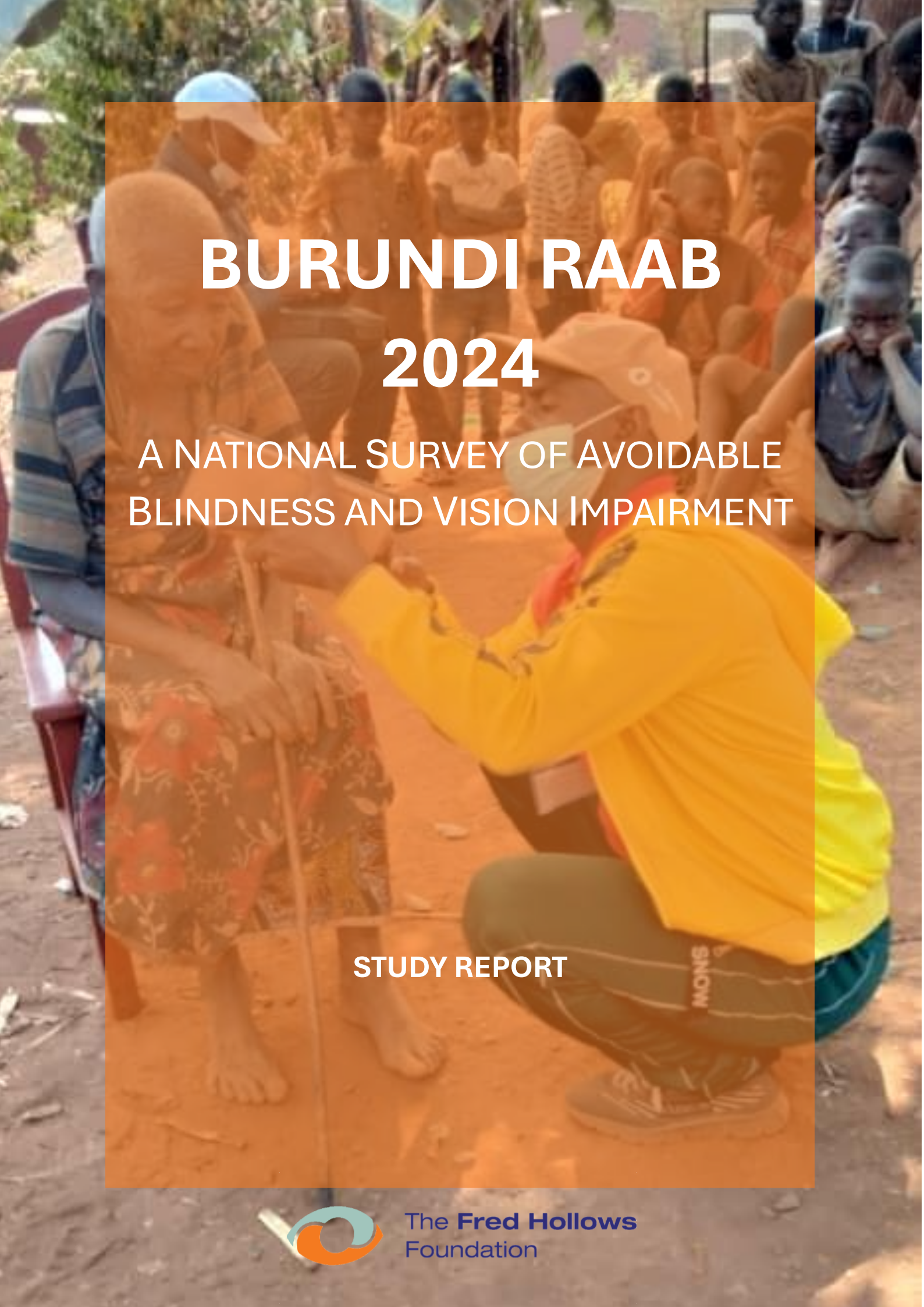

BURUNDI RAAB 2024

A NATIONAL SURVEY OF AVOIDABLE BLINDNESS AND VISION IMPAIRMENT

STUDY REPORT

The Fred Hollows Foundation

FOREWORD

It is with great pride and optimism that I present the 2024 Rapid Assessment of Avoidable Blindness (RAAB) survey report for Burundi. This initiative reflects our unwavering commitment to enhancing eye health for all Burundians, ensuring that everyone, regardless of their background or location, has the right to clear vision and improved quality of life.

In partnership with The Fred Hollows Foundation and other dedicated stakeholders, we have carried out this comprehensive survey to build a robust foundation for developing sustainable eye health strategies tailored to our nation's needs. As our country experiences demographic shifts, with an aging population and evolving healthcare demands, this report provides critical insights to help us plan effective and inclusive eye health services.

Burundi faces unique challenges, including the need to expand surgical capacity and improve access to high-quality eye care, particularly for our most vulnerable communities. Through this RAAB survey, we aim to strengthen our health system, promoting equity and inclusivity in eye health services. Our goal is to ensure that no one is left behind as we work towards achieving universal health coverage.

The results of this survey will guide targeted interventions and policies that prioritize cataract surgery, refractive error correction, and the prevention of other leading causes of blindness. This collaborative effort will contribute significantly to improving health outcomes and overall wellbeing for Burundians across all regions.

I extend my heartfelt gratitude to all the partners, healthcare workers, and communities who have supported and participated in this survey. Together, we are taking significant steps toward a brighter future where every Burundian enjoys the right to good vision and the opportunities that come with it.

[NAME]

[SINGATURE]

[TITLE]

ACKNOWLEDGMENTS

The Fred Hollows Foundation would like to extend our deepest gratitude to everyone who contributed to the success of this Rapid Assessment of Avoidable Blindness (RAAB) survey in Burundi.

First and foremost, we sincerely thank the survey participants for their time and cooperation. Your willingness to participate has been the foundation of this important work.

We express our appreciation to the Ministry of Health and the local health authorities of Burundi, whose collaboration and support have been instrumental. We are especially grateful to the local community leaders across the surveyed regions for facilitating our work and ensuring the smooth implementation of this project.

We would also like to extend our sincere gratitude to Dr Joseph Oye for his support in the planning for the RAAB and to Dr Deon Minnies, the RAAB Trainer, for his exceptional training and guidance, which were instrumental in the successful execution of this survey.

We are immensely grateful to our dedicated field team, whose hard work and commitment were crucial to the data collection process. Special thanks to Dr Levi Kandeke, the Principal Investigator and the wonderful and dedicated members of the data collection teams he led: Dr Adrien Bironkwaninguvu who played a crucial role in coordinating and implementing the RAAB, and (in alphabetical order): Gerard Biganama, Alexis Bikorimana, Adrien Bironkwaninguvu, Franck Bizimana, Didier Coyitungiye, Dr Juvenal Havyarimana, Bolis Iradukunda, Dr Dr Samuel Kwizera, Dr Malachie Ndikumukiza, Deogratias Nimpa, Dr Richard Nshimirimana, Gérard Ntahomvukiye, Dr Vianney Ntakirutimana, Donavine Riyazimana.

We acknowledge the guidance and expertise of our Technical Advisors, whose insights and advice greatly enhanced the quality of this study and report: the RAAB Team at the International Centre for Eye Health of the London School of Tropical Hygiene and Medicine and at Peek Vision in London, Imelda Barahinduka, Dr Deus Bigirimana, Dr Victor Bucumi, Dr Yenene Mulugeta Deneke, Jack Hennessy, Dr Patricia Marques, Dr Olivier Nijimbere, Maurice Nkurunziza, Desire Nduwimana, Jacqueline Ramke, Dr Mohammad Mostofa Sarwar, and Pushkar Silwal. Thank you also to our Advisor and report writer, Dr Fabrizio D'Esposito, for his work.

We extend our sincere gratitude to Annette Kobusingye, the Country Program Manager, whose leadership and dedication were vital to making the RAAB survey in Burundi a reality. Her strategic guidance and unwavering commitment throughout the process ensured that the survey was successfully implemented. We also thank Isabella Unzia, the Project Officer, for her outstanding management of relationships and logistics, which ensured the smooth execution of the survey. Their combined efforts made this project a success.

Lastly, we appreciate the financial support and contributions from all our partners and donors. Without your backing, this essential work would not have been possible.

Together, we are making significant strides towards improving eye health and reducing avoidable blindness in Burundi.

SUGGESTED CITATION

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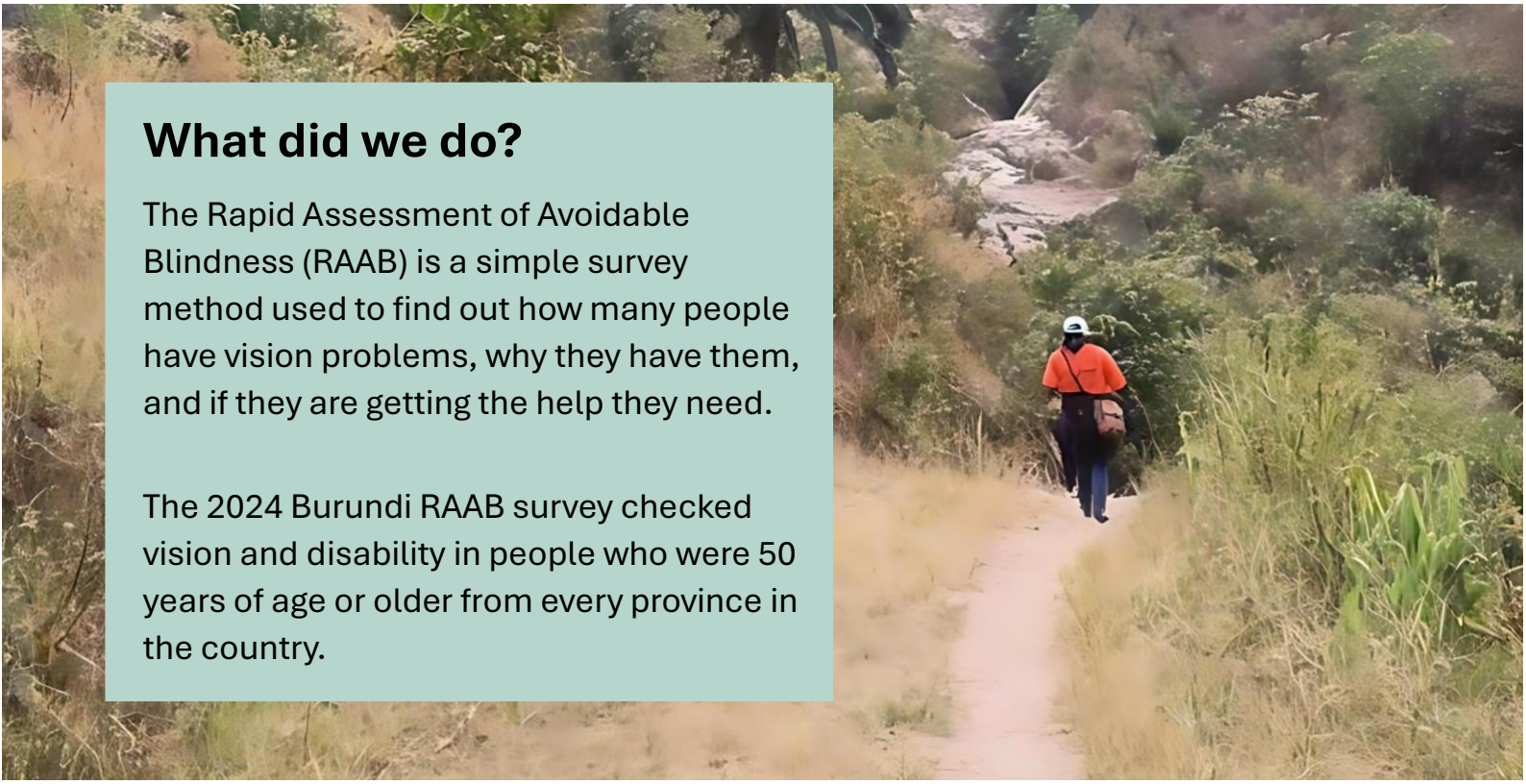
ABBREVIATIONS

95%CI	95% Confidence Intervals
CNS	Central Nervous System
CSC	Cataract Surgical Coverage
DALYs	Disability-Adjusted Life Years
eCSC	Effective Cataract Surgical Coverage
eREC	Effective Refractive Error Coverage
EVI	Early Vision impairment
EVI+	Early Vision Impairment or worse
HDI	Human Development Index
IAPB	International Agency for the Prevention of Blindness
IOL	Intraocular Lens
IQR	Inter-Quartile Ranges
MVI	Moderate Vision Impairment
MVI+	Moderate Vision Impairment or worse
PinVA	Pinhole Visual Acuity
PVA	Presenting Visual Acuity
RAAB	Rapid Assessment of Avoidable Blindness
REC	Refractive Error Coverage
SVI	Severe Vision Impairment
SVI+	Severe Vision impairment or worse
UCVA	Uncorrected Visual Acuity
VA	Visual Acuity
VI	Vision Impairment
WGQs	Washington Group Questions
WHO	World Health Organization

Rapid Assessment of Avoidable Blindness in Vanuatu

July – August 2024

The Fred Hollows Foundation



What did we do?

The Rapid Assessment of Avoidable Blindness (RAAB) is a simple survey method used to find out how many people have vision problems, why they have them, and if they are getting the help they need.

The 2024 Burundi RAAB survey checked vision and disability in people who were 50 years of age or older from every province in the country.

How did we do it?

We made a list of all the villages and neighbourhoods in the country with help from local authorities. We randomly picked 77 neighbourhoods and villages, and in each we then randomly picked 50 people who were 50 years of age or older. We only chose this age group because most vision problems happen in this age group.

We ended up visiting about 3,800 people all over the country and we looked at their eyes and we asked them whether they needed help doing everyday things. We also asked if they had any disability. We had five teams to do this survey, and each team had one eye health specialist and at least one eye health nurse.

What did we learn?

Prevalence of Vision Loss: More than two in 10 people aged 50 years and older in Burundi have a serious vision problem.

Avoidable blindness: Nine in 10 people aged 50 and older who are blind, don't need to be.

Cataracts as the Leading Cause: Cataracts are the main reason for blindness and severe vision problems in Burundi.

Uncorrected Refractive Errors: Not wearing the right glasses is the top reason for less severe vision problems in Burundi.

Cataract Surgical Coverage (CSC): Only about one in three people who are blind from cataracts have had surgery, and even fewer with moderate vision loss have been treated.

Visual Outcomes After Cataract Surgery: More than half of the people who had surgery still ended up with poor vision.

Effective Cataract Surgical Coverage (eCSC): The quality of cataract surgeries in Burundi can do with some improvement to help more people see well after surgery.

Distance Refractive Error Coverage: About one in ten people aged 50 years or older in Burundi need glasses to see in the distance.

Effective Refractive Error Coverage (eREC): Only one in twenty people aged 50 years or older who need glasses to see in the distance are getting glasses that work for them.

Use of reading glasses: Only around one in 36 people aged 50 years or older who need reading glasses in Burundi have them.

Disability: Around one in ten people aged 50 years or older in Burundi have difficulty doing everyday things. Having difficulty seeing, hearing, and moving are most common.

Disability and Vision Loss: People who have a disability are much more likely to also be blind than people who don't have any disability.

Eye Health, Disability and Gender: More women than men have problems seeing, need eye surgery, and are blind because of cataracts. More women also report having more difficulties with everyday tasks than men do.

What can we do about it?

We should make sure that eye doctors have the best tools and training to do cataract surgery well.

We should offer more eye surgeries, especially in places where people don't get enough help.

We should help more women get eye surgery by making it easier for them access services and hiring more female doctors.

We should make sure everyone, including people who need extra help, can get eye care.

We should make eye surgery cheaper and easier to get, especially for people who live far away.

We should support doctors to give better eye care and include eye checks in regular health visits.

We should set up a plan to check on people after eye surgery to help them see better.

We should work with other groups and communities to make sure more people get the eye care they need.

KEY MESSAGES

Prevalence of Blindness and Vision Impairment: The age- and sex-adjusted prevalence of blindness among those aged 50 and older in Burundi was 2.9%, with 89.2% of blindness being avoidable. This is higher than the 1.2% prevalence observed in the Northern Region in 2010 but is comparable to other East African countries. An estimated 320,000 older adults in Burundi are visually impaired, including about 38,000 who are blind.

Causes of Blindness and Vision Impairment: Cataract was the leading cause of blindness (71.2%), severe vision impairment (83.7%), and moderate vision impairment (61.7%) in Burundi. Uncorrected refractive errors were the main cause of early vision impairment (69.4%) and the second-leading cause of moderate vision impairment (27.6%). Posterior segment diseases were the second-leading cause of blindness (16.6%) and moderate vision impairment (9.9%).

