



A REPORT OF **RAPID ASSESSMENT OF AVOIDABLE BLINDNESS SURVEY**

2019, LUMBINI PROVINCE, NEPAL



Conducted By

Nepal Netra Jyoti Sangh

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Technical Support:



International Agency for Prevention
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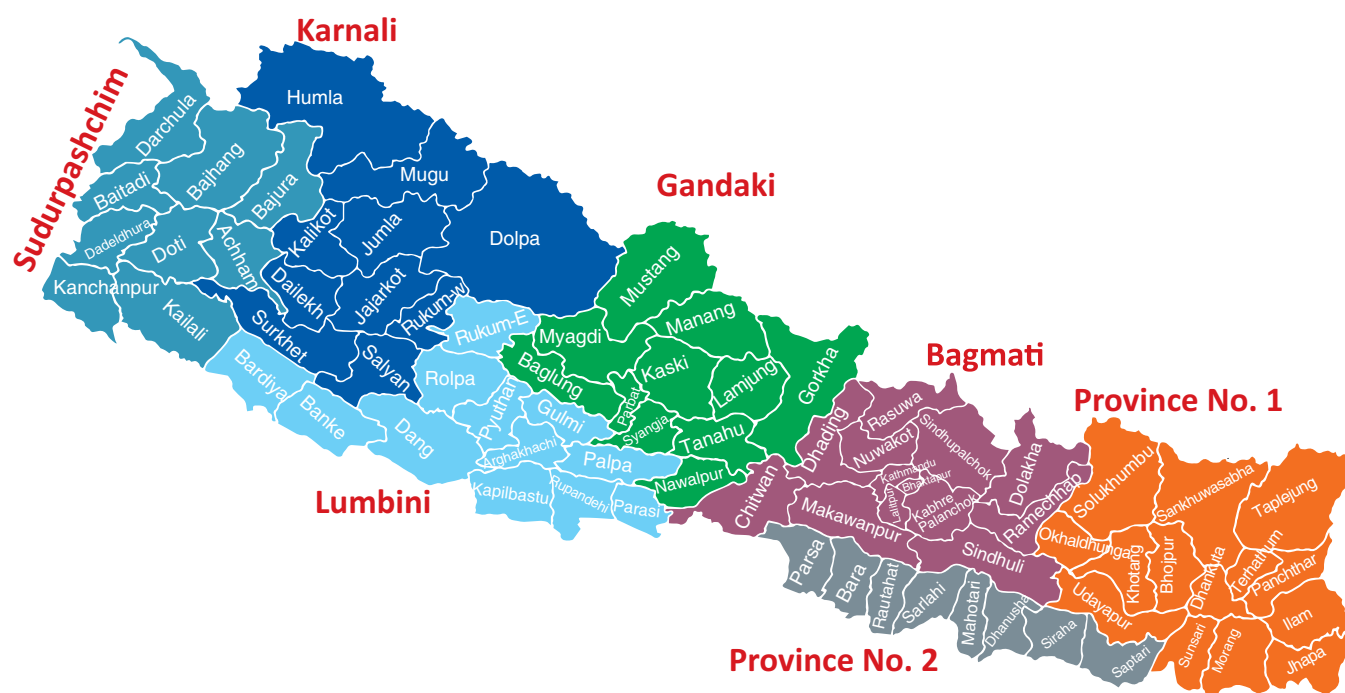


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A Report on Rapid Assessment of Avoidable Blindness



Blindness scenario 2019– Lumbini Province

Overall blindness	2.1%
Cataract leading cause of blindness	75.7%
Corneal opacity	4.3%
ARMD	1.7%
Posterior segment	8.7%
Glaucoma	1.7%
Globe /CNS	2.6%
Phthisis	3.5%
Diabetic retinopathy	0.9%
Myopic Degeneration	0.9%

Lumbini Province, Nepal





*Message from
Chief Minister: Lumbini Province*



I am very delighted to know that Nepal Netra Jyoti Sangh/Lumbini Eye Institute & Research Center is going to publish RABB survey report 2019. It is matter of pride for all of us that eye care service in Nepal is expanding in unique way and people are getting comprehensive eye care service within their reach. I am sure this RABB survey report will be a great source of information for the policy makers to make plans and move ahead for eye care services in the future.

I would like to express my gratitude to the hard work of Nepal Netra Jyoti Sangh and all the eye hospitals of Lumbini Province for their contribution to reduce the blindness.

Best wishes to all the employees and authorities in eye health care service within this Province and throughout the nation for further betterment of the eye care services.

Thank you.

Kul Prasad KC

Chief Minister,
Lumbini Province
Nepal



Remarks from Chairman, Nepal Netra Jyoti Sangh



This is a proud moment for us to share that the Rapid Assessment of Avoidable Blindness (RAAB-2019) survey report is being published as a book with the joint effort of Lumbini Eye Institute and Research Center and all eye care stakeholders.

Needless to say, this report will provide a clear insight on the current eye care situation in the Lumbini province and build up a strong base for the future planning and developing new eye care strategies for the province. There is still a need of quality and accessible eye care services available throughout the province and I strongly believe, with this report we can achieve this dream together.

For this big achievement, I would like to thank each and every individual, organization who were involved directly or indirectly towards the successful accomplishment of the RAAB survey. Last but not least, I would like to thank Mr. Y.D. Sapkota, IAPB for his contribution as RAAB survey expert and Seva Foundation for the financial support.

Prof. Dr. Chet Raj Pant

Chairman, Nepal Netra Jyoti Sangh

Lumbini Eye Institute and Research Center



Message from President Lumbini Province

It is my immense pleasure to announce that we are going to publish RABB survey report 2019 of Lumbini province via Lumbini Eye Institute and Research Center. I hope and expect that this book will be the key source of information regarding the status of eye health service in the western Nepal. Also, it will be a great reflection of our work over the last four decades and will be the guide to make new strategic plans in eye care service in the future.

Eye care service in Nepal is expanding with modern technologies and constant dedication of human resource working in this field. We are working with the guidance of central NNJS and providing comprehensive eye care service to Nepalese and citizens from the abroad as well. Conducting this type of survey and publication of the report along with the analytical data will certainly be a reference to all the people working in eye health in Nepal.

I would like to thank Lumbini Eye Institute & Research Center, Rapti Eye Hospital , Fatteh Bal Eye Hospital along with researchers , data collectors, writers and members of the editorial committee who have invested their precious time in development of this valuable piece of work.

Thank you.

Mr. Sagar Pratap Rana

Chairperson, Nepal Netra Jyoti Sangh, Lumbini Province

Chairman, Hospital Management Committee, LEIRC

Rupandehi, Nepal



Message from Chief Medical Director, LEIRC

It gives me an intense happiness to state that we are able to disseminate the report of RAAB survey of Lumbini Province Conducted by Lumbini Eye Institute and Research Centre and its networks with support of International Agency for Prevention of Blindness (IAPB).

From the day of the establishment, Lumbini Eye Institute has been committed for comprehensive Eye care to all groups of community at an affordable cost with a human touch. We are always following and working under the mission of reducing avoidable blindness and rehabilitating the incurable blindness. Academic activities on different streams of Ophthalmology and research are our added strength and we are now moving towards the direction of becoming “Centre of Excellence” as per recent NNJS Guidelines.

I like to express my heartily thanks to Provincial Government and Local government who has become always very supportive to us.

The year had been very challenging due to Covid-19 Pandemic. However, our dedicated Hospital staffs, NNJS volunteers have always supported us with high positive energy and motivations. I like to appreciate each of them.

There is always room to be better than now. In future we definitely look forward to do better and achieve our Goal of becoming Centre of Excellence and better patient care.

At last, I hope that the clear scenario of ocular problems as shown by this RAAB survey will act us as a guideline for better planning to reduce blindness in Lumbini Province.

Prof. Dr. Gyanendra Lamichhane

Chief Medical Director

Lumbini Eye Institute and Research Center



Remarks from The Seva Foundation Regional Manager (Asia)



It gives me an immense pleasure to be informed that Rapid Assessment of Avoidable Blindness Survey (RAAB)– 2019 of Lumbini province is coming up in the form of a handbook. I wish to commend all the team members who are involved in this survey for their hard works and diligence to complete this survey in these particularly difficult times.

There has been a remarkable progress in the eye care sector of Nepal in past four decades. Now, this report provides evidence-based detailed information on the present situation of blindness and eye care services in Lumbini province. We hope, this report will also provide a new baseline information which will be helpful for planning at the municipality/Rural municipality levels. The finding of this survey will also assist in strengthening the Provincial Eye Health Strategy of Lumbini Province.

Seva Foundation is very happy to be part of this RAAB survey. Seva is looking forward to work closely with local NNJS partners to reduce the avoidable blindness in the Lumbini province without any duplication of the resources. As you are all aware, Seva Foundation USA, Seva Canada Society, Canada have been working in Nepal since Nepal Blindness survey 1981 as a partner of NNJS. Currently Seva Nepal has been supporting 26 out of 77 districts in Nepal.

I am happy to mention here that historically Seva took the leadership for the first ever blindness survey in Nepal in 1980/81. Seva is proud to be part of Lumbini Eye Institute's development since its inception till today. Historically Seva has supported for the Lumbini blindness survey in 2006 and is delighted to continue its partnership in RAAB Survey of Lumbini Province 2020.

It is very important for us to link up the RAAB survey findings from 1980 and 2006 and compare with RAAB 2020. This new survey will help us to review and plan our strategies and build on our good works.

Finally, I once again wish to thank our competent partner hospital staff for accomplishing this important survey in the middle of the pandemic time.

Seva Nepal looks forward to continuing our partnership with the Lumbini Eye Institute Team in the coming days.

With warmest regards,

On behalf of Seva Nepal Team

Ravindra Shakya,
Regional Manager (Asia),
Seva Foundation

RAAB Survey Team

This survey was carried out in year 2019 by the following team of Lumbini Eye Institute, Rapti Eye Hospital and Fateh Bal Eye Hospital with the technical support of Mr. Yuddha Dhoj Sapkota, International Agency for Prevention of Blindness (IAPB).

