6 below that, not surprisingly, the more visually impaired individuals were more likely to report for and receive surgery. Those receiving surgery were almost twice as likely to be blind (BCVA worse than 3/60) than those eligible subjects who did not receive surgery (35.5% vs. 19.2%). Meanwhile, the inverse was true for those with ordinary visual impairment (BCVA worse than 6/18 but better than or equal to 6/60), who were less represented among those receiving surgery. This makes sense given the added imperative to receiving the surgery for those whose vision was worse. Severe visual impairment (BCVA worse than 6/60 but better than or equal to 3/60) was equally prevalent among those receiving surgery and not.

Table 3.6 – Visual Acuity of Individuals Having Cataract Surgery and Not Having Surgery (Surgery-Eligible Sample)

	Eligible (all)	Eligible (had surgery)	Eligible (no surgery)
Visually Impaired at Baseline (6/18 < BCVA <= 6/60)	0.453	0.364**	0.533**
Severely Visually Impaired at Baseline (6/60< BCVA <= 3/60)	0.278	0.280	0.275
Blind at Baseline (3/60 < BCVA)	0.269	0.355**	0.192**
N	227	107	120

* $p<0.05$; ** $p<0.01$; *** $p<0.001$

Impacts of Surgery on Visually Impaired Individuals

We first demonstrate the impact of surgery on vision in the following two tables. Table 3.7 shows the change in self-rated eyesight for each of the three groups of subjects: first, those eligible subjects who underwent surgery, followed by the ineligible subjects, and finally followed by those eligible subjects who did not undergo surgery. The scale asked subjects to rate their vision from 1 to 5, with 1 being the best ("very good"), 3 being moderate, and 5 being the worst ("very bad"). We see that at baseline, the average for all subjects was somewhere around a 2 ("good"). This itself may seem surprising, given the fact that these individuals are visually impaired by definition, but it should be kept in mind that nearly half of subjects were in the least visually impaired category (between 6/18 and 6/60), and therefore may not consider their vision to be that bad, all else considered.

Table 3.7 – Self-reported Impacts of Cataract Surgery on Vision

		Baseline	Follow-Up	Change
Had surgery	Self-rated Eyesight (mean)	2.27	1.16	-1.11***
N		92	92	
Did not have surgery (non-eligible controls)	Self-rated Eyesight (mean)	1.97	1.76	-0.21
N		75	75	
Did not have surgery (eligible but declined)	Self-rated Eyesight (mean)	2.21	1.93	-0.28**
N		90	90	

* $p<0.05$; ** $p<0.01$; *** $p<0.001$

Table 3.7 above shows that at follow-up, all subjects reported generally more favorable vision, though this was muted for those not having surgery and much larger and more significant

for those who underwent surgery.[34] This suggests the intervention had the effect intended on improved vision, and the regression analysis in Table 3.8 below shows the significant improvement in self-reported vision both for ITT and TOT. For the former, we see that being eligible results in a decrease in the eyesight rating of 0.4212 at 95% significance, or an improvement of almost half a gradation in self-reported vision. When looking just at those who had surgery, we see the value increase to 0.9046 at 99.9% significance. Further, Table 3.7 above shows a point value of 1.16 at follow-up for those who had surgery, indicating almost all subjects at follow-up felt their vision was "very good."

Table 3.8 – Estimates of impact of Cataract Surgery on Self-Reported Vision

	Eyesight	
	DID(ITT)	IV(TOT)
Eligible for surgery	0.2127	
	(0.1389)	
Time 2 X Eligible	**-0.4212**	
	(0.1644)**	
Time period 2 (T1 excluded)	-0.3333	
	(0.1385)**	
Had surgery (IV)		0.4132
		(0.1960)**
Time 2 X Had Surgery (IV)		**-0.9046**
		(0.2477)****
Female	-0.1733	0.1366
	(0.3588)	(0.0836)
Married	-0.0475	-0.0439
	(0.0831)	(0.0795)
Age	0.0044	0.0045
	(0.0027)*	(0.0027)*
R2	0.15	0.200
N	514	514

* $p<0.1$; ** $p<0.05$; *** $p<0.01$; **** $p<0.001$

[34] Keep in mind that a decrease in the self-rated vision score of 0.2 indicates that 1 person in 5 rated their vision 1 level better than they had at baseline, which can explain why vision on average appears to improve without surgery, when this can simply be due to the imprecision of subjectively rating one's vision from one year to the next.

Quality of Life

Next, we examine the impacts of this improved vision on quality of life indicators. Specifically, we look at variables from two separate indices, the first measuring generic health-related quality of life and the second looking more specifically at vision-related quality of life. The former was assessed using the European Quality of Life questionnaire, which consists of five descriptive domains known as the EQ5D: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Individuals are asked to respond how they feel that day for each of the domains above, responding among three prompts as to whether they feel "good," "limited," or "worst," and from this the EQ5D index is created, with a score of 0.0 being worst and 1.0 being best.[35]

To assess vision-related quality of life, we used the World Health Organization's Prevention of Blindness and Deafness 20-item Visual Functioning Questionnaire, adapted and validated for use in low-income settings, as was used in the previous two chapters. In this chapter, we then group results into two subscales, the first for general functioning (based on questions about difficulties with daily activities) and the second for psychosocial well-being. Both of these subscales were converted into a scale from 0 to 100, with 0 representing the worst quality of life and 100 representing the best, with respect to each subscale.