CSC and Unmet Need: The cataract surgical coverage (CSC) among those blind from the condition was critically low at 35%, well below global targets and regional and global averages. Only 10.2% of people with less severe cataracts received surgery, and there is a significant unmet need for cataract surgery with at least 100,000 people requiring it. Approximately 17,000 people are estimated to blind due to untreated cataracts, highlighting the urgent need for increased surgical capacity and resources.

eCSC and Surgery Visual Outcomes: Effective cataract surgical coverage (eCSC) among those blind from the condition was also extremely low, with only 6.1% receiving effective surgery. This is well below the East African regional average of 35.8%. The eCSC dropped to just 1.6% for less severe cases, indicating a significant quality gap in cataract surgery. Additionally, half of the cataract surgeries resulted in poor visual outcomes, compared with the 5% or less recommended by the WHO. This underscores the urgent need for improvements in surgical quality and postoperative care.

Need for Improved Quality and Increased Cataract Surgery Outputs: The low eCSC and significant unmet need for cataract surgery highlight the need for both increased outputs and improved quality. Burundi needs approximately 365 cataract surgeries per million people annually over the next 10 years to address the backlog. Enhancing the quality of surgery through better training, postoperative care, and follow-up services is essential before scaling up outputs.

Refractive Error, REC, and eREC: The prevalence of distance refractive error increased with age, reaching 16.1% among those aged 70 to 79 years. However, only 4.7% of the population used spectacles, and just 6.1% of those needing it had effective correction. The low refractive error coverage (REC) of 8.6% and effective refractive error coverage (eREC) of 6.1% emphasize the need for improved access to and quality of refractive services.

Disability: The survey found that 12.4% of the population self-reported disabilities, with seeing difficulties being the most common (6.9%). There is a strong intersection between disability and vision impairment, with a significantly higher prevalence of blindness among those reporting non-seeing disabilities (19.8%) compared to those without disabilities (1.0%). The study also highlighted a concerning gap in eCSC among people with disabilities, with an adjusted eCSC of 0.0%, indicating the urgent need for improved access to cataract surgery for this group.

Gender: While no significant differences were observed in the prevalence of blindness and vision impairment between women and men, women had a higher prevalence of vision loss and unmet need for cataract surgery across all levels of visual acuity and thresholds for surgery. Approximately 11,500 women are estimated to be blind from cataract compared to 5,500 men, and women also have a higher unmet need for refractive correction. Women also reported higher rates of disability across all domains compared to men, though these differences were not statistically significant.

EXECUTIVE SUMMARY

Background

Vision impairment and blindness are critical public health issues worldwide, with an estimated 2.2 billion people affected globally, of which at least one billion cases are preventable or treatable. The African Region, including Burundi, bears a significant portion of this burden. Vision loss, particularly in low- and middle-income countries, often results from limited access to quality eye care services, inadequate healthcare infrastructure, and a high prevalence of untreated conditions. This study, the 2024 Burundi Rapid Assessment of Avoidable Blindness (RAAB), was conducted to address the lack of recent comprehensive data on the prevalence and causes of blindness, vision impairment, and disability in the country.

Aims and Objectives

The primary aim of this study was to determine the prevalence and causes of blindness and vision impairment among people aged 50 years and older in Burundi. A secondary aim was to assess the prevalence of disability in the same population. The study focused on understanding the distribution and magnitude of blindness, severe vision impairment (SVI), moderate vision impairment (MVI), early vision impairment (EVI), and their avoidable causes. Additionally, the study sought to evaluate cataract surgical coverage (CSC) and effective cataract surgical coverage (eCSC), the barriers to receiving cataract surgery, the prevalence of uncorrected refractive errors, and the refractive error coverage (REC) and effective refractive error coverage (eREC).

Methodology

The RAAB survey was a cross-sectional, population-based study conducted across all six regions of Burundi. A total of 3,850 individuals aged 50 years and older were recruited from 77 collines (villages) and quartiers (neighbourhoods), ensuring a representative sample across the country. Data were collected on visual acuity, lens status, main causes of blindness and vision impairment, spectacle use, cataract surgery (if received) and the presence of disabilities using the Washington Group Questions (WGQs). Ethical approvals were obtained, and informed consent was secured from all participants.

Key Findings

Prevalence of Blindness and Vision Impairment: The age- and sex-adjusted prevalence of blindness was 2.9% (95%CI: 2.1%-3.7%), with SVI at 3.0% (95%CI: 2.2%-3.7%). This prevalence is higher than the previously observed prevalence of 1.2% (95%CI: 0.8%-1.5%) observed in the Norther Region of the country in 2010, but it is comparable to that from other countries in East Africa that have conducted RAABs since 2000. As previously hypothesized, the lower prevalence observed in 2010 may be due to the demographic structure of the country at the time and impact of the conflict. Eighty-nine point two percent of blindness in the study population was avoidable, meaning that nine in 10 people who are blind in Burundi don't need to be. The age- and sex- adjusted prevalence of SVI, MVI, and EVI was 3.0% (95%CI: 2.2%-3.7%), 10.7% (95%CI: 9.3%-12.1%), and 7.5% (95%CI: 6.6%-8.5%), respectively. Based on these an estimated 320,000 people aged 50 years and older in Burundi are visually impaired, including approximately 38,000 individuals who are blind.

Causes of Blindness and Vision Impairment: Cataract was the leading cause of blindness (71.2%), SVI (83.7%), and MVI (61.7%). Uncorrected refractive errors were the primary cause of EVI (69.4%) and the second-leading cause of MVI (27.6%). Posterior segment diseases were the second-leading cause of blindness (16.6%) and MVI (9.9%), reflecting global trends where cataract, uncorrected refractive errors, and other conditions like glaucoma and diabetic retinopathy are the most common causes of vision impairment.

CSC and Unmet Need: The CSC was significantly below both regional and global averages. The age- and sex-adjusted CSC for those blind from cataract (<3/60 threshold) was 35.0% 95%CI: 25.7%-44.2%), meaning only about one in three people who are blind from cataract receive surgery. This is well below the regional average of 60.3% and the 80% coverage discussed in the context of Universal Health Coverage targets. Additionally, when

considering a less severe threshold for surgery (<6/18), the CSC dropped to 10.2% (95%CI: 7.2%-13.3%), indicating that only one in ten people with operable cataracts who are not yet blind receive surgery. The study also revealed a significant unmet need for cataract surgery, with at least 100,000 people in need of cataract surgery, of which approximately 17,000 are blind from the condition., highlighting an urgent public health need for increased surgical capacity and resources.

eCSC and Surgery Visual Outcomes: The age- and sex-adjusted eCSC among people who are blind from the condition was low, with only 6.1% (95%CI: 1.9%-10.4%) of those who are blind receiving effective surgery, compared to an East African regional average of 35.8%. When using a less severe threshold for surgery (<6/18), the eCSC drops even further to 1.6% (95%CI: 0.6%-2.7%), significantly below the regional average of 19.1%. This suggests that Burundi's eCSC is lower than any other country in East Africa for which data is available and pointing to a large quality gap in cataract surgery. Additionally, half of the cataract surgeries in Burundi resulted in poor visual outcomes (PVA <6/60), far exceeding the WHO's recommended threshold of no more than 5% poor outcomes, underscoring the urgent need for improvements in surgical quality and postoperative care.

Need for Improved Quality and Increased Cataract Surgery Outputs: The low eCSC and large unmet need for cataract surgery highlight an urgent need for both improved surgical quality and increased outputs. As a priority, it is essential to enhance the quality of surgery through better training, postoperative care, and follow-up services before scaling up outputs, to avoid worsening the burden of visual impairment. To address the significant backlog of cataract cases, it is estimated that Burundi requires a cataract surgical rate of approximately 365 surgeries per million people annually over the next 10 years, or just over 5,000 surgeries per year.

Refractive Error, REC, and eREC: The prevalence of distance refractive error in Burundi increased with age, reaching 16.1% among those aged 70 to 79 years. However, spectacle use for correcting distance vision is low, with only 4.7% of the population using them, and just 6.1% of those needing correction having effective correction. The low REC of 8.6% and eREC of 6.1% indicate that a large proportion of individuals with refractive errors are not receiving the necessary corrective services. The overall low coverage and 29.2% quality gap highlights a significant gap in refractive care, emphasizing the need for better access to and quality of refractive services, especially for older adults. Nonetheless the eREC observed in Burundi is 6.1%, which is slightly higher than the average of 5.7% reported in sub-Saharan Africa and is comparable to the eREC observed in low- and middle-income countries globally.

Disability: The survey found that 12.4% of the population in Burundi self-reported disabilities across various functional domains, with seeing difficulties being the most common (6.9%). This prevalence is somewhat lower than the World Health Organization's (WHO) global estimate of 15% of the population has some form of disability. In Africa, however, official government statistics often report disability prevalence as low as 2% to 5%, though WHO notes that the actual rates are likely higher in certain areas due to factors such as conflict, forced displacement, and inadequate access to medical services. The survey also highlighted a strong intersection between disability and vision impairment, with blindness found in 19.8% (14.6%-25.0%) of individuals who reported non-seeing disabilities, compared with just 1.0% (0.6%-1.5%) of those without disabilities. Finally, the study revealed a concerning gap in eCSC among those with disabilities, with an adjusted eCSC of 0.0%, emphasizing the urgent need to improve access to cataract surgery for people with disabilities, especially those with vision-related challenges.

Gender: Although no significant differences were observed in the age- and sex-adjusted prevalence of blindness and vision impairment between women and men, women had a higher prevalence of vision loss at any level of impairment. Women also exhibited a higher unmet need for cataract surgery compared to men, particularly at lower surgery thresholds, , with approximately 11,500 women blind from cataract compared to 5,500 men, and an estimated 69,000 women needing surgery at the <6/18 threshold compared to 39,000 men. Additionally, while the prevalence of refractive error was similar between the genders and women were more likely to use distance spectacles, women still had a higher unmet need for correction due to the larger population of older women in the population. Lastly, women reported higher rates of disability across all domains, including seeing, mobility, and memory, compared to men, though these differences were not statistically significant.

Recommendations

1. Improve the Quality of Cataract Surgery: Standardize surgical protocols, enhance post-operative care, and upgrade surgical equipment and facilities to improve surgical outcomes. Establish a national cataract outcomes monitoring system to continuously track and improve the quality of care.

2. Increase Cataract Surgical Outputs: Expand access to cataract surgery through outreach programs, strengthen the surgical workforce, and optimize resource allocation to meet the growing demand, particularly in underserved areas.

3. Address Gender Inequalities in Access to Cataract Surgery: Implement gender-sensitive outreach and education programs, subsidize surgeries for women, monitor gender disparities, and increase female representation in the eye health workforce to reduce gender inequalities.

These three recommendations are designed to address the key priorities of improving surgical quality, increasing outputs, and addressing gender inequalities in cataract surgery access and outcomes in Burundi.

4. Promote Equity and Inclusivity in Eye Health Services: Implement targeted strategies and inclusive policies to ensure that people with disabilities have equitable access to cataract surgery and eye care services. Enhance workforce diversity by recruiting individuals with disabilities into the eye health workforce, promoting an inclusive environment that meets the unique needs of all patients.

5. Address Barriers to Accessing Cataract Surgery: Reduce financial and geographical barriers to cataract surgery by considering the provision of subsidies, improving service availability in remote areas, and increasing public awareness and education about cataract treatment.

6. Strengthen Health Systems and Workforce Capacity: Enhance training for healthcare workers, integrate eye care into primary health services, and improve data collection and monitoring to support better planning and resource allocation in eye health.

7. Enhance Patient Outcomes and Follow-Up Care: Establish a follow-up care program for cataract surgery patients, focus on visual rehabilitation for poor outcomes, and educate patients on post-operative care to improve surgical results.

8. Strengthen Partnerships and Collaboration: Collaborate with international organizations for technical expertise and resources and engage local communities to support and sustain eye health initiatives.

9. Expand Access to Refractive Error Services: Increase the availability of optical services, particularly in rural areas, through more optical centres and mobile vision clinics to improve access to vision correction devices.

10. Improve REC and eREC: Implement quality assurance in optical services and introduce follow-up mechanisms to ensure that patients receive effective vision correction that meets their needs.

11. Community-Based Vision Screening and Awareness Programs: Develop community-based vision screening programs and conduct community awareness campaigns to increase the uptake of refractive services and ensure timely correction of vision issues.

12. Subsidize Spectacle Costs: Provide affordable spectacles through subsidized programs and initiate recycling and donation programs to help low-income populations access vision correction.

13. Strengthen Workforce Capacity in Refractive Error Management: Train more optometrists and refractionists and integrate refractive error training into primary health care to expand the capacity for diagnosing and correcting refractive errors.

14. Monitor and Evaluate Refractive Error Services: Establish a monitoring system and conduct regular surveys to track the provision of refractive error services, assess their effectiveness, and inform future planning.

15. Plan for a Likely Increase in the Burden of Posterior Segment Disease: Expand diagnostic and treatment capacity, train specialized professionals, enhance access to advanced treatments, and integrate screening into routine eye care to address the growing burden of posterior segment diseases.

These recommendations aim to create a comprehensive strategy for improving cataract surgery quality and access, addressing gender and geographical disparities, and strengthening refractive error services, ultimately building a more equitable and sustainable eye health system in Burundi.

Conclusion

The 2024 RAAB survey provides critical insights into the current state of eye health and disability in Burundi. The findings underscore the urgent need for targeted interventions to reduce the burden of avoidable blindness and vision impairment, improve the quality and accessibility of cataract surgeries, and increase access to services among women and people living with disabilities. Addressing these challenges will enable Burundi to improve the quality of life for its aging population and move closer to achieving universal health coverage.

BACKGROUND

Blindness and vision impairment around the world and in the African Region

Globally, at least 2.2 billion people are blind or visually impaired, and of these at least one billion have blindness or vision impairment that could have been prevented or could be treated. [1] This figure is expected to increase in coming years due to ageing populations, lifestyle changes, and population growth.

The individual, social, and economic impacts of blindness and vision impairment are devastating and wide-ranging. Vision loss affects various domains of life, such as physical, cognitive, psychological, and social functioning, and significantly impacts overall quality of life and wellbeing. [2] Individuals with vision impairment face a heightened risk of falls, particularly among older adults. [3, 4] Around one third of people aged over 65 fall each year, and vision loss is an independent risk factor for these incidents. [5-7] Furthermore, vision impairment is associated with increased mortality; a meta-analysis showed that people with visual acuity below 6/12 have a higher hazard ratio for mortality compared to those with better vision. [2] Longitudinal studies indicate that vision impairment might be a risk factor for dementia and accelerated cognitive decline. [8-10] Interventions to improve vision, such as cataract surgery, have been shown to potentially reduce these risks, demonstrating the interconnectedness of vision health and cognitive wellbeing. [2, 11] The psychological toll of vision impairment is profound, with up to 25% of individuals in high- and middle-income countries exhibiting significant depressive symptoms. [12] This depression often correlates with the severity of vision loss, impacting individuals' independence and lowering their overall quality of life. [13, 14] Additionally, adults with vision impairment encounter employment difficulties, often being confined to lower-paying jobs or facing higher unemployment rates compared to their sighted counterparts. [15, 16] Recent global productivity losses due to vision impairment are estimated to be US$411 billion annually. [2]

Low- and middle-income countries (LMICs) experience approximately 90% of the burden of vision loss globally. [17] According to the World Health Organization (WHO), these countries bear the highest rates of blindness and vision impairment due to factors like limited access to eye care services, higher prevalence of untreated conditions, and inadequate healthcare infrastructure. [1]

Vision impairment is a significant health problem in the African Region, and it is estimated that 15.3% of the world's blind population reside in Africa. Approximately 26.3 million people in the African Region have a form of visual impairment. Of these, 20.4 million have low vision and 5.9 million are estimated to be blind. [18] The most common eye conditions include cataracts, uncorrected refractive errors, glaucoma, age-related macular degeneration, corneal opacities, diabetic retinopathy, trachoma and onchocerciasis.

Without effective and urgent action, vision loss has the potential to overwhelm already strained health systems, with devastating economic and social impacts.

A word on disability

Disability is an umbrella term, covering impairments, activity limitations, and participation restrictions. Impairments are problems in body functions or structures while activity limitations are difficulties encountered by an individual in executing tasks or actions.

Disability is more common among women, older, people, children, and adults who are poor. People with disabilities often have less education and have deprived living conditions, including insufficient food, poor housing, and lack of access to safe water and sanitation. This causes individuals with disabilities to have the highest risk for infectious and non-infectious diseases. [19]

An estimated 1.3 billion people – or 16% of global population worldwide – experience a significant disability today. [20] The African Region has an estimated prevalence of disability with 12.8%. [20]

People with disabilities often do not receive the needed. Data from four countries in the African Region found that only 17.5% to 47.3% of people received the medical rehabilitation they needed, [19] while only around about 15% to 25% of those in need of assistive products have access to them. [21]

No recent, comprehensive data on blindness, vision impairment and disability is available in Burundi

The Republic of Burundi, located on the northern shores of Lake Tanganyika in Central Africa, is one of the smallest and most densely populated countries on the continent. The country is divided into 18 provinces, that area commonly grouped into six regions, including the urban area around the capital city, Bujumbura Mairie. About 90% of the 14 million-strong population of Burundi relies on subsistence agriculture [22] and the country has a Human Development Index ranking of 187 out of 193 countries. [23] Like other countries around the world, Burundi is undergoing important demographic changes. The country is witnessing decreasing mortality rates and increasing life expectancy, with the associated increase in the elderly population. The average life expectancy increased from 43.8 years in 2000 to 64.0 years in 2021. [24]

There is very limited evidence on the burden of vision impairment and their causes in Burundi. In 2010, a Rapid Assessment of Avoidable Blindness (RAAB) survey was conducted in two provinces in the Northern Region, Kayanza and Ngozi. [25]

The survey found an age- and sex-adjusted prevalence of blindness, severe vision (SVI), and moderate vision impairment (MVI) of 1.2% (95%CI: 0.8%-1.5%), 0.6% (95%CI: 0.4%-0.9%), and 1.9% (95%CI: 1.5%-2.3%), respectively. The leading causes of blindness were cataract (55.0%) and posterior segment diseases (37.5%). SVI was caused by cataract (43.5%), refractive error (39.1%), and posterior segment disease (17.3%). MVI was primarily caused by refractive error (67.2%), cataract (18.0%), and posterior segment diseases (13.1%).

