

PREVALENCE AND CAUSES OF BLINDNESS AND VISUAL IMPAIRMENT IN SUDUR PASCHIM PROVINCE OF NEPAL

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ABSTRACT

The prevalence of blindness and visual impairment has not been assessed in Sudur Paschim Province since 2012, which is a very important tool to develop a strategic plan for eye health care. This study aims to determine the prevalence and causes of blindness and visual impairment among adults aged 50 years and older population in the Sudur Paschim Province of Nepal. This is a cross-sectional study using a random multistage cluster sampling procedure. The survey examined 4,573 out of 4,615 subjects enumerated, with a response rate of 99.1%. Among the examined, 2,214 (48.4%) were between 50-59 years old. The age and sex adjusted prevalence of blindness was 0.6% (95.0% CI 0.3–0.87). The age and sex adjusted prevalence of severe visual impairment, moderate visual impairment, and early visual impairment were 1.0% (95.0% CI 0.6–1.3), 5.3% (95.0% CI 4.5–6.2), and 7.0% (95.0% CI 6.0–8.0) respectively. The main causes of bilateral blindness were untreated cataract (36.4%), non-trachomatous corneal opacity (24.2%), glaucoma (21.2%), globe or central nervous system abnormalities (9.1%), age related macular degeneration (6.1%), and other posterior segment diseases (3.0%). The prevalence of blindness was reduced in the province in comparison to the previous survey. Cataract remains the major cause of blindness, severe visual impairment, and moderate visual impairment, followed by corneal opacity and glaucoma. The study suggests more attention to be given for cataract, corneal blindness, and glaucoma in future interventions to eliminate blindness.

KEYWORDS

Prevalence, blindness, visual impairment, cataract, Sudur Paschim Province, Nepal

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INTRODUCTION

Visual impairment (VI) is an important health problem in both developed and developing countries. It was estimated that 43.3 million people were blind globally, and 295 million had moderate or severe visual impairment. About 65% of the visually impaired and 82% of the blinds were of 50 years of age or older.¹⁻³ The prevalence of blindness in Nepal was 0.84% in 1981 and 0.35% in 2012, whereas the prevalence of blindness in Sudur Paschim Province was higher than the national average, 1.02% in 1981 and 0.41% in 2012.^{4,5}

Cataract is the most common cause of blindness in middle- and low-income countries,⁶⁻¹² while retinal disorders are the most common cause of blindness in high-income countries.¹³⁻¹⁹ The leading cause of blindness in Nepal was cataract (62.2%), and in Sudur Paschim Province also cataract (62.5%) was the leading cause of blindness, followed by posterior segment disease and glaucoma.⁵ Cataract was also the most common cause of blindness, followed by trachoma related blindness, according to the Nepal Blindness Survey conducted in 1981. A subsequent Rapid Assessment of Avoidable Blindness (RAAB) survey completed in 2012 determined cataract and posterior segment diseases as the leading cause of blindness. A community based approach had been implemented to combat cataract and trachoma at the national and regional levels for a long period. Some other eye diseases related to systemic conditions like diabetes, age, and occupational hazards have not been equally prioritized. Hence, there is a strong case to expect some shifts in the common causes of blindness and visual impairment in the region since the last survey was done about a decade ago.

As the prevalence of blindness and visual impairment has not been assessed in Sudur Paschim province since 2012, we planned this study to determine the prevalence of blindness and visual impairment among 50 years of age and older populations in this province in the recent scenario. This data will provide a measurement of the impact of eye care services in Sudur Paschim Province in terms of changes in the prevalence of blindness, and visual impairment. This will also help the government and stakeholders to develop focused strategies to combat specific causes of blindness as identified in the study.

