

Demand for and provision of eye care services in slum populations in Jaipur, India

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List of acronyms and abbreviations

AMD	Age-Related Macular Degeneration
AMRUT	Atal Mission for Rejuvenation and Urban Transformation scheme
BCT	Bhoruka Charitable Trust
CV	Contingent Valuation
FGD	Focus Group Discussion
GDP	Gross Domestic Product
GIS	Geographical Information System
GoR	Government of Rajasthan
GPS	Geographical Positioning System
HIG	High Income Group
HH	Household
HUP	Health for Urban Poor
IHMR	Indian Institute of Health Management Research
JDA	Jaipur Development Authority
JMC	Jaipur Municipal Corporation
LIG	Low Income Group
LMIC	Low- and Middle-Income Countries
LPG	Liquefied Petroleum Gas
MD	Missing Data
MIG	Middle Income Group
MLP	Mid-Level Personnel
NGO	Non-Government Organisation
OA	Ophthalmic Assistants
OBC	Other Backward Caste
PFI	Population Foundation of India
PHED	Public Health and Engineering Department
PIP	Programme Implementation Plan
PPP	Public Private Partnership
PRA	Participatory Rural Appraisal
PSU	Primary Sampling Unit
RARE	Rapid Assessment of Refractive Errors
RAY	Rajiv Awas Yojna
RE	Refractive Error
SC	Schedule Caste
SPSS	Statistical Package for Social Science
SRM	School of Rural Management
SSU	Secondary Sampling Unit
ST	Schedule Tribe
UCSF	University of California, San Francisco
URE	Uncorrected Refractive Error
USAID	United States Agency for International Development

VA
WHO
WTP

Visual Acuity
World Health Organisation
Willingness to Pay

Executive Summary

Background

253 million people are visually impaired globally, including 36 million who are blind and 217 million who have low vision. About 89% of visually impaired people live in low- and middle-income countries (LMICs). Uncorrected refractive errors are the main cause of moderate and severe visual impairment globally, while cataract is the leading cause of blindness in LMICs. Around 80% of all visual impairment is considered to be avoidable, i.e. it can be prevented or cured.

Blindness has been recognised as an important public health problem in India. India was one of the first countries to launch a publicly funded programme for the control of blindness, but despite a number of very significant achievements, the country is experiencing many problems at various levels. Although the availability of eye care services in urban areas in India is less challenging than in rural areas, these services are not necessarily accessible to all urban populations; marginalised groups, such as the poor or slum dwellers, often experience difficulties in accessing facilities available, but the number of studies investigating such differences is very limited.

The study reported here contributes to the evidence base on visual impairment and access to eye care services among urban slum dwellers in South Asia. The study was conducted in Jaipur, Rajasthan, India and is one of three studies conducted by Sightsavers with the aim to better understand the provision of and demand for eye care services in urban slums in the region. The other two studies were conducted in Dhaka, Bangladesh (2015) and Lahore, Pakistan (2018).

Aim and objectives

The overall aim of this study was to better understand the demand for and provision of eye care services in the city of Jaipur with a specific focus on urban slum-dwelling communities. The specific study objectives were:

1. To assess the socio-economic and demographic profile of slum dwellers.
2. To assess the exposure to eye health information and eye health messages among slum dwellers.
3. To explore eye health-seeking behaviour and the rationale for choosing eye care providers among slum dwellers.
4. To map and collect information on eye care providers delivering services to slum communities.
5. To assess slum-dwellers' willingness to pay for spectacles.

Methodology

Study design: The study used a mixed-methods design and collected both quantitative and qualitative data. The quantitative methods included a household survey and a GIS mapping and assessment of health care facilities available in the surveyed areas. The qualitative methods included focus group discussions (FGDs) and a Participatory Rural Appraisal (PRA). The study also planned to assess the prevalence of refractive error (RE) using Rapid Assessment of Refractive Error (RARE) methodology. Although the clinical examination was conducted and the patients with refractive error were identified, there were problems with coding the data and a significant proportion of records could not be linked and were considered invalid. Therefore, the study could not make accurate estimates of the prevalence of refractive error and the data was excluded from this report.

Sampling: The sample size for the household survey was calculated assuming a prevalence of refractive error of 5% in the age group 15-50 years; a confidence interval of 95%; a precision of 1% and a design effect of 1.7. The sample size required for the survey was 3,412 individuals aged 15-50 years. The household survey followed a multiple-stage cluster random sampling, where 50 slums were selected from the list available to the local authorities using probability proportional to size; and the households were selected using compact segment sampling. At the household level, the household head and all individuals aged 15-50 years were interviewed.

Two types of facilities were included in the facility assessment: a) specialist and large eye care providers across the city, which slum dwellers would use for secondary and tertiary eye care services and b) smaller facilities and/or primary eye care providers in the pre-defined geographical areas around the selected slums.

Focus groups were conducted in seven slums and the PRA exercise was conducted in two slums. Participants for these studies were recruited using convenience sampling to ensure diversity of the sample in terms of sex, age and socio-economic characteristics.

Study tools and processes: The study used several data collection tools: a) a household questionnaire, which included the Equity Tool to assess household relative wealth based on household infrastructure and durable assets; b) an individual questionnaire assessing socio-demographic status, self-reported ocular morbidity, health-seeking behaviour and exposure to eye health information; c) an eye examination form; and d) a Willingness to Pay (WTP) module.

The WTP was asked using the contingent valuation method (CVM), which is often used with individuals who have little or no experience of a particular service or product. In this study, the WTP module was administered to (i) any respondent diagnosed with refractive error following the ophthalmic examination; and (ii) one household member selected randomly among those with no visual impairment (VA \geq 6/12). Ready-made spectacles with different powers (+1, +2.5, +5) were used to simulate refractive error for people with no visual impairment (hypothetical users). For those with diagnosed refractive error, their vision was corrected using trial lens set and frame before eliciting WTP (best correction).

The elicitation method had a triple-bounded dichotomous choice format. It used a bidding-game approach, where survey respondents were asked “would you purchase product X if it were offered at price Y?”. The price varied according to the respondent’s answer and the bid value either increased (if accepted) or decreased (if rejected) using a pre-determined algorithm.

Data analysis: Descriptive statistics was used to report frequencies and distribution of the key variables. Logistic regression and ordered logistic regression analyses were conducted to explore the relationship between variables. FGDs were audio recorded and transcribed verbatim. Qualitative data was analysed thematically using priori codes aligned with the study objective. The PRA data was used to supplement the FGD data and to triangulate the household survey results.

Ethics: Ethical clearance for this study has been obtained from the Institutional Ethical Committee of the Indian Institute of Health Management Research (IIHMR). The objectives of the study were explained to all respondents prior to the data collection. A written informed consent was obtained from all respondents and from the heads of the households. All participation was voluntary and the respondents could withdraw their consent at any point in the study. All information was anonymised and only the research team had access to the data. The local administrative authorities were also informed and gave their consent to the study.

Key findings

Survey respondents and their characteristics: A total of 3,319 individuals aged 15-50 years participated in the household survey (99% response rate). About 51% were female and the mean age was 29.4 years. The majority were married (65.5%). Over 77% of respondents belonged to castes or tribes that are historically considered to be among the most disadvantaged socio-economic groups in India.

About a third of respondents (32.7%) did not have any formal education and 13.4% were illiterate. Among those with formal education, 38% had passed the secondary education level and about 10% had a graduate or post-graduate degree. Nearly 46% of respondents had been working in the 12 months preceding the survey; over 79% of them were men. Among those with work, 46% were daily labourers, 28% were salaried and 25% were self-employed.

Nearly 55% of respondents said they had no personal income. Among those with an income, the average monthly earning was INR 3,582 (US\$ 51.2).¹ The average household income per capita was INR 2,597 (US\$ 37.1). The results of the Equity Tool suggest that the study population was relatively wealthier than the average urban population in India, with over 50% of the respondents falling into two wealthiest quintiles (4 and 5) and less than 20% falling into two poorest quintiles.

¹ Yearly exchange rate 2016, USD/INR 69.956 (source: IRS)

Eye health knowledge and information: The majority of respondents (73%) had some knowledge regarding eye health. The most common sources of information were television (31%), friends and family (23%) and eye camps (15.5%). Almost all respondents (95.1%) knew where to get eye care services referring primarily to government hospitals (68.1%), followed by private hospital or clinics (17.7%). The exposure to eye health messages was individually associated with age, sex, caste, education and occupation.

Self-reported ocular morbidity and health-seeking behaviour: Among 3,319 survey respondents, 1,017 (30.6 %) reported having an eye problem at the time of the study. The most common problems were blurred vision (46.9%), abnormal eye secretion (21.5%), pain (11.6%), itching (8.9%) and redness (8.0%). Self-reported ocular morbidity was prevalent in all age groups, but was particularly high among older participants (52.5% among those aged 40-50 years compared to 19.1% among those aged 15-19 years). About 61% of respondents with an eye complaint identified their problem within one year preceding the study; and about 30% sought medical advice outside their home. Those who did not seek any care either did not feel the need (42%), had no money to pay (19%) or had other spending priorities (15%). The main reasons for those who sought care was pain in the eye (52%) and gradual change in vision (23%).

The preferred places for a medical consultation were government hospitals (59%) and private hospitals/clinics (23%). The service provider was chosen because of availability of free or low-cost services (20%), trust (18%), availability of medicines (13%), good attitudes (10%), proximity to home (9%) and easy access at any time (8%). Around 30% of respondent who sought care walked to their service provider, 32% used public transport and 30% used private vehicles. The most common treatment provided was eye drops (72%), followed by spectacles (16%).