The cataract surgical coverage (CSC) is a measure of how many people who need cataract surgery have received it, and it provides an indication of access to services. The CSC by person at the cataract surgical visual acuity (VA) thresholds of <3/60 and <6/18 was 18.4% (95%CI: 0.0%-40.8%) and 9.3% (95%CI: 0.0%-21.8%), respectively. The effective CSC (eCSC) measures the number of people in a population who have been operated on for cataract and had a good outcome (a post-operative PVA of at least 6/12). The eCSC at cataract surgical thresholds of <3/60 and <6/18 was 15.0% (95%CI: 0.0%-36.9%) and 7.6% (0.0%-21.8%), respectively. The gap between CSC and eCSC values can be considered a quality gap; the quality gap was 18.4% at both cataract surgical thresholds.

Overall, burden of disease and access to services in Kayanza and Ngozi were similar among women and men. However, women tended to have a higher extrapolated magnitude for certain types of vision impairment due to their slightly larger numbers in the older age groups (which are more affected by vision loss). The absolute numbers of women who had undergone cataract surgery also tended to be slightly lower than men, possibly reflecting gender disparities in healthcare access. [26]

No comprehensive, population-based, national surveys of blindness and vision impairment have ever been conducted in Burundi. To the best of the authors' knowledge, there is also no reliable population-based data on disability in Burundi. Finally, the observed and forecasted demographic changes that are taking place in the country are expected to cause an increase in the number of new patients with vision impairment and eye health problems, including cataract and posterior segment diseases. With economic growth, the demand for high quality eye health services – including for cataract surgery at earlier stages of the disease – in the public will also increase.

Up-to-date evidence is needed to assess the prevalence of blindness. vision impairment, and disability in Burundi, to gain insights about how eye care services are responding to the anticipated increase in demand, and to inform the efforts in country going forward.

AIMS AND OBJECTIVES

The primary aim of this study was to determine the prevalence and causes of blindness and vision impairment among people aged 50 years and older in Burundi. A secondary aim of this study was to determine the prevalence of disability in the same population. The study objectives were to determine:

1. Prevalence of blindness, severe, moderate, and early vision impairment
2. Proportion of blindness, severe, moderate, and early vision impairment that is avoidable
3. Main causes of blindness, severe, moderate, and early vision impairment
4. Prevalence of operable cataract
5. Vision outcomes following cataract surgery
6. Cataract surgical coverage (CSC) and effective cataract surgical coverage (eCSC)
7. Barriers to receiving cataract surgery
8. Cataract surgery indicators: place, type, and cost
9. Prevalence of uncorrected refractive errors
10. Effective refractive error coverage (eREC)
11. Prevalence of disability

The survey provided data on all indicators above disaggregated by gender; the survey also provided data on prevalence of blindness, severe, and moderate and early vision impairment as well as eCSC disaggregated by disability status.

METHODS

Study design

This was a cross-sectional population-based survey completed in all six regions of Burundi. The study used the well-established Rapid Assessment of Avoidable Blindness (RAAB) survey methodology. [27, 28]

The study population was adults living in Burundi who were aged 50 years and older at the time of data collection.

Participants and recruitment

Sample Size

The total population in Burundi in 2024 was estimated to be 14,337,000 (7,190,000 women and 7,147,000 men). The population aged 50 years and older was estimated at 1,333,000 (701,000 women and 632,000 men). The proportion of people aged 50 years and older in the country was therefore 9.3%. This data was kindly provided by the Bureau Central du Recensement du Burundi.

The required sample size was determined to be 3,850 people, distributed across 77 geographical clusters of 50 residents aged 50 years and older each. This sample was determined to have sufficient statistical power to measure an assumed national prevalence of blindness of 4.0%, with an accuracy of ±20%, a design effect of 1.5, a compliance of at least 90%, and a probability of 95% or more. The RAAB7 software was used for the sample size calculations. This sample size and number of clusters was considered logistically achievable despite the large distances and often difficult roads. The estimated prevalence of blindness was based on data from the Nigeria Nationwide Survey. [29]

Recruitment Approach

The sampling frame was a list of all collines (villages) and quartiers (neighbourhood) Burundi, which was kindly provided by the Bureau Central du Recensement du Burundi. Collines and quartiers are the smallest administrative unit in the country. The list also included the size of the population in each colline and quartier, along with the of province, district sanitaire (health district), and commune (municipality), that each colline and quartier is in and the health centre that provides basic medical services therein.

Seventy-seven collines and quartiers were randomly selected using a probability proportional to size approach based on the settlement's population size; the list of selected collines and quartiers is shown in Appendix 1. Given that 9.3% of the population were estimated to be aged 50 years and older, a colline or quartier with a total population of approximately 527 people was expected to include approximately 50 people aged 50 years and older. If collines or quartiers larger than 527 people were randomly selected, these where then subdivided into smaller segments of approximately 527 people each and a sub-segment was then randomly selected for data collection.

Five survey teams accompanied by a local guide visited all households in the selected collines and quartiers door-to-door until 50 people aged 50 years and older were identified. The purposes of the study and examination procedure were explained to the potential participants and informed consent was sought before commencement of data collection (more on this can be found in the relevant section of this report).

In cases were an eligible person lived in one of the visited households but was not present at the time of data collection, the survey team returned to their household once again on the same day to examine them. If they still could not be examined, information about their visual status was collected from relatives or neighbours. If the data collection team visited all households in a cluster, but failed to identify 50 eligible residents, then the team continued recruitment in the closest cluster.

Data collection

The field work was conducted between July and August 2024.

Key definitions

We will refer to key indicators of eye health throughout the remained of this report. In this section we provide a list of abbreviations as well as the definition of key indicators used.

Indicator	Abbreviation	Definition
Visual acuity	VA	The clarity of vision of an individual
Uncorrected visual acuity	UCVA	
Pinhole visual acuity	PinVA	VA with best available refraction correction – for the purpose of this study, this is pinhole vision
Presenting visual acuity	PVA	VA with refraction correction that is available to participant
Blindness	n/a	VA <3/60 in the better eye
Severe vision impairment	SVI	VA <6/60 to 3/60 in the better eye
Moderate vision impairment	MVI	VA <6/18 to 6/60 in the better eye
Early vision impairment	EVI	VA <6/12 to 6/18 in the better eye
Severe vision impairment or worse	SVI+	VA <6/60 in the better eye
Moderate vision impairment or worse	MVI+	VA <6/18 in the better eye
Early vision impairment or worse	EVI+	VA <6/12 in the better eye
Bilateral		This refers to vision impairment in both eyes
Unilateral		This refers to vision impairment in one eye
Cataract surgery threshold		A threshold for cataract surgery is the level of vision impairment or severity of cataract at which surgery is recommended or considered necessary to improve vision.
Cataract surgical coverage	CSC	[(x+y)/(x+y+z)]*100 Where: x = individuals with unilateral pseudo/aphakia (i.e. operated cataract) and operable cataract in the other eye; y = individuals with bilateral pseudo/aphakia, regardless of VA; z = individuals with bilateral operable cataract.
Effective cataract surgical coverage	eCSC	[(a+b)/(x+y+z)]*100 Where: a = individuals with unilateral pseudo/aphakia achieving PVA of 6/18 or better in the operated eye and operable cataract in the other eye; b = individuals with bilateral pseudo/aphakia achieving PVA of 6/18 or better in at least one eye; x, y and z as above for CSC.
Refractive error coverage	REC	[(a+b+c)/(a+b+c+d)]*100 Where *a* = individuals with UCVA <6/12 in the better eye who present with spectacles or contact lenses for distance vision and whose PVA is ≥6/12 in the better eye (met need); *b* = individuals with a history of refractive surgery whose UCVA is ≥6/12 in the better eye (met need); *c*=individuals with UCVA <6/12 in the better eye who present with spectacles or contact lenses for distance vision and have PVA <6/12 in the better eye, but who improve to ≥6/12 on pinhole or refraction (undermet need) *d*=individuals with UCVA <6/12 in the better eye who do not have distance vision correction and who improve to ≥6/12 on pinhole or refraction (unmet need)
Effective refractive error coverage	eREC	[(a+b)/(a+b+c+d)]*100 Where *a* = individuals with UCVA <6/12 in the better eye who present with spectacles or contact lenses for distance vision and whose PVA is ≥6/12 in the better eye (met need); *b* = individuals with a history of refractive surgery whose UCVA is ≥6/12 in the better eye (met need); *c*=individuals with UCVA <6/12 in the better eye who present with spectacles or contact lenses for distance vision and have PVA <6/12 in the better eye, but who improve to ≥6/12 on pinhole or refraction (undermet need) *d*=individuals with UCVA <6/12 in the better eye who do not have distance vision correction and who improve to ≥6/12 on pinhole or refraction (unmet need)

Training of data collectors

Five experienced ophthalmologists and five techniciens supérieur en ophtalmologie (senior ophthalmic technicians) were trained for five days prior to data collection. The training covered the RAAB principles, the survey and eye examination protocol, and data entry into the data management system.

In order to measure inter-observer agreement, each of the teams examined 50 people at the end of the training, and prior to the commencement of the field work. Measurements for VA, lens examination results, and cause of blindness for each patient were compared between team members and the team leader. Results were compared between the teams to ensure that they were of an acceptable standard (i.e., kappa ≥0.60).

Examination procedure

All participants were interviewed on whether they experienced any problems with their eyes and whether they owned glasses.

VA was then checked using *Peek Acuity*, a validated mobile tablet-based VA test, or two simplified tumbling 'E' charts. VA was checked placing the tablet or 'E' charts three meters away from the participants. First, UCVA was checked in broad daylight. CVA and PinVA were then checked using a pinhole if participants had a UCVA and/or CVA of <6/12. PVA is calculated from the combined UCVA and CVA data available and used in subsequent logic skips as per previous versions of RAAB.

All participants were directed into a shaded area or indoors for lens examination using a light torch.

If PinVA was <6/12 and no lens opacity was observed, the participants' pupils were dilated with tropicamide 0.5% solution, and direct ophthalmoscopy was performed to determine the cause of reduced vision for each eye.

The overall primary cause of VA <6/12 was determined to be the cause that was most easily treatable. For example, if one eye had vision impairment due to refractive error, while the other had reduced VA due to significant cataract, refractive error was chosen to be the overall primary cause.

The lens status of participants who had undergone cataract surgery was recorded, and these participants were asked where they had received care.

Participants with obvious lens opacity and vision impairment or blindness with pinhole were asked the reasons for not having received cataract surgery.

Participants identified as requiring further eye care were counselled and referred to appropriate services.

Assessment of disability status

Disability was assessed using the Washington Group Question (WGQs). The WGQs were developed by the Washington City Group, who were set up by the United Nations Statistical Division. The WGQs are the main tool used to measure disability in national census and other population-based surveys. They do not ask people whether they think they have a disability. Disability is strongly stigmatised in many settings, so instead they ask about difficulties in functioning, in line with the International Classification of Functioning, Disability and Health and the Convention on the Rights of Persons with Disabilities. Following the eye health assessment, the data collectors used the 'Short Set Enhanced' WGQs to assess disability status among participants. Any participant reporting 'a lot of difficulty' or 'cannot do at all' in any domain is considered to have a disability.

Data management and analysis

Data was recorded on android mobile tablets using the RAAB application. Data from the RAAB application were then transmitted via a secure encrypted connection to the RAAB data management software, located on a secure cloud-based server (Version 7, London School of Hygiene & Tropical Medicine, UK).

The data was assessed regularly with the RAAB software's in-built consistency check function. Any discrepancies identified were immediately flagged with the team leaders by the RAAB trainer for clarification and then rectified as appropriate.

Once data collection was completed, the RAAB Trainer closed the survey, locking the dataset. The Principal Investigator downloaded automated reports and a copy of the data for local storage, while the raw dataset and reports were also securely

backed up for safekeeping by the International Centre for Eye Health at the London School of Hygiene and Tropical Medicine.

The Burundi Ministry of Health also gave permission for the main survey outputs[1] produced by the London School of Tropical Hygiene and Medicine using the data to be shared on the RAAB repository.

Ethical and other approvals obtained

Approval for the implementation of this research study was granted by the Comité National d'Éthique pour la Recherche en Santé (CNER) du Burundi.

Consent was obtained from each commune and quartier administration prior to the survey. Informed consent was also sought from all eligible subjects eligible to participate at the time of data collection. A participant information sheet and consent form were developed to explain the study's purpose, procedures, risks, benefits, confidentiality considerations, and the voluntary nature of participation in the survey. Provided in French, Kirundi, and English they were read and given to participants, who then provided written consent if they chose to participate in the study.

Survey teams mitigated any stress caused by new diagnoses by providing adequate counselling on the spot and referring participants to health facilities to receive care as appropriate.

Consent forms were securely stored, and the participants' identifiable data that was initially entered in the RAAB mobile tablet used for data collection were deleted post-survey.

[1] Prevalence of vision impairment and blindness, main causes of vision impairment and blindness, cataract surgical coverage, effective cataract surgical coverage, and effective refractive error coverage (total, male, female).

RESULTS

Response rate

The survey included 3,850 people aged 50 years and older, of whom 3,781 were examined. The coverage was 98.2%: 48 eligible individuals (1.2%) were absent, 13 (0.3%) were unable to comply with the examination, and eight (0.2%) refused to participate in the study (Table 1).

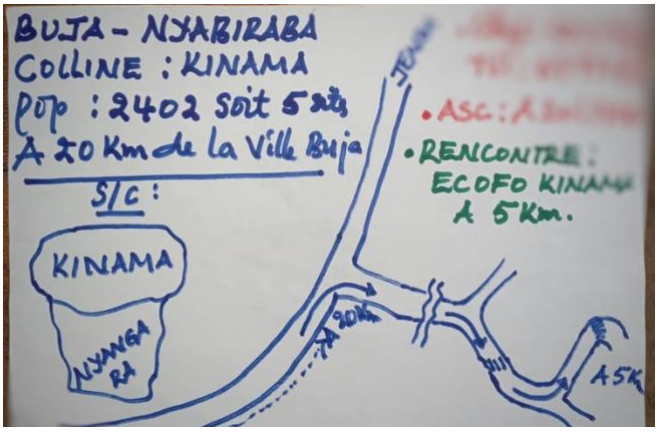


Table 1. Eligible persons, coverage, absentees, and refusals

Examination status	Women		Men		Total	
	n	%	n	%	n	%
Examined *	2,129	98.3	1,652	98.1	3,781	98.2
Refused	6	0.3	2	0.1	8	0.2
Incapable	11	0.5	2	0.1	13	0.3
Unavailable	20	0.9	28	1.7	48	1.2
Total	2,166	100.0	1,684	100.0	3,850	100.0

** The response rate is the percent examined*

Representativeness of study population

To check whether the study population is representative of the Burundi population aged 50 years and older, the age and sex composition of the sample was compared with that of broader population of Burundi (Table 2).

Ideally, the study population should have the same composition by age and by gender as the total population aged 50 years and older in the survey area. However, we found that women were under-represented in the 50 to 59 years age group and over-represented in the 80+ years age group, whilst men were under-represented in the 50 to 59 years and 60-69 years age groups. To account for these discrepancies, we have provided both crude (study population) and age- and sex-adjusted estimates where appropriate

Table 2. Age and gender composition of country and study population

	Women		Men		Total	
Age group (Years)	**Study sample** n (% total 50+)	**National** n (% total 50+)	**Study sample** n (% total 50+)	**National** n (% total 50+)	**Study sample** n (% total 50+)	**National** n (% total 50+)
50-59	917 (43.1)	335,542 (47.9)	601 (36.4)	328,636 (52.0)	1,518 (40.1)	664,178 (49.8)
60-69	660 (31.0)	227,539 (32.5)	577 (34.9)	200,751 (31.8)	1,237 (32.7)	428,290 (32.1)
70-79	382 (17.9)	108,484 (15.5)	362 (21.9)	84,441 (13.4)	744 (19.7)	192,925 (14.5)
80+	170 (8.0)	29,432 (4.2)	112 (6.8)	18,208 (2.9)	282 (7.5)	47,640 (3.6)
Total	2,129 (100.0)	700,997 (100.0)	1,652 (100.0)	632,036 (100.0)	3,781 (100.0)	1,333,033 (100.0)

Prevalence of blindness and vision impairment

Prevalence in the study population

The crude prevalence of blindness with available correction (i.e., PVA) was 3.7% (95%CI: 2.9%-4.4%). The crude prevalence of SVI, MVI, and EVI were 3.7% (95%CI: 3.0%-4.5%), 12.9% (95%CI: 11.6%-18.2%), and 8.2% (7.3%-9.1%), respectively. This means that the prevalence of moderate-to-severe vision impairment was 16.6% (95%CI: 15.0%-18.2%). No statistically significant differences were observed between women and men in the prevalence of blindness and vision impairment (as indicated by the overlapping confidence intervals); however, there appears to be a trend for high prevalence among women compared with men (Table 3).