MATERIALS AND METHODS

The study was conducted after ethical approval from the Nepal Health Research Council (Ref No. 22 dated July 19, 2020). Verbal consents were taken from all subjects prior to the study after explaining the procedure of the examination, and subjects were requested for their volunteer participation in the study. This is a cross-sectional population based survey using RAAB survey methodology. In the RAAB methodology, the 50 years and older population is considered because of the highest prevalence of blindness in this age group. RAAB was first developed by Hans Limburg in 1997 as a rapid assessment of cataract surgical services and later developed as RAAB in 2004. Recently, it has been updated to mRAAB where data collection is done on mobile phones. It makes the survey cost-effective and rapid.²⁰ The sample size was calculated for this study using the RAAB+DR V.6 software using the following indicators: population 50 years and older: 250,982 inhabitants as per the Nepal census 2011,²¹ the assumed prevalence of blindness among this group as 2.9% with 20.0% tolerable error, a 1.4 cluster design effect for a cluster of 35 people, 95.0% confidence intervals, and a 10.0% non-response rate. The total required sample size was estimated to be 4,619, divided into 132 clusters, each consisting of 35 adults aged 50 years and older.

In this survey, we used a multistage cluster sampling methodology. According to 2011 census data, approximately 15.0% of the population was of 50 years or older. Hence, we created a population unit of approximately 250 people to meet the 35 study participants in each cluster. In the previous political division of Nepal, the village development committee ward was the smallest population unit, close to our desired cluster size. Therefore, all 3517 wards in the survey area were listed, which served as the sampling frame for this study. In the first stage, 132 population units were randomly selected as study clusters from the sampling frame.

In the second stage, 35 eligible people in each cluster were randomly selected via compact segment sampling. The enumeration area was divided into segments of approximately equal population size with well-demarcated boundaries (using the map) so that each segment included the desired cluster size of 35 people aged 50 or older, and one segment was randomly selected. In the selected study cluster, all eligible households were enrolled with door-to-door enumeration until the desired number

of people aged 50 and older were identified. If there were fewer than the required number of people aged 50 or older in the segment, an adjacent segment was randomly selected, and enrolment with data collection continued until a total of 35 survey participants were enrolled.

RAAB methodology training was provided to all survey team members for five days by a certified trainer including three days training in the field. An ophthalmologist led team comprised of one ophthalmic assistant and one eye worker went to selected study clusters and examined the sample population. Verbal consent of the participants was taken after explaining about the survey and procedure in their own languages. An ophthalmic assistant measured the visual acuity at a distance of 6 meters using tumbling-E optotypes (Precision Vision, Villa Park, Illinois) with and without pinhole. People wearing glasses were tested with them, and their visual acuity was considered as presenting visual acuity. Anterior segment eye examination was carried out with torch light and a portable slit lamp. The fundus examination was done using a direct ophthalmoscope. Data collection was carried out on tablets installed with mRAAB 7 software. If any people with ocular morbidity

RESULTS

A total of 4,615 people aged 50 years or older were enrolled. Out of them, 4,573 (99.1%) underwent eye examinations and data collection. Only 42 (0.9%) people either did not allow eye examination or were not present at the time of examination. Out of 4,573 examined people, males were 1995 (43.6%) and females were 2,578 (56.4%) (Table 1). Among the examined, 2,214 (48.4%) were between the age of 50-59 years, 1,233 (27.0%) were between the age of 60-69 years, 842 (18.4%) were between the age of 70-79 years and 284 (6.2%) were 80 years of age or older. These age groups that participated in the study were adjusted with census data from the same age group and presented as age and sex adjusted results.

The age and sex adjusted prevalence of blindness was 0.6%. The age and sex adjusted prevalence of severe visual impairment (SVI), moderate visual impairment (MVI) and early visual impairment (EVI) were 1.0%, 5.3% and 7.0% respectively (Table 2). The numbers on the table show estimates for the total population aged over 50 in Sudur Paschim province, obtained by extrapolating the prevalence. In the previous 2012 RAAB survey, the prevalence of

Box 1: Definitions as per the WHO World Report on Vision

Terms	Definitions
Blindness	Presenting visual acuity (PVA) of less than 3/60 in the better eye
Severe visual impairment (SVI)	PVA of less than 6/60 to 3/60 in the better eye
Moderate visual impairment (MVI)	PVA of less than 6/18 to 6/60 in the better eye
Early visual impairment (EVI)	PVA of less than 6/12 to 6/18 in the better eye

requiring further examination, investigation, or treatment were sent to Geta Eye Hospital or its nearest eye center for further management. Data were analyzed by the mRAAB 7 software, and reports were generated through the same software.