Nearly 8% of respondents reported using spectacles at the time of the survey; out of them, 24.1% had distance spectacles, 40.2% had near (reading) spectacles and 32.2% had both. The most common type of facility for obtaining a prescription and purchasing spectacles was private-for-profit hospitals/clinics (34.5% and 36.8% respectively); followed by optical shops (19.2% and 23.4%), government hospitals/clinics (16.5% and 14.6%), private non-for-profit (NGO) hospitals/clinics (13.4% and 11.9%), eye camps (7.3% and 5.4%), doctor practices (4.2% for both) and pharmacies (1.1% and 1.5%). The majority of respondents (86.6%) purchased their spectacles, while 8.4% received spectacles for free. Among those who paid for spectacles, half (50.5%) paid between 200 and 599 INR (US\$ 2.9-8.6), 16.9% paid between 600 and 999 INR (US\$ 8.6-14.3), and 20.8% paid 1,000 INR or more (>US\$ 14.3). About 12% of respondents paid less than 200 INR (US\$ 2.9). One in ten respondents with spectacles (11.1%) said that they had stopped wearing spectacles; the main reasons were spectacles failed to improve vision or made it worse (44%), inability to replace lost or broken spectacles (32%) and they did not like the quality or style of the spectacles (12%).

Willingness to pay for spectacles and affordability: Among survey participants with no refractive error, 725 respondents were asked about their willingness to pay. Almost all respondents (99.7%) said that they would be willing to pay for spectacles to restore their sight. The most frequent price range chosen by 20% of respondents with normal vision and 25% of respondents with refractive error was INR 700-800 (US\$ 10.0-11.4); but half of the participants in both categories would not pay more than INR 600-700 (US\$ 9.4-10). One in five participants were willing to pay more than INR 800 (US\$11.4) and around 6% were willing to pay up to INR 300 (US\$ 4.3). Based on their incomes, about 33% of respondents said it would be easy to pay the elicited amount, 48.7% would find it somewhat difficult and 17% would find it very difficult to pay. The WTP was associated with participants' caste, education and relative wealth.

Mapping and survey of eye care facilities: Out of 319 facilities sampled for the study, 101 facilities provided eye care services. These included general hospitals (81), doctors' clinics and diagnostic centres (131), optical shops (66) and eye hospitals (33). About 82% of facilities reported providing ophthalmic consultations and 90% provided refraction services. About a quarter provided cataract services and a quarter provided low-vision services. In-patient services were available in 26% of facilities, and 9% of facilities organised outreach services.

Qualitative data: Findings from the FGDs and PRA exercise corroborated the survey and facility assessment results. The participants identified a number of common eye health problems prevalent in their communities, including redness of the eye, itching, watery eyes, cataract and poor eyesight more broadly. It was pointed out that all people - irrespective of age or sex - were affected by eye problems, but the types of problems experienced by different population subgroups differed. Some participants said that women were more likely to be affected by poor eyesight than men. Some associated weak eyes with poor physical health and referred to bad eating habits and lack of nutrients in the food. Seasonality in eye health problems was also noted and some occupation groups, such as carpenters and rickshaw drivers, were thought to be particularly vulnerable to eye diseases.

When asked about seeking care, almost all participants said that their first response to an eye problem was to wash eyes with cold water and wait to see if the problem subsided. If it did not resolve, the next step was to seek medical advice. Most respondents said that they would go to the nearest clinic available. These were largely optical shops or local clinics rather than specialist services. Many respondents said that specialist eye health facilities were available, but the fees were too high. Many were aware of government facilities with free or subsidised services, but these were at a distance and many were overcrowded and had long waiting times; therefore, patients went there only if they had no other choice. A number of respondents said that they wanted to have more accessible government hospitals and more check-up camps organised by the government or NGOs.

Conclusion

In conclusion, ocular morbidities are common in the surveyed slum population in Jaipur. The population has a variety of eye care facilities available to them, and the majority of the population knows about eye health and where to seek eye care. The majority understands the importance of eye care in general, and spectacles in particular, and are willing to pay for spectacles to correct vision. This study did not have accurate data on the prevalence of visual impairment, and it is difficult to comment on the uptake of spectacles and eye care services more broadly.

We did not find strong evidence of a stigma of spectacles in this community; however, the data on self-reported blurred vision and availability of spectacles may suggest that the uptake of spectacles is relatively low. Data on eye health-seeking behaviour also suggests that, similarly to other settings, people experiencing eye problems do not rush to services unless their condition causes pain, discomfort or substantial vision loss. With minor or asymptomatic conditions, people prefer to wait and see whether the situation improves - the main reasons for this are time, distances and costs of services. In addition, many perceive eye problems to be a normal sign of aging. More marketing research is required into what makes eye care services - and specifically spectacles - attractive to this population. Further research into the prevalence of visual impairment and cataract coverage would also be useful to guide local planning of eye health services for this population.

1. Introduction

1.1 Background

The Global Burden of Diseases study estimates that there are 253 million visually impaired people globally, including 36 million who are blind and 217 million who have low vision [1]. About 89% of visually impaired people live in low- and middle-income countries (LMICs). Over 70% of all cases are found in three regions: South East Asia (28%), Western Pacific (26%) and Africa (16.6%).

Uncorrected refractive errors are the main cause of moderate and severe visual impairment globally, while cataract remains the leading cause of blindness in LMICs. Around 80% of all visual impairment is considered to be avoidable, i.e. it can be prevented or cured [2].

Blindness is an important public health problem in India [3]. India was the first country to launch a fully-funded programme for the control of blindness [4] but despite a number of very significant achievements, the country is experiencing many eye care challenges at various levels. About 65% of surgeries in the country are performed in the private (for profit and non-profit) sector and only 35% are within the government sector. About 50% of 11,000 ophthalmologists are surgically inactive. The ophthalmologist to population ratio in urban India is 1:25,000 compared to 1:250,000 in rural areas [5].

Although the availability of eye care services in urban India is less challenging than in rural areas, these services are not necessarily accessible to all urban populations; marginalised groups - such as the poor or slum dwellers - often experience difficulties in accessing facilities available, but the number of studies investigating such differences is very limited. A study carried out by Sightsavers in slums in Delhi found that the prevalence of visual impairment among slum dwellers aged 40 years and above was 11.4% and the prevalence of blindness was 1.2%. Uncorrected refractive error was the leading cause of visual impairment (53.4%) followed by cataract (33.8%). Visual impairment was found to be associated with older age and illiteracy [6].

The study reported here contributes to the evidence base on visual impairment and access to eye care services among urban slum dwellers in South Asia. The study was conducted in Jaipur, Rajasthan, India and is one of three studies conducted by Sightsavers with the aim to better understand the provision of and demand for eye care services in urban slums in the region. The other two studies were conducted in Dhaka, Bangladesh (2015) and Lahore, Pakistan (2018).

1.2 Rajasthan state profile

Rajasthan is a state in the north western region of India. It is the largest state of India, covering an area of 342,239 square kilometres or 10.4 percent of the total geographical area of the country. It is also the 8th largest state in terms of the population, with an estimated population of 6.85 million people [7]. The population density is 201 per sq. km, lower when compared to the national average of 382 per sq. km. The state is known for its low female to male ratio, which is 928:1000 [8].

The state literacy rate in Rajasthan is estimated at 67%, lagging behind the national average of 74%. The literacy rate is particularly low among women, estimated at 52%, compared to the national average of 65% [8].

Rajasthan is primarily rural with 75% of its population living in rural areas [7]. Rajasthan's economy is primarily agricultural and pastoral. The main industries are minerals, agriculture and textiles [8].

The State Level Slum Household survey data estimates that there are 383,134 households living in slums in Rajasthan. Out of them, 56.5% of the slums are considered good, 40% are liveable and 3.5% are in dilapidated conditions. About 69% of slum dwellers have a water source in their homes, 20% have a water source nearby, and 11% have to travel far to source their water. About 89% of slum households have electricity and 71% have latrines. Nearly 48% of slum households use banking services, 63% have televisions, 66% have mobile phones and 1.8% have computers with internet access [7, 9]

1.3 Jaipur district

Jaipur is one of the first planned cities of India. It is the capital city of Rajasthan and is the centre of the socio-economic and political life of the state. Jaipur District has witnessed fast growth both infrastructure-wise and demographically [10].

Jaipur district has a population of 6.6 million and a population density of 595 per sq. km, and 48% of the district's residents live in rural areas. Jaipur city has a population of about 3.1 million people. The city witnessed a 32% population growth in the past decade.

There are 63,600 households hosting 324,000 people living in slums in Jaipur district.

About 190 slums in the district are under Jaipur Municipal Corporation (JMC) and Jaipur District Authority (JDA), while 61 slums are unlisted (Figure 1) [10].

1.4 Aims and objectives of the study

1.4.1 Aim

The overall aim of this study is to better understand the demand for and provision of eye care services in the city of Jaipur, with a specific focus on urban slum-dwelling communities.

1.4.2 Objectives

1. To assess the socio-economic and demographic profile of slum dwellers.
2. To assess the exposure to eye health information and eye health messages among slum dwellers.
3. To explore eye health-seeking behaviour and the rationale for choosing eye care providers among slum dwellers.
4. To map and collect information on eye care providers delivering services to slum communities.
5. To assess slum-dwellers' willingness to pay for spectacles.

1.4.3 Research questions

- What is the socio-economic and demographic profile of the slum-dwelling communities in Jaipur?
- How do slum-dwelling communities receive information about eye health and eye care services?
- What are the main reasons for the seeking or non-seeking of eye care, and how do slum dwellers choose their eye care provider?
- What are the characteristics of health providers delivering eye care services to slum communities?
- What is the willingness-to-pay (WTP) for spectacles among slum dwellers? Does the WTP vary by demographic and the socio-economic characteristics of slum dwellers?