Table 3. Crude prevalence of blindness by impairment level and gender

Bilateral PVA	Women		Men		Total	
	n	% (95%CI)	n	% (95%CI)	n	% (95%CI)
Blindness (PVA <3/60)	88	4.1 (3.1-5.2)	51	3.1 (2.2-4.0)	139	3.7 (2.9-4.4)
SVI (PVA <6/60 – 3/60)	95	4.5 (3.4-5.6)	46	2.8 (1.9-3.6)	141	3.7 (3.0-4.5)
MVI (PVA <6/18 – 6/60)	284	13.3 (11.7-14.9)	202	12.2 (10.5-13.9)	486	12.9 (11.6-14.1)
MVI and SVI (<6/18 – 3/60)	379	17.8 (15.9-19.7)	248	15.0 (12.9-17.2)	627	16.6 (15.0-18.2)
EVI (PVA <6/12 – 6/18)	179	8.4 (7.2-9.6)	131	7.9 (6.7-9.2)	310	8.2 (7.3-9.1)

Age- and sex-adjusted prevalence and extrapolated magnitude

The extrapolated (age- and sex-adjusted) prevalence of blindness with available correction (i.e. PVA) was 2.9% (95%CI: 2.1%-3.7%). The age- and sex-adjusted prevalence of SVI, MVI, and EVI were 3.0% (95%CI: 2.2%-3.7%), 10.7% (95%CI: 9.3%-12.1%), and 7.5% (95%CI: 6.6%-8.5%), respectively. This means that the prevalence of moderate-to-severe vision impairment was 13.7% (95%CI: 11.9%-15.4%). No statistically significant differences were observed between women and men in the prevalence of blindness and vision impairment (as indicated by the overlapping confidence intervals); however, there appears to be a trend for high prevalence among women compared with men (Table 4).

Based on the observed prevalence, an estimated 320,760 people aged 50 years and older – 189,432 women and 131,327 men – have vision loss in Burundi. These numbers include 38,294 who are blind.

Table 4. Age- and sex- adjusted prevalence of blindness and extrapolated magnitude by impairment and gender

Bilateral PVA	Women		Men		Total	
	% (95%CI)	Extrapolated magnitude	% (95%CI)	Extrapolated magnitude	% (95%CI)	Extrapolated magnitude
Blindness (PVA <3/60)	3.3 (2.2-4.4)	23,185	2.4 (1.5-3.3)	15,108	2.9 (2.1-3.7)	38,294
SVI (PVA <6/60 - 3/60)	3.8 (2.7-4.9)	26,528	2.0 (1.2-2.9)	12,839	3.0 (2.2-3.7)	39,367
MVI (PVA <6/18 - 6/60)	11.8 (10.2-13.5)	83,057	9.4 (7.6-11.2)	59,617	10.7 (9.3-12.1)	142,674
MVI and SVI (<6/18 - 3/60)	15.6 (13.7-17.6)	109,585	11.5 (9.2-13.7)	72,456	13.7 (11.9-15.4)	182,041
EVI (PVA <6/12 - 6/18)	8.1 (6.9-9.3)	56,662	6.9 (5.7-8.2)	43,763	7.5 (6.6-8.5)	100,425

Causes of blindness and vision impairment in the study population

Untreated cataract was the most common cause of blindness identified in the study population. This condition accounted for 71.2% of cases, with posterior segment disease (other than glaucoma, age-related macular degeneration, and diabetic retinopathy) accounting for 10.1% of blindness as the second leading cause. Glaucoma was the third leading cause, accounting for 6.5% of blindness. Cataract and other posterior segment disease were also the leading (83.7%) and second leading (9.9%) causes of SVI. Refractive error was the third most common cause of SVI (4.3%). Cataract was the leading cause of MVI (61.7%) and refractive error was the second leading cause of MVI (27.6%). Refractive error was also the most common cause of EVI (69.4%). (Table 5).

It should be noted that with glaucoma the central vision remains unaffected until very late in the disease process. It was not possible to conduct reliable visual field analysis in this survey. The number of patients who have glaucoma and still have normal VA is likely to be higher.

Eighty-nine-point-two percent of all blindness in the study population was avoidable. Specifically, 72.6% of blindness was treatable, 3.6% was preventable with primary health care and/or primary eye care, and 13.0% was preventable through more advanced ophthalmic services. Posterior segment diseases accounted for 16.6% of all bilateral blindness.

The leading causes of blindness, SVI, MVI, and EVI are the same between women and men with one exception: glaucoma in the third leading cause of blindness among women (8.0%) and the fourth leading cause among men (3.9%); however, the number of people affected is small (nine in total) and it is therefore inappropriate to draw any conclusions from this.

Table 5. Main causes of blindness, SVI, MVI and EVI in the study population

	Blindness		SVI		MVI		EVI	
	n	%	n	%	n	%	n	%
By cause								
Cataract	99	71.2	118	83.7	300	61.7	80	25.8
Other posterior segment disease	14	10.1	14	9.9	35	7.2	12	3.9
Glaucoma	9	6.5	0	0.0	3	0.6	0	0.0
Cataract surgical complications	9	6.5	2	1.4	5	1.0	0	0.0
Other corneal opacity	3	2.2	1	0.7	4	0.8	1	0.3
Refractive error	2	1.4	6	4.3	134	27.6	215	69.4
Trachomatous corneal opacity	1	0.7	0	0.0	0	0.0	0	0.0
Phthisis	1	0.7	0	0.0	0	0.0	0	0.0
Other globe or CNS abnormalities	1	0.7	0	0.0	0	0.0	0	0.0
Age-related macular degeneration	0	0.0	0	0.0	2	0.4	2	0.6
Aphakia	0	0.0	0	0.0	0	0.0	0	0.0
Pterygium	0	0.0	0	0.0	0	0.0	0	0.0
Onchocerciasis	0	0.0	0	0.0	0	0.0	0	0.0
Diabetic retinopathy	0	0.0	0	0.0	3	0.6	0	0.0
Myopic degeneration	0	0.0	0	0.0	0	0.0	0	0.0
Total	139	100.0	141	100.0	486	100.0	310	100.0
By intervention category								
A. Treatable	101	72.6	124	88.0	434	89.3	295	95.2
B. Preventable (PHC/PEC services)	5	3.6	1	0.7	4	0.8	1	0.3
C. Preventable (Ophthalmic services)	18	13.0	2	1.4	11	2.2	0	0.0
D. Avoidable (A+B+C)	124	89.2	127	90.1	449	92.3	296	95.5
E. Posterior segment causes	23	16.6	14	9.9	43	8.8	14	4.5

PHC: Primary Health Care; PEC: Primary Eye Care

Cataract

Unmet need for cataract surgery

Unmet need for cataract surgery in the study population

The crude unmet need for cataract surgery among people aged 50 years and older who experienced blindness from the condition was 1.9% (95%CI: 1.4%-2.4%); this was slightly higher among women (2.2%, 95%CI: 1.5%-2.9%) compared with men (1.5%, 95%CI: 0.9%-2.1%), although this difference was not statistically significant. The crude unmet need among people with SVI+, MVI+, and EVI+ from the condition was 3.7% (95%CI: 2.8%-4.5%), 10.7% (9%CI 9.2%-12.3%), and 15.0% (95%CI: 13.1%-16.9%). As for blindness, the prevalence of unmet need for cataract surgery for SVI+, MVI+, and EVI+ was higher among women compared with men, although this difference was not statistically significant (Table 6).

Table 6. Unmet need for cataract surgery at PinVA thresholds <3/60, <6/60, <6/18 and <6/12 in the study population

Unmet need threshold	Women		Men		Total	
	n	% (95%CI)	N	% (95%CI)	n	% (95%CI)
Blind (PinVA <3/60)	47	2.2 (1.5-2.9)	25	1.5 (0.9-2.1)	72	1.9 (1.4-2.4)
SVI+ (PinVA <6/60)	91	4.3 (3.2-5.3)	48	2.9 (1.9-3.9)	139	3.7 (2.8-4.5)
MVI+ (PinVA <6/18)	257	12.1 (10.2-14.0)	148	9.0 (7.1-10.8)	405	10.7 (9.2-12.3)
EVI+ (PinVA <6/12)	356	16.7 (14.6-18.8)	212	12.8 (10.6-15.0)	568	15.0 (13.1-16.9)

The crude unmet need for cataract surgery among people aged 50 years who experience bilateral blindness from the condition was 1.9% (95%CI: 1.3%-2.4%); this was higher among women (2.2%, 95%CI: 1.5%-2.9%) compared with men (1.4%, 95%CI: 0.8%-2.0%), although this difference was not statistically significant. The crude prevalence of SVI+, MVI+, and EVI+ due to bilateral cataract was 3.6% (95%CI: 2.7%-4.4%), 10.4% (95%CI: 8.8%-11.9%), and 14.4% (95%CI: 12.6%-16.3%). As for blindness, the prevalence of unmet need for cataract surgery for SVI+, MVI+, and EVI+ from bilateral cataract was higher among women compared with men, although this difference was not statistically significant (Table 7).

The crude unmet need for cataract surgery among people aged 50 years and older who experience unilateral blindness from the condition was 3.0% (95%CI: 2.4%-3.7%); this was slightly lower among women (2.7%, 95%CI: 1.9%-3.5%) compared with men (3.5%, 95%CI: 2.5%-4.4%), although this difference was not statistically significant. The crude prevalence of SVI+, MVI+, and EVI+ due to unilateral cataract was 4.8% (95%CI: 4.1%-5.6%), 7.4% (95%CI: 6.3%-8.4%), and 8.6% (95%CI: 7.5%-9.7%). The prevalence of unmet need for cataract surgery for SVI+, MVI+, and EVI+ from unilateral cataract was comparable between women and men (Table 7).

Table 7. Unmet need for bilateral and unilateral cataract surgery at PinVA thresholds <3/60, <6/60, <6/18 and <6/12 in the study population

Cataract surgical threshold	Women		Men		Total	
	n	% (95%CI)	N	% (95%CI)	n	% (95%CI)
Blind (PinVA<3/60)						
Bilateral cataract	47	2.2 (1.5-2.9)	23	1.4 (0.8-2.0)	70	1.9 (1.3-2.4)
Unilateral cataract	58	2.7 (1.9-3.5)	57	3.5 (2.5-4.4)	115	3.0 (2.4-3.7)
SVI+ (PinVA <6/60)						
Bilateral cataract	90	4.2 (3.2-5.3)	45	2.7 (1.8-3.7)	135	3.6 (2.7-4.4)
Unilateral cataract	101	4.7 (3.8-5.7)	82	5.0 (3.9-6.0)	183	4.8 (4.1-5.6)
MVI+ (PinVA <6/18)						
Bilateral cataract	250	11.7 (9.9-13.6)	142	8.6 (6.8-10.4)	392	10.4 (8.8-11.9)
Unilateral cataract	157	7.4 (6.1-8.6)	122	7.4 (6.0-8.8)	279	7.4 (6.3-8.4)
EVI+ (PinVA <6/12)						
Bilateral cataract	342	16.1 (14.0-18.1)	204	12.3 (10.2-14.5)	546	14.4 (12.6-16.3)
Unilateral cataract	178	8.4 (7.1-9.6)	147	8.9 (7.4-10.4)	325	8.6 (7.5-9.7)

Age- and sex-adjusted prevalence of and extrapolated magnitude of unmet need for cataract surgery

The age- and sex-adjusted prevalence of unmet need for cataract surgery among people aged 50 years and older who experienced blindness from the condition was 1.3% (95%CI: 0.7%-1.8%); this was higher among women (1.7%, 95%CI: 0.9%-2.4%) compared with men (0.9%, 95%CI: 0.3%-1.5%), although this difference was not statistically significant. The crude unmet need among people with SVI+, MVI+, and EVI+ from the condition was 2.6% (95%CI: 1.8%-3.5%), 8.1% (95%CI: 6.5%-9.8%), and 11.5% (95%CI: 9.4%-13.5%). As for blindness, the prevalence of unmet need for cataract surgery for SVI+, MVI+, and EVI+ was higher among women compared with men, although this difference was not statistically significant (Table 8).

This means that there are an estimated 108,368 people aged 50 years and older in Burundi – 69,418 women and 38,950 men – with MVI+ (PinVA <6/18) who would benefit from cataract surgery. This includes 17,191 people – 11,590 women and 5,601 men – who are blind from the condition (Table 8).

Table 8. Age- and sex-adjusted prevalence of and extrapolated magnitude of cataract at surgical thresholds <3/60, <6/60, <6/18 and <6/12

Cataract surgical threshold	Women		Men		Total	
	Adj. % (95%CI)	Extrapolated magnitude	Adj. % (95%CI)	Extrapolated magnitude	Adj. % (95%CI)	Extrapolated magnitude
Blind (PinVA <3/60)	1.7 (0.9-2.4)	11,590	0.9 (0.3-1.5)	5,601	1.3 (0.7-1.8)	17,191
SVI+ (PinVA <6/60)	3.4 (2.3-4.4)	23,625	1.8 (0.8-2.8)	11,503	2.6 (1.8-3.5)	35,128
MVI+ (PinVA <6/18)	9.9 (7.9-11.9)	69,418	6.2 (4.2-8.1)	38,950	8.1 (6.5-9.8)	108,368
EVI+ (PinVA <6/12)	14.0 (11.8-16.2)	98,204	8.7 (6.3-11.1)	54,879	11.5 (9.4-13.5)	153,082

The extrapolated unmet need for cataract surgery among people aged 50 years who experience bilateral blindness from the condition was 1.3% (95%CI: 0.7%-1.8%); this was higher among women (1.7%, 95%CI: 0.9%-2.4%) compared with men (0.9%, 95%CI: 0.3%-1.5%), although this difference was not statistically significant. The extrapolated prevalence of SVI+, MVI+, and EVI+ due to bilateral cataract was 2.6% (95%CI: 1.7%-3.4%), 7.9% (95%CI: 6.3%-9.5%), and 11.1% (95%CI: 9.1%-13.1%). As for blindness, the prevalence of unmet need for cataract surgery for SVI+ and MVI+ from bilateral cataract was higher among women compared with me, although this difference was not statistically significant. The prevalence of unmet need for cataract surgery for EVI+ from bilateral cataract surgery was significantly higher among women compared with men (Table 9).

This means that there are an estimated 105,379 people aged 50 years and older in Burundi – 67,731 women and 38,950 men – with bilateral MVI+ (PinVA <6/18) from bilateral cataract who need surgery. This includes 16,680 people – 11,590 women and 5,601 men – who are blind from the condition.

Unmet need for cataract surgery by bilateral and unilateral cases

The extrapolated unmet need for cataract surgery among people aged 50 years who experience unilateral blindness from the condition was 2.4% (95%CI: 1.8%-3.1%); this was similar among women (2.5%, 95%CI: 1.7%-3.3%) and with men (2.4%, 95%CI: 1.8%-3.1%). The extrapolated prevalence of SVI+, MVI+, and EVI+ due to bilateral cataract was 3.9% (95%CI: 3.1%-4.7%),6.2% (95%CI: 5.1%-7.3%), and 7.4% (95%CI: 6.3%-8.5%). As for blindness, the prevalence of unmet need for cataract surgery for SVI+, MVI+, EVI+ from unilateral cataract appeared slightly lower among women compared with men, although this difference was not statistically significant (Table 9).

This means that there are an estimated a further 98,907 people aged 50 years and older in Burundi – 54,879 women and 44,148 men – with MVI+ (PinVA <6/18) from unilateral cataract who would need surgery. This includes 32,557 people – 17,360 women and 15,196 men – who are unilateral blind from the condition.