In Table 3.9 below, we see that all groups reported neutral or positive changes at follow-up across all three variables described above, with one exception: the eligible group who did not receive surgery reported a decrease in their psychosocial well-being, and one might wonder if this was perhaps in any way related to their inability to receive surgery as part of the intervention. Nevertheless, the decrease was neither large nor statistically significant.

[35] See http://www.euroqol.org/

Meanwhile, we see that the surgery group reports far larger improvements in all three subscales related to quality of life, all significant at the 99% level or higher. In particular, their general functioning score increases by over 20 points, from 68.28 to 88.64 (29.6%), and their psychosocial score increases by 9 points, from 68.82 to 77.85 (13.1%).

Table 3.9 – Self-reported Impacts of Cataract Surgery on Quality of Life

		Baseline	Follow-Up	Change
Had surgery	EQ5D (mean)	0.738	0.812	0.074**
	General Functioning (mean)	68.28	88.64	20.37***
	Psychosocial (mean)	68.82	77.85	9.04**
N		92	92	
Did not have surgery (non-eligible controls)	EQ5D (mean)	0.800	0.835	0.039
	General Functioning (mean)	71.49	77.91	6.42
	Psychosocial (mean)	74.33	74.33	0.00
N		75	75	
Did not have surgery (eligible but declined)	EQ5D (mean)	0.728	0.741	0.013
	General Functioning (mean)	70.35	76.74	6.39*
	Psychosocial (mean)	67.01	64.40	-2.61
N		90	90	

* $p<0.05$; ** $p<0.01$; *** $p<0.001$

The regression estimates presented in Table 3.10 below are all positive, but only the estimate on general functioning reaches a level of statistical significance (95%), with an improvement of 11.7 points on this scale for those who had surgery (TOT). The generic quality of life indicator effect is small and not significant. When looking at intention to treat, we find much smaller effects, none of which are significant at even a 90% level; this is again due to the fact that almost 50% of the target population did not undergo the surgery, which waters down the overall impact on the eligible population.

Table 3.10 – Estimates of Self-reported Impacts of Cataract Surgery on Quality of Life

	EQ5D		General Functioning		Psychosocial	
	DID(ITT)	IV(TOT)	DID(ITT)	IV(TOT)	DID(ITT)	IV(TOT)
Eligible for surgery	-0.0223		1.0549		-2.7019	
	(0.0330)		(3.9911)		(4.5675)	
Time 2 X Eligible	**-0.0275**		**1.0549**		**6.2804**	
	(0.0352)		**(3.9911)**		**(5.1048)**	
Time period 2 (T1 excluded)	0.0647		11.0819		-0.2778	
	(0.0297)**		(3.2903)***		(4.2966)	
Had surgery		-0.0384		1.2042		-8.1789
		(0.0434)		(6.2907)		(7.1867)
Time 2 X Had Surgery (IV)		**0.0171**		**11.6865**		**4.1582**
		(0.0503)		**(5.8549)****		**(7.8050)**
Female	0.0532	-0.0216	10.2652	-1.4187	-2.9045	-3.2937
	(0.0790)	(0.0187)	(9.0020)	(2.5009)	(11.3006)	(2.9578)
Married	0.0680	0.0664	3.0067	2.7196	2.7687	3.3536
	(0.0208)***	(0.0188)****	(2.5843)	(2.5356)	(2.8190)	(2.8571)
Age	-0.0029	-0.0029	-0.1880	-0.1951	-0.1617	-0.1532
	(0.0007)****	(0.0006)****	(0.0828)**	(0.0840)**	(0.0904)*	(0.0955)
R2	0.12	0.12	0.09	0.09	0.04	0.03
N	514	514	514	514	513	513

* $p<0.1$; ** $p<0.05$; *** $p<0.01$; **** $p<0.001$

Economic Activities and Time Use

We next look at economic activities, starting at the individual level, including employment and time spent in productive activities. While Table 3.11 below indicates only a small positive change in employment of subjects having surgery from baseline to follow-up, we see that the other two groups actually experienced a decrease in their employment, equal to or larger than the increase in employment among those having surgery (though it should be kept in mind that those having surgery started off at far lower levels of employment, as seen in Table 3.5 above and in the table below).

Table 3.11 – Surgery Recipients: Employment and Time in Productive Activities

		Baseline	Follow-Up	Change
Had surgery	Employed (share)	0.099	0.110	0.011
	Hours in productive activity (mean)	2.05	2.30	0.25
N		92	92	
Did not have surgery (non-eligible controls)	Employed (share)	0.147	0.107	-0.040
	Hours in productive activity (mean)	2.35	2.96	0.60
N		75	75	
Did not have surgery (eligible but declined)	Employed (share)	0.154	0.148	-0.011
	Hours in productive activity (mean)	2.57	2.57	0.00
N		90	90	

* $p<0.05$; ** $p<0.01$; *** $p<0.001$

While the TOT regression estimate for employment in Table 3.12 below remains positive at almost 2%, it is not significant at even a 90% level. Meanwhile, for hours spent in productive activity the day before, the levels not only remain low across all groups (between 2-3 hours, as seen in Table 3.11 above), but the ITT and TOT regression estimates for those having surgery

are actually negative (though not statistically significant) when compared to the ineligible group, who saw a relatively higher surge in productivity.