Table 1: Total participants in the study

	Enrolled	Examined	Response rate%
Male	2007	1995	99.4%
Female	2608	2578	98.8%
Total	4615	4573	99.1%

Table 2: Age and sex adjusted prevalence of blindness, severe visual impairment, moderate visual impairment, and early visual impairment by bilateral presenting visual acuity

	Male		Female		All	
	n	% (95%CI)	n	% (95%CI)	n	% (95%CI)
Blindness PVA <3/60	639	0.5 (0.2-0.9)	857	0.7 (0.4-1.0)	1496	0.6 (0.4-0.8)
SVI PVA (<6/60-3/60)	1,298	1.0 (0.5-1.5)	1084	0.9 (0.5-1.3)	2382	1.0 (0.6-1.3)
MVI PVA(<6/18-6/60)	6,224	4.9 (3.9-6.0)	7183	5.7 (4.5-7.0)	13407	5.3 (4.5-6.2)
EVI PVA(<6/12-6/18)	8,967	7.1 (5.8-8.4)	8620	6.9 (5.7-8.1)	17602	7.0 (6.0-8.0)

Table 3: Crude prevalence of blindness (PVA<3/60) by age group

	Male		Female		Total	
	n	% (95%CI)	n	% (95%CI)	n	% (95%CI)
50-59 years	2	0.2 (0.0-0.5)	6	0.5 (0.1-0.8)	8	0.4 (0.1-0.6)
60-69 years	0	0.0 (0.0-0.0)	4	0.6 (0.0-1.2)	4	0.3 (0.0-0.6)
70-79 years	7	1.9 (0.5-3.2)	6	1.3 (0.3-2.3)	13	1.5 (0.7-2.4)
80+ years	5	3.6 (0.5-6.7)	3	2.1 (0.0-4.3)	8	2.8 (1.0-4.6)
All 50+ years	14	0.7 (0.4-1.1)	19	0.7 (0.4-1.0)	33	0.7 (0.5-1.0)

Table 4: Causes of blindness, severe visual impairment, moderate visual impairment, and early visual impairment

	Blindness (PVA<3/60)		SVI (PVA <6/60-3/60)		MVI (PVA <6/18-6/60)		EVI (PVA <6/18-6/12)	
	n	%	n	%	n	%	n	%
	Cataract untreated	12	36.4%	42	85.7%	150	55.1%	55
Non trachomatous corneal opacity	8	24.2%	0	0.0%	6	2.2%	6	1.8%
Glaucoma	7	21.2%	1	2.0%	2	0.7%	4	1.2%
All other globe/ CNS abnormalities	3	9.1%	0	0.0%	0	0.0%	0	0.0%
Age related macular degeneration	2	6.1%	2	4.1%	12	4.4%	2	0.6%
Other posterior segment disease	1	3.0%	1	2.0%	1	0.4%	3	0.9%
Refractive error	0	0.0%	1	2.0%	87	32%	256	76.2%
Cataract surgical complication	0	0.0%	1	2.0%	11	4.0%	8	2.4%
Aphakia uncorrected	0	0.0%	1	2.0%	2	0.7%	1	0.3%
Trachomatous corneal opacity	0	0.0%	0	0.0%	1	0.4%	1	0.3%

blindness (presenting visual acuity <3/60) was 2.7% among 50 years and older population.⁵

The prevalence of blindness was higher in the elderly population, with the highest prevalence among the age group 80+ years (2.8%, 95% CI 1.0-4.6), followed by the age group 70-79 years (1.5%, 95% CI 0.7-2.4) (Table 3).