2 Methods

2.1 Survey design

The study had a mixed-method design using both quantitative and qualitative data collection methods (Table 1):

Table 1: Methods and tools for each research objective

Objectives	Method	Tool
Mapping and collecting information on health providers delivering eye care services to slum communities	GIS mapping and facility -based survey	Tools adapted from ICDDR used for mapping health services in Dhaka and Sylhet City Corporations, Bangladesh
Key factors influencing health-seeking behaviour and provider choices	Household survey, participatory rural appraisal and focus groups	Structured questionnaires and topic guides to determine respondents' exposure to eye health message and their attitudes and practices around eye health-seeking behaviour
Demographic and socio-economic status of respondents	Household survey	Socio-demographic questionnaire; the Equity Tool which assessed dwelling characteristics and the ownership of durable assets
Willingness-to-pay (WTP) for spectacles among slum dwellers	Household survey	Contingent valuation (CV) method using an iterative bidding design for eliciting WTP. Hypothetical users conditioned by simulating visual impairment caused by RE. Individuals diagnosed with uncorrected RE in the household survey were also asked their WTP for spectacles after their vision has been corrected using trial lens set and frame

2.2 Household survey

The household survey was carried out in 50 sampled slum areas within Jaipur Municipal Corporation. A multi-stage cluster sampling was used to first select slums, then households and then individuals within the households. There were a number of tools used in the household survey.

2.2.1 Head of households questionnaire

Heads of households were asked to complete the household schedule and to answer questions from the Equity Tool, which measures socio-economic differences and assigns scores based on dwelling characteristics and the possession of durable assets (house structure, roof, water source etc.). The scores are used to categorise respondents into five quintiles, where the cut-off points are based on the national level data. As we surveyed an urban population, the urban wealth quintile cut-off points were used. Each respondent's quintile represented their relative wealth compared to the rest of the urban population in India.

2.2.2 Respondents' characteristics, eye health-seeking behaviour and exposure to eye health message

Household members aged 15 to 50 years answered a questionnaire, which included i) demographic and socio-economic information; ii) self-reported eye morbidity and health-seeking behaviour and iii) exposure to eye health messages and sources of information.

2.2.3 Willingness to pay for spectacles

The WTP questionnaire was administered to two categories of respondents:

- Any respondent diagnosed with uncorrected refractive error following the ophthalmic examination
- One household member randomly selected among those with no visual impairment (VA $\geq 6/12$)

The WTP was assessed using the contingent valuation method (CVM), which is often used with individuals who have little or no experience of a particular service or product and are asked to consider a hypothetical scenario (i.e. a health condition or intervention which is described in detail).

The first stage of the WTP elicitation was the description of the scenario, which contained information about spectacles. Ready-made spectacles with different powers (+1, +2.5, +5) were used to simulate refractive error for people with no visual impairment (hypothetical users). For those with diagnosed refractive error, their vision was corrected using trial lens set and frame (best correction).

The elicitation method had a triple-bounded dichotomous choice format. It used a bidding-game approach, where survey respondents were asked a sequence of questions that progressively narrowed down their willingness to pay. A sequence of dichotomous ('yes/no') answers was given to the question "would you purchase product X if it were offered at price Y?". The price varied according to the respondent's answer and the bid value either increased (if accepted) or decreased (if rejected) using a pre-determined algorithm.

2.3 Qualitative study

2.3.1 Focus group discussions

Community members who did not take part in the survey were invited to take part in Focus group discussions (FGDs). Seven FGDs were conducted to explore community perceptions of eye illnesses as well as barriers and enablers in accessing eye care. Participants were chosen using convenience sampling to ensure the diversity of participant characteristics (age, sex, location). Two research officers conducted Focus Group Discussions as follows:

1. Gautam Nagar – males (10) aged 15-50 years
2. Sundar Nagar – females (9) aged 15-50 years
3. Ashok Nagar - females (11) aged 15-50 years
4. Jawahar Nagar Teela No. 1 (MD)- Youths, girls 15-18 years
5. Sanjay Nagar Kachhhi Basti - Females (8) aged 15-50 years
6. Nahargarh Kachhi Basti - males (10) aged 15-50 years
7. Jawhar Nagar Kachhi Basti - males (8) aged 15-50 years

The discussions were guided by the following broad questions:

- General health problems prevalent in the area, and eye health problems
- Populations affected by eye health problems and types of eye problems prevalent in the community
- Seasonality in eye health problems and other variations
- Eye health-seeking behaviour and difficulties in accessing care
- Opportunities for improving eye health
- Sources of knowledge about eye health
- Attitudes towards spectacles

2.3.2 Participatory rural appraisal

Participatory Rural Appraisal (PRA) tools were used in two slums. This semi-structured method aimed to understand the community behaviour through the eyes of the people living in the community. Three PRA tools were used in the study:

1. Participatory mapping and modelling
2. Seasonal diagrams
3. Causal diagrams

Two slum areas, Mouzi Colony and Balai Basti, were selected for the PRA research. These two slums are located in two different parts of Jaipur. Mouzi Colony is situated in Shashtri Nagar, the old city, while Balai Basti is on the outskirts of Jaipur. The slums have similar socio-economic profiles but differ in caste representation and livelihood patterns. Balai residents are from the Under

Scheduled Caste category and are usually employed as labourers, but the background and caste profile is more mixed than in Mouzi Colony, where all families are *Regar*, which is also an Under Scheduled Caste category.

2.4 Facility mapping and assessment

A mapping of public and private facilities and their services was carried out in selected areas of the city where the household survey took place. The assessment included various facilities providing eye care services, including doctor chambers, optical shops, pharmacies and others. The work was carried out in three steps:

Step 1: Provider listing: making a comprehensive inventory of facilities in selected wards using existing information from the health department and NGOs.

Step 2: GIS mapping: using existing base maps and updating these maps by sending data collection teams to the field to identify health providers and update base maps in selected wards. GPS coordinates and basic characteristics were recorded for each facility.

Step 3: Detailed facility assessments, which included visiting facilities with eye care services and conducting a facility survey using a structured questionnaire.

2.5 Sampling

2.5.1 Household survey

Sample size: The sample size required was calculated based on the estimated prevalence of refractive error of 5% in the age group 15-50 years with a confidence interval of 95%, a precision of 1%, and a design effect of 1.7 [11]. The required sample size was 3,412 individuals aged 15-50 years. We assumed that people 15-50 years constitute approximately 54% of the households, so the study required a total of 1,264 households. The estimates of the population were based on the India Census 2011 and the USAID Health for Urban Poor (HUP) data [7].

Sampling Approach: The household survey followed a multi-stage cluster random sampling, with the primary sampling unit being the slums (PSU) and the secondary cluster being the household (SSU).

1. Selection of slums: The probability proportional to size (PPS) sampling was used to select 50 slums. A list of registered slums with their estimated populations was provided by the city authorities and the USAID HUP surveys.
2. Selection of households: The second stage involved the selection of individual households (SSU) from slums. Households were selected using compact segment sampling, where the slums were divided into segments of equal populations; the segments were numbered and a pre-determined number of segments was randomly chosen from the map. All households in the selected segments were included in the survey.
3. Selection of respondents: Individual respondents within the households were selected, as follows:

- The head of the household was interviewed to provide data on all permanent residents in the household and to complete the Equity Tool questionnaire.
- All household members aged 15-50 years had an eye examination including a distant visual acuity test (and near-vision test for respondents aged 35+) and completed a schedule on socio-demographic characteristics, self-reported ocular morbidity and awareness of eye health services.
- Respondents with self-reported visual impairment or any other (non-visually impairing) ocular morbidity were asked to complete a questionnaire on health seeking behaviour and barriers to services. Respondents diagnosed with uncorrected refractive error answered questions about the use of spectacles and also completed the WTP module following the correction of their vision using a trial lens set and frame (best correction).
- One of the household members was randomly selected among those with no visual impairment to complete the WTP module (after simulating refractive error using ready-made spectacles).

Each individual received a unique identification number to link different data sets.

2.5.2 Facility mapping and assessment

Health facilities mapped in this study were selected in two ways:

1. A list frame was used to select specialist and large eye care providers across the city; these were the facilities that slum dwellers were likely to use for secondary and tertiary eye care.
2. Area frames were used for smaller facilities and/or primary eye care providers, such as doctor chambers, optical shops, drugs sellers/pharmacies etc. The area frames were developed for pre-defined geographical areas only.

All health facilities identified were mapped; but the detailed facility assessment was carried out in a sample of facilities only.

2.6 Teams and roles

The household survey team comprised of four teams including one ophthalmologist (or ophthalmic resident); 1-2 optometrist(s) or ophthalmic assistants (OA) and two social science assistants. In addition, three field researchers were deployed for the mapping and assessment of health facilities.

All teams were trained for four days, including a field-testing exercise in two clusters. Two research officers regularly monitored the field team to ensure data quality.

2.7 Data analysis

2.7.1 Quantitative component

Data from the household survey and facility assessments was analysed using Stata. Descriptive statistics was used to report the frequencies and distribution of the key variables. Logistic regression and ordered logistic regression analyses were conducted to explore relationship between variables.

2.7.2 Qualitative component

Focus group discussions (FGDs) were audio recorded and transcribed verbatim. Deductive coding was done using a-priori codes aligned with study objectives. Following the coding, a qualitative data matrix was developed, and a thematic analysis was conducted following this matrix. The PRA data was used to supplement the FGD data and to triangulate the household survey data.

2.8 Ethical approval

Ethical clearance for this study has been sought from the Institutional Ethical Committee at the Indian Institute of Health Management Research. The objectives of the study were explained to all respondents prior to data collection. Written informed consent was obtained from each respondent and from the heads of the households. All participation was voluntarily with no remuneration provided, and the respondents could withdraw their consent at any point in the study. All interviews were conducted to protect privacy and confidentiality. All information was anonymised and only the research team had access to the data. The local administrative authorities were also informed and gave their consent to the study.

3 Results

3.1 Respondent characteristics

A total of 3,352 individuals were invited to take part in the household survey and 3,319 were included in the study, while 33 individuals refused to take part (99% response rate).

About 51% of respondents were female and the mean age was 29.4 years. Nearly 55% of the sample were aged 15-30 years. The majority of respondents were married (65.5%) and 32.2% were single/never married. The average household size was 6.6 individuals per household.