Table 3.12 – Estimates of impact of Surgery on Employment and Productive Activity

	Employed		Productive Hours	
	DID(ITT)	IV(TOT)	DID(ITT)	IV(TOT)
Eligible for surgery	-0.0070		1.3152	
	(0.0609)		(0.5640)**	
Time 2 X Eligible	**0.0313**		**-0.6730**	
	(0.0728)		**(0.7113)**	
Time period 2 (T1 excluded)	-0.0222		1.3542	
	(0.0613)		(0.5992)**	
Had surgery		0.0188		0.8546
		(0.1105)		(0.8651)
Time 2 X Had Surgery		**0.0800**		**-0.9561**
		(0.1192)		**(1.1756)**
Female	0.0057	-0.0211	5.5492	1.3835
	(0.1585)	(0.0359)	(1.5291)****	(0.3546)****
Married	-0.0109	-0.0149	-0.4348	-0.3535
	(0.0362)	(0.0360)	(0.3250)	(0.3618)
Age	-0.0024	-0.0025	-0.0396	-0.0394
	(0.0012)**	(0.0012)**	(0.0104)****	(0.0129)***
R2	0.01	0.01	0.13	0.08
N	514	514	514	514

* $p<0.1$; ** $p<0.05$; *** $p<0.01$; **** $p<0.001$

Given the findings above, it seems unlikely that the improvement of vision in the visually impaired subject would carry over into improved economic outcomes in the subjects' households. We examine these changes next through three different household level economic

variables: assent index, consumption (as measured through average monthly per capita expenditure – PCE), and relative wealth rating.

We see an improvement in the asset index[36] variable for those subjects having surgery, though they remain on average worse off (as indicated by the negative value at follow-up) compared to the rest of the sample, while more modest gains are seen with respect to PCE and relative wealth ratings, especially when compared to the ineligible subjects, who experience larger gains in both categories.

Table 3.13 –Assets, Household Consumption, and Relative Wealth Rating at Baseline and Follow-up, by Group (Patient Had Surgery, Non-Eligible, Eligible but Declined Surgery)

		Baseline	Follow-Up	Change
Had surgery	Asset Index (mean)	-0.146	-0.118	0.028
	PCE (mean)	$20.00	$20.79	$0.79
	Relative Wealth Rating (mean)	3.38	3.78	0.40
N		92	92	
Did not have surgery (non-eligible controls)	Asset Index (mean)	0.300	0.186	-0.114
	PCE (mean)	$16.30	$23.66	$7.36**
	Relative Wealth Rating (mean)	3.81	4.52	0.72*
N		75	75	
Did not have surgery (eligible but declined)	Asset Index (mean)	-0.019	-0.174	-0.155
	PCE (mean)	$19.44	$21.08	$1.64
	Relative Wealth Rating (mean)	3.73	3.93	0.20
N		90	90	

* $p<0.05$; ** $p<0.01$; *** $p<0.001$

Treatment on the treated estimates shown in Table 3.14 below show decreases across the board in household economic indicators, though only two are significant - consumption and

[36] The asset index was recalculated at followup using the pooled two year sample of households to ensure comparability across years

relative wealth rating. We thus find that by and large, economic impacts of cataract surgery on these households are difficult to be seen. Re-running the regressions looking at blind subjects only (or blind and severely impaired subjects only), results of which are not included here, did nothing to change these outcomes, though at these sample sizes we lost significant power.

Table 3.14 – Estimates of impact of Surgery on Household Assets, Consumption, and Relative Wealth Rating

	Asset Index		PCE		Relative Wealth Rating	
	DID(ITT)	IV(TOT)	DID(ITT)	IV(TOT)	DID(ITT)	IV(TOT)
Eligible for surgery	-0.2567		1.96		-0.1034	
	(0.1542)*		(2.88)		(0.3550)	
Time 2 X Eligible	**0.0905**		**-5.32**		**-0.6118**	
	(0.0998)		**(3.27)**		**(0.3377)***	
Time period 2 (T1 excluded)	-0.1019		5.98		0.8000	
	(0.0841)		(2.75)**		(0.2842)***	
Had surgery		-0.5440		4.4812		-0.2317
		(0.2555)**		(3.7361)		(0.5283)
Time 2 Had Surgery (IV)		**0.1019**		**-12.0785**		**-1.0555**
		(0.1460)		**(5.3527)****		**(0.5496)***
Female	0.2606	0.1200	-5.07	-0.2940	0.3696	0.3424
	(0.2742)	(0.1137)	(7.21)	(2.1626)	(0.7851)	(0.2201)
Married	0.2729	0.2906	-4.80	-4.7933	0.7214	0.7310
	(0.1083)**	(0.1033)***	(1.77)***	(2.1356)**	(0.2327)***	(0.2139)****
Age	-0.0065	-0.0061	0.05	0.0501	-0.0003	-0.0002
	(0.0035)*	(0.0034)*	(0.06)	(0.0645)	(0.0075)	(0.0067)
R2	0.08	0.07	0.04	0.02	0.06	0.03
N	514	514	510	510	510	510

* $p<0.1$; ** $p<0.05$; *** $p<0.01$; **** $p<0.001$

Section 3.6: Demand for Surgery

We conclude our analysis by turning our attention to the demand for surgery, comparing those eligible subjects who attended the surgical eye camp with those who did not, and examining responses to questions asked at follow-up that sought to gain a deeper understanding as to why eligible subjects did not report to the surgical eye camp as instructed.