Name	Designation	Organization
Lumbini Eye Institute & Research Centre		
Dr. Anjita Hirachan	Ophthalmologist	Lumbini Eye Institute
Dr. Amrit Banstola	Ophthalmologist	Lumbini Eye Institute
Dr. Saurav Man Shrestha	Ophthalmologist	Lumbini Eye Institute
Ms. Saraswati Khadka Thapa	Research Coordinator	Lumbini Eye Institute
Mr. Sanjeev Adhikari	Outreach Coordinator	Lumbini Eye Institute
Mr. Sunil Bhusal	Ophthalmic Assistant	Lumbini Eye Institute
Mr. Bishal Mani Tripathi	Ophthalmic Assistant	Lumbini Eye Institute
Mr. Mohammad Rafik	Ophthalmic Assistant	Lumbini Eye Institute
Mr. Ashok Kumar Yadav	Ophthalmic Assistant	Lumbini Eye Institute
Mr. Ramesh Bajracharya	Driver	Lumbini Eye Institute
Mr. Bishwa Raj Thapa	Driver	Lumbini Eye Institute
Mr. Ramu Bhandari	Driver	Lumbini Eye Institute
Rapti Eye Hospital Team		
Dr. Suresh Rasaily	Ophthalmologist	Rapti Eye Hospital
Mr. Madan Chaudhary	Optometrist	Rapti Eye Hospital
Mr. Salik Ram Gautam	Ophthalmic officer	Rapti Eye Hospital
Mr. Opendra Chand	Ophthalmic Assistant	Rapti Eye Hospital
Mr. Jeevan Paharai	Enumerator	Rapti Eye Hospital
Mr. Man Bahadur Oli	Driver	Rapti Eye Hospital
Mr. Chhedu Chaudhary	Driver	Rapti Eye Hospital
Fateh Bal Eye Hospital Team		
Dr. Rajesh Shrestha	Ophthalmologist	Fateh bal Eye Hospital
Mr. Umar Ahamad Sadiq	Ophthalmic officer	Fateh bal Eye Hospital
Mr. Anup Raj Sharma Adhikari	IT	Fateh bal Eye Hospital
Mr. Badshah Khan	Driver	Fateh bal Eye Hospital
Technical Support		
Mr. Yuddha Dhoj Sapkota	Regional coordinator, South East Asia – IAPB	International Agency for the Prevention of Blindness (IAPB)
Dr. Sailesh Kumar Mishra	Executive Director	Nepal Netra Jyoti Sangh
Mr. Ranjan Shah	Program Manager	Nepal Netra Jyoti Sangh
Mr. Man Bahadur Kunwar	Project Manager	Nepal Netra Jyoti Sangh

We also like to thank Mr. Ram Prasad Kandel, Seva Foundation for his encouragement, valuable input, and support during this entire process.

Abbreviations

ARMD	Age Related Macular Degeneration
BCVA	Best Corrected Visual Acuity
CSC	Cataract Surgical Coverage
CSR	Cataract Surgical Rate
DR	Diabetic Retinopathy
ECF	Eye Care Foundation
EVI	Early Visual Impairment
GoN	Government of Nepal
IAPB	International Agency for Prevention of Blindness
IOL	Intra Ocular Lens
MVI	Moderate Visual Impairment
NGO	Non Government Organization
NNJS	Nepal Netra Jyoti Sangh
PVA	Presenting Visual Acuity
RAAB	Rapid Assessment of Avoidable Blindness
SVI	Severe Visual Impairment
SICS	Small Incision Cataract Surgery
VA	Visual Acuity
WHO	World Health Organization

EXECUTIVE SUMMARY

Background

The main objective of the Rapid Assessment of Avoidable Blindness (RAAB) survey 2019 was to assess the magnitude of blindness and visual impairment, its causes and impact of existing eye care services in Lumbini Province, Nepal.

Results:

Prevalence of Blindness and Visual Impairment

The survey achieved a 98.9 % response rate. The crude prevalence of bilateral blindness from all causes among people aged 50 years and above was 2.1 % (95% CI 1.6-2.5). The crude prevalence of severe vision impairment (SVI), moderate vision impairment (MVI) and early vision impairment (EVI) were 2.9 % (95%CI 2.3-3.5), 12.6 % (95%CI 11.1-14.0) and 12.2% (95%CI 10.9-13.4) respectively.

The age- and sex-adjusted prevalence of blindness was 1.7% (95%CI 1.3-2.2). The age- and sex-adjusted prevalence of SVI, MVI, and EVI were 2.6% (95%CI 2.0-3.1), 11.2% (95%CI 9.8-12.7) and 11.4% (95%CI 10.2-12.7) respectively.

Based on the observed prevalence, an estimated 11,444 people aged 50 and older (4764 men and 6,680 women) were found to be bilaterally blind in Lumbini Province. A total of 1, 77,005 people aged 50 and older (83061 men and 93,944 women) were estimated to have vision impairment (PVA<6/12) including blindness.

Similarly, total number of eyes affected with all causes of blindness was estimated to be 75,068 in this province. A total of 4, 69,316 eyes were found to have vision impairment from all causes (PVA<6/12) including blindness.

Prevalence of Cataract Causing Blindness and Vision Impairment

The crude prevalence of blindness due to bilateral cataract among people aged 50 years and older was 1.2% (95% CI 0.9-1.6). The crude prevalence of SVI, MVI and EVI due to bilateral cataract were 2.7% (95% CI 2.1-3.2), 8.9% (95% CI 7.7-10.1) and 12.8% (95% CI 11.4-14.2) respectively.

The age- and sex-adjusted prevalence of blindness due to bilateral cataract among people aged 50 years and older was 1.1% (95% CI: 0.7-1.4) corresponding to an estimated 6,935 people aged 50 years and older blind due to cataract in Lumbini Province. We also estimated that 45,216 eyes (prevalence 3.4%) are blind due to cataract among people aged 50 years and older in Lumbini Province of Nepal.

The age- and sex-adjusted prevalence of SVI due to bilateral cataract was 1.3% (95% CI 0.9-1.7) corresponding to an estimated 8,475 people aged 50 years and older in Lumbini Province. The estimated number of eyes with

SVI due to cataract was 26,340 (prevalence 2.0%) in the province.

The age- and sex-adjusted prevalence of MVI due to bilateral cataract was 5.5% (95% CI 4.6-6.4) corresponding to an estimated 36,057 people aged 50 years and older in Lumbini Province. We also estimated that 94,027 eyes (prevalence 7.2%) are affected by MVI due to cataract.

The age- and sex-adjusted prevalence of EVI due to bilateral cataract was 1.7% (95% CI 1.1-2.3) corresponding to an estimated 22,353 people aged 50 years and older in Lumbini Province. We also estimated that 47,961 eyes (prevalence 3.7%) are affected by EVI due to cataract.

The total workload of vision impairment due to bilateral cataract (BCVA<6/12 in the better eye) is estimated to be 73,820 people aged 50 years and older. The total number of eyes affected with vision impairment (BCVA<6/12) including blindness due to cataract is estimated to be 213,544 in this province.

Causes of Blindness and Visual Impairment

The main cause of bilateral blindness was untreated cataract (75.7%). Cataract was still the leading cause of SVI (87.0%) and MVI (68.2%). Uncorrected refractive error was the leading cause of EVI (66.5%).

Eighty seven percent of all blindness in the study population was avoidable. Specifically, 75.7% of blindness was treatable, 8.7% was preventable with primary health care and/or primary eye care, and 2.6% was preventable through more advanced ophthalmic services. Posterior segment disease accounted for 13.9% of all bilateral blindness.

Cataract surgery should be the main priority, because blindness and vision impairment due to posterior segment diseases might be prevented through regular control and timely intervention, targeted health education and specialist ophthalmic services might contribute to reducing avoidable blindness and vision impairment further. Low vision training and services are required for the remaining 13.9% of all blindness that is permanent and untreatable.

Cataract Surgical Coverage

The cataract surgical coverage (CSC) in persons indicates which proportion of people with cataract at a predefined VA have been operated in one or both eyes. This indicator measures the coverage of cataract surgical services.

At 88.4%, the age- and sex-adjusted CSC among people who are blind (PVA<3/60) is higher than the target of at least 85% recommended by the International Agency for the Prevention of Blindness (IAPB).

The age- and sex-adjusted CSC for eyes with cataract at a VA of <6/60 found to be 74.4% which indicates the coverage of the total workload of operable cataract in the province.

The effective CSC (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 having bilateral blindness due to cataract was 73.4%.

Visual Outcome of Cataract Surgery

In this survey, 98.7% of the total evaluated eyes had an intraocular lens (IOL) implanted. Overall good visual outcome by WHO definition was seen in 77.5% ($PVA \geq 6/18$) and 85.8% ($BCVA \geq 6/18$) of the cataract operated eyes. Overall poor outcome was seen in 8.8% ($PVA < 6/60$) and 6.8% ($BCVA < 6/60$) after cataract surgery.

The proportion of surgeries with a very good or good outcome was highest in eye camps (78.9%) followed by charitable hospitals (77.5%), private hospitals (75.0%) and government hospitals (58.5%) respectively.

The main causes of poor visual outcomes following cataract surgery were ocular co-morbidities (43.5%), immediate surgical complications (28.6%), absence and/or inadequate optical corrections (17.8%) and long-term surgical complications (10.1%).

Refractive Error, Presbyopia and Functional Low Vision

The prevalence of refractive error was 21.8% and 10.6% of people aged 50 years and older who had a refractive error did not have glasses. On the other hand, 82.6% of the study population did not wear glasses for near.

The age- and sex-adjusted prevalence of functional low vision (FLV) requiring low vision services in people aged 50 years and older in Lumbini Province was 1.2% (95%CI 0.9-1.5) with an estimated 7,906 people aged 50 and older requiring low vision services.

Barriers to Uptake Cataract Surgical Services

Among the people having bilateral cataract with $BCVA < 6/60$, the most prominent barriers to uptake cataract surgery services were lack of felt need (41.0%), Cost (35.9%) and Inaccessibility (19.7%).

Diabetes and Diabetes Retinopathy

The total prevalence of diabetes among the people aged 50 years and above in this survey was 3.3 %. The prevalence of any grade of diabetic retinopathy was found 13.5 % among the people with diabetes.

Conclusion and Recommendation

Blindness and vision impairment from all causes still remains as a major public health problem among the people aged 50 years and above in Lumbini Province, of Nepal. There remains a significant workload of avoidable blindness and vision impairment to be addressed by the eye health system. The visual outcome of cataract surgery below the WHO standards despite more than eighty five percent service coverage suggests further improvement in quality of surgical services. Huge backlog of vision impairing cataract can further be explained by the perceived barriers of lack of felt need, Cost and Inaccessibility preventing the uptake of cataract surgical services among the people 50 years and older. Along with cataract as the leading causes of blindness, SVI and MVI, posterior segment diseases, uncorrected refractive error, diabetic retinopathy and functional low vision are major issues to be resolved by the eye care system in this province.

To conclude, this survey provides evidence of public health significance regarding the magnitude of blindness and visual impairment, its causes and performance evaluation of ongoing eye care programs in the province. The information from this survey will help the concerned decision makers to formulate appropriate strategies to combat this needless burden of avoidable blindness and visual impairment.

To recommend, the findings from this survey make sensitization to the concerned authorities to scale up eye care services to those whose eye health needs are often not met yet as a goal to achieve Universal Eye Health Coverage.

CHAPTER I: INTRODUCTION

1.1 Background

The first nationwide epidemiological blindness survey was conducted in 1981 to estimate the prevalence and causes of blindness in Nepal. The survey was the first activity of the Nepal Blindness Prevention and Control Project, a joint initiative of the then Government of Nepal and World Health Organization. The survey estimated prevalence of bilateral blindness 0.84%, unilateral blindness 1.66% and low vision 1.85% in the Nepalese population. Cataract was found to be the leading cause of blindness accounting for 80% of all avoidable blindness (1). The findings of the first blindness survey were enormous milestones for the development of one of the efficient and elaborate eye health systems that exists in Nepal after more than 3 decades (2).