Untreated cataract was by far the most common cause of blindness (36.4%), SVI (85.7%), and MVI (55.1%) in our study. The other common causes of blindness after untreated cataract were non trachomatous corneal opacity (24.2%), and glaucoma (21.2%). Diabetes was identified in 129 (2.8%, 95% CI 2.3-3.4) people, and among diabetic cases, 17 (13.2%, 95% CI 6.3-20) had diabetic retinopathy and/or diabetic maculopathy, and only 1 (0.8% 95% CI 0.0-2.3) had sight threatening diabetic retinopathy. Refractive error was the major cause of early visual impairment, which was 76.2% and second major cause of moderate visual impairment, (32.0%) (Table 4).

DISCUSSION

According to the 2011 census, the Sudur Paschim province of Nepal, which consists of nine districts, had a population of 2,552,517 people.²¹ This is one of the least developed province with an area of 19,539 square kilometers, and about 75.0% of the land is hilly and mountainous terrain where about 50.0% of the population lives. The literacy rate is 66.3% (male 79.0% and female 54.8%).²¹ Access to basic services like health facilities are limited largely due to difficult mountainous terrain and poor transportation facilities.

The only tertiary level eye hospital in this province is Geta Eye Hospital (GEH). The hospital also runs three secondary level hospitals, two surgical eye centers, and eighteen primary eye care centers in different parts of this province. This hospital has been providing eye care services through these centers and also through screening and surgical eye camps since its establishment in 1981. Apart from GEH and its branches, the province has only one

newly opened private eye hospital and a few small private optical shops in the city areas. Private hospitals are referring patients for subspecialty eye care while small optical shops are providing limited primary eye care services and referring patients to GEH. Government hospitals and health centers have no provision for eye care services in the province. Hence, the bulk of eye care services in this province are provided by GEH and its affiliated hospitals and eye centers. Hence, this study was conducted to understand the impacts of eye care services in the province and also to understand the major causes of blindness and visual impairment in the province to streamline future eye care strategies.

The total number of people aged 50 years or older enrolled in the study was 4,615, and the total number of people examined was 4,573, with a response rate of 99.1%. In a similar study done in the Maldives, the response rate was 97.4%, which was slightly lower than our study.²³ Another similar study done in west Nigeria, the response rate was 85.0%.²⁴

In our study, the age-sex adjusted prevalence of blindness among people aged 50 years or older was 0.6% (95% CI, 0.4%-0.8%). The previous RAAB survey conducted in this province in 2012 reported the age-sex adjusted prevalence of blindness 2.7% (95%CI, 1.8%-3.7%). One of the major reason for this reduction in blindness was the successful implication of a community based approach to eye care with special focus on outreach surgical camps, which have been able to provide good outcomes.²⁵ According to unpublished data from the RAAB survey, Bagmati province, Gandaki Province, Karnali Province, and Lumbini Province of Nepal showed prevalence of blindness 0.7%, 0.9%, 0.9%, and 1.7%, respectively. The prevalence of blindness in other provinces of Nepal is higher than the prevalence of blindness in Sudur Paschim Province. The prevalence of SVI 1.0% (95% CI, 0.6-1.3%) and MVI 5.3% (95% CI, 4.5-6.2%) has also decreased from previous rates of 2%, and 7.6%, respectively.⁵ The epidemiology of visual impairment and blindness study done in three ecological regions in Nepal showed 0.9% blindness and 9.5% moderate to severe visual impairment in the 50 years and older population, which was slightly higher than our study.²⁶ The prevalence rate of blindness and visual impairments noted in our study also compares favorably to those reported from some of the developing countries in the region. The age-sex adjusted prevalence of blindness, severe visual impairment and moderate visual impairment in Malaysia were 1.2% (95.0% CI, 1.0% - 1.4%), 1.0% (95.0% CI, 0.8% - 1.2%), and