Ultimately, 119 (52.4%) of the 227 eligible subjects reported to the surgical eye camp at Kitete Hospital in Tabora. This differs from the surgery figures above because 12 of those individuals who reported for surgery were ultimately told, after further examination at Kitete, that they were not good candidates for surgery after all. Table 3.15 below examines the characteristics of those reporting to the surgical eye camp compared with those eligible subjects who did not report.

Table 3.15 – Characteristics of Individuals Reporting for Surgery and Not Reporting for Surgery (Surgery-Eligible Sample)

	Eligible (all)	Eligible (reported for surgery)	Eligible (did not report)
Female (share)	0.40	0.33*	0.47*
Age (mean years)	70.87	70.36	71.43
Muslim (share)	0.749	0.748	0.750
Employed (share)	0.132	0.109	0.157
Education level (mean)	1.96	2.12	1.79
Any education (share)	.0436	0.479	0.389
Literate (share)	0.401	0.429	0.370
Married (share)	0.542	0.538	0.546
Household size (mean)	5.24	5.58	4.86
QoL (EQ5D mean)	0.725	0.711	0.741
Self-rated Eyesight (mean)	2.269	2.294	2.241
Hours in productive activity (mean)	2.304	1.914*	2.735*
Any assistance in ADLs (share)	0.172	0.168	0.176
Subject is HoHH (share)	0.665	0.681	0.648
Asset Index (mean)	-0.035	-0.027	-0.043
PCE (mean)	$19.31	$20.44	$18.07
Owns large livestock (share)	0.167	0.185	0.148
Number of large livestock (mean)	2.98	2.61	3.40
Relative wealth rating (mean)	3.61	3.50	3.73
N	227	119	108

* $p<0.05$; ** $p<0.01$; *** $p<0.001$

The findings are similar to those comparing subjects who had surgery with those who did not, given the significant overlap between the two groups (all but twelve subjects). In particular, we see women are much less likely to report for surgery than men, as are those who are employed, both of which were explored earlier when looking at surgery rates. Below, in Table 3.16, we confirm that those reporting for surgery were more likely to have worse visual acuity.

Table 3.16 – Visual Acuity of Individuals Reporting for Surgery and Not Reporting for Surgery (Surgery-Eligible Sample)

	Eligible (all)	Eligible (reported for surgery)	Eligible (did not report)
Visually Impaired (6/18 < BCVA <= 6/60)	0.453	0.370**	0.546**
Severely Visually Impaired (6/60< BCVA <= 3/60)	0.278	0.286	0.269
Blind (3/60 < BCVA)	0.269	0.345**	0.185**
N	227	119	108

* $p<0.05$; ** $p<0.01$; *** $p<0.001$

We conducted a probit analysis to measure determinants of reporting to the surgical eye camp, which are presented in Table 3.17 below. We find that being blind is the only determinant that significantly impacts reporting for surgery at a minimum of 95% significance, with blind individuals being 21.5% more likely to report for surgery than their non-blind counterparts.

Table 3.17 – Determinants of Reporting for Surgery—Probit Results

Variable	Marginal Effect	Z-statistic	P-Value
Married	-0.078	-0.96	0.339
Female	-0.156	-1.79	0.074*
Age	-0.004	-1.26	0.207
Employed	-0.137	-1.33	0.185
Literate	0.096	1.24	0.216
Relative Wealth Rating	-0.037	-1.65	0.100
Muslim	-0.017	-0.20	0.838
Subject is Head of Household	0.013	-0.16	0.874
EQ5D Index	-0.021	-0.09	0.926
General Functioning	-0.002	-0.73	0.462
Psychosocial Well-being	0.002	1.24	0.215
Household Size	0.017	1.60	0.110
Blind	0.215	2.44	0.015**
Number of observations	227		

* $p<0.1$; ** $p<0.05$; *** $p<0.01$; **** $p<0.001$

Women are 15.6% less likely to report for surgery, but this finding is only significant at the 90% level. Again we see the impact of employment, though not significant here. Being Muslim also plays a small though insignificant role, showing that Ramadan did not seem to impact results.

Finally, we included a short questionnaire at follow-up for those 108 subjects eligible for surgery who did not report to Kitete, 80 of whom were included in the follow-up study (43 men and 37 women), in which we investigate their stated reasons for not attending, as well as some beliefs about surgery. Results from this additional set of questions are provided in Table 3.18 below, broken down by gender, given the fact that women were so much less likely to report than their male counterparts.

Of these 80 subjects, 26 (32.5%) claimed they did not want surgery at the time it was offered, and only 10 of these were women. The biggest reason offered was fear of surgery, with 8 men and 6 women listing this as their main reason. Interference from family or not having anyone to take them seems to have played a limited role, with only 3 subjects total claiming any of these reasons out of the 26. Interestingly, when these same 26 individuals were asked at follow-up if they would like surgery now if offered another opportunity, 12 said yes. Five of these 12 were subjects who previously feared the surgery, while another 2 had previously believed they did not think surgery would help them, which shows some limited evidence that the success of the campaign itself on others in their villages may have influenced their own wishes for surgery. Of all 80 subjects asked if they would like surgery now if offered another opportunity, 30 men and 23 women said yes. Still, these additional 53 subjects would only increase the uptake rate to 64.3% would they have reported for an additional surgical camp.