In 1995, a population based cross sectional study was done among 5112 people aged 45 years and above in Bheri and Lumbini zones of Nepal by using stratified cluster sampling design. The main purpose of the study was to estimate prevalence and causes of blindness and visual impairment and to assess the impact after 1981 blindness survey. The study revealed the prevalence of blindness reduced from 5.45% (in 50 years and above) in 1981 to 3.0% in population aged 45 years and above. Cataract surgical coverage among bilateral cataract blind people increased from 35.0% in 1981 to 58.0% in 1995. But, almost 30.0% of the cataract operated cases were still blind or with severe visual impairment (3).

Two customized population-based blindness surveys were conducted between 2002 and 2006 in Gandaki, Lumbini and Narayani zones of Nepal by using stratified cluster sampling and multi stage cluster sampling techniques respectively (4, 5). The study from the Gandaki zone among 5863 people aged 45 years and above found the prevalence of blindness 2.6% and cataract as the leading cause of blindness in 60.5%. Cataract surgical coverage was found to be improved reaching to 59.5% among the cataract blind people (4).

Another population based cross sectional study conducted among 5138 people aged 50 years and above in Lumbini and Narayani zones of Nepal found the age and sex adjusted prevalence of Blindness and Visual Impairment to be 4.6% and 18.9% respectively. The overall cataract surgical coverage was found to be 66.6% among the cataract blind people (5).

Eleven Rapid Assessment of Avoidable Blindness (RAAB) surveys were conducted from 2006-2010 in different zones of Nepal. The main purpose of these surveys was to assess the prevalence of blindness and visual impairment, to evaluate the impact of eye care delivery system of Nepal after 1981 National Blindness Survey. The prevalence of blindness was found reduced from 0.84% in 1981 to an estimated 0.35% in 2011, a 58% reduction. Cataract was still found to be the leading cause of blindness and quality of cataract surgery improved but still did not meet the WHO standard (6).

Towards Universal Eye Health: A Global Action Plan (GAP) 2014-2019 was endorsed and adopted by its member countries at the Sixty Sixth World Health Assembly in 2013 in Geneva, Switzerland. The vision of the global action plan is a world in which nobody is needlessly visually impaired, where those with unavoidable vision loss can achieve their full potential, and where there is universal access to comprehensive eye care services (7).

Nepal has already been one of the signatories of the Global Action Plan 2014-2019 at the World Health Assembly in 2013 and has complied to operationalize the global target of reducing prevalence of avoidable visual impairment by 25% from the baseline of 2010 by 2019. It strongly recommends conducting population based surveys to provide evidences on magnitude and causes of blindness and visual impairment for planning and evaluating impact of eye health programs.

More than 80% of the avoidable blindness and visual impairment resides among the people aged 50 years and above mainly caused by cataract and uncorrected refractive errors alone (8). So, the greatest gains will be achieved through reduction of prevalence of avoidable visual impairment among the population aged 50 years and above.

1.2 Problem Statement

There is paucity of current evidence on the prevalence, trend and causes of visual impairment in Nepal since the completion of population surveys in 2010 to inform the evidence-based decision making for formulating plans, policies and strategies to accomplish the unfinished agenda of The Vision 2020: The Right to Sight, a global initiative of the World Health Organization (WHO) and International Agency for Prevention of Avoidable Blindness (IAPB).

Lumbini Province is one of seven provinces of the Federal Democratic Republic of Nepal as provisioned by the new constitution which came on effect on September 2015. The total area of the province is 22,288 square kilometers making it the third largest province in Nepal. According to the 2011 Nepal census, the population of the province is 4,499,272, making it the fourth most populous province in Nepal. The total number of people 50 years and above in this province is 6, 55,927 (male 3, 27,357 and female 3, 28,570).

In the new political and administration system, health service delivery is the main responsibility of provincial government. Hence, a population based RAAB survey was conducted for assessing the prevalence and causes of blindness and visual impairment in this province in order to provide the evidence for monitoring the target set by the WHO GAP 2014-2019.

1.3 Rationale of the Survey

The survey aimed to assess the prevalence of blindness and visual impairment among the selected participants of aged 50 years and above in the Lumbini Province of Nepal by using RAAB survey methodology. The findings from this survey will inform the decision makers to plan universal, equitable and sustainable eye care policies and programs for the future.

1.4 General Objective

The main objective of the survey was to assess the magnitude and causes of blindness and visual impairment among people 50 years and above, impact of eye care services, in Lumbini Province of Nepal by using epidemiologically sound survey methodology.

1.5 Specific Objectives

The specific objectives of the survey were to assess:

- Prevalence of blindness and visual impairment from all causes
- Prevalence of blindness and visual impairment from avoidable causes
- Prevalence of blindness and visual impairment from cataract
- Main causes of blindness and visual impairment
- Cataract surgical coverages
- Visual outcomes of cataract surgery
- Cause of poor outcome after surgery
- Barriers to cataract surgical services
- Prevalence of uncorrected refractive errors, presbyopia and low vision
- Prevalence of diabetic retinopathy

CHAPTER II: METHODOLOGY

This cross-sectional population-based blindness survey was conducted in Lumbini Province of Nepal by using standardized RAAB methodology in 2019. It was accomplished with the technical support from the International Agency for Prevention of Avoidable Blindness, South East Asia.

2.1 Study Population

The study population was adults living in Lumbini Province who were aged 50 years or older at the time of data collection

2.2 Sampling Frame

The national census data of 2011 was used for creating the sampling frame. Based on the census data, ward level population was used as population unit/cluster. Thus, a total of 5,430 population units were created which formed the sampling frame for this survey.

2.3 Sample Size

The total sample size required was 5,670 people, distributed across 162 clusters of 35 people 50 years or older in each. Sample size calculations were performed using the RAAB7 software. We assumed a prevalence of bilateral blindness of 2.5% (P). This was based on the observed prevalence of blindness in Nepal in the previous RAAB survey, a worst tolerable alpha error consideration of 20% (D), 95% confidence level ($Z=1.96$), and 10% non-response rate. The formula used for the sample size calculation was $N = (1.96)^2(P(1-P))/D \cdot D$. As we used cluster sampling, adjusting cluster design effect of 1.4 for the cluster size of 35 people with 10% non-response rate required sample size was 5,670 people. In order to enroll adequate sample in the survey, a total of 162 clusters were randomly selected from the sampling frame according to population proportionate to size.

2.4 Recruitment Approach

The sampling frame for the survey was a list of wards, obtained from the 2011 census data. Each ward was considered a cluster. A total of 5,430 clusters were available for random selection in Lumbini Province. A total of 162 clusters were randomly selected using a probability proportionate to size approach based on the clusters' population size.

The survey teams, accompanied by a local guide, visited all households in the selected clusters door-to-door until 35 people aged 50 years or older were identified. The purposes of the study and examination procedure were explained to the subjects and informed consent was sought before data collection.

In cases where 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 35 eligible residents, then the team continued recruitment in the closest cluster.

2.5 Data Collection Process

Three teams were trained for data collection in this survey. In the selected clusters, the team led by an Ophthalmologist visited house to house to enroll the eligible survey participants. After informed written consent, the eligible survey participants underwent visual acuity assessment, anterior segment examination with torch light and media and fundus examination with direct ophthalmoscope. The data collection was done in tablets with mRAAB7 data collection software installed.

In this survey, we also included the Diabetic Retinopathy module of RAAB7. All eligible participants also underwent for blood glucose test. Participants with random blood glucose 200 mg/dl and known diabetic participants also underwent detail fundus examination to assess the Diabetic Retinopathy.

2.6 Ethical Consideration

The survey conforms to the tenets of the Declaration of Helsinki. The survey protocol was reviewed and approved by Nepal Health Research Council under the Ministry of Health, Government of Nepal. Before enrollment and examination, all eligible participants were explained about the purpose and procedures of the survey. Written informed consent was taken from each respondent to voluntarily participate in data collection and examination procedures. Appropriate remedial actions were taken to address any eye and other health related problems if found among the participants.

2.7 Operational Definitions

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

Blindness : A study participant having presenting visual acuity (PVA) $< 3/60$ in the better was considered as blind.

Presenting Visual Acuity(PVA) : Visual Acuity measured with available correction if any.

Best Corrected Visual Acuity(BCVA) : Visual Acuity measured and recorded after pinhole correction. Blindness and Visual Impairment due to cataract in this survey were based on the BCVA.

Severe Visual Impairment(SVI) : Presenting Visual Acuity of $< 6/60 - 3/60$ in the better eye was considered as SVI.

Moderate Visual Impairment(MVI) : Presenting Visual Acuity of $< 6/18 - 6/60$ in the better eye was considered as MVI.

Early Visual Impairment(EVI) : Mild visual impairment with presenting visual acuity of $< 6/12 - 6/18$ in the better eye was considered as EVI.

Functional Low Vision (FLV) : Best corrected visual acuity of $< 6/18 - PL+$ in the better eye (not due to cataract or refractive error) was considered as FLV.

CHAPTER III: FINDINGS

3.1 Response Rate

The survey included 5,642 people aged 50 years and older, of whom 5,582 were examined. The coverage was 98.9%. A total of 60 (1.1%) eligible individuals were not evaluated for the study purpose due to unavailability, self-refusals and for not being capable to communicate. (Table 1)

Table 1: Eligible Participants, Coverage and Refusals

Study Participants	Examined		Not Available		Refused		Not Capable		Total Enrolled	
	n	%	n	%	n	%	n	%	n	%
Male	2,500	98.5	35	1.4	0	0.0	3	0.1	2,538	100.0
Female	3,082	98.3	20	0.6	2	0.1	0	0.0	3,104	100.0
Total	5,582	98.9	55	1.0	2	0.0	3	0.1	5,642	100.0

3.2 Representativeness of Sample Population

To check whether the study population is representative of the Nepalese population aged 50 years and older, the age and sex composition of the sample was compared with that of broader population of Lumbini Province.

Ideally, the study population should have the same composition by age and by sex as the total population aged 50 years and older in the survey area. However, we found that men and women aged 70 years and older were over-represented, and men and women younger than 70 years were under-represented (Table 2).

To account for these discrepancies, we have provided both crude (study population) and age- and sex-adjusted estimates where appropriate.