Nearly 8 out of 10 respondents (77.1%) belonged to the castes or tribes that are historically considered to be among the most disadvantaged socio-economic groups in India.

About a third of respondents (32.7%) did not have any formal education and 13.4% were illiterate. About 64% of respondents with no formal education were women. Among those with formal education, 38% had reached the secondary education level and about 10% had a graduate or post-graduate degree.

Around 45.5% of respondents had been working in the 12 months preceding the survey; and over 79% of them were men. Around 36.3% of individuals had housework or childcare as their main activity and 16.6% were students. Among those in employment, 46% were daily labourers, 28% were salaried and 25% were self-employed. Over 73% of those working were skilled and unskilled production workers.

Nearly 55% of study respondents said they had no personal income. Among those with an income, the average monthly earning was INR 3,582 (US\$ 51.2).² The average household income per capita (household income divided by the number of individuals in the household) was INR 2,597 (US\$ 37.1).

The results of the Equity Tool suggest that the study population was wealthier than the average urban population in India, with over 50% of the respondents falling into two wealthiest quintiles (4 and 5) and less than 20% falling into two poorest quintiles (1 and 2).

² Yearly exchange rate 2016, USD/INR 69.956 (source: IRS)

3.2 Eye health information and health-seeking behaviour

3.2.1 Exposure to eye health messages and awareness of eye care services

About 73% of respondents reported that they had heard or read about eye health or eye diseases in the year preceding the survey. The most frequent source of eye health information was television (31%) followed by friends/relatives (23%), eye camps (15.5%) and newspapers/magazines (14.3%). Almost all respondents (95.1%) knew where to get eye care services, referring primarily to government hospitals (68.1%), followed by private hospitals or clinics (17.7%) (Table 2).

Table 2: Exposure to eye health messages and awareness of eye care services

Variable	Frequency	Percentage
Exposure to eye health message (in past 12 months)	N=3,319	
Yes	2,408	72.6
No	865	26.1
Don't know	46	1.4
Source of information	N=2,408	
Newspaper/magazine	344	14.3
Pamphlet/brochure	59	2.5
Television	754	31.3
Radio	29	1.2
Medical staff at facility	59	2.5
Eye health camps	373	15.5
Community health worker	205	8.5
BCT and NGO staff	17	0.7
Friend/relative	561	23.3
Other	6	0.3

Variable	Frequency	Percentage
Knowledge where to get eye care services if needed	N=3,319	
Yes	3,158	95.2
No	161	4.9
Type of service provider	N=3,158	
Government medical college	81	2.6
Government hospital	2,149	68.1
Government health post	33	1.0
Private Hospital/clinic	215	6.8
Doctor private practice	22	0.7
Private hospital/clinic	551	17.5
NGO hospital/clinic	9	0.3
Optical shop	58	1.8
Pharmacy	8	0.3
Eye camp	30	0.9
Registered medical practitioner	1	0.0
Other	1	0.0

3.2.2 Self-reported ocular morbidity

Among 3,319 survey respondents, 1,017 (30.6 %) reported having an eye problem at the time of the survey. The most common problem among those with a self-reported ocular morbidity was blurred vision (46.9%) followed by abnormal eye secretion (21.5%), pain (11.6%), itching (8.9%) and redness (8.0%). The prevalence of self-reported ocular morbidity among study respondents is shown in Table 3.

Table 3: Self-reported ocular morbidity at the time of survey

Variable	Frequency	Percentage
Eye health status (self-reported)	N=3,319	
Normal eyes	2,302	69.4
Blurred vision	477	14.4
Abnormal eye secretion	219	6.6
Pain	118	3.6
Itching	93	2.8
Redness	81	2.4
Others	29	0.9

The prevalence of self-reported ocular morbidity was associated with age. Thus, 19.1% of respondents aged 15-19 years reported an ocular morbidity compared to 52.5% of those aged 40-50 years. This was mainly driven by the higher proportion of respondents with blurred vision in the older age groups (Table 4).

Table 4: Self-reported ocular morbidity by age category

Age category	No ocular morbidity (normal eyes)	Respondents with self-reported ocular morbidity	
		Blurred vision	Other ocular morbidity
15-19 yrs	609 (80.9 %)	36 (4.8%)	108 (14.3 %)
20-29 yrs	832 (78.6 %)	86 (8.1%)	141 (13.3%)
30-39 yrs	480 (68.0 %)	103 (14.6%)	123 (17.4 %)
40-50 yrs	381 (47.6 %)	252 (31.5%)	168 (21.0 %)
Total	2,302 (69.3%)	477 (14.4%)	540 (16.3%)

3.2.3. Spectacle wear and purchase history

Nearly 8% of all respondents examined reported using spectacles at the time of the survey, out of whom 24.1% had distance spectacles, 40.2% had near (reading) spectacles and 32.2% had both (including bifocal and multifocal lenses).

The most common type of facility used to obtain a prescription and purchase spectacles was private-for-profit hospitals or clinics (34.5% and 36.8% respectively), followed by optical shops (19.2% and 23.4%), government hospitals or clinics (16.5% and 14.6%), private non-for-profit

(NGO) hospitals or clinics (13.4% and 11.9%), eye camps (7.3% and 5.4%), doctor practices (4.2% for both) and pharmacies (1.1% and 1.5%).

The majority of respondents (86.6%) purchased their spectacles, while 8.4% received spectacles for free. Among the respondents who paid for their spectacles, half (50.5%) paid between 200 and 599 INR (US\$ 2.9-8.6), 16.9% paid between 600 and 999 INR (US\$ 8.6-14.3) and 20.8% paid 1,000 INR or more (>US\$ 14.3). Only 12% of the respondents paid less than 200 INR (US\$ 2.9).

One in ten respondents with spectacles (n=25 (11.1%)) said that they had stopped wearing spectacles. The most common reasons were inability to replace lost or broken spectacles (32%), they could see well without spectacles (28%), spectacles did not improve vision (16%), and they did not like the quality or style of spectacles (12%) (Table 5).

Table 5: Spectacle wear and purchase history

Variable	Frequency	Percentage
Using spectacles presently	N=3,319	
Yes	261	7.9
No	3058	92.1
Type of spectacles	N=261	
Near spectacles	105	40.2
Both near and distance spectacles*	84	32.2
Distance spectacles	63	24.1
Don't know	9	3.4
Spectacles prescribed from	N=261	
Private hospital/clinic	90	34.5
Optical shop	50	19.2
Government hospital/clinic	43	16.5
NGO hospital/clinic	35	13.4
Eye camp	19	7.3
Doctor's practice	11	4.2
Pharmacy	3	1.1
Others	10	3.8

Variable	Frequency	Percentage
Spectacles purchased from	N=261	
Private hospital/clinic	96	36.8
Optical shop	61	23.4
Government hospital/clinic	38	14.6
NGO hospital/clinic	31	11.9
Eye camp	14	5.4
Doctor's practice	11	4.2
Pharmacy	4	1.5
Others	6	2.3
Paid for spectacles	N=261	
Yes **	226	86.6
No	22	8.4
Don't remember	13	5.0
Amount paid for spectacles	N=226	
< 200 INR	27	12.0
200–399 INR	65	28.8
400-599 INR	49	21.7
600-799 INR	27	12.0
800-999 INR	11	4.9
1000-1199 INR	14	6.2
≥1200 INR	33	14.6
Used spectacles in the past	N=226	
Yes	201	88.9
No	25	11.1

Variable	Frequency	Percentage
Type of spectacles	N=25	
Distance spectacles	10	40.0
Near spectacles	6	24.0
Both near and distance spectacles*	6	24.0
Don't know	3	12.0
When you stopped wearing spectacles	N=25	
< 1 month	1	4.0
1-2 years	13	52.0
3-4 years	4	16.0
>5 years	6	24.0
Don't remember	1	4.0
Reason for discontinuing use of spectacles	N=25	
Can see well without glasses/no improvement in vision	11	44.0
Unable to replace lost/broken glasses	8	32.0
Don't like quality/style	3	12.0
Make me look less attractive	1	4.0
Uncomfortable to wear	1	4.0
Others	1	4.0

* Including respondents wearing bifocal or multifocal correction

** Paying either full or discounted price for spectacles

3.2.3 Eye health-seeking behaviour

Appendix B summarises data on eye health-seeking behaviour of survey respondents diagnosed with uncorrected refractive error or presbyopia and/or other self-reported ocular morbidities. About 24% of the respondents with an ocular morbidity had noticed their problem within one month preceding the study, while 62% had noticed it within the past year. Only 30% of the respondents said that they had sought medical care for their problem. The main reasons for seeking care were pain (51%) and gradual change in vision (22%). Those who did not seek care reported that they did not feel the need (42%), had no money to pay (19%) or had other spending priorities (15%). About 6% of respondents said that it was not their decision to make.

Care was sought in either government hospitals (56%) or private hospitals/clinics (23%). The service provider was chosen due to the availability of free or low-cost services (20%), trust (18%), availability of medicines (13%), good attitudes (10%), proximity to home (9%) and easy access at any time (8%). Around 30% of respondent who sought care walked to their service provider, 32% used public transport and 30% used private vehicles. The most common treatment provided was eye drops (72%), followed by spectacles (16%).

3.2.4 Factors associated with exposure to eye health messages

The results of the univariate analysis show that the exposure to eye health messages (either heard or read about) was associated with age, sex, caste, education and occupation. People aged 40-50 years were 1.4 times more likely to have heard eye health messages than those aged 15-19 years ($p=0.0011$). Women were 18% less likely to have received eye health messages than men ($p=0.0129$). Those in Scheduled Castes were two times more likely and those with “Other Backward Classes” were 1.5 times more likely to have received eye health information compared to those who did not belong to these groups ($p<0.001$). Exposure to eye health information increased with the levels of education with those with education (primary, secondary and undergraduate degree) being 1.3-1.5 times more likely to have received eye health messages than those with no formal education ($p<0.001$). Finally, those, who were looking for work were 2.2 times more likely, while those unable to work due to ill health or disability were 26% less likely to have heard eye health messages compared to those who had jobs ($p=0.0033$). There was no difference in the exposure to eye health information by socio-economic quintiles (Table 6).