Table 9. Age- and sex-adjusted prevalence of and extrapolated magnitude of cataract at surgical thresholds <3/60, <6/60, <6/18 and <6/12

Cataract surgical threshold	Women		Men		Total	
	Adj. % (95%CI)	Extrapolated magnitude	Adj. % (95%CI)	Extrapolated magnitude	Adj. % (95%CI)	Extrapolated magnitude
Blind (PinVA <3/60)						
Bilateral cataract	1.7 (0.9-2.4)	11,590	0.9 (0.3-1.5)	5,601	1.3 (0.7-1.8)	16,680
Unilateral cataract	2.5 (1.7-3.3)	17,360	2.4 (1.5-3.3)	15,196	2.4 (1.8-3.1)	32,557
SVI+ (PinVA <6/60)						
Bilateral cataract	3.3 (2.3-4.4)	23,452	1.8 (0.8-2.8)	11,503	2.6 (1.7-3.4)	34,282
Unilateral cataract	4.1 (3.1-5.1)	28,681	3.6 (2.6-4.7)	22,903	3.9 (3.1-4.7)	51,584
MVI+ (PinVA <6/18)						
Bilateral cataract	9.7 (7.7-11.6)	67,731	6.2 (4.3-8.0)	38,950	7.9 (6.3-9.5)	105,379
Unilateral cataract	6.7 (5.4-7.9)	46,849	5.6 (4.2-7.1)	35,649	6.2 (5.1-7.3)	82,498
EVI+ (PinVA <6/12)						
Bilateral cataract	13.5 (11.3-15.6)	94,615	8.7 (6.3-11.0)	54,879	11.1 (9.1-13.1)	147,725
Unilateral cataract	7.8 (6.6-9.0)	54,760	7.0 (5.4-8.6)	44,148	7.4 (6.3-8.5)	98,907

Cataract surgical coverage and effective cataract surgical coverage

The CSC in persons indicates which proportion of people with cataract and a predefined VA have been operated on for the condition. This indicator measures the coverage of cataract surgical services. The age- and sex-adjusted CSC among people who are blind (PVA <3/60) was 35.0% (95%CI: 25.7-44.2%); the CSC was lower among women (27.9%, 95%CI: 16.8%-39.0%) compared with men (45.9%; 32.0%-59.8%), although this difference was not statistically significant. The age- and sex-adjusted CSC among people with SVI+ (PVA <6/60), MVI+ (PVA <6/18), and EVI+ (PVA <6/12) was 23.4% (95%CI: 16.6%-30.2%), 10.2% (95%CI: 7.2%-13.3%), and 7.6% (95%CI: 5.3%-9.8%), respectively. As for the CSC among people who are blind from cataract, the CSC for SVI+, MVI+, and EVI+ was lower among women compared with me, although this difference was not statistically significant (Table 10).

The eCSC combines coverage and outcome of cataract surgery and indicates what proportion of the people with bilateral operable cataract have been operated upon in one or both eyes and can see 6/18 or better after surgery. The eCSC among people who are blind was 6.1% (95%CI: 1.9%-10.4%); this was similar among women (6.4%, 95%CI: 0.9-11.9%) and men (6.1%; 95% 1.9%-10.4%). eCSC among people with SVI+, MVI+, and EVI+ was 4.3% (95%CI: 1.5%-7.0%), 1.6% (95%CI: 0.6%-2.7%), and 1.2% (95%CI: 0.4%-2.0%), respectively (Table 10). The eCSC among people with SVI+, MVI+, and EVI+ among women and men were comparable. The quality gap between CSC and eCSC among people who are blind, have SVI+, MVI+, and EVI+ was found to be 82.5%, 81.8%, 84.1%, and 84.3%, respectively.

Table 10. Age- and sex-adjusted CSC and eCSC at the person level

Cataract surgical threshold	Women % (95%CI)	Men % (95%CI)	Total % (95%CI)	Relative Quality Gap %
<3/60				
CSC	27.9 (16.8-39.0)	45.9 (32.0-59.8)	35.0 (25.7-44.2)	82.5
eCSC	6.4 (0.9-11.9)	5.6 (0.0-12.6)	6.1 (1.9-10.4)	
<6/60				
CSC	18.8 (10.9-26.6)	31.6 (20.5-42.6)	23.4 (16.6-30.2)	81.8
eCSC	4.7 (1.1-8.4)	3.5 (0.0-7.9)	4.3 (1.5-7.0)	
<6/18				
CSC	8.3 (4.8-11.9)	13.4 (8.2-18.6)	10.2 (7.2-13.3)	84.1
eCSC	1.8 (0.4-3.2)	1.3 (0.0-3.0)	1.6 (0.6-2.7)	
<6/12				
CSC	6.0 (3.4-8.6)	10.2 (6.3-14.0)	7.6 (5.3-9.8)	84.3
eCSC	1.3 (0.3-2.4)	1.0 (0.0-2.2)	1.2 (0.4-2.0)	

Visual outcome after cataract surgery

In this study 69 eyes had cataract surgery; 50 (72.5%) eyes had an intraocular lens (IOL) implanted and eight eyes (21.7%) did not have an IOL. There was no view of the lens in three (5.8%) participants.

Overall good visual outcome was seen in 11.6% (PVA 6/12) and 23.2% (PinVA 6/12) of eyes with and without pinhole correction, respectively. Overall, a poor outcome was seen in 52.2% (PVA <6/60) and 42.0% (PinVA <6/60) of eyes (Table 11).

The proportion of eyes with a poor outcome appeared to be somewhat lower in women (50.0% and 39.5% with and without pinhole, respectively) compared to men (54.8% and 45.2% with and without pinhole, respectively), whilst the proportion with a good outcome appeared higher in women (15.8% and 28.9% with and without pinhole, respectively) compared with men (6.5% and 16.1% with and without pinhole, respectively); however, it is not possible to say so conclusively (Table 11).

Table 11. Post-operative visual outcome in the study population, count by eyes

Outcome	Women		Men		Total	
	n	%	n	%	n	%
PVA						
Good: 6/12	6	15.8	2	6.5	8	11.6
Borderline: 6/12 to 6/60	13	64.2	12	38.7	25	36.2
Poor: <6/60	19	50.0	17	54.8	36	52.2
Total	38	100.0	31	100.0	69	100.0
PinVA						
Good: 6/12	11	28.9	5	16.1	16	23.2
Borderline: 6/12 to 6/60	12	31.6	12	38.7	24	34.8
Poor: <6/60	15	39.5	14	45.2	29	42.0
Total	38	100.0	31	100.0	69	100.0

Among those who were able to report this information, most participant who had received cataract surgery were operated upon in either government hospitals (54.8%) or private hospitals (35.5%), with a further three (9.7%) receiving surgery in charitable hospitals (data not shown). The visual outcome appeared to be best in the private and charity hospitals compared with public hospitals, however the number of participants who provided this information is too low to draw any conclusions (data not shown).

Barriers to cataract surgery

The main barriers to cataract surgery were 'Cost' (40.3%), 'Other' (25.2%), and 'Cannot access surgery' (22.1%). The distribution of barriers were similar among women and men (Table 12).

Table 12. Barriers to cataract surgery in study population (bilateral PinVA <6/60 due to cataract)

Barrier	Women		Men		Total	
	n	%	n	%	n	%
Cost	61	41.2%	30	38.5%	91	40.3%
Other	37	25.0%	20	25.6%	57	25.2%
Cannot access surgery	32	21.6%	18	23.1%	50	22.1%
Unaware treatment possible	12	8.1%	5	6.4%	17	7.5%
Fear	3	2.0%	3	3.8%	6	2.7%
Felt not needed	3	2.0%	1	1.3%	4	1.8%
Surgery denied by provider	0	0.0%	1	1.3%	1	0.4%
Total	148	100.0	78	100.0	226	100.0

Participants can report one or two barriers each

Refractive error

Prevalence of distance refractive error in the study population

The definition of refractive error used in RAAB7 is UCVA worse than 6/12 improving to 6/12 with spectacle correction or pinhole. This definition of refractive error prevalence includes people with corrected refractive error–who will have an ongoing need for refractive error services–as well as people without correction who are yet to access services.

The crude prevalence of refractive errors was 10.4% (95%CI: 9.5%-11.3%), and this tended to increase with age until the age of 79 years. Overall, the prevalence of refractive error was similar among women (10.5%, 95%CI: 9.2%-11.8%) and men (10.3%, 95%CI: 8.9%-11.7%) (Table 13).

Table 13. Prevalence of distance refractive error by age group and gender in the study population

Age Group	**Women**		**Men**		**Total**	
(Years)	n	% (95%CI)	n	% (95%CI)	n	% (95%CI)
50-59	58	6.3 (4.8-7.8)	50	8.3 (6.1-10.5)	108	7.1 (6.0-8.2)
60-69	77	11.7 (9.3-14.0)	55	9.5 (7.2-11.9)	132	10.7 (9.1-12.3)
70-79	69	18.1 (14.0-22.2)	51	14.1 (10.6-17.6)	120	16.1 (13.2-19.1)
80+	20	11.8 (7.5-16.0)	14	12.5 (7.1-17.9)	34	12.1 (8.9-15.2)
Total	224	10.5 (9.2-11.8)	170	10.3 (8.9-11.7)	394	10.4 (9.5-11.3)

Spectacles use in the study population

Overall, 4.7% and 2.7% of participants used distance and/or near spectacles, respectively. Women appeared more likely than men (6.4% *cf.* 2.4%) to use distance spectacles, although it's impossible to say so conclusively. Use of near spectacles was similar among women and men. Approximately half (48.6%) of the participants who had distance spectacles reported acquiring them in the two years prior to the survey; the majority (78.5%) reported acquiring distance spectacles within five years of the survey (Table 14). The categories of distance and near use are not mutually exclusive, that is, some participants will use both. It should also be noted that not all participants with spectacles have a need for correction according to the standard definition in the effective refractive error correction calculation (i.e., some have 6/12 uncorrected VA).

Table 14. Distance and near vision spectacle use in the study population

Spectacles type and time since current spectacles were acquired (Years)	Women		Men		Total	
	n	% (95%CI)	n	% (95%CI)	n	% (95%CI)
Distance vision spectacles	137	6.4%	40	2.4%	177	4.7%
<2 years	71	51.8%	15	37.5%	86	48.6%
2-5 years	38	27.7%	15	37.5%	53	29.9%
>5 years	28	20.4%	10	25.0%	38	21.5%
Near vision spectacles	62	2.9%	44	2.7%	106	2.8%

Distance refractive error coverage and effective refractive error coverage

Effective refractive error coverage (eREC) for distance vision measures the number of people in a population in need of distance optical correction who have received correction and had a good outcome (i.e., can see at least 6/12 corrected) as a proportion of all people in need of distance optical correction who have accessed correction or still require it. Therefore, eREC describes service access (i.e., REC) adjusted for quality.

Age- and sex-adjusted REC and eREC were 8.6% (95%CI: 4.9%-12.4%) and 6.1.3% (95%CI: 3.1%-9.1), respectively. Both REC and eREC appeared to be higher among women (11.9% and 8.8%), compared with men (4.9% and 3.0%) (Table 15). However, this difference was not statistically significant as indicated by the overlapping 95% confidence intervals.

Table 15. Age- and sex-adjusted distance eREC and REC

	Women		Men		Total		Quality gap
	%	(95%CI)	%	(95%CI)	%	(95%CI)	%
Distance eREC	8.8	(4.2-13.3)	3.0	(0.6-5.5)	6.1	(3.1-9.1)	29.2
Distance REC	11.9	(6.4-17.4)	4.9	(1.9-7.9)	8.6	(4.9-12.4)	

Extrapolated magnitude of need for distance refractive error correction

The extrapolated need for distance refractive error correction among people aged 50 years and older is 10.7%, of which approximately 93.0% is either undermet (approx. 3.0%) or not met at all (approx. 90.0%). The prevalence of need that is met is higher among women (0.9%, 95%CI: 0.4%-1.4%) compared with men (0.3%, 95%CI: 0.0%-0.5%), although this difference is not statistically significant (Table 16).

Table 16. Age- and sex-adjusted prevalence of and extrapolated magnitude of met need, undermet need, unmet need and no need for distance refractive

Need	Women		Men		Total	
	Adj. % (95%CI)	Extrapolated magnitude	Adj. % (95%CI)	Extrapolated magnitude	Extrapolated magnitude	Adj. % (95%CI)
Met need	0.9 (0.4-1.4)	6,214	0.3 (0.0-0.5)	1,837	0.6 (0.3-0.9)	8,051
Undermet need	0.3 (0.0-0.8)	2,191	0.2 (0.0-0.4)	1,128	0.2 (0.0-0.6)	3,319
Unmet need	8.9 (7.0-10.8)	62,422	9.1 (7.1-11.2)	57,683	9.0 (7.1-10.9)	120,105
No need	89.9 (69.5-100.0)	630,170	90.4 (69.5-100.0)	571,387	90.1 (70.1-100.0)	1,201,557

Disability

Self-reported disability in the study population

The overall prevalence of any self-reported disability and any non-seeing disability in the study population was 12.4% (95%CI: 6.9%-12.5%), and 9.7% (95%CI: 6.9%-12.5%), respectively. Seeing (8.8%, 95%CI: 6.6%-10.9%), mobility (8.5%, 95%CI: 6.4%-10.6%), and memory impairments (5.8%, 95%CI: 4.3%-7.4%) were the most prevalent forms of disabilities reported by both genders. Although these differences were not statistically significant, women reported higher rates of disability across all domains compared with men (Table 17).

Table 17. Prevalence of self-reported disability by functional domain in the study population

Domain	Women (%) (95%CI)	Men (%) (95%CI)	Total (%) (95%CI)
Seeing	9.8 (7.3-12.3)	7.4 (5.3-9.5)	8.8 (6.6-10.9)
Mobility	9.3 (6.8-11.7)	7.5 (5.3-9.7)	8.5 (6.4-10.6)
Memory	7.0 (5.1-8.9)	4.4 (3.0-5.8)	5.8 (4.3-7.4)
Upper Body Dexterity	5.4 (3.4-7.3)	3.5 (2.1-4.9)	4.5 (3.0-6.1)
Self-Care	4.9 (3.2-6.6)	3.3 (2.2-4.3)	4.2 (2.9-5.5)
Hearing	3.8 (2.5-5.0)	2.7 (1.7-3.6)	3.3 (2.4-4.2)
Anxiety	4.2 (2.8-5.5)	3.0 (2.1-3.8)	3.6 (2.6-4.7)
Upper Body Strength	4.6 (1.9-7.3)	3.1 (0.7-5.4)	3.9 (1.6-6.3)
Communication	3.3 (1.9-4.6)	1.8 (1.0-2.6)	2.6 (1.6-3.7)
Depression	2.1 (0.3-3.9)	1.3 (0.2-2.4)	1.8 (0.4-3.2)
Any Domain	16.8 (13.0-20.6)	13.4 (10.3-16.5)	15.3 (12.1-18.6)
Any Non-Seeing Domain	13.5 (10.3-16.6)	10.8 (8.1-13.5)	12.3 (9.6-15.0)

Age- and sex-adjusted disability in the study population

The overall age- and sex-adjusted prevalence of any self-reported disability and any non-seeing disability was 12.4% (95%CI: 9.1%-15.7%), and 9.7% (95%CI: 6.9%-12.5%), respectively. Seeing (6.9%, 95%CI: 4.8%-9.1%), mobility (6.3%, 95%CI: 4.1%-8.5%), and memory impairments (4.3%, 95%CI: 2.7%-5.9%) were the most commonly reported forms of disabilities in both sexes. As for prevalence in the study population, differences in age- and sex-adjusted prevalence between women and men were not statistically significant; however, women reported higher rates of disability across all domains compared with men (Table 18).

Table 18. Age- and sex-adjusted prevalence of self-reported disability by functional domain

Domain	Women (%) (95%CI)	Men (%) (95%CI)	Total (%) (95%CI)
Seeing	8.2 (5.7-10.8)	5.5 (3.4-7.7)	6.9 (4.8-9.1)
Mobility	7.3 (4.8-9.9)	5.1 (2.9-7.3)	6.3 (4.1-8.5)
Memory	5.4 (3.4-7.3)	3.1 (1.7-4.6)	4.3 (2.7-5.9)
Upper Body Dexterity	4.1 (2.1-6.1)	2.3 (0.8-3.7)	3.2 (1.6-4.9)
Self-Care	3.6 (1.9-5.3)	2.1 (1.1-3.2)	2.9 (1.6-4.2)
Hearing	2.9 (1.6-4.2)	1.8 (0.8-2.8)	2.4 (1.4-3.3)
Anxiety	3.4 (2.0-4.7)	2.1 (1.3-2.9)	2.8 (1.8-3.8)
Upper Body Strength	3.4 (0.6-6.3)	2.1 (0.0-4.5)	2.8 (0.3-5.3)
Communication	2.6 (1.2-4.0)	1.1 (0.3-1.9)	1.9 (0.9-2.9)
Depression	1.6 (0.0-3.5)	1.0 (0.0-2.1)	1.3 (0.0-2.8)
Any Domain	14.4 (10.6-18.2)	10.2 (7.1-13.4)	12.4 (9.1-15.7)
Any Non-Seeing Domain	11.2 (8.0-14.4)	7.9 (5.2-10.7)	9.7 (6.9-12.5)

Disability and vision impairment

The prevalence of blindness, SVI, MVI, and EVI among those with any non-seeing disability, was 19.8% (95%CI: 14.6%-25.0%), 11.6% (95%CI: 8.4%-14.8%), 26.7% (95%CI: 21.7%-31.6%), and 7.9% (95%CI: 6.9%-8.8%), respectively. In comparison, among those with no disability, the prevalence of blindness, SVI, MVI, and EVI was 1.0% (95%CI: 0.6%-1.5%), 2.0% (95%CI: 1.4%-2.7%), 9.6% (95%CI: 8.3%-11.0%), and 7.1% (95%CI: 4.6%-9.6%) respectively. Based on the 96%CIs, the prevalence of blindness, SVI, and MVI was significantly higher among those with non-seeing disabilities than among those with no disability (Table 19).