Table 2: Age and Sex Composition of Province and Sample Population

Age and Sex Composition of the Sample Population						
Age Group	Male		Female		Total	
	n	%	n	%	n	%
50-59	892	35.7	1335	43.3	2227	39.9
60-69	836	33.4	979	31.8	1815	32.5
70-79	587	23.5	607	19.7	1194	21.4
80 above	185	7.4	161	5.2	346	6.2
Total	2500	100.0	3082	100.0	5582	100.0
Age and Sex Composition of the Province						
50-59	148028	45.2	152527	46.4	300555	45.8
60-69	110266	33.7	111469	33.9	221735	33.8
70-79	53019	16.2	48568	14.8	101587	15.5
80 above	16044	4.9	16006	4.9	32050	4.9
Total	327357	100.0	328570	100.0	655927	100.0

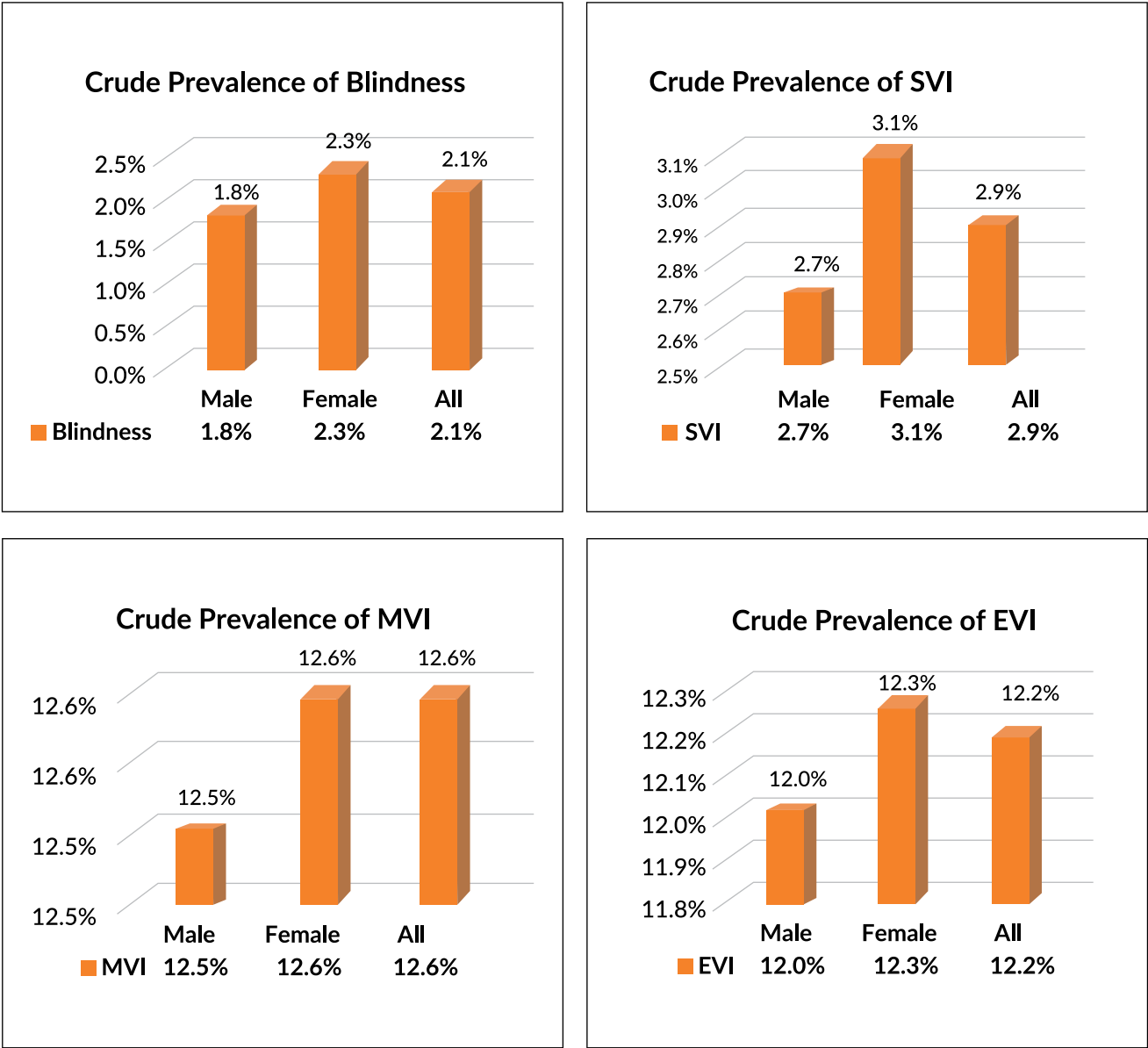
3.3 Crude Prevalence of Blindness and Visual Impairment

The crude prevalence of blindness with available correction was 2.1% (95%CI 1.6-2.5). The crude prevalence of SVI, MVI, and EVI were 2.9% (95%CI 2.3-3.5), 12.6% (95%CI 11.1-14.0) and 12.2% (95%CI 10.9-13.4) respectively. The crude prevalence of FLV was 1.3% (95%CI 1.0-1.7) (Table 3).

Table 3: Crude Prevalence of Blindness and Visual Impairment

Vision Category	Male, %(95% CI)	Female, %(95% CI)	All , %(95% CI)
Blindness	1.8(1.1-2.4)	2.3(1.7-2.9)	2.1(1.6-2.5)
SVI	2.7(1.9-3.5)	3.1(2.4-3.7)	2.9(2.3-3.5)
MVI	12.5(10.8-14.2)	12.6(10.9-14.3)	12.6(11.1-14.0)
EVI	12.0(10.5-13.6)	12.3(10.8-13.8)	12.2(10.9-13.4)
FLV	1.2(0.8-1.7)	1.4(1.0-1.9)	1.3(1.0-1.7)

Figure 1: Crude prevalence of blindness and visual impairment



3.4 Prevalence of Blindness According to Age Group

The prevalence of blindness among survey participants aged 50 years and above was 2.1%(95%CI 1.6-2.5) and increased with age. The prevalence of bilateral blindness was found maximum 8.1%(95%CI 4.9-11.3) among the participants aged 80 years and above (Table 4).

Table 4: Prevalence of Blindness According to Age Group

Age Group	Male			Female			Total		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
50 – 59	4	0.5	0.0-0.9	8	0.6	0.2-1.0	12	0.5	0.2-0.9
60 – 69	13	1.6	0.6-2.5	14	1.4	0.6-2.2	27	1.5	0.8-2.1
70 – 79	12	2.0	0.8-3.3	36	5.9	4.1-7.8	48	4.0	2.8-5.2
80 above	15	8.1	3.7-12.5	13	8.1	3.7-12.5	28	8.1	4.9-11.3
Total	44	1.8	1.1-2.4	71	2.3	1.7-2.9	115	2.1	1.6-2.5

3.5 Age and Sex Adjusted Prevalence for All Causes of Blindness and Visual Impairment

The age- and sex-adjusted prevalence of blindness with available correction was 1.7% (95% CI 1.3-2.2). The age- and sex-adjusted prevalence of SVI, MVI, and EVI were 2.6% (95% CI 2.0-3.1), 11.2% (95% CI 9.8-12.7) and 11.4% (95% CI 10.2-12.7) respectively. The age- and sex-adjusted prevalence of FLV was 1.2% (95% CI 0.9-1.5). The number of women affected by blindness and vision impairment was found to be larger than number of men with no statistically significant difference (Table 5).

Based on the observed prevalence, an estimated 11444 people aged 50 and older (4764 men and 6680 women) were found to be bilaterally blind in Lumbini Province. A total of 177005 people aged 50 and older (83061 men and 93944 women) were estimated to have vision impairment including blindness. An estimated 7906 people aged 50 and older (3432 men and 4474 women) were found to have permanent low vision requiring low vision services (Table 5).

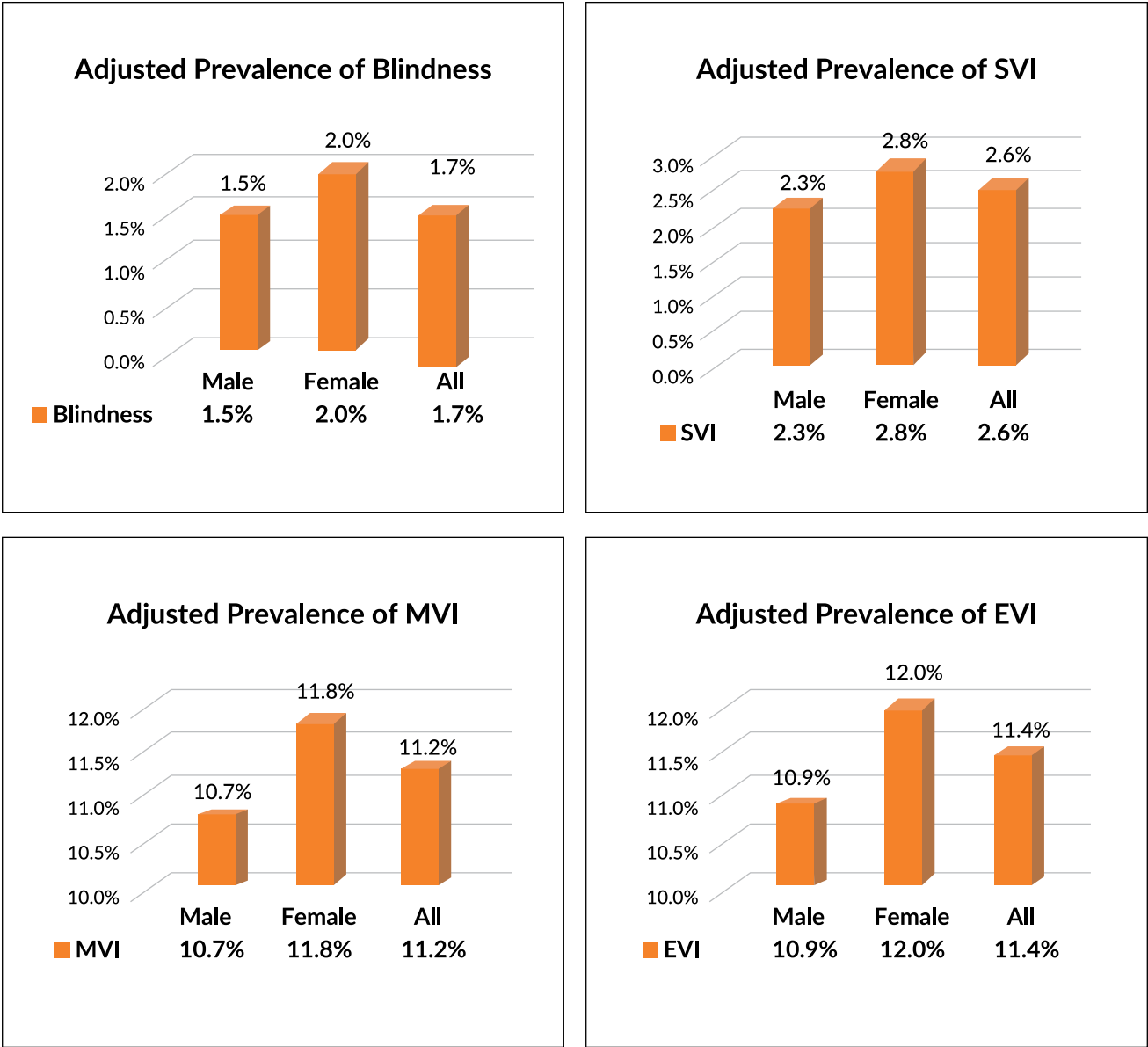
Similarly, total number of eyes affected with all causes of blindness was estimated to be 75068 in this province. A total of 469316 eyes were found to have vision impairment including blindness (Table 5).