Table 6: Exposure to eye health messages by socio-demographic characteristics of participants

Exposure to eye health messages N=3,319	Odds ratio
Age group	p.value=0.0011
15-19	Ref
20-29	0.9519
30-39	1.0171
40-50	1.4272**
Sex	p.value= 0.0129
Male	Ref
Female	0.8238*
Caste	p.value=0.0000
Do not belong to SC, ST or OBC	Ref.
Scheduled Caste (SC)	2.0485***
Scheduled Tribe (ST)	1.1683
Other Backward Classes (OBC)	1.4661***
Educational status	p.value=0.0000
No formal education (illiterate)	Ref.
No formal education (literate)	0.8083
Primary	1.513**
Secondary	1.2941*
Undergraduate	1.4503
Postgraduate	1.506
Other	1 (empty)

Exposure to eye health messages N=3,319	Odds ratio
Occupation	p.value=0.0033
Work	Ref.
Going to school/studying	1.1817
Housework/childcare	0.8728
Looking for work	2.2345**
Unable to work/ill/disabled	0.7448*
Retired	1 (empty)
Other	0.1241
Wealth quintile	p.value=0.3419
Quintile 1 (relative poorest group)	Ref.
Quintile 2	0.9914
Quintile 3	1.2563
Quintile 4	1.1819
Quintile 5 (relative richest group)	1.0886

Exponentiated coefficients; *p*-values in parentheses

* *p* < 0.05, ** *p* < 0.01, *** *p* < 0.001

3.3 Willingness to pay for spectacles

3.3.1 Willingness to pay for spectacles – hypothetical users

Among survey participants with no refractive error, 725 respondents were asked about their willingness to pay following the simulation of refractive error with ready-made spectacles (hypothetical users). Almost all respondents (99.7%) said that they would be willing to pay for spectacles to restore their sight. Table 7 shows the distribution of responses on how much the participants would be willing to pay. Based on their incomes, about 33% of respondents said it would be easy to pay the elicited WTP amount, 48.7% would find it somewhat difficult and 17% would find it very difficult to pay. The most common strategies to cope with these expenditures would be savings (41%), current monthly income (23.5%) and borrowing money (21%). About 13% of respondents said that they would have to cut down on their expenditures to be able to pay for spectacles. In 62% of cases it was the respondent's own decision whether to pay for spectacles or not, and in 38% of cases the decision was dependent on others in the household.

Table 7: Willingness to pay among hypothetical users (blurred vision caused by refractive error is simulated)

Variables	Frequency	Percentage
Willing to purchase/pay money for spectacles	N=725	
Yes	723	99.7
No	2	0.2
Willingness to pay for spectacles	N=725	
<100 INR	4	0.6
100-200 INR	12	1.7
200-300 INR	31	4.3
300-400 INR	89	12.3
400-500 INR	98	13.5
500-600 INR	95	13.1
600-700 INR	92	12.7
700-800 INR	145	20.0
800-900 INR	43	5.9
900-1,000 INR	77	10.6
1,000-1,100 INR	12	1.7
>1,100 INR	27	3.7

Variables	Frequency	Percentage
Difficult/easy to pay the amount	N=725	
Very easy	66	9.1
Somewhat easy	176	24.3
Somewhat difficult	353	48.7
Very difficult	126	17.4
Impossible	4	0.6
Strategy to cope with expenditure	N=725	
Income from this month	170	23.5
Savings	298	41.1
Reduce consumption (food, etc.)	98	13.52
Borrow from relatives/friends	114	15.72
Borrow from lenders	42	5.8
Sell household assets	3	0.41
Decision maker for seeking healthcare	N=725	
Respondent	451	62.2
Someone else	274	37.8

4.1.1 Willingness to pay for spectacles – best correction

Among the participants with a diagnosed refractive error, 99% of respondents were willing to pay for spectacles when their vision was corrected. The most frequent response was INR 700-800 (US\$ 10.0-11.4), which was chosen by 25% of respondents, and half of the respondents in this category would not pay more than INR 600-700 (US\$ 8.6-10.0). Just over 6% were willing to pay up to INR 300 (US\$ 4.3) and one in five (20%) were willing to pay more than INR 800 (US\$ 11.4). The results are summarised in Table 8.

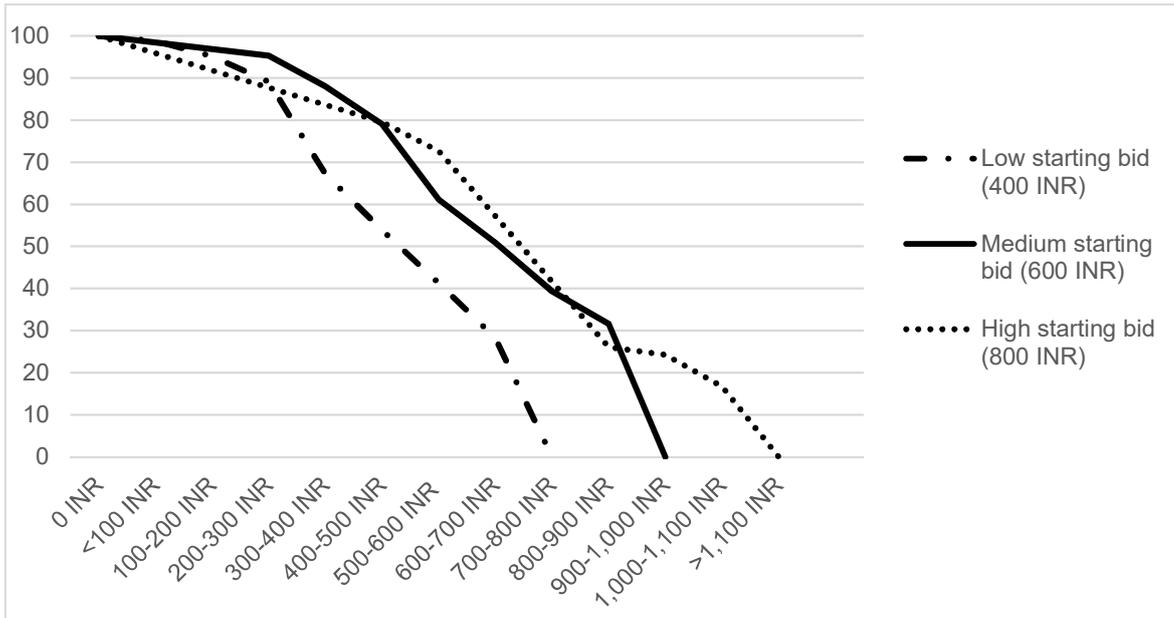
Table 8: Willingness to pay for spectacles among respondents diagnosed with refractive error

Variables	Frequency	Percentage
Willing to purchase/pay money for spectacles	N=299	
Yes	296	99.0
No	3	1.0
Willing to pay	N=299	
<100 INR	0	0.0
100-300 INR	9	3.0
200-300 INR	9	3.0
300-400 INR	41	13.7
400-500 INR	27	9.0
500-600 INR	39	13.0
600-700 INR	40	13.4
700-800 INR	75	25.1
800-900 INR	21	7.0
900-1,000 INR	21	7.0
1,000-1,100 INR	4	1.4
>1,100 INR	13	4.4

4.1.2 Demand for spectacles curves

Considering that the assumption of downwards transitivity holds, we were able to draw demand curves for spectacles as depicted in Figure 2. We found an association between the starting bid and the WTP, suggesting an instrumental bias, i.e. participants with the lower starting bid showed lower WTP, while participants with the higher starting bid showed higher WTP.

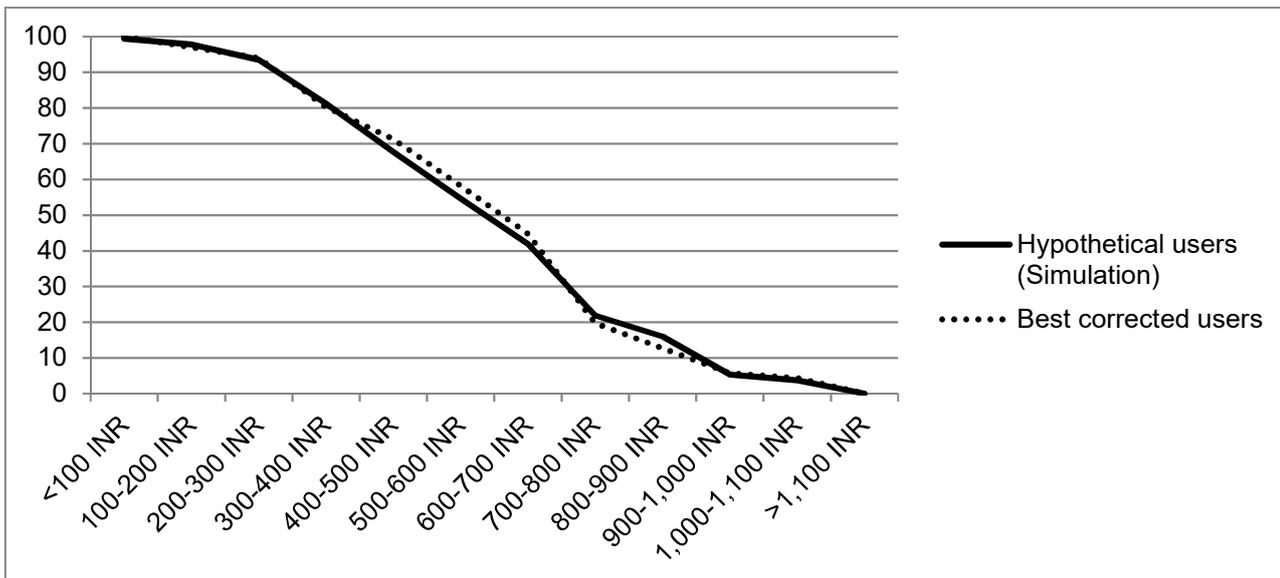
Figure 2: Hypothetical demand curves derived from maximum WTP for spectacles by starting bid values



4.1.3 Validity of the WTP for spectacles

Figure 3 represents the demand curves for spectacles for all starting bids from the respondents diagnosed with refractive error (dotted line) and from hypothetical users (solid line). Both curves follow the same demand downward trend as the price of spectacles increases and the curves are similar. No WTP for spectacles differences were observed between hypothetical users and those suffering from refractive error confirming the theoretical validity of the WTP methodology for estimating spectacles prices.