Table 19. Age- and sex-adjusted prevalence of vision impairment (VI) by disability status

VI level	Any disability (%) (95%CI)	Any non-seeing disability (%) (95%CI)	No disability (%) (95%CI)
Blind	18.1 (13.3-22.9)	19.8 (14.6-25.0)	1.0 (0.6-1.5)
SVI	12.8 (9.5-16.0)	11.6 (8.4-14.8)	2.0 (1.4-2.7)
SVI	29.5 (24.9-34.1)	26.7 (21.7-31.6)	9.6 (8.3-11.0)
Moderate-to-Severe VI	42.2 (37.5-47.0)	38.3 (32.9-43.6)	11.7 (10.0-13.4)
EVI	9.0 (5.9-12.0)	7.1 (4.6-9.6)	7.9 (6.9-8.8)

Disability and cataract surgery

The data reveals that individuals with any form of disability, including non-seeing disabilities, had no eCSC across all thresholds (0.0%, 95%CI: 0.0-0.0), while those without disabilities had some coverage, ranging from 2.1% (95%CI: 0.4-3.7) to 17.5% (95%CI: 2.2-32.8).

Health Economics Module – An update

To gather better information about the economics of eye health, we also conducted a pilot of a 'health economics module' as part of the overarching RAAB. We collected data on the employment status and benefits, affordability of eye health services, and costs incurred by people with vision impairment.

Importantly, the module assessed the extent to which individuals had participated in paid, unpaid, and informal labor activities, allowing us to estimate the impact of eye health on a wide range of economic activities. Data collection and cleansing had been completed at the time of writing of this report, with data analysis expected to conclude in December 2024.

The pilot collected data from 224 individuals in Burundi, with 53% of participants (n=119) female and 47% (n=105) male. Similarly, 53% (n=118) lived in a rural location, while 47% (n=106) lived in an urban location.

Just over 20% (n=45) of our sample had normal vision (> 6/12), 14% (n=32) had EVI (< 6/12 but at least 6/18), 22% (n=50) had MVI (<6/18 but at least 6/60), 19% (n=42) had SVI (<6/60 but at least 3/60) and 26% (n=55) of our sample was blind. The primary cause of visual impairment for individuals in our sample was cataract.

Of the participants who had accessed formal eye care services, 84% (n=32) paid the full out of pocket cost for services. Of these individuals, 63% (n=20) reported that they felt difficulty or great difficulty in paying for these services. This finding implies that most individuals accessing eye care services in Burundi fund these services through out-of-pocket costs, and that these out-of-pocket costs place financial pressure on individuals and households.

Preliminary analysis shows that poor eye health likely has an impact on the extent to which individuals in Burundi can work for paid labor. Of the 26% of people who had been absent from work in the past four weeks, 40% of these individuals were absent primarily due to eye health conditions. Almost 45% of our sample indicated that there were days where they were unable to perform household activities (*i.e.* unpaid labor) because of eye health or other health problems. Of these individuals, over 60% indicated that the main reason they could perform less unpaid labor was due to eye health conditions alone. Further, we found that, on average, these individuals required assistance from friends or family to perform these activities for 21 days out of each month.

DISCUSSION

The 2024 Burundi RAAB survey provides a comprehensive analysis of the current state of eye health in the country, revealing important insights into achievements and opportunities for work going forward.

Prevalence and causes of blindness and vision impairment

The age- and sex-adjusted prevalence of blindness among adults aged 50 years and older in Burundi was found to be 2.9% (95%CI: 2.1%-3.7%), which is significantly higher than the prevalence found in the 2010 RAAB survey of Ngozi and Kayanza provinces (1.2%, 95%CI: 0.8%-1.5%). The investigators who conducted the 2010 survey hypothesised that the relatively low prevalence observed at the time could have been due to the population structure in Burundi and the effects of the previous years of conflict in which those with decreased vision may have been most likely to perish. [25] Indeed, life expectancy at birth in Burundi was 58.6 years in 2010, compared with 64 years in 2021. [24]

Notably, 89.2% of all blindness in the study population was avoidable. This is consistent with global estimates which indicate that 90% of people with vision impairment have a preventable or treatable cause with existing highly cost-effective interventions. [2]

Specifically, 72.6% of blindness was treatable, 3.6% was preventable with primary health care and/or primary eye care, and 13.0% was preventable through more advanced ophthalmic services. Posterior segment diseases accounted for 16.6% of all bilateral blindness.

The prevalence of blindness found in this study is comparable to that observed in other countries in East Africa for which RAAB data is available. Publicly available data for countries in East Africa was extracted from the RAAB database;[28] in addition data from a national RAAB conducted in Eritrea was obtained from the study's principal investigators. The data was pooled and minimum, maximum, average, and median prevalence of blindness, MVI, SVI, and EVI (where available) were calculated for women, men, and for the total population aged 50 years and older. This data is provided in Appendix 2. Based on this data, the average and median prevalence of blindness for the East Africa region is 3.0% and 2.7%, respectively. The prevalence of blindness ranges from 0.7% in the Analamanga region of Madagascar to 6.7% in Eritrea. The IAPB Vision Atlas indicates that the age-standardised prevalence of blindness among people aged 50 years and older in Sub-Saharan Africa is 3.7%, [30] whilst the global age-standardised prevalence in this same population is estimated to be 1.9% (95%CI: 1.6%-2.1%). [2]

It is also worth noting that the survey found an age- and sex-adjusted prevalence of moderate-to-severe vision impairment of 13.7% (95%CI: 11.9%-15.4%), affecting an estimated 182,041 people (109,585 women and 72,456 men). This category therefore represents a significant public health concern.

The survey identified cataract as the leading cause of blindness, SVI, and MVI in Burundi, responsible for 71.2%, 83.7%, and 61.7% of cases in the study population, respectively. Uncorrected refractive errors were the leading cause of EVI (69.4%) and the second-leading cause of MVI (27.6%). Posterior segment diseases were the second leading cause of blindness (16.6%) and MVI (9.9%). This pattern is consistent with global trends, which show that cataract, uncorrected refractive errors, glaucoma, diabetic retinopathy, corneal scarring, and trachoma are the most common causes of vision impairment. [2] Corneal opacity was responsible for 2.9% of blindness in this study, including one case of blindness from trachomatous corneal opacity.

Cataract

Cataract surgical coverage

The age- and sex-adjusted CSC considering a VA threshold for surgery of <3/60 was found to be 35.0% (95%CI: 25.7%-44.2%). This suggests that only around one in three people who are blind from cataract receive surgery. Though there is no internationally accepted target as to what constitutes an adequate CSC, 80% coverage has been used in discussions around the Universal Health Coverage target to be included within the Sustainable Development Goals. [31] The CSC among people who are blind from cataract in Burundi was found to be well below this threshold. Using the approach described earlier, data on CSC and eCSC

was also extracted from publicly available RAAB reports and for Eritrea; this data is provided in Appendix 3. Based on this data, the average and median CSC for East Africa at a threshold of <3/60 is 60.3% and 61.7%, respectively. The CSC in the region ranged from 32.1% in the Inhambane province of Mozambique to 84.1% in Nakuru County in Kenya. This suggests that the CSC at this threshold in Burundi is lower than the regional average and only slightly higher than the lowest observed.

When considering a threshold for surgery of <6/18 (*cf.* <3/60) the age- and sex-adjusted CSC was found to be 10.2% (95%CI: 7.2%-13.3%). This suggests that only one in ten people who have operable cataract receive surgery if they are not blind. The average and median CSC for East Africa at this threshold is estimated to be 33.0% and 32.5%, respectively. The CSC in the East Africa ranges from 10.8% in Southwestern Malawi to 57.7% in Kericho County in Kenya. As for CSC at a threshold of <3/60, this suggests that the CSC in Burundi at a threshold of <6/18 is lower than the regional average and only slightly higher than the lowest observed. A metanalysis of data from the broader region found a median CSC of 26.5% in Africa at a surgical threshold of <6/18, [18] which is also higher than the CSC for this threshold observed in this study. The global median for CSC using a threshold for surgery of <6/18 is 40.0%. [18]

Unmet cataract surgery need

This study identified a large need for cataract surgery in Burundi. It is estimated that more than 100,000 people are in need of cataract surgery, of which approximately 17,000 are blind from the condition. Notably, this comprises around twice as many women (approximately 11,500) as men (approximately 5,500). A further 82,000 people are in need of unilateral cataract surgery, and of these more than 32,000 people are blind in one eye from the condition. This means that almost 200,000 people aged 50 years and older are estimated to need cataract surgery in Burundi.

Quality of surgery notwithstanding, this reality underscores an urgent public health need, which could result in widespread blindness if immediate action is not taken. To address this, strategies must include rapidly scaling up surgical capacity, enhancing workforce training, and securing necessary resources, while simultaneously implementing robust screening programs to prevent further backlog.

Effective cataract surgical coverage

The eCSC among people who are blind was 6.1% (95%CI: 1.9%-10.4%). The average and median eCSC for East Africa at a surgical threshold of <3/60 is estimated to be 35.8% and 34.6%, respectively. The eCSC in the region at this threshold ranges from 17.0% in the Southwestern Malawi to 56.3% in Analamanga region of Madagascar. This suggests that the eCSC in Burundi at this threshold is lower than any country in East Africa for which there is comparable data available.

When considering a threshold for surgery of <6/18, the eCSC was found to be 1.6% (95%CI: 0.6%-2.7%). The average and median eCSC for East Africa at a VA threshold of <6/18 is estimated to be 19.1% and 16.6%, respectively. The eCSC in the region at this threshold ranged from 4.3% in the Southwestern Malawi to 35.1% in Nakuru County in Kenya. As for eCSC at a threshold of <3/60, this suggests that the eCSC at this threshold in Burundi is lower than any country in East Africa for which there is comparable data available. The median CSC at a surgical threshold of <6/18 in Africa and globally is estimated to be 13.9% and 24.8%. [18]

The gap between CSC and eCSC values can be considered a quality gap, with lower values reflecting better quality of cataract surgery. The quality gap in Burundi was found to be 82.5% and 81.8% for surgical VA thresholds of <3/60 and <6/18, respectively. It has been recommended that countries with a quality gap of 25% or higher should choose to particularly invest in quality improvement initiatives before focusing on actions to increase access or outputs. [18]

Visual outcomes following cataract surgery

Further, good visual outcome was seen in 11.6% (PVA ≥6/12) and 23.2% (PinVA ≥6/12) of eyes with and without pinhole correction, respectively. The difference between PVA and PinVA can be minimized by adequate biometry, good surgical technique, individually adjusted IOLs, and optical correction after cataract surgery. It is also worth noting that 21.7% of eyes where aphakic (meaning that they did not have an IOL). Although it's impossible to tell when the participants underwent surgery, most aphakic eyes today are planned IOL surgery with complications like vitreous loss or

capsular tear, whereby IOL implantation could not be done.

One in two surgeries (52.2%) resulted in a poor outcome (PVA <6/60), by WHO definition. [32] WHO recommends that after surgery no more than 5% of the operated eyes should have a PVA of <6/60, which is referred to as poor visual outcome. This further highlights the need for enhanced surgical techniques and postoperative care to improve visual outcomes.

Need for improved quality and increased surgery outputs

The low CSC, large unmet need for cataract surgery, and wide quality gap in cataract surgery in Burundi highlights an urgent need for immediate improvements in surgical outcomes and increased outputs.

As recommended in the literature, [18] it is crucial to first enhance surgical quality before scaling up outputs to avoid worsening the burden of visual impairment. This can be achieved through enhanced surgical training, better postoperative care, and follow-up services to ensure that patients achieve the best possible visual outcomes in Burundi.

The high prevalence of untreated cataract underscores the need for increased surgical capacity and outreach programs to increase cataract surgical rate (CSR) and address this preventable cause of blindness.

It is possible to estimate the CSR required to clear the cataract backlog, although several assumptions are necessary. The formula for this calculation is:

Required CSR = [Total surgeries needed / (population x time frame)] x 1,000,000

Where the total number of surgeries needed includes both the current backlog and the new cases expected over the target time. The new cases expected can be calculated using this formula:

Annual incidence = Overall prevalence / Duration of the condition

A five-year survival has come to be a commonly used estimate in low- middle-income countries epidemiology for the longevity of a person who becomes blind due to senile onset cataracts. [33] Given that an estimated 17,000 people are blind from cataract, the annual incidence of new cases of blindness from cataract in Burundi is approximately 3,400 (i.e., 17,000/5). Thus, if a plan is to be developed to clear the backlog over 10 years:

Required CSR in Burundi = [(17,000+3,400 x 10) / (14,000,000 x 10)] x 1,000,000

This results in a CSR of approximately 365 surgery per million people per year over the course of 10 years, or approximately 5,100 surgeries per year. It is important to note that these calculations only relate to individuals who are blind from cataract.

Refractive error coverage and effective refractive error coverage

The prevalence of distance refractive error in the study population was 10.4% (95%CI: 9.5%-11.3%). The prevalence appeared to be slightly higher in men (8.3%; 95%CI: 6.1%-10.5%) compared to women (6.3%; 95%CI: 4.8%-7.8%); however, this difference was not statistically significant. The prevalence increased with age, beginning at a relatively low 7.1% (95%CI: 6.0%-8.2%) among 50- 59-year-olds and rose significantly with age, reaching 16.1% (95%CI: 13.2%-19.1%) among those aged 70 to 79 years. The prevalence declined to 12.1% (95%CI: 8.9%-15.2%) in the 80+ years group, although this difference was not significant compared to the those aged 60 to 69 years and 70 to 79 years.

It is important to note that, in contrast to cataract, which predominantly affects the population 50 years and older, refractive error presents across the life course. RAAB surveys do not provide information on the prevalence of refractive error in the population under 50 years of age.

Spectacle use for correcting distance vision was found to be relatively low, with 4.7% of the study population utilizing spectacles for this purpose. Almost half (48.6%) of the spectacles used by the study population were acquired within the two years prior to the survey, and the majority (77.5%) were acquired within the five years prior. This might suggest an increased uptake in recent times, or a reasonable turnover in spectacle usage likely due to changes in vision or access to new corrective measures. Near vision spectacle use was also low, with 2.8% of the population using them.

Among those who needed correction, only 6.1% had correction that met their need. This means that

there are approximately 123,000 people aged 50 years and older who need correction (2.7%) and either have the wrong correction or have no correction at all (97.3%).

This low level of spectacle use, especially for near vision, and relatively high unmet need for distance refractive error correction highlights a potential gap in the uptake of corrective measures and underscores the need for increased attention to refractive services as individuals grow older, particularly in their 60s and 70s.

The age- and sex-adjusted REC was 8.6% (95%CI: 4.9%-12.4%), meaning that less than one in 10 people who need spectacles have access to these. This low coverage also indicates that a large proportion of individuals with refractive errors are not receiving the necessary corrective services.

The age- and sex-adjusted eREC was 6.1% (95CI%: 3.1%-9.1%), which also indicates that a relatively small proportion of individuals in need of distance optical correction receive correction that results in good visual outcomes. There is limited evidence on eREC in Sub-Saharan Africa; a review of eREC in adults aged 50 years and older from 61 countries reported an eREC of only 5.7% (3.1%-9.0%) in the region, which is lower than that found in this study. Nonetheless, a significant quality gap of 29.2% remains, indicating that many who receive correction do not achieve the desired visual acuity. This emphasizes the importance of not only providing refractive services but also ensuring that these services are effective in improving visual outcomes.

Disability

The survey revealed an overall prevalence of self-reported disabilities of 12.4% (9.1%-15.7%) across various functional domains. WHO reports that approximately 15% of the global population has some form of disability. Official government statistics from the Africa region report the percentage of persons with disabilities to be as low as 2-5%; however, in some countries it is likely closer to 20-22%, due to the prevalence of conflict, forced displacement, and a lack of access to adequate medical services. Difficulties seeing was the most commonly reported disability (6.9%, 4.8%-9.1%), followed by poor mobility (6.3%, 4.1%-8.5%) and difficulties with memory (4.3%, 2.7%-5.9%).

Notably, people with non-seeing disabilities were significantly more likely to have any level of vision impairment than people who reported no disability. For example, 19.8% (14.6%-25.0%) of people who reported another (non-seeing) disability compared with only 1.0% (0.6%-1.5%) of people who did not report any disability. This stark difference highlights the intersection between disability and vision impairment, emphasizing the need for comprehensive, people-centred eye health services.

The study also revealed a concerning gap in eCSC among those with disabilities. The age- and sex-adjusted eCSC at any surgery threshold among people who reported any disability was 0.0%. This underscores the urgent need to address barriers to accessing cataract surgery for people with disabilities in Burundi, particularly for those with seeing disabilities.

Gender

No significant nor large differences were observed in the age- and sex-adjusted prevalence of blindness and vision impairment between women and men; nonetheless, it should be noted that there is a clear trend with the prevalence of vision loss at any level of impairment being higher among women compared with men.