5.9% (95.0% CI, 5.3% -6.5%), respectively.²⁷ In a study conducted in Bihar, India, the age – sex adjusted prevalence of blindness among people 50 years of age and older was 2.2% (95.0% CI, 1.6-2.8). The prevalence of SVI, MVI, and EVI were 3.4% (95.0% CI, 2.6-4.3%), 18.3% (95.0% CI, 16.8-19.9%), and 16.9% (95.0% CI, 15.1-18.7), respectively.²⁸

The prevalence of blindness was higher in females 0.7% (95.0% CI, 0.4%-1.0%) compared to males 0.5% (95.0% CI,0.2%-0.9%) which may be due to gender based differences in eye health service accessibility. A study on health literacy of common ocular diseases in Nepal showed a significant difference in awareness level of cataract in females in comparison to males (odds ratio = 1.77 (95.0% confidence interval (CI) = 1.46-2.14, p <0.001).²⁹ The prevalence of blindness in this study was highest in those aged 80 or older (2.8%) followed by 1.5% in those aged 70-79 years. In a similar study done in Bhutan, the prevalence of blindness was 6.5% in age group 80+ years which was higher than our study.³⁰

The proportion of cataract related blindness has decreased from 62.5 % in 2012⁵ to 36.4% in our study. One of the important reason for this decrease in the prevalence of cataract related blindness is the adoption of high volume cataract surgery protocols by GEH to be able to address the large backlog as evidenced in the previous study. These protocols have also been able to provide high quality outcomes, helping to decrease the prevalence of blindness and visual impairment in the province.^{25,31}

Despite this progress, cataract is still the main cause of blindness (36.4%) followed by non trachomatous corneal opacity (24.2%), glaucoma (21.2%), all other globe or CNS abnormalities (9.1%), ARMD (6.1%), and other posterior segment diseases (3.0%). Again, cataract is the main cause in SVI (85.7%) and MVI (55.1%) categories. This shows that cataract intervention programs still need to be an important part of the eye care services, along with efforts to tackle other rising causes of blindness and visual impairment in this province. Cataract was the major cause of SVI in India (77.5%), Bangladesh (73.6%), and Bhutan (74.1%) which is almost double than our study.³² According to the same report, cataract was the main cause of MVI in India (58.1%), and Bhutan (57.1%), whereas in Bangladesh, uncorrected refractive error (63.6%) was the main cause of MVI.³²

The second major cause of blindness in this study is non-trachomatous corneal opacity (24.2%), which was only 2.8% in the previous

study. Similarly, glaucoma has come up as the third major cause of blindness in this study, which has increased to 21.2% from 9.7% in the previous study.⁵ Refractive error was the major cause of early visual impairment and the second major cause of moderate visual impairment in our study. These findings show that vision loss due to other eye diseases has been increasing in proportion as we have been able to reduce cataract related blindness to some extent in the community. Hence, we also need to develop strategic plans to combat these eye problems in the future as we did for cataract and trachoma. We need to strengthen primary eye care centers in remote areas to address refractive error, identify and refer corneal diseases, and glaucoma at an early stage. The hospital has also strengthened subspecialty clinics to treat glaucoma, corneal diseases, and diabetic retinopathy cases to reduce the burden due to these emerging conditions. There is not a single case of trachomatous scar in blindness category in this study, whereas it was 4.2% in the previous study. Nepal has already been declared as a trachoma eliminated country, thanks to the efforts of both the government and various non-governmental organizations working together to eliminate trachoma.

In conclusion, the prevalence of blindness has been reduced significantly in the province in comparison to the previous survey. Although

cataract prevalence has decreased, it still remains the major cause of blindness, SVI and MVI followed by corneal opacities, and glaucoma, which are emerging as the second and third major causes of blindness respectively. Hence, higher priority should be given to cataract, corneal blindness, and glaucoma in future interventions to eliminate blindness in the Sudur Paschim Province of Nepal. There is a need to deploy more human resources to accelerate cataract surgical services as well as cornea, and glaucoma subspecialty services. Refractive error has been identified as a major cause of early visual impairment and a second major cause of moderate visual impairment which can be overcome by increasing accessibility through the establishment of more primary eye care centers.

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