Figure 3: Hypothetical demand curves from WTP analysis



4.1.4 Association between WTP and respondent characteristics

The results of the multivariate ordered logistic regression are presented in Table 9. The WTP was associated with participants' caste, education, starting bid (instrumental bias, see section 3.3.3) and relative wealth. The WTP was significantly higher for those who did not belong to a Scheduled Caste, Scheduled Tribe or "Other Backward Classes"³, those who had an undergraduate or postgraduate degree and those who were in the two wealthiest quintiles. There was no significant association between the WTP and age or sex.

Table 9: Multivariate ordered logistic regression results

Willingness to pay for spectacles (0 to >11,000 PKR) N=725	Odds ratio
Age group	p.value=0.007
15-19	Ref
20-29	1.065
30-39	1.036
40-50	1.687
Sex	p.value=0.081
Male	Ref
Female	0.710
Family size (number)	p.value=0.869
1-2	Ref
3-4	0.804
5 or more	0.856
Education level	p.value=0.005
No formal education (illiterate)	Ref
No formal education (literate)	1.099
Primary (class 1-5)	0.885
Secondary (class 6-12)	1.353
Undergraduate	1.881
Postgraduate	3.076**

³ Term officially used by the government of India

Willingness to pay for spectacles (0 to >11,000 PKR) N=725	Odds ratio
Caste	p.value=0.002
Scheduled Caste	Ref
Scheduled Tribe	0.830
Other Backwards Classes	1.242
None of them	1.784**
Occupation	p.value=0.092
Work	Ref
Housework/childcare	1.127
Going to school/studying	1.350
Looking for work	0.558
Retired	0.875
Unable to work/ill/disabled	0.957
Other	6.927
Starting bid	p.value=0.000
INR 400	Ref
INR 600	4.857***
INR 800	8.078***
Equity Tool (urban quintile)	p.value=0.000
Quintile 1 (poorest)	Ref
Quintile 2	1.316
Quintile 3	1.628
Quintile 4	2.259**
Quintile 5 (richest)	3.675***

Exponentiated coefficients; *p*-values in parentheses
* *p* < 0.05, ** *p* < 0.01, *** *p* < 0.001

4.2 Facility assessment and choice of healthcare provider

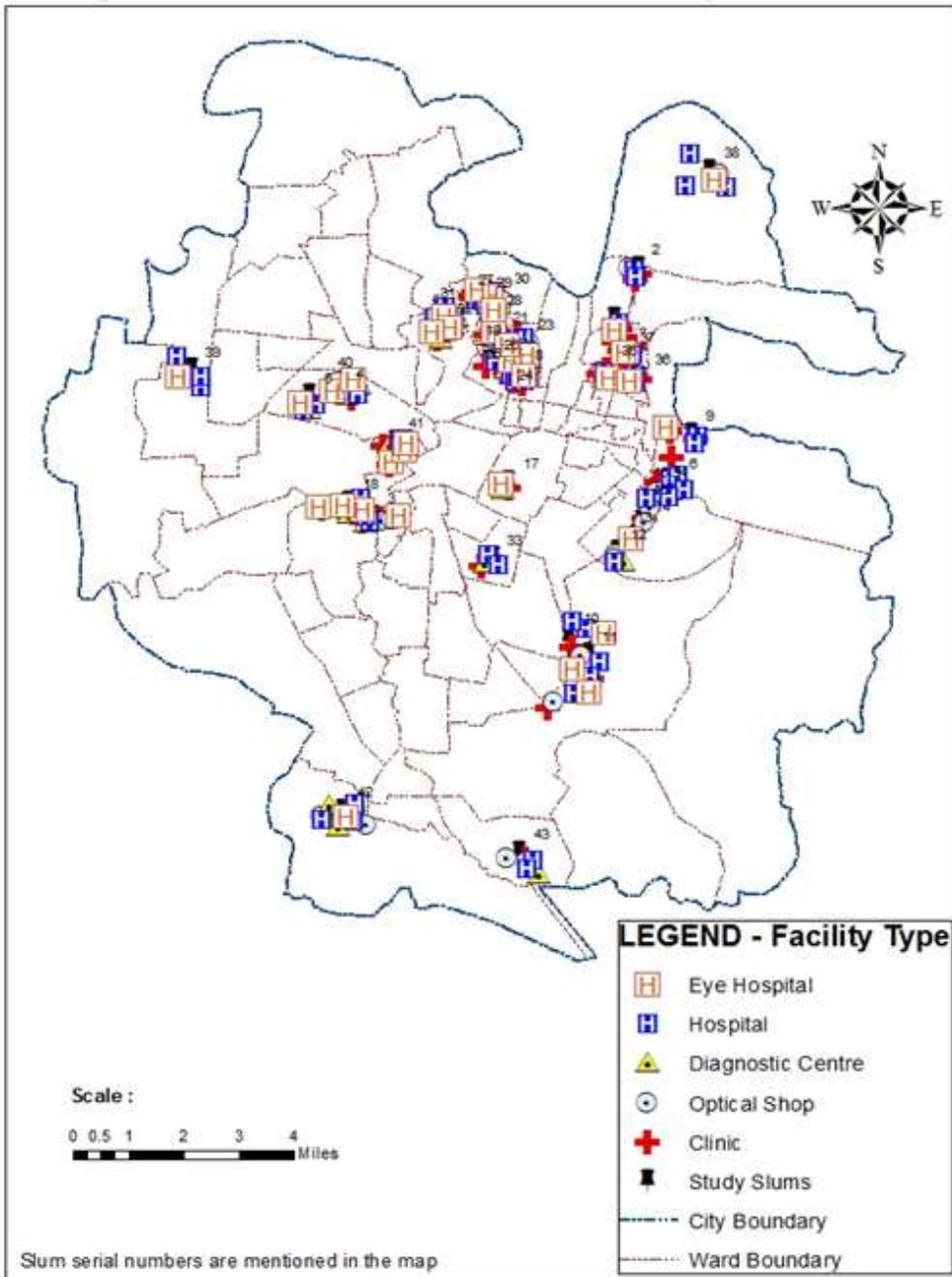
4.2.1 GIS mapping and eye care facility assessment

The 319 facilities included doctors' clinics and diagnostic centres (131), general hospitals (81), optical shops (66) and specialist eye hospitals (33). 101 of these facilities provided eye care services (Table 10).

Table 10: Eye care facilities

Availability of eye care services	Frequency	Percentage
Available	101	31.7
Not Available	218	68.3
Total	319	100

Figure 4: Geographical distribution of eye care facilities



4.2.2 Provision of eye care services

Table 11 shows the types of services provided in the facilities included in the survey. About 82% of facilities provided ophthalmic consultations, 90% provided refraction services and 78% had facilities for spectacles/optical lens dispensing. A quarter of the facilities provided cataract services and about 24% had optometry and low-vision services.

Table 11: Provisions of eye care services

Category	Frequency	Percentage
Ophthalmic services	N=213	
Ophthalmic consultations	83	82.2
Cataract services	25	24.8
Optometry and low vision	24	23.8
Glaucoma	22	21.8
Cornea and refractive surgery	17	16.8
Vitreo-retina & uvea/oculoplasty	14	13.9
Paediatric ophthalmology and neuro ophthalmology	13	12.9
Preventive ophthalmology and rehabilitation	12	11.9
Eye bank/eye donation centre	3	3.0
List of services provided	N=212	
Refraction	91	90.1
Refractive surgery/laser	14	13.9
Spectacle/optical lens dispensing	79	78.2
Spectacles/lens finishing lab	28	27.7
Cataract surgeries	N=124	
Cataract surgery (Phacoemulsification)	26	25.7
Cataract surgery (MSICS)	22	21.8
Paediatric cataract surgery	22	21.8
Counselling (pre- and post-surgery)	25	24.8
YAG laser capsulotomy/YAG	22	21.8
Others (cornea, corneal opacity, keratoplasty, stunt surgery)	4	4.0

4.2.3 Facility information systems

Overall, facilities included in the survey were reluctant to show their data. The responses given were largely around services provided and the type of data collected rather than the volume of services or the number of patients. About 83% of facilities surveyed maintained data on outpatient visits, 81% had data on referrals and 69% had data on spectacles dispensed. Around 22% of facilities said that they maintained inpatient records and the number of surgeries performed. About 30% of hospitals had dedicated hospital beds for eye patients. About 30% of facilities organised eye care camps and about 24% visited schools for eye screening. About 19% kept records of the number of patients referred for refractive errors (Table 12).