Table 5: Age and Sex Adjusted Prevalence for All Causes of Blindness and VI

Age and Sex Adjusted Prevalence for All Causes of Blindness and VI - Persons									
PVA Category	Male			Female			All		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Blindness	4764	1.5	0.8-2.1	6680	2.0	1.5-2.6	11444	1.7	1.3-2.2
SVI	7600	2.3	1.5-3.1	9229	2.8	2.1-3.5	16829	2.6	2.0-3.1
MVI	34912	10.7	9.0-12.3	38768	11.8	10.1-13.5	73680	11.2	9.8-12.7
EVI	35789	10.9	9.4-12.5	39267	12.0	10.5-13.4	75056	11.4	10.2-12.7
FLV	3432	1.1	0.6-1.5	4474	1.4	0.9-1.8	7906	1.2	0.9-1.5

Age and Sex Adjusted Prevalence for All Causes of Blindness and VI – Eyes									
Blindness	34697	5.3	4.3-6.3	40371	6.1	5.3-7.0	75068	5.7	5.0-6.5
SVI	23450	3.6	2.8-4.4	26617	4.1	3.4-4.7	50067	3.8	3.2-4.4
MVI	88682	13.5	11.9-15.2	92510	14.1	12.5-15.6	181192	13.8	12.4-15.2
EVI	75633	11.6	10.3-12.9	87355	13.3	11.8-14.7	162988	12.4	11.3-13.6

Figure 2: Age and Sex Adjusted Prevalence for All Causes of Blindness and Visual Impairment



3.6 Causes of Blindness and VI in the Study Population

The main cause of bilateral blindness was untreated cataract (75.7%) followed by other posterior segment diseases (8.7%), non-trachomatous corneal opacity (4.3%), Phthisis (3.5%), all other globe/CNS abnormalities (2.6%), glaucoma (1.7%) and ARMD (1.7%). Cataract was the leading cause of SVI (87.0%) and MVI (68.2%).

Uncorrected refractive error was the leading cause of EVI (66.5%) (Table 6).

The proportion of blindness due to glaucoma was 1.7%. However, it should be noted that with glaucoma the central vision remains unaffected until very late in the disease process. It is 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 seven percent of all blindness in the study population was avoidable. Specifically, 75.7% of blindness was treatable, 8.7% was preventable with primary health care and/or primary eye care, and 2.6% was preventable through more advanced ophthalmic services. Posterior segment disease accounted for 13.9% of all bilateral blindness (Table 6).

The main intervention strategies to reduce avoidable blindness in Lumbini Province are shown in Figure 4. Cataract surgery should be the main priority, because blindness and vision impairment due to posterior segment diseases like glaucoma, diabetic retinopathy and ARMD might be prevented through regular control and timely intervention, targeted health education and the development of specialist ophthalmic services might contribute to reducing avoidable blindness and vision impairment further.

Low vision training and services are required for the remaining 13.9% of all blindness that is permanent and untreatable.

Table 6: Causes of Blindness and VI in Sample Population

Category	Blindness		SVI		MVI		EVI	
	n	%	n	%	n	%	n	%
By cause								
Cataract untreated	87	75.7	141	87.0	478	68.2	180	26.5
Other posterior segment disease	10	8.7	5	3.1	20	2.9	7	1.0
Non-trachomatous corneal opacity	5	4.3	2	1.2	11	1.6	10	1.5
Phthisis	4	3.5	1	0.6	2	0.3	1	0.1
All other globe/CNS abnormalities	3	2.6	0	0.0	1	0.1	1	0.1
ARMD	2	1.7	2	1.2	10	1.4	8	1.2
Glaucoma	2	1.7	5	3.1	5	0.7	2	0.3
Onchocerciasis	1	0.9	3	1.9	3	0.4	0	0.0
Diabetic retinopathy	1	0.9	1	0.6	6	0.9	1	0.1
Myopic Degeneration	0	0.0	0	0.0	6	0.9	3	0.4
Refractive error	0	0.0	2	1.2	135	19.3	452	66.5
Aphakia uncorrected	0	0.0	0	0.0	0	0.0	0	0.0
Cataract surgical complications	0	0.0	0	0.0	24	3.4	15	2.2
Total	115	100.0	162	100.0	701	100.0	680	100.0

Table 6 continued.....

By intervention category								
A. Treatable	87	75.7	143	88.3	613	87.5	632	92.9
B. Preventable (PHC/PEC services)	10	8.7	6	3.7	22	3.1	14	2.1
C. Preventable (Ophthalmic services)	3	2.6	6	3.7	35	5.0	18	2.7
D. Avoidable (A+B+C)	100	87.0	155	95.7	670	95.6	664	97.7
E. Posterior segment causes	16	13.9	16	9.9	44	6.3	18	2.7

Figure 3: Causes of Blindness

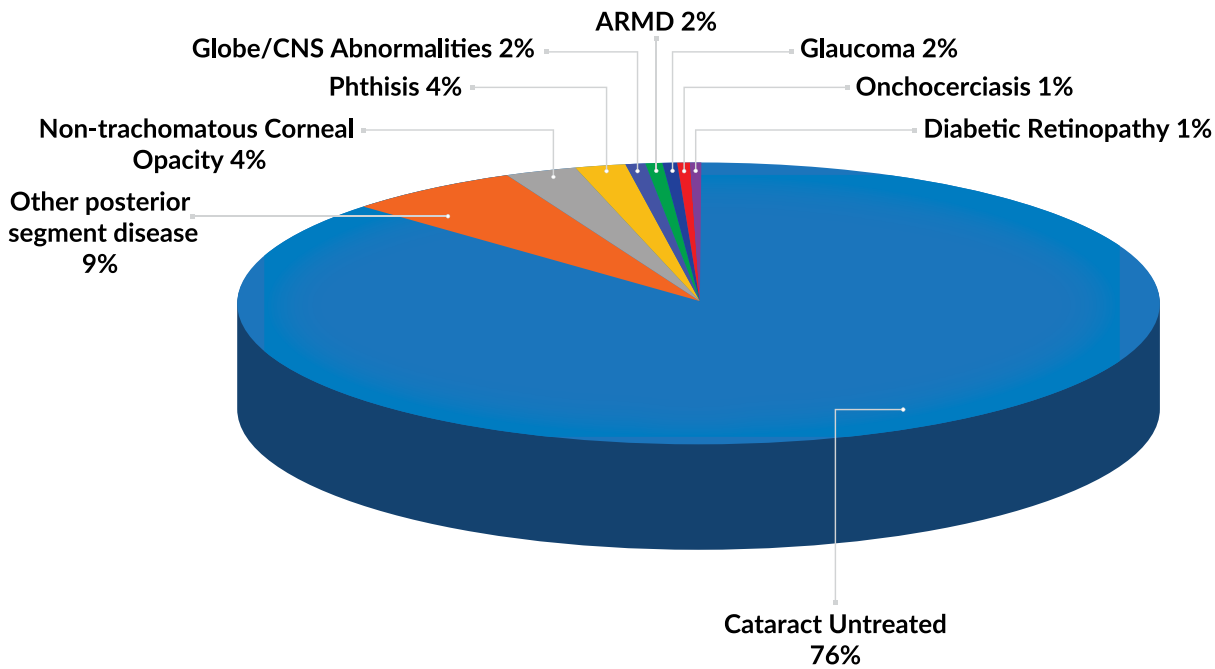
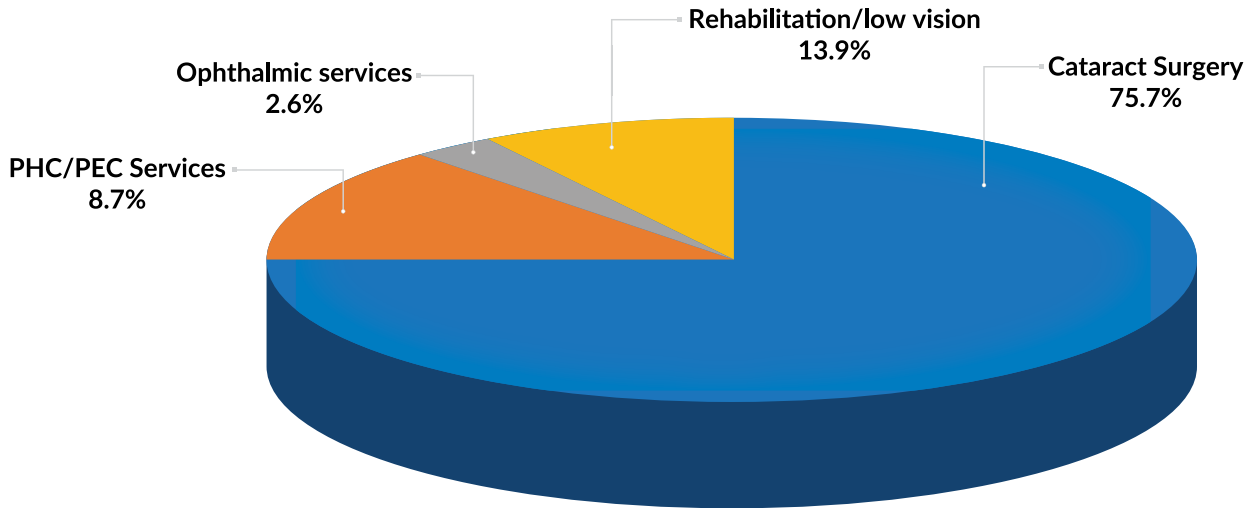


Figure 4: Actions required to reduce blindness



3.7 Crude Prevalence of Blindness and Visual Impairment due to Cataract

The crude prevalence of blindness due to bilateral cataract among people aged 50 years and older was 1.2% (95% CI 0.9-1.6). The crude prevalence of eyes that are blind from cataract was 3.9% (95% CI 3.3-4.6) (Table 7).

The crude prevalence of SVI due to bilateral cataract was 2.7% (95% CI 2.1-3.2). The crude prevalence of eyes affected by SVI due to cataract was 6.2% (95% CI 5.3-7.1) (Table 7).

The crude prevalence of MVI due to bilateral cataract was 8.9% (95% CI 7.7-10.1). The crude prevalence of eyes that are affected by MVI due to cataract was 14.2% (95% CI 12.8-15.7) (Table 7).