Table 3.18 – Survey of Surgery Decliners-Selected Results

	Men	Women	All
Of those *not wanting* surgery after diagnosis, reasons given:			
N (number of individuals)	16	10	26
Didn't think it would help me	3	0	3
Afraid of the surgery	8	6	14
Too sick/tired	2	1	3
Too sad/depressed	0	0	0
No one would take me	2	0	2
Too old/not economically active, so no point	1	1	2
Family does not want me to have the surgery	0	1	1
Other	0	1	1
Of those *wanting* surgery after diagnosis:			
N	27	27	54
Was informed about pickup time/location	26	27	53
Attempted to meet bus transport, if informed	10	3	13
Of those *wanting* surgery after diagnosis but *not attempting to meet the transport*, reason given (#)			
N	16	24	40
Location too far	0	0	0
Too disabled	0	0	0
Too sick/tired	4	3	7
Too sad/depressed	0	2	2
Conflicted with other event	3	2	5
No one would take me	0	4	4
Family does not want me to have surgery	1	3	4
Decided I not want surgery after all	1	1	2
Other	7	9	16
Of those *attempting/planning* to meet the transport, reasons for failing to do so:			
N	10	3	13
Location too far	0	0	0
Too disabled	0	0	0
Too sick/tired	0	1	1
Too sad/depressed	1	0	1
No one would take me	1	0	1
Arrived late	3	2	5
Had wrong date/time/location	0	0	0
Transport never arrived	0	0	0
Other	5	0	5
All revisited surgery decliners:			
N	43	37	80
Believes Surgery would make vision better (share)	0.837	0.730	
Believes Surgery could make vision worse (share)	0.400	0.243	
Believes People could die from the surgery (share)	0.140	0.081	

Of the remaining 54 who did want surgery, all but one knew the date, time and location of pickup, thus communication of information played nearly no role in those not reporting for surgery. Nevertheless, only 13 attempted to meet the bus. The main reasons listed for those 40 not attempting to reach the bus was "other" (16 subjects reported this); regrettably, this response was not followed up with further explanation, a shortcoming of the questionnaire. Besides this, we see illness played the next largest role (n=7), followed by a conflicting event (n=5) and issues related to having no one to take them (n=4) or family objecting (n=4); these latter two groups were all women, except for one, reinforcing the gender discrimination referenced throughout the chapter. Meanwhile, the main reasons listed among the remaining 13 who unsuccessfully attempted to reach the bus were again "other" (n=5) and also arriving late (n=5). Finally, at the bottom of the table, we see that beliefs about surgery were generally positive, with 73.0% of women and 83.7% of men believing it could make vision better, and a minority believing it could make vision worse (which in reality is a possibility, though rare). Very few believed it could result in death, a virtually impossible outcome.

Section 3.7: Discussion and Conclusions

Despite its limited size and scope, not to mention considerably different setting and population, the study in this chapter reaffirms many conclusions from the study covered in the previous two chapters. First, even in a setting that is quite accustomed to various interventions across multiple sectors,[37] with proven mechanisms, staff and outreach to mobilize its population, we come up against the difficulties in reaching those expect to be visually impaired. This is best exemplified in the large and significant difference between visually impaired men and women.

[37] An issue which itself proves problematic to the potential external validity of findings herein.

In a setting where one would expect women to be at least as represented in visual disability as their male counterparts, we find just 40% of women actually being counted as visually impaired through the screenings. The first step to treating visual impairment of any kind, but especially that resulting from something as cost-effectively treatable as cataracts, is to be able to cost-effectively identify those with visual impairment, preferably through some kind of self-selection. That said, women who know they are suffering from eye problems face considerable barriers to receiving even the first entry point to treatment – that of screening and diagnosis. These barriers need to be overcome in creative ways in order to have hope of reducing the cataract backlog, especially in any kind of equitable way.

In addition to the difficulties of reaching the visually impaired, we find further difficulties of getting those eligible for sight-restoring cataract surgery into treatment, even when various direct and indirect costs are eliminated, such as transport, lodging, meals and the costs of surgery itself. There are many reasons for this, but as opposed to the last study, we find here that most of these were *not* logistical in nature, but rather do to reasons such as fear, illness, and discrimination. On this last note, we again observe that above all else, gender discrimination is the single largest obstacle to addressing the backlog of blindness and visual impairment due to cataracts, with significantly fewer women reporting for surgery than men. Through our follow-up questionnaire, we see clear evidence of discrimination at work: women who otherwise desire the surgery are prevented either explicitly by family who refuse them to go or indirectly through not providing accompaniment to the bus or hospital.

We also note that given the overall less severe visual impairment of referred subjects in this study, both as compared to the study in Ethiopia and also as compared to other the variety of visually impaired subjects of this study in Tanzania, uptake rates are even lower despite

considerable advantages in terms of logistics and communication. Yet those blind from cataracts today are the very same who were moderately visually impaired from cataracts a few years ago, and these (free) surgical eye camps have been until now a rare occurrence in villages such as these. Thus to prevent today's visually impaired – or yet-to-be impaired – cataract subjects from the same fate of blindness, there must either be a huge ramping up of massive eye camps (which seems unlikely and not very cost-effective or sustainable), or a shift toward more comprehensive health systems that are indigenous and local in nature. Putting off cataract surgery in a setting such as this is a liability not worth taking on, and yet too many do, especially those who can still see rather well today.