Table 12: Facility activity records

Category	Frequency*	Percentage
Outpatient - data collection regarding	N=101	
Number of outpatient visits at hospital	84	83.2
Number of patients refracted	82	81.2
Number of glasses dispensed	70	69.3
Inpatient (OT) - data collection regarding	N=101	
Number of surgeries performed	23	22.8
Number of cataract surgeries performed	23	22.8
Number of other surgeries performed (SICS)	21	20.8
Inpatient (ward)	N=101	
Number of hospital beds available	30	29.7
Number of hospital beds dedicated to eye patients	30	29.7
Number of patients admitted in ward	22	21.8

Category	Frequency*	Percentage
Community screening and referrals	N=101	
Number of eye camps organised	31	30.7
Number of schools visited	24	23.8
Number of patients screened	29	28.7
Number of refractive error patients referred	19	18.8
Number of patients referred	34	33.7
Number of other patients referred	42	41.6

*Multiple answers

4.2.4 Human resources for eye health

About 30% of facilities providing eye health services had an ophthalmologist in post. About 80% had an optometrist and 56% employed ophthalmic assistants. Around 20% of facilities employed ophthalmic nurses and 42% had at least one vision technician. Over half (52.4%) of the facilities had a spectacles sale outlet (Table 13).

Table 13: Human resources for eye health

Category	Frequency*	Percentage
Eye health staff	N=101	
Ophthalmologist (posted as ophthalmologist)	30	29.7
Optometrist	80	79.2
Ophthalmic assistants	57	56.4
Ophthalmic nurse	20	19.8
Vision technician	42	41.6
Optical filter/dispensing technicians	9	8.9
Administrator	6	5.9
Equipment/biomedical technician	3	3.0
Eye bank officers	2	2.0
Spectacle sales	53	52.5

*Multiple answers

4.2.5 Eye care equipment

Table 14 shows a detailed inventory of the equipment available in the facilities surveyed. Most facilities had eye examination and diagnostic equipment, such as torches (93%), distance vision charts (91%) and refraction sets (85%). About 20% had surgical equipment, such as operating microscopes, cryosurgical units, cataract surgical sets and phaco emulsification machines. About 20% of facilities had biometry equipment such as ultrasound A-scan and keratometer. The number of different types of equipment available was not provided by the facilities.

Table 14: Eye care equipment inventory in the facilities surveyed

Category	Frequency*	Percentage
Diagnostic equipment	N=101	
Slit lamp	41	40.6
Direct ophthalmoscope	36	35.6
Indirect ophthalmoscope	30	29.7
Aplanation tonometer	19	18.8
Non-contact tonometer	25	24.8
Streak retinoscope	51	50.5
Humphrey field analyser	18	17.8
Auto-refractometer	74	73.3
Refraction set (trial lens set+ frame)	86	85.1
Low vision set	77	76.2
Fundus camera	15	14.9
Torch	94	93.1
Distance vision charts	92	91.1
Lensometer	69	68.3
Lens edger	56	55.4
Lens blocker	49	48.5

Category	Frequency*	Percentage
Surgical equipment	N=101	
YAG laser	18	17.8
LASIK laser	14	13.9
Operating microscope	22	21.8
Cryosurgical unit	20	19.8
Cataract surgical sets	22	21.8
Phaco emulsification machine	22	21.8
Vitreectomy machine	18	17.8
Autoclave	17	16.8
OT table	22	21.8
Electrocardiogram	21	20.8
Biometry	N=101	
Ultrasound A-scan	21	20.8
Ultrasound B-scan	17	16.8
Keratometer	21	20.8
Laser interferometer	11	10.9
IOL Master	19	18.9

*Multiple answers

4.2.6 Funding sources

The facilities were reluctant to share any financial information and only broadly talked about the sources of funding available to them. About 75% of facilities charged patients user fees for eye care services. Three facilities had government grants and two facilities received donations from NGOs and private foundations. Only one facility had arrangements with a health insurance scheme. About 12% of facilities provided services under central, state or district plans like CGHS, RSBY and ESIS. About 65% of facilities provided free services to poor patients and 73% served poor patients at a reduced fee (Table 15).

Table 15: Funding sources of the facilities surveyed

Category	Frequency*	Percentage
Facility income sources	N=101	
Patient fees (out-of-pocket expenditures)	76	75.2
Government grants (central/state/district)	3	3.0
Donations (NGO, private foundations, etc.)	2	2.0
Health insurance schemes (public & private)	1	1.0
Providing services under any plan	N=101	
Rashtiya Swasthya Bima Yojana (RSBY)	2	2.0
Central Government Health Scheme (CGHS)	4	4.0
Employment State Insurance Scheme (ESIS)	3	3.0
Universal Health Insurance Scheme (UHS)	1	1.0
State health insurance programmes	1	1.0
Others (specify)	1	1.0
Working with any private health insurance or community health insurances scheme	N=101	
Yes	1	1.0
No	92	91.1
Not responded	8	7.9
Provision for poor patients	N=101	
No specific provision	6	5.9
Free services (for all patients)	66	65.3
Free services (for indigent patients only)	4	4.0
Reduced fees (third party sponsored - specify)	74	73.3
Reduced fees (cross-subsidies)	8	7.9
Specific payment agreement (differed payment, by instalments, etc.)	-	-
Micro-credit or loan facilities	-	-

*Multiple answers

4.2.7 Opening hours

This information was collected from all facilities included in the survey irrespective of whether they provided eye care services. Almost all facilities (98%) provided services daily. One quarter provided morning services only. Most facilities (83%) provided outpatient services. Around 71% had pharmacies and about one quarter (26%) provided inpatient care. About 9% of facilities delivered outreach services (Table 16).

Table 16: Opening hours of the facilities surveyed

Category	Frequency*	Percentage
Service pattern	N=319	
Daily	314	98.4
Weekly	4	1.3
Other	1	0.3
Operating days	N=319	
All week	308	96.7
Monday	9	2.8
Sunday	1	0.3
Variable	1	0.3
Service provision	N=319	
Outpatient services	266	83.4
Pharmacy services	225	70.5
Inpatient services	85	26.6
Laboratory services	72	22.6
Surgery	84	26.3
Screening and outreach services	29	9.1

*Multiple answers

4.3 Qualitative data

The participants of both FGDs and PRA identified a number of common health problems prevalent in their areas, including cold, cough, flu, fever, diarrhoea, skin itching, asthma and vomiting. Stomach-related problems and skin itching were noted as the most troublesome issues. The most common eye conditions were redness, itching, watering eyes, cataract and poor eyesight more broadly. The majority of participants emphasised the importance of sight for their life, work and social participation.

“Eye is one of the most important organs of a body, if eye is lost, life becomes very difficult, so money needs to be spent for eye care.”

It was pointed out that all people irrespective of age or sex were affected by eye problems, but the types of problems experienced by different population subgroups differed. People above 50 years of age were more likely to experience poor eye sight and cataract. Poor distance vision was noted in younger people and children.

“Earlier ... elderly people were found wearing glasses, now even young children wear them. Probably because they are glued to television all the time watching cartoons.”

“Over exposure to TV and smart phones is the main reason of eye problems in youth these days, whereas elders suffer because of old age.”

Some said that women were more likely to be affected by poor eyesight than men. The PRA participants associated weak eyes with poor physical health and referred to bad eating habits and lack of nutrients in the food.

Seasonality in eye health-related problems was noted with a rise in the number of patient cases in the rainy season; in summer and autumn, watering eyes, redness and itching were also common due to dust and pollution.

“More people ... have eye problems, probably because of ... industrial units and resultant pollution.”

Some professional groups, such as carpenters and rickshaw drivers, were also thought to be vulnerable to eye problems. Some women participating in PRA said that their eyes were getting weaker because of their working activities such as *silai*, *kadhai* and cleaning grains on a regular basis.

When asked about treatments and seeking care, almost all participants said that their first response to an eye problem was to wash eyes with cold water and wait to see if the problem subsided. If it did not happen, the next step was to seek medical advice. Most respondents said

that they would go to the nearest clinic available. These were largely optical shops or local clinics rather than specialist services. Many respondents said that specialist eye health facilities were available, but the fees were too high. Many were aware about government facilities with free or subsidised services, but these were a distance away, and many were overcrowded with long waiting times. Therefore, patients went there only if they had no other choice. A number of respondents said that they wanted to have more accessible government hospitals and more check-up camps organised by the government or NGOs.

“Most of us ... go to a government health facility for any type of illness. We don't know about any private health providers in the area. We also have one behenji in our area and she provides spectacles at a lower cost.”

Participants were divided on their opinion about whether eye problems were preventable. Some talked about eating more green vegetables and Vitamin A-rich foods. Others referred to better care like washing eyes with lukewarm water and washing hands. Some mentioned home remedies like eating black pepper. However, a number of participants said it was not possible to prevent eye problems, particularly for older people.

When asked about sources of information about eye health, almost all study participants said their knowledge was from their community, the elders and their families. A number of participants mentioned newspapers and television. A few pointed to doctors as their source of information.

FGD participants said that there was no stigma associated with wearing spectacles. Many said that spectacles were important for both men and women and those who need them should wear them. However, female PRA participants said that women did not like wearing spectacles because they were heavy and uncomfortable, and caused headaches.

5 Discussion

This study aimed to better understand the demand for and provision of eye care services in urban slums in the city of Jaipur. The study used a mixed-methods design, including a household survey, GIS mapping and a survey of local facilities, focus group discussions and the Participatory Rural Appraisal.

The survey was conducted among participants aged 15-50 years and the results are similar to the findings of similar studies in other settings. The majority of study participants in Jaipur had some knowledge about eye health, with the most frequent sources of information being television and family and friends. The majority of participants knew where to get care, and government hospitals were named as the most common provider followed by private hospitals/clinics. Slum-dwellers had to trade-off between affordability and quality of care when choosing their healthcare provider, as governmental facilities were more affordable but were often a distance away and overcrowded. Private facilities were thought to be of a better quality, but were often too expensive.

Similar to other research in low- and middle-income contexts, self-reported ocular morbidities were common with about one in three participants reporting an eye problem at the time of the study. The main complaints were blurred vision, abnormal eye secretion, pain, itching and redness. Also, participants in Jaipur did not rush to seek care and often preferred to wait to see whether their problem would resolve. Two-thirds of the survey respondents said that they had identified their eye problem within the past year, and only one third sought advice outside their home. Those who did not seek care said that they did not feel any need, while one in five had no money to pay for services and one in six had other spending priorities. The preferred place for consultation was a government hospital followed by private hospitals/clinics. Proximity to home, low cost of services, convenient opening hours and staff attitudes were important considerations for this population when choosing their service provider.