As for blindness and vision impairment, a clear trend was observed for the age- and sex-adjusted unmet need for cataract surgery, with women having a higher unmet need compared with men. Although these differences were not significant, they increased with decreasing threshold for surgery with minimal overlap in the 95%Cis at the <6/18 and <6/12 thresholds. For example, unmet need for cataract surgery at PinVA <6/18 and <6/12 among women was 9.9% (95%CI: 7.9%-11.9%) and 14.0% (95%CI: 11.8% - 16.2%) compared with 6.2% (95%CI: 4.2%-8.1%) and 8.7% (95%CI: 6.3%-11.1%) among men. Coupled with the fact that there are now some 70,000 more women than men aged 50 years and older in the country, this results in an estimated backlog of approximately 11,500 women who are blind from cataract compared with approximately 5,500 men, and 69,000 women with a threshold for surgery of <6/18 compared with 39,000 men. This higher unmet need among women suggests barriers to accessing cataract surgery,

including financial, cultural, or logistical challenges, which disproportionately affect women.

The same trend was also observed for age- and sex-adjusted CSC, with women having a lower CSC than men at all thresholds for surgery. The eCSC and post operative outcomes were comparable between the two genders across thresholds for surgery.

Although the prevalence of refractive error was similar among women (10.5, 95%CI: 9.2%-11.8%) and men (10.3%, 95%CI: 8.9%-11.7%) in the study population, women appeared to be more likely (6.4%) than men (2.4%) to use distance spectacles. Nonetheless, a greater number of women (approximately 65,000) then men (59,000) were estimated to have an unmet or undermet need for correction, on account of the larger number of women in the aged 50 years and older in the population.

Difference between women and men were also observed in the self-reported disability. Although not significantly so, women showed a higher prevalence of disability across all domains compared with men. The prevalence of any disability among women was 14.4% (95%CI: 10.6%-18.2%) compared with 10.2% (95%CI: 7.1%-13.4%) among men. Difficulties seeing, with mobility, and with memory were the most commonly reported disability among both genders. Indeed, disability, gender, and discrimination are inextricably linked. One in five women globally live with a disability for several reasons, including discrimination in health care and violence against women. [34] Women with disabilities are also three times more likely to be illiterate, and twice less likely to be employed or use the internet. [34]

CONCLUSIONS

The 2024 Rapid Assessment of Avoidable Blindness (RAAB) survey in Burundi reveals a critical and urgent need for strengthened eye health services across the country. With an age- and sex-adjusted prevalence of blindness at 2.9%, this survey highlights a significant burden of vision impairment among people aged 50 years and older, with cataracts emerging as the leading cause of blindness. The fact that 89.2% of blindness in the study population is avoidable underscores the missed opportunities for prevention and treatment, pointing to substantial gaps in the availability and quality of eye care services.

The findings on CSC and eCSC further emphasize the dire need for improvement in Burundi's eye health system. At 35%, the CSC for individuals blind from cataract is far below the widely recognised target of 80%, as well as below regional and global averages. The eCSC among people who are blind, which stands at 6.1%, also reflects a large quality gap in surgical outcomes; indeed, half of the cataract surgeries performed in the country resulted in poor visual outcomes, compared with the 5% or less target set by WHO. These findings indicate that improving both the quality and accessibility of cataract surgery must be a top priority for public health officials and policymakers in Burundi, especially given the large backlog of untreated cataract cases and the projected increase in demand due to an aging population.

A large portion of the population also remains without necessary vision correction. Addressing the low REC and eREC is a crucial challenge that is Burundi shares with low- and middle-income countries around the world. Expanding access to quality refractive services will be essential in reducing the overall burden of vision impairment in Burundi.

Moreover, the intersection between vision impairment and disability, particularly among women, presents an additional layer of complexity that must be addressed in the planning and delivery of eye care services. The survey reveals that women are disproportionately affected by vision impairment and face higher unmet needs for both cataract surgery and refractive error correction. The complete absence of effective cataract surgical coverage among individuals with disabilities, as indicated by the eCSC of 0.0%, highlights the urgent need for inclusive and equitable eye health services that cater to the most vulnerable populations. Addressing these disparities will require a concerted effort to integrate gender-sensitive and disability-inclusive strategies into national eye health programs, ensuring that all Burundians have access

to the eye care they need to lead healthy, productive lives.

In conclusion, the 2024 RAAB survey presents a clear mandate for the Government of Burundi, healthcare providers, and international partners to take decisive action to improve eye health in the country. By prioritizing quality improvements in cataract surgery, expanding access to refractive error services, and addressing gender and disability-related disparities, Burundi can make significant strides toward reducing the burden of avoidable blindness and vision impairment. Achieving these goals will not only improve the quality of life for thousands of Burundians but also contribute to broader public health and economic development objectives, moving the country closer to achieving universal health coverage and the Sustainable Development Goals.

RECOMMENDATIONS

1. Improve the Quality of Cataract Surgery

- **Implement Standardized Surgical Protocols**: Ensure that all cataract surgeries follow standardized protocols to minimize post-operative complications and improve visual outcomes. Training and refresher courses should be regularly conducted for ophthalmologists and ophthalmic technicians.
- **Enhance Post-Operative Care**: Establish a robust post-operative care system that includes follow-up visits to monitor patients' recovery and address complications early. This will help improve eCSC by ensuring better outcomes after surgery.
- **Upgrade Surgical Equipment and Facilities**: Invest in modern surgical equipment and improve the infrastructure of operating theatres, particularly in public hospitals, to enhance the overall quality of cataract surgeries performed.
- **Establish and implement a cataract outcomes monitoring (CSOM) system**: Implement a national CSOM system to track surgical outcomes and identify areas for enhancement. Encourage a culture of continuous quality improvement through regular audits, setting benchmarks, and incorporating patient feedback to ensure high standards of care and better surgical results.

2. Increase Cataract Surgical Outputs

- **Expand Access to Surgery**: Increase the number of cataract surgeries performed by scaling up outreach programs in rural and underserved areas. This could involve mobile surgical units or partnerships with private and non-governmental organizations to extend services.
- **Strengthen the Surgical Workforce**: Recruit and train more ophthalmologists and ophthalmic technicians to meet the growing demand for cataract surgeries. Consider providing incentives for professionals to work in remote areas.
- **Optimize Use of Resources**: Improve the allocation of resources by identifying high-demand areas and focusing efforts where they are most needed. This includes better management of surgical schedules and ensuring the availability of necessary supplies.

3. Address Gender Inequalities in Access to Cataract Surgery

- **Targeted Outreach and Education**: Develop gender-sensitive outreach programs that specifically address the barriers women face in accessing cataract surgery, such as cost, fear, and lack of awareness. Community health workers can play a key role in educating women about the importance of cataract surgery and how to access it.
- **Subsidize Surgery for Women**: Implement financial assistance programs or subsidies for women who cannot afford cataract surgery. This could be supported by government health funds or partnerships with international organizations.
- **Monitor and Report Gender Disparities**: Establish a system for monitoring gender disparities in cataract surgery uptake and outcomes. Regular reporting on these metrics can help track progress and ensure that strategies to reduce gender inequality are effective.
- **Increase Gender Representation in the Eye Health Workforce**: Actively recruit and support women in eye health professions through targeted training programs and mentorship, ensuring a balanced and diverse workforce that can contribute to addressing the unique needs of all patients.

These three recommendations are designed to address the key priorities of improving surgical quality, increasing outputs, and addressing gender inequalities in cataract surgery access and outcomes in Burundi

4. Promote Equity and Inclusivity in Eye Health Services

- **Prioritize Access for People with Disabilities and other Marginalized and Vulnerable Groups:** Implement targeted strategies to ensure equitable access to cataract surgery and eye care services for marginalized populations, especially people with disabilities, who often face multiple barriers. Tailor outreach programs and services to meet the specific needs of these groups, recognizing that individuals with vision impairment are more likely to have additional disabilities.
- **Advocate for Inclusive and Disability-Focused Policies:** Collaborate with policymakers to develop and implement inclusive policies that ensure access to eye care for all, with a special emphasis on addressing the unique challenges faced by people with disabilities and other vulnerable populations.
- **Enhance Workforce Diversity with a Focus on Disability Inclusion**: Actively recruit and support individuals with disabilities, including those with vision impairment who often experience additional disabilities, into the eye health workforce. This strategy promotes an inclusive environment that better addresses the complex needs of all patients and ensures a more equitable delivery of care.

5. Address Barriers to Accessing Cataract Surgery

- **Reduce Financial Barriers**: Establish a national cataract surgery subsidy program or provide free surgeries for the poorest segments of the population. This could be funded through government health budgets, international aid, or partnerships with NGOs.
- **Improve Geographical Accessibility**: Expand the availability of cataract surgery services in remote and rural areas by setting up satellite clinics or utilizing mobile eye care units. Strengthening referral systems and providing transportation for patients in rural areas could also help reduce geographical barriers.
- **Increase Awareness and Education**: Develop community education programs to raise awareness about cataract, its treatability, and the importance of early intervention. These programs should target both the general public and healthcare providers at the primary care level to improve referral practices.

6. Strengthen Health Systems and Workforce Capacity

- **Capacity Building for Healthcare Workers**: Implement ongoing training and capacity-building initiatives for all levels of eye care providers, including community health workers, to enhance early detection, referral, and post-operative care. Consider partnerships with international eye health organizations to facilitate this training.
- **Integrate Eye Care into Primary Health Services**: Encourage the integration of basic eye care services into primary healthcare, allowing for earlier detection and management of cataract and other eye conditions. This could involve training primary healthcare providers to perform basic eye exams and refer cases to specialized services.
- **Improve Data Collection and Monitoring**: Strengthen the capacity for data collection, management, and analysis related to cataract surgeries and outcomes. This will improve planning, resource allocation, and monitoring of progress towards national eye health goals.

7. Enhance Patient Outcomes and Follow-Up Care

- **Implement a National Follow-Up Program**: Establish a national follow-up care program for cataract surgery patients to monitor outcomes and manage any complications. This program should include regular follow-up appointments, and the data collected should be used to continuously improve surgical practices.
- **Focus on Visual Rehabilitation**: Develop programs that offer visual rehabilitation services for patients with poor post-operative outcomes, including those who do not regain functional vision despite surgery. This could include the provision of low-vision aids and support services.
- **Patient Education on Post-Operative Care**: Ensure that patients and their families are educated about the importance of post-operative care and follow-up visits to maximize the chances of successful surgery outcomes.

8. Strengthen Partnerships and Collaboration

- **Collaborate with International Organizations**: Leverage partnerships with international organizations, such as the World Health Organization (WHO) and NGOs focused on eye health, to access technical expertise, funding, and resources to scale up cataract surgery services.
- **Engage Local Communities**: Foster strong partnerships with local communities and leaders to support eye health initiatives, increase community buy-in, and enhance the sustainability of interventions.

9. Expand Access to Refractive Error Services

- **Increase Availability of Optical Services**: Establish more optical centres, particularly in rural and underserved areas, to improve access to spectacles and other vision correction devices. This could involve training optometrists and other eye care professionals and setting up partnerships with private optical businesses.
- **Mobile Vision Clinics**: Implement mobile vision clinics to reach populations in remote areas. These clinics can provide vision screening, refraction services, and immediate dispensing of spectacles.

10. Improve Refractive Error Coverage (REC) and Effective Refractive Error Coverage (eREC)

- **Quality Assurance in Optical Services**: Implement quality assurance programs to ensure that the spectacles provided meet the required standards and that they effectively correct the patients' vision. This includes regular monitoring of optical centres and training for opticians.
- **Post-Dispensation Follow-Up**: Introduce follow-up mechanisms to ensure that patients who receive spectacles are satisfied with the correction and that the spectacles are being used effectively. This could include scheduled follow-up visits or telephone check-ins.

11. Community-Based Vision Screening and Awareness Programs

- **Community-Based Vision Screening**: Develop and implement community-based vision screening programs to identify and correct refractive errors in the population.
- **Community Awareness Campaigns**: Conduct community-based awareness campaigns to educate the public about the importance of regular eye exams and the availability of corrective services for refractive errors. This can help increase demand for refractive services and ensure that more people receive the correction they need.

12. Subsidize Spectacle Costs

- **Provide Affordable Spectacles**: Establish a subsidized spectacle program to make vision correction more affordable, especially for low-income populations. This could be achieved through government subsidies, partnerships with NGOs, or bulk purchasing agreements with spectacle manufacturers.
- **Recycling and Donation Programs**: Initiate programs that collect, refurbish, and redistribute used spectacles to those in need, particularly in underserved areas. This could help bridge the gap for those who cannot afford new spectacles.

13. Strengthen Workforce Capacity in Refractive Error Management

- **Train More Optometrists and Refractionists**: Increase the number of trained optometrists and refractionists in the country through dedicated training programs and continuous professional development opportunities. This will help expand the capacity to diagnose and correct refractive errors.
- **Integrate Refractive Error Training into Primary Health Care**: Train primary healthcare providers to perform basic vision screening and refer patients for further assessment and correction of refractive errors. This can help in the early identification and management of refractive issues at the community level.

14. Monitor and Evaluate Refractive Error Services

- **Establish a Monitoring System**: Develop a system to track the provision of refractive error services, including the number of people screened, prescribed spectacles, and the effectiveness of the correction provided. This data can inform future planning and resource allocation.
- **Conduct Regular Surveys**: Periodically conduct population-based surveys to assess the prevalence of refractive errors and the effectiveness of the services provided. This will help in understanding the evolving needs and improving service delivery.

15. Plan for a Likely Increase in the Burden of Posterior Segment Disease

- **Expand Diagnostic and Treatment Capacity:** Invest in advanced diagnostic tools and treatment options for posterior segment diseases to ensure timely and effective care.
- **Train Specialized Eye Care Professionals:** Increase the number of ophthalmologists and technicians with expertise in posterior segment diseases through targeted training programs.
- **Enhance Access to Advanced Treatments:** Ensure the availability of cutting-edge medical technologies and treatments, particularly in rural and underserved areas.
- **Integrate Screening into Routine Eye Care:** Incorporate regular screening for posterior segment diseases into standard eye care practices to detect and manage conditions early.

These additional recommendations aim to create a comprehensive strategy that not only addresses immediate needs but also builds a stronger, more equitable, and sustainable eye health system in Burundi. These recommendations aim to improve access to and the quality of refractive error services in Burundi, ultimately reducing the burden of uncorrected refractive errors and improving the overall eye health of the population.

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APPENDIX 1. SELECTED CLUSTERS

Cluster Name	Province	Population
Buhama	Tangara	1,394
Bugendana	Bugendana	7,581
Bukemba	Bukemba	5,059
Burambi	Burambi	3,841
Butezi	Butezi	4,020
Buyengero	Buyengero	3,191
Carama1	Ntahangwa	24,024
Cibitoke	Rugombo	23,812
Cibitoke I	Ntahangwa	12,379
Cishwa	Bugendana	7,581
Colline Busebwa	Rumonge	7,739
Colline Mutambara	Rumonge	21,284
Colline Nyamurunga	Buyengero	3,191
Gahandu	Vugizo	3,916
Gahondo	Ndava	3,898
Gakere	Kiremba	2,378
Gakoni	Giteranyi	9,459
Gashubu	Gashoho	5,814
Gasebeyi	Mabayi	3,113
Gatare	Rango	6,123
Gatura	Muhanga	5,637
Gihungwe	Gihanga	6,375
Gisoro	Ruyigi	8,070
Gishuha	Gasorwe	3,818
Gishingano	Isare	10,619
Gisenyi	Burambi	3,841
Gishubi	Gishubi	2,099
Gitwa	Kayanza	3,848
Gitwaro	Vyanda	2,765
Kabaya1	Bukinanyana	6,072
Kanenga	Mpanda	2,864
Kavumu	Ntahangwa	5,460
Kavumu (Camp Des Réfugiés)	Cankuzo	19,808
Kigo	Shombo	1,823
Kinama	Nyabiraba	2,402
Kinaniraii	Muha	15,371
Kirika	Bisoro	3,407
Kirinzi	Mugamba	1,930
Kiyange	Buhinyuza	4,779
Kimina	Kabezi	3,436

Cluster Name	Province	Population
Mahembe	Makamba	1,900
Masama	Mbuye	3,173
Mbabazi	Nyabikere	3,167
Mihigo	Busiga	5,336
Mihigo	Giteranyi	5,719
Mubone	Muhuta	6,422
Muhanza	Bubanza	3,855
Muhweza	Muramvya	2,463
Munyinya	Gisuru	4,100
Munzenze	Mishiha	13,551
Musongati	Kiganda	3,616
Musugi	Kanyosha	5,679
Mutaho	Mutaho	12,755
Mutobo	Ruhororo	1,672
Muyange	Butezi	4,020
Mushasha Ii	Mutimbuzi	9,553
Ngomante	Giharo	8,010
Nimba	Buganda	751
Nyabisindu	Musongati	4,125
Nyabigina	Nyanza-Lac	11,071
Nyakazi	Kibago	5,556
Nyamabega	Buhiga	4,065
Nyanza	Ngozi	1,895
Quartier Iii Jabe	Mukaza	4,285
Remba	Nyabitsinda	3,894
Rugarama	Bukemba	5,059
Rugasa	Bugabira	11,490
Runyonza	Kirundo	8,150
Rukobe Ii	Itaba	6,935
Rusama	Songa	3,624
Rusumo	Muyinga	2,636
Ruyenzi	Bwamba	5,940
Shatanya	Gitega	3,715
Tangara	Butihinda	8,884
Teme	Bugenyuzi	5,112
Vumwe	Kinyinya	4,996

APPENDIX 2. POOLED VISION IMPAIRMENT DATA

The data in this appendix was extracted from the RAAB Database [28] and pooled to calculate sub-regional prevalence of blindness and vision impairment in people aged 50 years and older.