Finally, when it comes to impacts of cataract surgery in these settings, we see limited evidence. When it comes to spillover effects beyond this, including economic effects on both the subjects themselves and their households, the evidence is even more mixed, and we cannot draw any strong conclusions based on this current sample population and study design. The focus must therefore emphasize the gender and age inequities inherent in the persistence of suffering due to visual impairment and blindness among millions worldwide, for want of one of the more cost-effective interventions today in terms of improved well-being. To overcome these inequities will require improved health systems that not only reach the poorest of the poor in more effective ways, but also overcome biases inherent in these settings against the most vulnerable and disadvantaged.

OVERALL CONCLUSIONS

While the two studies in the three chapters above differ substantially, there is enough complementary overlap to speculate on some potential overall conclusions and questions for future research as a result of examining all three chapters in their totality.

For instance, one of the major findings of the Tanzania study is that individuals in Sub-Saharan Africa tend to wait to seek treatment until visual impairment is relatively severe. This has been documented in other studies, and is in no doubt related to anecdotal evidence of some limits to the quality of cataract surgery in these settings under the existing health infrastructure. As an example, when visiting satellite locations in Tigray Province for the Ethiopia study, I learned that locally trained cataract surgeons – ophthalmic nurses who undergo an additional two years of training to be able to perform cataract surgeries, but to a substandard degree relative to fully trained ophthalmologists – may perform a successful surgery only 50% of the time, even with the most mature cases of cataracts (which are generally easier to remove than immature ones). As such, surgery is not even attempted at these remote locations until the subject is almost blind, so that if the surgery is botched, very little additional visual capability is lost (light perception or hand movement, for example). To the extent this is true elsewhere, this would likely explain part of the decision to wait for surgery as the visual acuity continues to degrade.

Chapters One and Two, however, suggest respectively that severe visual impairment and blindness (i) bring negative economic impacts that (ii) cannot be undone by merely reversing blindness. It remains a possibility, therefore, that intervening earlier (before severe visual impairment and blindness), which might prove more costly, could nevertheless prove more cost-effective than providing massive eye camps for the most severely visually impaired and blind, as was done in the Ethiopia study. This would be due to the possible increased savings from the

negative effects of blindness explored in the first chapter, which might not be so reversible later. Additional factors related to uptake could support this logic, including that it might be less costly to bring in less severely impaired cataract subjects, who would presumably be younger, less disabled, and more able to guide themselves to a treatment facility on their own. The cost for such care, however, needs to be juxtaposed with the high degree of training and capacity needed to perform successful cataract surgeries en masse, especially for less mature cataracts. This is an area ripe for future research and possible policy consideration.

Despite lacking conclusive findings for the purely economic case of cataract surgeries for blind and visually impaired individuals, the quality of life and other effects on mental health cannot be underestimated. This is similar in some respects to the Moving to Opportunity intervention in New York, which also sought to find cost-effective economic outcomes, but perhaps instead found more important consequences related to mental health (e.g. Leventhal & Brooks-Gunn, 2003). Increased well-being is oftentimes the intended end goal of many economically-minded interventions, so to the extent significant gains in mental health and well-being can be found despite increased economic potential, these should be equally valued and celebrated, if not monetized (future research could be included here to examine other measures of cost-effectiveness related to valuations of the improvement in DALYs, mental health/well-being, EQ-5D, etc.). Similarly, another major finding common to all three chapters in their totality is that the social dimensions to uptake are vast, and that women, the elderly, and the disabled suffer the most disadvantage. We cannot even begin to talk about a world where there is no one blind from preventable or treatable blindness until we consider these deep discriminations, which may require clever incentives, awareness campaigns and other creative responses to be fully addressed.

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APPENDIX

Findings from Qualitative Interviews of Surgery Patients and Caregivers

Shortly after the completion of the survey, a specialist in qualitative interviewing was assigned to return to twelve households of surgery patients to interview both the patient and his or her caregiver. The purpose of these semi-structured interviews was to gather in-depth information on the impacts of surgery on patients and their families to provide a fuller portrait of the potentially wide-ranging impacts of surgery beyond the quantitative measurements enabled by the survey. These interviews also provide an means of validating the main survey findings.

The interviews were conducted in three kebeles—two in Meket and one in Wadla, reflecting the overall distribution of the survey sample between the two districts. The individuals were randomly selected from the list of survey participants in these kebeles who had undergone surgery. No specific criteria for selection was imposed beyond this. After the initial draw of 12 individuals, two individuals were added to ensure gender balance, but one was not used in this analysis as that person had had surgery before the intervention and was not part of the study. All individuals who were approached agreed to the interview. Analysis of the interviews indicates that the final sample of 7 males and 6 females captured a range of living situations and household wealth.