Sample spectacles coverage was relatively low among slum-dwellers compare to other studies [12-14]. Only 8% of respondents reported using glasses at the time of the survey, although there was no accurate data on visual impairment collected in this study and it was not possible to make more definitive conclusions about the uptake of spectacles or eye care services more broadly. Glasses were primarily prescribed by and purchased from private hospitals/clinics, followed by optical shops, government hospitals/clinics and NGOs. The overwhelming majority of study participants paid for their glasses and over two-thirds paid up to INR 600 (US\$ 9.6).

This study identified a large number of eye care facilities in the vicinity of the surveyed slums, comparable to the results of the Pakistan and Bangladesh in analogous settings. Out of 319 facilities included in the study, 101 provided eye care services. These included doctors' clinics and diagnostic centres, general hospitals, optical shops and specialist eye hospitals. The majority of facilities provided ophthalmic consultations and refraction services. Over three-quarters had spectacles/optical lens dispensing units. Just over a quarter of facilities provided cataract services and a quarter provided low-vision services.

Assuming stated willingness to pay translates in actual price, almost all study respondents were willing to pay for spectacles in the WTP study. Nonetheless, it should be noted that 19% of the respondents have stated a WTP lower than the median actual price paid for spectacles (INR 400-599). The WTP for spectacles was similar for hypothetical users and those with diagnosed refractive error. Half of the participants in both categories would not pay more than INR 600-700 (US\$ 9.4-10), confirming the theoretical validity of the survey [15]. Based on their incomes, over half of the respondents would find it somewhat difficult to cover the costs of spectacles and about a third would find it easy. The results suggest the possibility of introducing a cross-subsidisation system, offering different price range of spectacles to subsidise access to spectacles to those not willing or not able to pay the full price.

It is important to note that the study initially planned to assess the prevalence of refractive error (RE) using Rapid Assessment of Refractive Error (RARE) methodology. Although the clinical examination was conducted and the patients with refractive error were identified, there were problems with coding the data and a significant proportion of records were considered invalid. Therefore, the study could not make estimates of the prevalence of refractive error and the data was excluded from this report. Also, it should be emphasised that the study did not control for the willingness to pay stated and the actual price paid for spectacles. Such control would require a follow-up study to compare respondents' stated WTP and actual price paid for spectacles. Moreover, a common [15, 16] instrument bias has been observed, where the lowest initial starting price tended to result in lower maximum stated WTP.

In conclusion, ocular morbidities are common in the surveyed slum population in Jaipur. The population has a variety of eye care facilities available to them and the majority knows about eye health and where to seek eye care. The majority of the respondents surveyed understood the importance of eye care in general and spectacles in particular, and stated a willingness to pay for spectacles to correct vision. This study did not have accurate data on the prevalence of visual impairment, and so it is difficult to comment on the uptake of spectacles and eye care services more broadly.

We did not find strong evidence of stigma of spectacles in this community; however, the data on self-reported blurred vision and availability of spectacles may suggest that the uptake of spectacles is relatively low. Data on eye health-seeking behaviour also suggests that, similarly to other settings, people experiencing eye problems do not rush to services unless their condition causes pain, discomfort or substantial vision loss. With conditions that are minor or asymptomatic, people prefer to wait and see whether the situation improves. The main reasons are time, distances and costs of services. In addition, many perceive eye problems as a normal sign of aging. More marketing research into what makes eye care services and specifically spectacles attractive to this population is required. Further research into the prevalence of visual impairment and cataract coverage would also be useful to guide local planning of eye health services for this population.

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Appendices

Appendix A: Socio-demographic profile of respondents

Variable	Frequency	Percentage
Gender	N=3,319	
Male	1,621	48.8
Female	1698	51.2
Age	N=3,319	
15-19	753	22.7
20-29	1,059	31.9
30-39	706	21.3
40-50	801	24.1
Age (mean)	29.4 years	
Marital status	N=3,319	
Currently married	2,169	65.4
Living with a partner	7	0.2
Widowed	56	1.7
Divorced/separated	14	0.4
Single (never married)	1,073	32.3
Household size (mean)	6.5 members per HH	
Highest level of education	N=3,319	
No formal education (illiterate)	444	13.4
No formal education (literate)	641	19.3
Primary	676	20.4
Secondary	1,248	37.6
Undergraduate	204	6.2
Postgraduate	105	3.2
Other	1	0.0

Variable	Frequency	Percentage
Caste	N=3,319	
Scheduled Caste (SC)	968	29.2
Scheduled Tribe (ST)	211	6.4
Other Backward Classes (OBC)	1,379	41.6
None of them	761	22.9
Worked in the past 12 months	N=3,319	
Yes	1,502	45.3
No	1,817	54.8
Main activity (last 12 months)	N=3,319	
Work	1,463	44.1
Housework/childcare*	1,207	36.4
Going to school/studying	555	16.7
Looking for work	63	1.9
Retired	3	0.1
Unable to work/disabled	24	0.7
Other	4	0.1
Employment type	N=1,463	
Salaried	407	27.8
Daily labourer	672	45.9
Self employed	371	25.4
Not paid	4	0.3
Contract	7	0.5
Other	2	0.1

Variable	Frequency	Percentage
Occupation**	N=1,463	
Production worker (skilled)	646	44.2
Production worker (unskilled)	424	29.0
Sales worker (formal)	137	9.4
Sales worker (informal)	49	3.4
Service worker (transport)	36	2.5
Service worker (domestic)	36	2.5
Service worker (other)	57	3.9
Professional	62	4.2
Other	16	1.1
Monthly income (individual) in INR	N=3,319	
No income	1,818	54.8
Less than 5,000	418	12.6
5,000-9,999	639	19.3
10,000-19,999	353	10.6
20,000-29,999	68	2.1
30,000 and above	23	0.7
Individual monthly income (mean)	3,567 INR	
Average household income, per month in INR	N=3,319	
No income	13	0.4
Less than 5,000	2,952	88.9
5,000-9,999	301	9.1
10,000-19,999	46	1.4
20,000-29,999	6	0.2
Average household per capita income, per month (mean)	2,597 INR	

Variable	Frequency	Percentage
Wealth quintile	N=3,319	
Quintile 1 (Lowest relative wealth group)	150	4.5
Quintile 2	497	15.0
Quintile 3	747	22.5
Quintile 4	1,086	32.7
Quintile 5 (Richest relative wealth group)	839	25.3

* Within their own household (not as employee)

** Skilled production workers refers to manual workers such as builders, carpenters, artisans, etc. Sales worker (informal) includes petty traders and hawkers. Service worker (domestic) refers to persons who are employed to carry out domestic chores (maids, etc). Professional category includes technical, administrative, and managerial occupations.

Appendix B: Health-seeking behaviour of the respondents

Variable	Frequency	Percentage
Time when problem noticed	N=288	
For less than a week	14	4.9
Within past month	55	19.1
Within past year	108	37.5
Within past four years	55	19.1
More than four years ago	26	9.0
Don't remember	30	10.4
Consult	N=288	
Yes	87	30.2
No	201	69.8
Reasons for seeking treatment	N=87	
Red eye	6	6.9
Pain in the eye	44	50.6
Problem not resolving on its own	1	1.2
Problem perceived as urgent	9	10.3
Gradual change in vision	19	21.8
Trauma/accident	1	1.2
Others	4	4.6
No reason	3	3.5
Reasons for not seeking treatment	N=201	
Recent problem	3	1.5
Wait to see what happens	2	1.0
Need not felt	85	42.3
No money to pay	38	18.9
Other priorities for spending money	30	14.9
Not my decision to make	11	5.5
Need to work/earn money	13	6.5
Don't know where to go	12	6.0
Too far from home/workplace	2	1.0
No person to accompany	4	2.0
Self-diagnosis/treatment	1	0.5

Variable	Frequency	Percentage
Choice of healthcare facilities	N=87	
Government facilities	49	56.3
Private medical college	4	4.6
Doctor private practice	3	3.4
Private hospital/clinic	20	23.0
NGO hospital/clinic	1	1.1
Optical shop	5	5.7
Other	2	2.3
N/A	3	3.4
Reasons for choosing that particular healthcare facility	N=87	
Near home	8	9.2
Easy to access anytime	7	8.0
Good attitude of provider	9	10.3
Less waiting time	5	5.7
Trust and acquaintances	16	18.4
Medicine availability	11	12.6
Availability of free/low-cost services	17	19.5
Pay later	2	2.3
Quality of care	7	8.0
Others	2	2.3
N/A	3	3.4
How did you travel to that facility	N=87	
On foot	26	29.9
Public vehicle (bus, etc.)	28	32.2
By private vehicle	26	29.9
By rickshaw	2	2.3
Other	2	2.3
N/A	3	3.4

Variable	Frequency	Percentage
Type of treatment provided by healthcare facility	N=87	
Spectacles	14	16.1
Eye drops	63	72.4
Medicine (pills, etc.)	1	1.1
Surgery	1	1.1
Traditional/home remedy	1	1.1
Referred to another facility	1	1.1
No treatment prescribed	2	2.3
Other	1	1.1
N/A	3	3.4
If so, why did you not get glasses (as prescribed)?	N=14	
Need not felt	8	57.1
No money to pay	1	7.1
Other priorities for spending money	1	7.1
Don't know where to go	1	7.1
Glasses would make me look less good	2	14.3
People/friend would make fun of me	1	7.1
Did you comply with the prescribed treatment?	N=87	
Yes	81	93.1
No	3	3.4
N/A	3	3.4
If no, why did you not comply with prescribed treatment?	N=3	
Need not felt	1	33.3
No person to accompany	1	33.3
Other	1	33.3