Blindness

RAAB COUNTRY (YEAR)	50+ Population			Extr. Magnitude Blind			Prev. Blind		
	Women	Men	Total	Women	Men	Total	Women	Men	Total
	n	n	n	n	n	n	%	%	%
Botswana (2014)	143,864	108,911	252,775	5,950	5,453	11,403	4.1%	5.0%	4.5%
Eritrea	349,353	281,698	631,051	25,218	17,020	42,232	7.2%	6.0%	6.7%
Ethiopia, Oromia (Jimma 2021)	190,272	165,504	355,776	7,761	4,060	11,821	4.1%	2.5%	3.3%
Kenya, Coast Kwale (2011)	35,847	35,477	70,964	1,199	686	1,885	3.3%	1.9%	2.7%
Kenya, Eastern Embu (2007)	15,800	13,760	29,560	178	171	350	1.1%	1.2%	1.2%
Kenya, Rift Valley Kericho (2007)	42,246	41,148	83,394	916	587	1,503	2.2%	1.4%	1.8%
Kenya, Rift Valley Nakuru (2005)	44,195	44,519	88,714	489	576	1,065	1.1%	1.3%	1.2%
Madagascar, Analamanga (2015)	3,438	2,063	5,501	24	14	38	0.7%	0.7%	0.7%
Malawi, Southwestern (2023)	237,272	206,116	443,388	6,475	4,948	11,423	2.7%	2.4%	2.6%
Mozambique, Inhambane (2016)	113,993	67,620	181,613	8,022	3,578	11,600	7.0%	5.3%	6.4%
Mozambique, Nampula (2018)	219,209	230,003	449,212	11,361	8,873	20,233	5.2%	3.9%	4.5%
Rwanda (2015)	625,505	465,865	1,091,370	5,654	5,940	11,594	0.9%	1.3%	1.1%
Tanzania, Morogoro (2016)	127,124	123,968	251,092	3,787	2,913	6,699	3.0%	2.3%	2.7%
Tanzania, Singida (2017)	75,539	91,473	167,012	3,265	2,423	5,688	4.3%	2.6%	3.4%
Uganda, Central Mubende (2012)	22,057	23,958	46,015	415	517	932	1.9%	2.2%	2.0%
Uganda, Northern Karamoja (2023)	30,720	22,140	52,860	1,655	920	2,575	5.4%	4.2%	4.9%
Uganda, Western Hoima (2013)	22,100	22,000	44,100	459	397	856	2.1%	1.8%	1.9%
Uganda, Western Ntungamo (2011)	21,283	16,972	38,255	359	178	537	1.7%	1.0%	1.4%
Zambia, Muchinga (2017)	29,208	27,092	56,300	1166	1147	2,314	4.0%	4.2%	4.1%
TOTAL	2,349,025	1,990,287	4,338,952	84,353	60,401	144,748	3.6%	3.0%	3.3%
MIN	3,438	2,063	5,501	24	14	38	0.7%	0.7%	0.7%
MAX	625,505	465,865	1,091,370	25,218	17,020	42,232	7.2%	6.0%	6.7%
AVERAGE	123,633	104,752	228,366	4,440	3,179	7,618	3.3%	2.7%	3.0%
MEDIAN	44,195	44,519	88,714	1,655	1,147	2,575	3.0%	2.3%	2.7%

SVI

RAAB COUNTRY (YEAR)	50+ Population			Extr. Magnitude SVI			Prev. SVI		
	Women	Men	Total	Women	Men	Total	Women	Men	Total
	n	n	n	n	n	n	%	%	%
Botswana (2014)	143,864	108,911	252,775	2,312	1,735	4,047	1.6%	1.6%	1.6%
Eritrea	349,353	281,698	631,051	10,227	6,478	16,705	2.9%	2.3%	2.6%
Ethiopia, Oromia (Jimma 2021)	190,272	165,504	355,776	5,770	3,705	9,475	3.0%	2.2%	2.7%
Kenya, Coast Kwale (2011)	35,847	35,477	70,964	1,034	766	1,800	2.9%	2.2%	2.5%
Kenya, Eastern Embu (2007)	15,800	13,760	29,560	144	82	226	0.9%	0.6%	0.8%
Kenya, Rift Valley Kericho (2007)	42,246	41,148	83,394	645	597	1,242	1.5%	1.5%	1.5%
Kenya, Rift Valley Nakuru (2005)	44,195	44,519	88,714	439	680	1,119	1.0%	1.5%	1.3%
Madagascar, Analamanga (2015)	3,438	2,063	5,501	29	13	42	0.8%	0.6%	0.8%
Malawi, Southwestern (2023)	237,272	206,116	443,388	5,766	5,532	11,298	2.4%	2.7%	2.5%
Mozambique, Inhambane (2016)	113,993	67,620	181,613	4,717	2,506	7,223	4.1%	3.7%	4.0%
Mozambique, Nampula (2018)	219,209	230,003	449,212	6,965	5,364	12,329	3.2%	2.3%	2.7%
Rwanda (2015)	625,505	465,865	1,091,370	4,582	3,328	7,910	0.7%	0.7%	0.7%
Tanzania, Morogoro (2016)	127,124	123,968	251,092	3,372	3,794	7,166	2.7%	3.1%	2.9%
Tanzania, Singida (2017)	75,539	91,473	167,012	1,745	1,420	3,165	2.3%	1.6%	1.9%
Uganda, Central Mubende (2012)	22,057	23,958	46,015	306	205	511	1.4%	0.9%	1.1%
Uganda, Northern Karamoja (2023)	30,720	22,140	52,860	910	709	1,618	3.0%	3.2%	3.1%
Uganda, Western Hoima (2013)	22,100	22,000	44,100	368	410	777	1.7%	1.9%	1.8%
Uganda, Western Ntungamo (2011)	21,283	16,972	38,255	158	216	374	0.7%	1.3%	1.0%
Zambia, Muchinga (2017)	29,208	27,092	56,300	833	895	1728	2.9%	3.3%	3.1%
TOTAL	2,349,025	1,990,287	4,338,952	50,322	38,435	88,755	2.1%	1.9%	2.0%
MIN	3,438	2,063	5,501	29	13	42	0.7%	0.6%	0.7%
MAX	625,505	465,865	1,091,370	10,227	6,478	16,705	4.1%	3.7%	4.0%
AVERAGE	123,633	104,752	228,366	2,649	2,023	4,671	2.1%	1.9%	2.0%
MEDIAN	44,195	44,519	88,714	1,034	895	1,800	2.3%	1.9%	1.9%

MVI

RAAB COUNTRY (YEAR)	50+ Population			Extr. Magnitude MVI			Prev. MVI		
	Women	Men	Total	Women	Men	Total	Women	Men	Total
	n	n	n	n	n	n	%	%	%
Botswana (2014)	143,864	108,911	252,775	9,579	8,421	18,000	6.7%	7.7%	7.1%
Eritrea	349,353	281,698	631,051	32,299	27,448	59,741	9.2%	9.7%	9.5%
Ethiopia, Oromia (Jimma 2021)	190,272	165,504	355,776	18,688	12,280	30,968	9.8%	7.4%	8.7%
Kenya, Coast Kwale (2011)	35,847	35,477	70,964	4,996	4,392	9,387	13.9%	12.4%	13.2%
Kenya, Eastern Embu (2007)	15,800	13,760	29,560	716	621	1,336	4.5%	4.5%	4.5%
Kenya, Rift Valley Kericho (2007)	42,246	41,148	83,394	1,913	2,238	4,152	4.5%	5.4%	5.0%
Kenya, Rift Valley Nakuru (2005)	44,195	44,519	88,714	1,848	2,000	3,848	4.2%	4.5%	4.3%
Madagascar, Analamanga (2015)	3,438	2,063	5,501	118	42	159	3.4%	2.0%	2.9%
Malawi, Southwestern (2023)	237,272	206,116	443,388	17,456	12,381	29,837	7.4%	6.0%	6.7%
Mozambique, Inhambane (2016)	113,993	67,620	181,613	9,732	5,562	15,294	8.5%	8.2%	8.4%
Mozambique, Nampula (2018)	219,209	230,003	449,212	24,496	24,808	49,305	11.2%	10.8%	11.0%
Rwanda (2015)	625,505	465,865	1,091,370	19,561	9,221	28,782	3.1%	2.0%	2.6%
Tanzania, Morogoro (2016)	127,124	123,968	251,092	12,493	15,021	27,514	9.8%	12.1%	11.0%
Tanzania, Singida (2017)	75,539	91,473	167,012	5,697	5,611	11,308	7.5%	6.1%	6.8%
Uganda, Central Mubende (2012)	22,057	23,958	46,015	1,054	1,097	2,151	4.8%	4.6%	4.7%
Uganda, Northern Karamoja (2023)	30,720	22,140	52,860	2,245	2,009	4,255	7.3%	9.1%	8.0%
Uganda, Western Hoima (2013)	22,100	22,000	44,100	1,035	1,275	2,310	4.7%	5.8%	5.2%
Uganda, Western Ntungamo (2011)	21,283	16,972	38,255	1,097	859	1,955	5.2%	5.1%	5.1%
Zambia, Muchinga (2017)	29,208	27,092	56,300	2,728	2,685	5,412	9.3%	9.9%	9.6%
TOTAL	2,349,025	1,990,287	4,338,952	167,751	137,971	305,714	7.1%	6.9%	7.0%
MIN	3,438	2,063	5,501	118	42	159	3.1%	2.0%	2.6%
MAX	625,505	465,865	1,091,370	32,299	27,448	59,741	13.9%	12.4%	13.2%
AVERAGE	123,633	104,752	228,366	8,829	7,262	16,090	7.1%	7.0%	7.1%
MEDIAN	44,195	44,519	88,714	4,996	4,392	9,387	7.3%	6.1%	6.8%

EVI

RAAB COUNTRY (YEAR)	50+ Population			Extr. Magnitude EVI			Prev. EVI		
	Women	Men	Total	Women	Men	Total	Women	Men	Total
	n	n	n	n	n	n	%	%	%
Botswana (2014)	143,864	108,911	252,775	*	*	*	*	*	*
Eritrea	349,353	281,698	631,051	24,462	21,990	46,453	7.0%	7.8%	7.4%
Ethiopia, Oromia (Jimma 2021)	190,272	165,504	355,776	18,381	10,208	28,589	9.7%	6.2%	8.0%
Kenya, Coast Kwale (2011)	35,847	35,477	70,964	*	*	*	*	*	*
Kenya, Eastern Embu (2007)	15,800	13,760	29,560	*	*	*	*	*	*
Kenya, Rift Valley Kericho (2007)	42,246	41,148	83,394	*	*	*	*	*	*
Kenya, Rift Valley Nakuru (2005)	44,195	44,519	88,714	*	*	*	*	*	*
Madagascar, Analamanga (2015)	3,438	2,063	5,501	*	*	*	*	*	*
Malawi, Southwestern (2023)	237,272	206,116	443,388	18,710	11,988	30,699	7.9%	5.8%	6.9%
Mozambique, Inhambane (2016)	113,993	67,620	181,613	*	*	*	*	*	*
Mozambique, Nampula (2018)	219,209	230,003	449,212	*	*	*	*	*	*
Rwanda (2015)	625,505	465,865	1,091,370	*	*	*	*	*	*
Tanzania, Morogoro (2016)	127,124	123,968	251,092	13,312	11,911	25,223	10.5%	9.6%	10.0%
Tanzania, Singida (2017)	75,539	91,473	167,012	*	*	*	*	*	*
Uganda, Central Mubende (2012)	22,057	23,958	46,015	*	*	*	*	*	*
Uganda, Northern Karamoja (2023)	30,720	22,140	52,860	2,127	2,018	4,144	6.9%	9.1%	7.8%
Uganda, Western Hoima (2013)	22,100	22,000	44,100	*	*	*	*	*	*
Uganda, Western Ntungamo (2011)	21,283	16,972	38,255	*	*	*	*	*	*
Zambia, Muchinga (2017)	29,208	27,092	56,300	*	*	*	*	*	*
TOTAL	2,349,025	1,990,287	4,338,952	76,992	58,115	135,108	8.2%	7.3%	7.8%
MIN	3,438	2,063	5,501	2,127	2,018	4,144	6.9%	5.8%	6.9%
MAX	625,505	465,865	1,091,370	24,462	21,990	46,453	10.5%	9.6%	10.0%
AVERAGE	123,633	104,752	228,366	15,398	11,623	27,022	8.4%	7.7%	8.0%
MEDIAN	44,195	44,519	88,714	18,381	11,911	28,589	7.9%	7.8%	7.8%

APPENDIX 3. POOLED CSC AND eCSC DATA

The data in this appendix was extracted from the RAAB Database [28] and pooled to calculate sub-regional prevalence of blindness and vision impairment in people aged 50 years and older.

RAAB COUNTRY (YEAR)	CSC						eCSC						Quality gap	
	<3/60			<6/18			<3/60			<6/18			<3/60	<6/18
	Women	Men	Total	Women	Men	Total	Women	Men	Total	Women	Men	Total	Total	Total
Botswana (2014)	74.8	79.8	76.8	51.9	54.3	52.9	54.2	40.6	48.7	36.9	26.2	32.6	36.6	38.4
Ethiopia, Oromia (Jimma 2021)	53.8	72.8	61.1	30.4	39.6	33.9	20.1	29.0	23.5	10.5	15.4	12.3	61.5	63.6
Kenya, Coast Kwale (2011)	67.3	84.7	75.2	33.7	48.2	40.0	49.5	57.5	53.1	23.5	31.0	26.7	29.4	33.2
Kenya, Eastern Embu (2007)	66.6	77.7	72.5	32.4	41.0	36.5	37.0	32.8	34.7	19.3	15.6	17.6	52.1	51.9
Kenya, Rift Valley Kericho (2007)	75.8	89.9	82.6	55.0	60.4	57.7	45.3	62.3	53.5	33.9	35.2	34.6	35.3	40.2
Kenya, Rift Valley Nakuru (2005)	85.4	82.9	84.1	55.7	59.2	57.5	59.5	47.2	53.3	37.4	32.8	35.1	36.6	38.1
Madagascar, Analamanga (2015)	77.8	73.1	75.8	45.0	47.8	46.1	62.0	48.4	56.3	35.3	32.3	34.2	25.8	25.8
Malawi, Southwestern (2023)	21.9	48.7	36.1	6.1	17.7	10.8	8.6	24.4	17.0	1.7	8.2	4.3	53.0	59.7
Mozambique, Inhambane (2016)	22.4	51.0	32.1	11.3	24.3	15.5	8.6	34.7	17.4	4.3	16.1	8.2	45.6	47.6
Mozambique, Nampula (2018)	25.2	42.9	33.3	9.1	21.3	14.4	11.1	30.1	19.9	4.3	13.4	8.3	40.4	42.7
Rwanda (2015)	69.9	68.2	69.3	44.4	46.8	45.2	54.7	51.0	53.4	33.2	35.6	33.9	22.9	24.9
Tanzania, Morogoro (2016)	48.3	70.6	59.0	17.0	24.3	20.6	19.9	31.4	25.4	6.4	10.8	8.6	56.9	58.2
Tanzania, Singida (2017)	46.4	63.3	54.1	22.3	34.3	27.7	29.4	39.1	33.9	14.3	20.1	16.9	37.4	38.9
Uganda, Central Mubende (2012)	44.8	45.8	45.3	19.8	24.0	21.7	34.3	35.2	34.8	14.4	18.4	16.2	23.3	25.4
Uganda, Northern Karamoja (2023)	57.0	83.8	71.0	33.6	49.0	41.2	15.7	28.4	22.3	9.0	15.8	12.3	68.6	70.1
Uganda, Western Hoima (2013)	37.4	70.9	53.9	15.2	26.6	20.8	21.6	47.6	34.4	8.6	17.3	12.9	36.1	38.0
Uganda, Western Ntungamo (2011)	57.3	69.3	62.2	32.7	29.1	31.1	33.3	46.5	38.7	19.6	18.4	19.1	37.8	38.7
Zambia, Muchinga (2017)	25.9	53.8	41.3	11.4	28.1	19.6	20.7	26.3	23.8	8	13.6	10.8	42.4	45.2
MIN	21.9	42.9	32.1	6.1	17.7	10.8	8.6	24.4	17.0	1.7	8.2	4.3	22.9	24.9
MAX	85.4	89.9	84.1	55.7	60.4	57.7	62.0	62.3	56.3	37.4	35.6	35.1	68.6	70.1
AVERAGE	53.2	68.3	60.3	29.3	37.6	33.0	32.5	39.6	35.8	17.8	20.9	19.1	41.2	43.4
MEDIAN	55.4	70.8	61.7	31.4	37.0	32.5	31.4	37.2	34.6	14.4	17.9	16.6	37.6	39.6

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