The protocol for the interview included the following questions for the surgery patient, which correspond to different topic areas of the main survey:

1. Tell me about your vision now—are you satisfied with it?

2. As a result of your surgery, are you doing things you could not do before?

3. Are there some things you still cannot do that you hoped you would be able to after the surgery?

4. How else has your life been affected by the surgery?

5. Overall, what was the most important impact of the surgery on your life?

6. Were there any unexpected impacts of the surgery?

7. What about the others in your household? Has the surgery changed things for them?

For the caregiver or household head the questions were:

1. Has NAME's surgery affected the economic situation of your household?

2. How has NAME's surgery affected your life personally?

3. What is the main effect of NAME's surgery on the household?

These questions served as general guides to the discussion. The respondent was encouraged to speak in detail and freely on these topics, and the interviewer followed up on any unexpected or promising comments. We summarize the main findings in what follows.

Satisfaction with Vision

Ten of thirteen subjects said their sight was significantly improved or completely restored. Among these patients comments like the following, from a woman in Wadla and a man in Meket, were typical of the reaction to this life-altering change:

> *Prior to operation I lost my eyesight and left in bed. I was taken to Woldiya, the zonal capital and diagnosed and operated my eye. Then I regained my sight. At that event, I felt happiness and I prayed to God for what he did to me, regained my sight.*

> *Right before surgery [I was] bedridden and lost sight for two years. With the surgery I regained my sight and consequently my happiness has no boundary. How can I tell you? I am extremely a happy woman. Before surgery I used to live in a dark. With the surgery I came from total darkness to full bright.*

Even among those reporting restored or improved vision, a surprisingly significant number (eight) reported some kind of continued problems a year after surgery, including pain or excessive sensitivity and tearing. Some expressed concern that their eyesight was continuing to deteriorate or that such deterioration had resumed. This may reflect continued worsening of an unoperated eye for those who have only one eye operated, though several indicated that they thought the operated eye was getting worse. One man from Meket said:

> *I feel discomfort from pain of my eyes during dusty, windy days and at noon when it hot and of strong rays of light. This all disturbing me and triggers tears. It appears, my eyesight is deteriorating [in both eyes] in the last couple of months particularly after January 2013. I want checkup and look [for] the usual cooperation.*

Several other patients also expressed a desire to consult a specialist again. These responses point to the need to have appropriate follow-up care even in this difficult environment. Several respondents noted that they were now careful to avoid irritating their eyes from cooking smoke, though this may be difficult with indoor fires in cramped quarters.

Activities after Surgery

With the exception of the few who said they did not experience benefit to their vision, respondents expressed great satisfaction and joy at being able to resume activities that they were unable to do before regaining their vision, including domestic work, farm work (for men especially), social activities, and the simple tasks of walking unescorted, dressing oneself, and eating unassisted (being 'able to tell the injera [bread] from the sauce'):

> *Frankly speaking, before I was in a total darkness. I do nothing and used to demand assistance of someone from family members, mainly my wife. At the present, I do virtually everything apart from plowing of arable land. Before I quit going church and after surgery resume going (Man, Wadla).*

> *Before the surgery I do nothing. Now I live alone and have no caregiver; I am managing the household. I am involving in all household activities including*

baking injera. Thanks to the surgery I am participating in crop cultivation and started to engage in weeding and harvesting. I am able to go to church without assistance. I became [a] member of religious association and participate in the religious ceremony held weekly at the nearby Orthodox Church (woman, Meket)

Before the surgery I need the services of caregiver for virtually everything. I was escorted by family member to go where ever I wanted. Now after surgery I don't need services of caregivers for routine activities. Now I can eat, wear clothes and go to church independently. (man, Meket)

[My neighbors now say:] owing to his improved his eyesight nowadays it is difficult to find Ato at home. He may be working in the crop field, cutting grasses and prepare livestock feed or forage, manage crops and livestock or trek to market or to urban centers. (man, Meket)

In addition to resuming these activities, several of the male patients made a point of saying that they had regained their standing in the community (has "status" again; is a "full member" of the community) as a result of regaining their sight. Recall from above that a large majority of operated survey respondents indicated that they were enjoying more respect from the community (and within the family) as a result of their surgery. One sign of enhanced status, noted by several men in the qualitative interviews, is that they are being asked to mediate in disputes:

After the surgery my social standing has improved. This is particularly exhibited by frequent invitation to mediate people during conflict. A week ago we negotiate and settled dispute between husband and wife. (Man, Meket)

One man also noted that he was not only able to work again, but was able to obtain a loan from a local credit institution, with which he "bought one bull and one heifer. I kept and nurtured the animals for the last one year."

While most noted with enthusiasm their resumption of activities, many (eight respondents) also said that their advanced age and/or poor physical health prevented them from doing more work or other activities:

Of course I regained my eyesight but the challenge is I am aged and 78 years old. I have all the skill required in agriculture, crop and livestock. I like if I work in the farmlands but unable to do so because of the advancing age and deterioration in body strength. Had I had been strong enough physically I would have managed and cultivated land that is under my ownership (Man, Meket)

I am old and my physical strength is deteriorating. We are coming close to the point where unable to assist our selves. We have a plan to separate with my wife late this year. She will go to her relatives and I will move to one of my children's home (Man, Wadla)

These responses should not be unexpected given the age of this sample. They also accord with the findings of only small increases in work activities in the survey as well as the general lack of change in household incomes reported after surgery. All of these results point to a relatively limited addition to household income or production due to these older adults regaining sight.