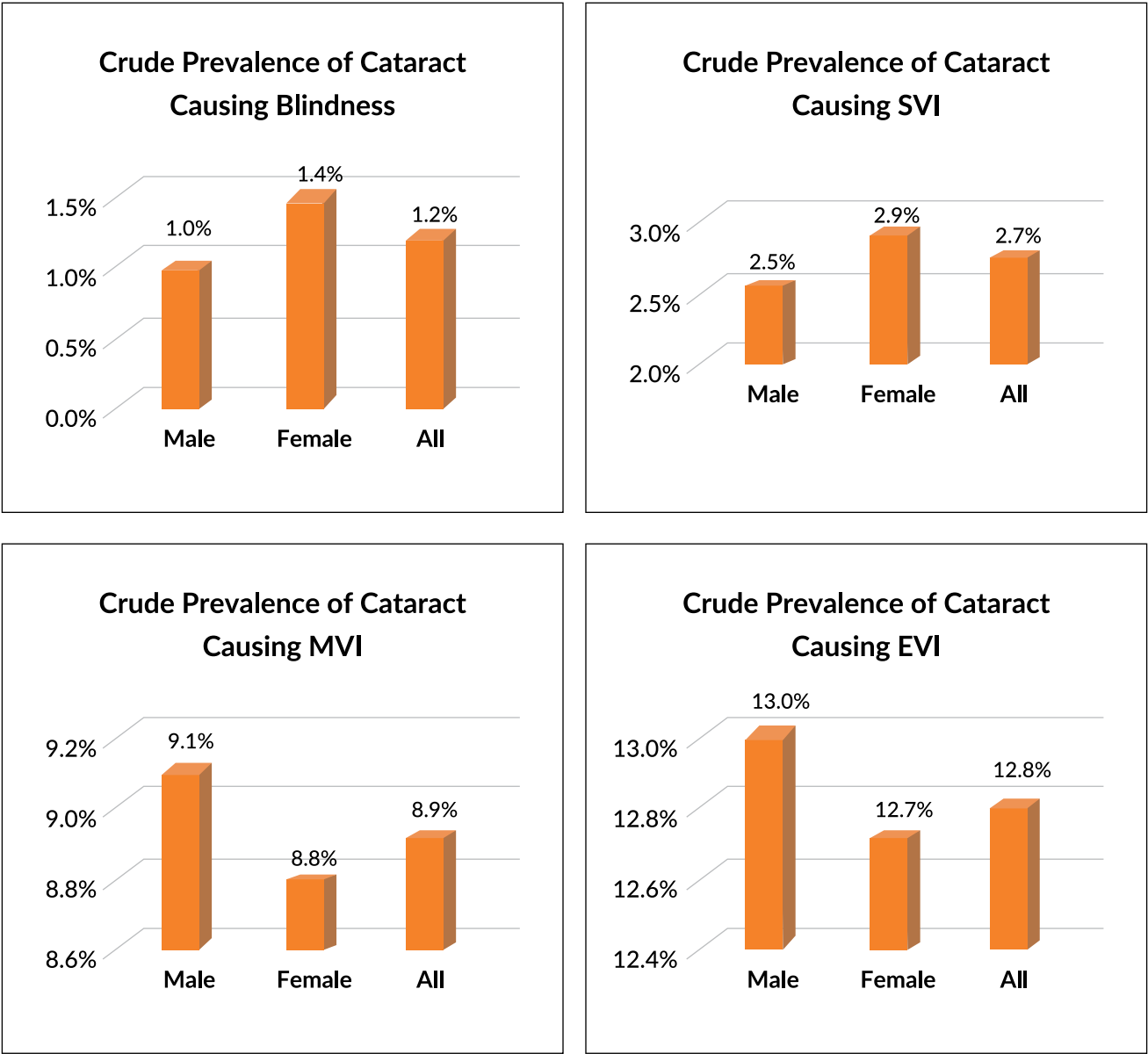
The crude prevalence of EVI due to bilateral cataract was 12.8% (95% CI 11.4-14.2). The crude prevalence of eyes that are affected by EVI due to cataract was 18.3% (95% CI 16.9-19.9) (Table 7).

Although not significantly different, the survey suggests that the prevalence of bilateral blindness due to cataract is greater among women than men.

Table 7: Crude Prevalence of Blindness and Visual Impairment due to Cataract

	Male			Female			Total		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Cataract causing blindness									
Bilateral cataract	26	1.0	0.6-1.5	43	1.4	0.9-1.9	69	1.2	0.9-1.6
Unilateral cataract	136	5.4	4.3-6.6	165	5.4	4.5-6.3	301	5.4	4.5-6.2
Cataract eyes	188	3.8	2.9-4.6	251	4.1	3.4-4.8	439	3.9	3.3-4.6
Cataract causing SVI									
Bilateral cataract	62	2.5	1.8-3.2	88	2.9	2.1-3.6	150	2.7	2.1-3.2
Unilateral cataract	173	6.9	6.5-9.2	214	6.9	6.7-9.3	387	6.9	6.8-9.0
Cataract eyes	297	5.9	4.8-7.1	390	6.3	5.3-7.3	687	6.2	5.3-7.1
Cataract causing MVI									
Bilateral cataract	227	9.1	7.6-10.5	271	8.8	7.4-10.1	498	8.9	7.7-10.1
Unilateral cataract	261	10.4	8.9-11.9	331	10.7	9.5-12.0	592	10.6	9.5-11.7
Cataract eyes	715	14.3	12.5-16.1	873	14.2	12.6-15.7	1588	14.2	12.8-15.7
Cataract causing EVI									
Bilateral cataract	324	13.0	11.2-14.7	390	12.7	11.1-14.2	714	12.8	11.4-14.2
Unilateral cataract	279	11.2	9.8-12.6	339	11.0	9.9-12.1	618	11.1	10.1-12.0
Cataract eyes	927	18.5	16.6-20.0	1119	18.2	16.5-19.8	2046	18.3	16.8-19.9

Figure 5: Crude prevalence of cataract causing blindness and VI



3.8 Age and Sex Adjusted Prevalence of Cataract Causing Blindness and VI

The age- and sex-adjusted prevalence of blindness due to bilateral cataract among people aged 50 years and older was 1.1% (95% CI: 0.7-1.4). We therefore estimated that that 6,935 people aged 50 years and older are blind due to cataract in Lumbini Province. This includes 2,966 men and 3,969 women. Although not significantly different, the survey suggests that the prevalence of bilateral blindness due to cataract is greater among women than men. The age- and sex-adjusted prevalence of eyes that are blind from cataract was 3.4% (95% CI 2.8-4.1) with an estimated 45,216 eyes blind due to cataract among people aged 50 years and older in Lumbini Province of Nepal (Table 8).

The age- and sex-adjusted prevalence of SVI due to bilateral cataract was 1.3% also (95% CI 0.9-1.7) corresponding to an estimated 8,475 people aged 50 years and older in Lumbini Province. The age and sex adjusted prevalence

of eyes affected by SVI due to cataract was 2.0% (95% CI 1.6-2.4) corresponding to an estimated 26,340 affected eyes in the province (Table 8).

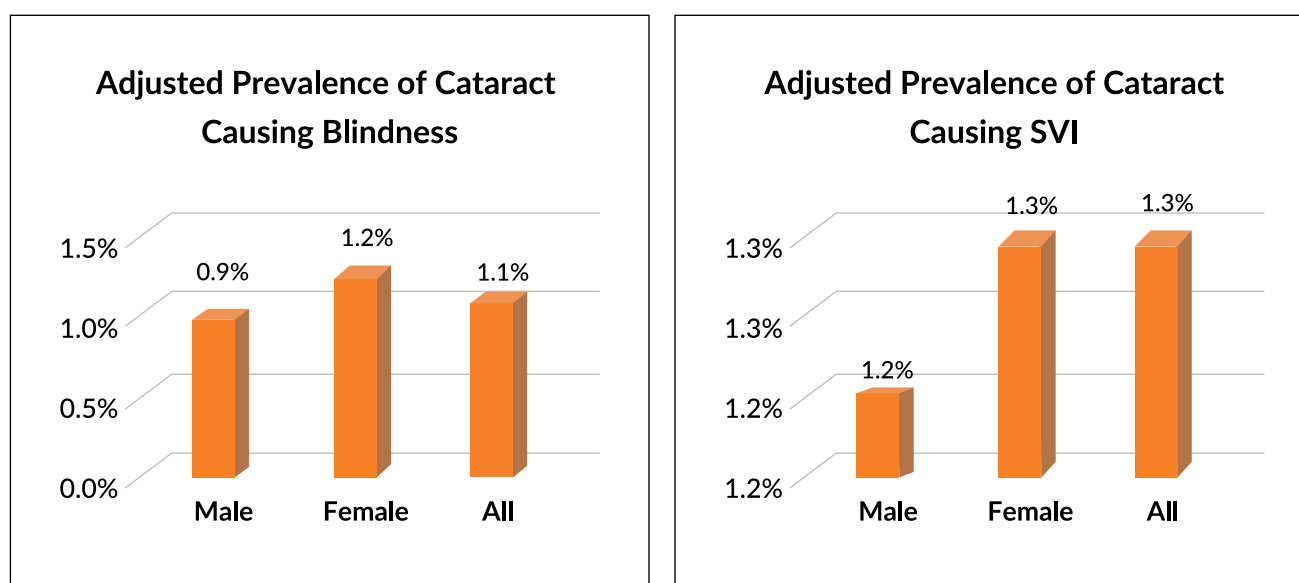
The age- and sex-adjusted prevalence of MVI due to bilateral cataract was 5.5% (95% CI 4.6-6.4) corresponding to an estimated 36,057 people aged 50 years and older in Lumbini Province. We also estimated that 94,027 eyes (prevalence 7.2%) are affected by MVI due to cataract (Table 8).

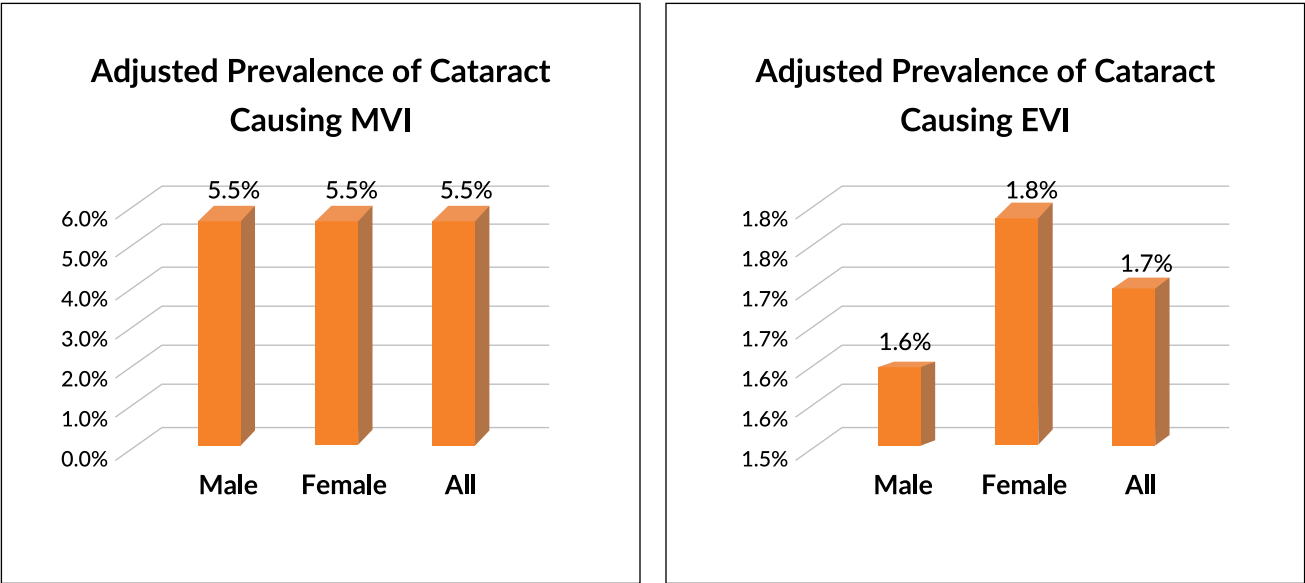
The age- and sex-adjusted prevalence of EVI due to bilateral cataract was 1.7% (95% CI 1.1-2.3) corresponding to an estimated 22,353 people aged 50 years and older in Lumbini Province. We also estimated that 47,961 eyes (prevalence 3.7%) are affected by MVI due to cataract (Table 8).