There is also a suggestion from at least three of the interviews that spending years in blindness and relative inactivity had deleterious cumulative effects on physical condition over and above normal aging—as the baseline comparisons of blind and non-blind health measures in Chapter One suggested:

Sadly, however, four years of blindness and living in a dark had robbed me my physical strength and even my endurance. I believe, after surgery that deterioration of mental and physical health is abated but I found myself too weak to engage in livelihood activities (Man, Meket).

Had I gained my previous strength I would have participated in grinding grains; weaving and spinning; and baking injera and others. Now I stopped them altogether. Even now I am getting weaker and weaker in the course of time. I remember the six years of darkness when I was mostly confined to bed is horrible period of my life; and contributing for such physical powerlessness (Woman, Meket).

Effects on Others in the Household

The interviewed surgery patients were also asked how the household was affected by their surgery. Those who experienced recovery of their vision almost uniformly stressed the significant burden of their care that was now lifted from other family members. These individuals were now free to devote more time to their livelihoods or other pursuits:

> *I am living with my daughter who has work responsibility at kebele level, Keble Cabinet. Before the surgery she abandoned that responsibility because of my sickness and household responsibility. Now we exchanged that responsibility. I take the responsibility of work at the household and she resumed working at the kebele. Now she has no worry with the household chores and she is going anywhere and engages in any activity. (Woman, Wadla)*

> *My caregivers are my daughter and her husband, son- in-law. We are the household of three; they have no children or other family members. Therefore, before the surgery, either my daughter or her husband required to extend to support me at any one time with virtually all activities of clothing, movement, eating etc. Now I don't need any such support and they are free to move and involve in their social and livelihood activities. (Man, Meket)*

> *Prior to the surgery I was demanding constant attendance of caregiver. The caregiver was a girl and family member and who dedicated to assisting me sacrificing most of her time until she married. She had remained in assisting me from adolescent to adulthood. With the surgery I found myself independent and not demanding services of caregiver. I even start to contribute labor to household activities. With the successful surgery the caregiver is liberated and now she is married and has family of her own (Woman, Meket)*

These impacts seem very significant, and are in line with caregiver responses on the topic of reduced care burden/enhanced ability to do other activities seen in the survey.

Responses of Caregivers

In nine cases, caregivers were also interviewed. Asked about how the surgery of the patient affected the economic situation of the households, four of the nine indicated that there was an improvement.

> *Yes, I witness a lot of change in the economy of the household after the surgery. The economic situation of the household has undoubtedly improved. He is assisting in the management of the household affair. He is working now in crop and vegetable production in the homestead and he also supervises livestock and children. After he recovered his eyesight our compound is respected and he assisting me in our livelihood endeavor; now I have the partner who has recovered his health and eyesight and who stood beside me and assists me in livelihood activities. (female caregiver of man, Wadla)*

In a few cases where economic improvement did not occur, poor crop yields were mentioned as the reason. One caregiver indicated that since the surgery recipient has no land of her own, there was no change in the income of her (the caregiver's) household.

Caregivers were also asked about the effect of the surgery on them specifically. A consistent response was that a significant burden of care had been lifted. Further, in several cases it is clear that the burden was emotional as well as physical:

> *Before we are occupied physicality and emotionally. We had been assisting him in any of his activities/routines; and emotionally we are not free where ever around him or away from him. Particularly we are worried when we went away from household as we are not sure finding him alive in return. Now he does not need the assistance of anyone. Before the surgery he was not even able to eat; and pets- hens and cats - sharing and taking away what was supplied to him; and he was not able to differentiate between sauce and injera. Thanks God, after the surgery he eats, dress, move without assistance. (caregiver to man, Meket)*

> *Before the surgery I myself was in the state of darkness and in extremely difficult situation. Now it is pleasure to have healthy man beside me. I feel now things are relatively in good shape or order. Culturally men and women have different roles. Before I was engaged in activities that were the roles of men and women's. Now he is sharing the livelihood and social burden and assuming some responsibilities. (caregiver to man, Wadla)*

Asked about the main effect of the surgery on the household, the responses of caregivers varied. Some mentioned freeing up time of other household members for other activities. One mentioned the lack of worry about the blind person when they had to leave him alone in the house. Several pointed to the renewed ability of the individual to contribute to household or livelihood activities.

> *Thanks God, after the surgery he eats, dress, move without assistance. (Caregiver of man, Meket)*

Summary

Semi-structured interviews with about a dozen surgery recipients confirm findings from the quantitative survey while adding new insights. Most interviewees experienced significant and dramatic improvement in vision, leading to resumption of work and social activities. Respondents strongly emphasized the difference in their capabilities and outlook as a result of the surgery. Many stressed the pleasure of being able simply to eat or dress unassisted after years of not being able to do so. Economic benefits to surgery was said to have occurred in some but not all households. As many of the respondents themselves indicated, they were already at an age where deteriorating health and strength would prevent them from engaging in all productive activities—though a few apparently felt that years of disability or inactivity from blindness had also weakened them physically, beyond their years. Benefits to the household also included, most consistently, the reduction in the burden of care on others. Many patients and some caregivers emphasized that caregivers were free now to work and engage in other pursuits far more than before.

Three of the 13 patients said their sight did not improve after surgery. A substantial number of others reported pain or excessive sensitivity and tearing, and several felt that their sight, even in the operated eye, was worsening again. While it should be cautioned that this small sample is not representative, these findings point to the need to ensure adequate follow-up care, even in difficult low income environments such as rural Ethiopia.