Table 8: Age and Sex Adjusted Prevalence of Cataract Causing Blindness and VI

Cataract Causing Bilateral Blindness and VI in persons									
Category	Male			Female			All		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Blindness	2966	0.9	0.5-1.4	3969	1.2	0.7-1.7	6935	1.1	0.7-1.4
SVI	4084	1.2	0.8-1.7	4391	1.3	0.9-1.8	8475	1.3	0.9-1.7
MVI	17861	5.5	4.3-6.6	18196	5.5	4.5-6.6	36057	5.5	4.6-6.4
EVI	10725	1.6	0.7-2.5	11628	1.8	1.0-2.5	22353	1.7	1.1-2.3
Cataract Causing Blindness and VI in eyes									
Blindness	21192	3.2	2.4-4.1	24024	3.7	2.9-4.4	45216	3.4	2.8-4.1
SVI	12460	1.9	1.4-2.4	13880	2.1	1.6-2.6	26340	2.0	1.6-2.4
MVI	46001	7.0	5.8-8.3	48026	7.3	6.3-8.3	94027	7.2	6.2-8.1
EVI	23635	3.6	2.8-4.4	24326	3.7	3.1-4.4	47961	3.7	3.1-4.2

Figure 6: Age and Sex Adjusted Prevalence of Cataract Causing Blindness and VI





3.9 Cataract Surgical Coverage

The cataract surgical coverage (CSC) in persons indicates which proportion of people with cataract at a predefined VA have been operated in one or both eyes. This indicator measures the coverage of cataract surgical services.

At 88.4%, the age- and sex-adjusted CSC among people who are blind (PVA<3/60) is higher than the target of at least 85% recommended by the International Agency for the Prevention of Blindness (IAPB). The age- and sex-adjusted CSC was higher in men (90.2%) compared with women (87.0%) (Table 9).

The age- and sex-adjusted CSC among people at a VA of <6/60 and <6/18 are 78.9% and 56.9%, respectively. This suggests that fewer people who have cataract receive surgery if they are not blind (Table 9).

The age- and sex-adjusted CSC for eyes with cataract (as opposed to individuals with cataract) at a VA of <3/60 indicates the coverage of the total workload of operable cataract. This is 74.4%, with slightly higher coverage in men (75.2%) than in women (73.7%) (Table 9).

The effective CSC (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 73.4%. The eCSC among people with a VA of <6/60 and <6/18 are 65.2% and 45.8%, respectively (Table 9).

Table 9: Cataract Surgical Coverage

Vision Category	Male	Female	Total
Cataract Surgical Coverage (Persons) – percentages			
VA <3/60	90.2	87.0	88.4
VA <6/60	80.5	77.7	88.4
VA <6/18	57.1	56.8	56.9
Cataract Surgical Coverage (Eyes) – percentages			
VA <3/60	75.2	73.7	74.4
VA <6/60	65.8	64.4	65.0
VA <6/18	44.4	44.7	44.6
Effective Cataract Surgical Coverage (persons)- percentages			
VA <3/60	77.4	70.1	73.4
VA <6/60	68.2	62.7	65.2
VA <6/18	47.3	44.5	45.8

3.10 Visual Outcome of Cataract Surgery

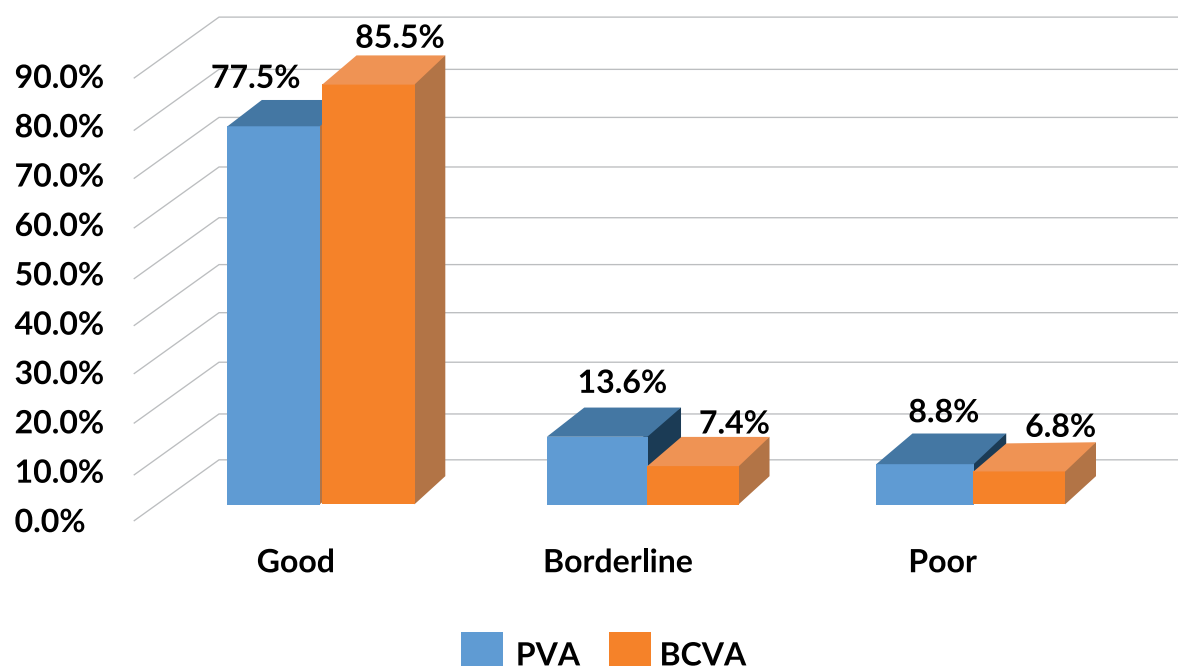
In this survey 1,277 eyes had cataract surgery, 1,260 (98.7%) eyes had an intraocular lens (IOL) implanted and 17(1.3%) eyes did not have an IOL. Overall good visual outcome by WHO definition was seen in 77.5% (PVA $\geq 6/18$) and 85.8% (BCVA $\geq 6/18$) of the cataract operated eyes. Overall poor outcome was seen in 8.8% (PVA <6/60) and 6.8% (BCVA <6/60) after cataract surgery. The difference between PVA and BCVA can be minimized by adequate biometry, good surgical technique, individually adjusted IOLs, and optical correction after cataract surgery (Table 10 and Figure 7).

Table 10: Visual Outcome of Cataract Surgery in the Study Population

Visual outcome	VA Type	Non-IOL		IOL		Total	
		n	%	n	%	n	%
Very good $\geq 6/12$	PVA	7	41.2	776	61.6	783	61.3
	BCVA	7	41.2	1004	79.7	1011	79.2
Good: $\geq 6/18$	PVA	0	0.0	207	16.4	207	16.2
	BCVA	1	5.9	83	6.6	84	6.6
Borderline: <6/18 - 6/60	PVA	3	17.6	171	13.6	174	13.6
	BCVA	3	17.6	92	7.3	95	7.4
Poor: < 6/60	PVA	7	41.2	106	8.4	113	8.8
	BCVA	6	35.3	81	6.4	87	6.8

* PVA = Presenting visual acuity, *BCVA = Best Corrected Visual Acuity

Figure 7: Visual outcome of cataract surgery



3.11 Visual Outcome of Cataract Surgery According to Postoperative period

As expected, the proportion of very good or good outcome is highest among those who are up three years postop (80.7%) and lowest among those who are seven years or more postop (72.7%) (Table 11).

Table 11: Visual Outcome of Cataract Surgery According to Postoperative period

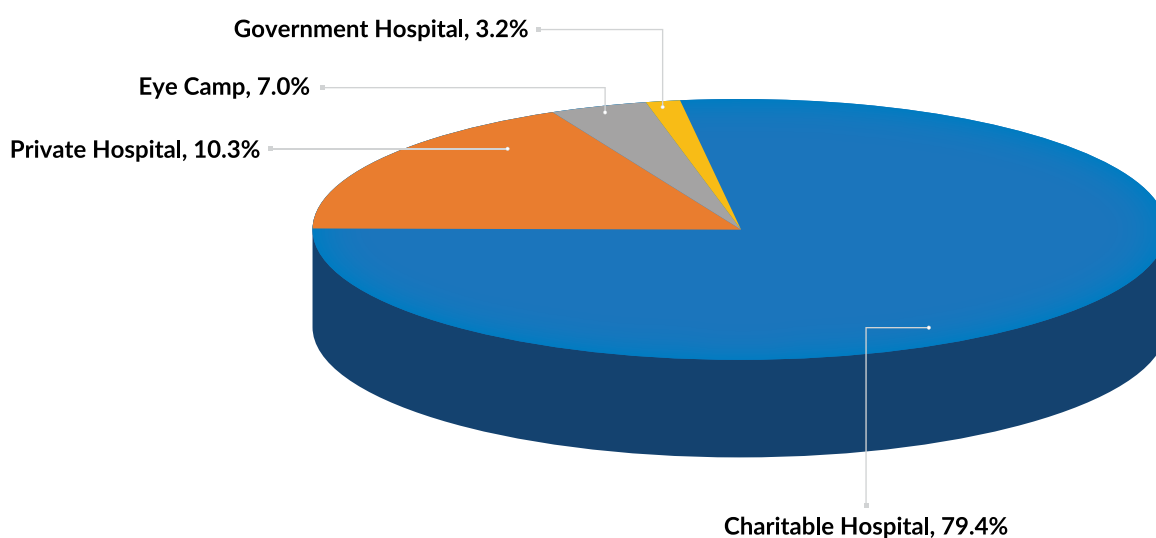
Visual Outcome in Cataract Operated Eyes by years after surgery (n=1277)								
Category PVA	0-3 years		4-6 years		7+ years		Total	
	n	%	n	%	n	%	n	%
Very Good $\geq 6/12$	409	66.3	192	57.5	182	55.8	783	61.3
Good : $\geq 6/18$	89	14.4	63	18.9	55	16.9	207	16.2
Borderline : $< 6/18 - 6/60$	76	12.3	48	14.4	50	15.3	174	13.6
Poor : $< 6/60$	43	7.0	31	9.3	39	12.0	113	8.8
Total	617	100.0	334	100.0	326	100.0	1277	100.0

3.12 Visual Outcome of Cataract Surgery According to Place of Surgery

Most patients were operated upon in charitable eye hospitals (79.4%), whilst others received surgery in private eye hospitals (10.3%), eye camps (7.0%) and government hospitals (3.2%) (Table 12).

Table 12: Proportion of Cataract Surgeries Performed According to Places

Places of Surgery	Male		Female		Total	
	n	%	n	%	n	%
Government Hospital	23	4.0	18	2.5	41	3.2
Voluntary/Charitable Hospital	448	78.5	566	80.2	1014	79.4
Private Hospital	62	10.9	70	9.9	132	10.3
Eye Camp	38	6.7	52	7.4	90	7.0
Total	571	100.0	706	100.0	1277	100.0

Figure 8: Proportion of Cataract Surgeries Performed According to Places

The proportion of surgeries with a very good or good outcome was highest in eye camps (78.9%) followed by charitable hospitals (77.5%), private hospitals (75.0%) and government hospitals (58.5%) respectively (Table 13).

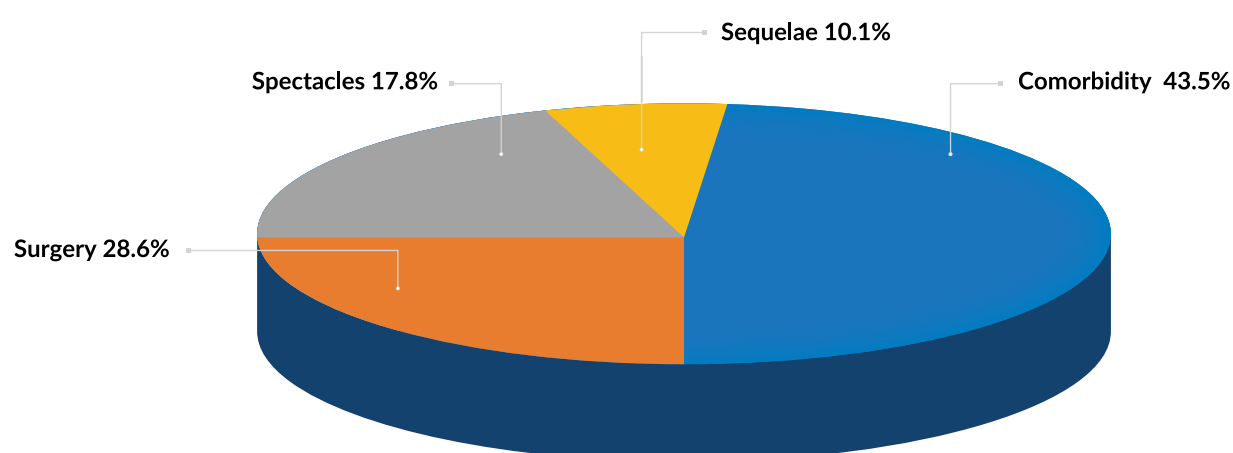
Table 13: Post-Operative Visual Outcome According to Place of Surgery

Visual Outcome (PVA)	Government Hospital		Charitable Hospital		Private Hos-pital		Eye Camps		Total	
	n	%	n	%	n	%	n	%	n	%
Very good: $\geq 6/12$	18	43.9	629	62.0	76	57.6	60	66.7	783	61.3
Good: $\geq 6/18$	6	14.6	167	16.5	23	17.4	11	12.2	207	16.2
Borderline: $< 6/18-6/60$	11	26.8	129	12.7	25	18.9	9	10.0	174	13.6
Poor: $< 6/60$	6	14.6	89	8.8	8	6.1	10	11.1	113	8.8
Total	41	100.0	1014	100.0	132	100.0	90	100.0	1277	100.0

The main causes of poor visual outcomes following cataract surgery were ocular co-morbidities (43.5%) and immediate surgical complications (28.6%). The other causes were absence of or inadequate optical corrections (17.8%) and long-term surgical complications (10.1%) (Table 14).

Table 14: Causes of Poor Outcome among Cataract Operated Eyes

Causes	Borderline Outcome		Poor Outcome		Total	
	n	%	n	%	n	%
Comorbidity	45	25.8	80	70.8	125	43.5
Surgery	64	36.8	18	16.0	82	28.6
Spectacles	47	27.0	4	3.5	51	17.8
Sequelae	18	10.4	11	9.7	29	10.1
Total	174	100.0	113	100.0	287	100.0

Figure 9: Causes of poor outcome among cataract operated eyes


3.13 Barriers to Uptake Cataract Surgical Services

Among the people having bilateral cataract with BCVA <6/60, the most prominent barriers to uptake cataract surgery services were lack of felt need (41.0%), Cost (35.9%), Inaccessibility (19.7%) and Fear of surgery (2.6%) (Table 15).

Table 15: Barriers to Uptake Cataract Surgical Services

Barriers	Men		Women		Total	
	n	%	n	%	n	%
Need not felt	43	43.9	53	39.0	96	41.0
Cost	33	33.7	51	37.5	84	35.9
Cannot access treatment	19	19.4	27	19.9	46	19.7
Fear	2	2.0	4	2.9	6	2.6
Unaware treatment is possible	1	1.0	1	0.7	2	0.9

3.14 Refractive Error in People Aged 50 Years and Older

The prevalence of refractive error was 21.8% and 10.6% of people aged 50 years and older who had a refractive error did not have glasses. On the other hand, 82.6% of the study population did not wear glasses for near. The prevalence of refractive error (corrected and uncorrected) was almost similar between men and women (Table 16).

Table 16: Prevalence of Uncorrected Refractive Error and Uncorrected Presbyopia

Types	Male		Female		Total	
	n	%	n	%	n	%
Total Refractive Error	576	23.0	640	20.8	1216	21.8
Uncorrected Refractive Error	252	10.1	337	10.9	589	10.6
Total Presbyopia	2500	100.0	3082	100.0	5582	100.0
Uncorrected Presbyopia	1936	77.4	2660	86.3	4596	82.3

3.15 Functional Low Vision Requiring Low Vision Services

The age- and sex-adjusted prevalence of FLV requiring low vision services in people aged 50 years and older in Lumbini Province was 1.2% (95% CI 0.9-1.5). Out of the estimated 101,952 people aged 50 and older with PVA <6/18, 7.5% (7,906) require low vision services or training. The most common cause of FLV was other posterior segment disease (34.7%) followed by non-trachomatous corneal opacity (13.3%), ARMD (9.3%), glaucoma (9.3%) and diabetic retinopathy (9.3%) (Table 17).

Table 17: Prevalence of Functional Low Vision

Crude Prevalence of FLV (n=5,582)						
Age Group	Male		Female		Total	
	n	%	n	%	n	%
50 – 59	5	0.6	13	1.0	18	0.8
60 – 69	7	0.8	10	1.0	17	0.9
70 – 79	8	1.4	12	2.0	20	1.7
80+	11	6.0	9	5.6	20	5.8
Total	31	1.2	44	1.4	75	1.3
Age and Sex Adjusted Prevalence of FLV in the Province (n=6,55,927)						
Aged 50 and older	3,432	1.1	4,474	1.4	7,906	1.2

3.16 Diabetes and Diabetic Retinopathy

Out of total 5,582 survey participants aged 50 years and older, 3.3% (185) had diabetes in this province (Table 18).

Table 18: Prevalence of Diabetes among the Study Participants

Age Group	Male		Female		Total	
	n	%	n	%	n	%
50 – 59	28	3.2	48	3.6	76	3.4
60 – 69	24	2.9	35	3.6	59	3.3
70 – 79	22	3.8	20	3.3	42	3.5
80+	5	2.7	3	1.9	8	2.3
Total	79	3.2	106	3.5	185	3.3

Among the people with diabetes, 10.8% had any degree of retinopathy and 6.5% had any grade of maculopathy. In total 13.5% of people with diabetes had any grade of retinopathy and or maculopathy. Prevalence of sight threatening retinopathy and /or maculopathy was found to be 2.7% among the people with diabetes (Table 19).

Table 19: Prevalence of Diabetic Retinopathy

Retinopathy Grade	n	Among the Diabetic	
		%	(95% CI)
No retinopathy(R0)	165	89.2	84.8-93.5
Background DR- Mild(R1)	6	3.2	0.8-5.7
Background DR- Observable (R2)	6	3.2	0.8-5.7
Background DR –Referable (R3)	7	3.8	1.1-6.5
Proliferative DR (R4)	1	0.5	0.0-1.6
Ungradable DR (R6)	0	0.0	0.0-0.0
Any Retinopathy	20	10.8	6.5-15.2
Maculopathy Grade			
No maculopathy(M0)	173	93.5	89.9-97.2
Maculopathy-observable (M1)	7	3.8	1.1-6.5
Maculopathy – referable(M2)	5	2.7	0.4-5.0
Ungradable Maculopathy (M6)	0	0.0	0.0-0.0
Any Maculopathy	12	6.5	2.8-10.1
Any retinopathy and/or Maculopathy	25	13.5	8.6-18.4
Sight threatening DR (R4 and/or M2)	5	2.7	0.4-5.0
Any laser scars	1	0.5	0.0-1.6

Conclusion and Recommendation

Blindness and vision impairment from all causes still remains as a major public health problem among the people aged 50 years and above in Lumbini Province, of Nepal. There remains a significant workload of avoidable blindness and vision impairment to be addressed by the eye health system. The visual outcome of cataract surgery below the WHO standards despite more than eighty five percent service coverage suggests further improvement in quality of surgical services. Huge backlog of vision impairing cataract can further be explained by the perceived barriers of lack of felt need, Cost and Inaccessibility preventing the uptake of cataract surgical services among the people 50 years and older. Along with cataract as the leading causes of blindness, SVI and MVI, posterior segment diseases, uncorrected refractive error, diabetic retinopathy and functional low vision are major issues to be resolved by the eye care system in this province.

To conclude, this survey provides evidence of public health significance regarding the magnitude of blindness and visual impairment, its causes and performance evaluation of ongoing eye care programs in the province. The information from this survey will help the concerned decision makers to formulate appropriate strategies to combat this needless burden of avoidable blindness and visual impairment.

To recommend, the findings from this survey make sensitization to the concerned authorities to scale up eye care services to those whose eye health needs are often not met yet as a goal to achieve Universal Eye Health Coverage.

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