National Survey on Blindness and Visual Outcomes after Cataract Surgery

(2001-2002)

Report

National Programme for Control of Blindness,
Directorate General Health Services,
Ministry of Health & Family Welfare,
Govt. of India

Data analysis & compilation of report:
Community Ophthalmology Section
Dr. Rajendra Prasad Centre for Ophthalmic Sciences,
All India Institute of Medical Sciences,
Ansari Nagar, New Delhi – 110029

2002

Survey Teams and Districts Covered

States Covered	Districts Covered	Survey Teams
Andhra Pradesh	Prakasam	Jawaharlal Institute of Post Graduate Medical Education & Training, Pondicherry
Bihar	Vaishali	State Institute of Ophthalmology, Allahabad
Chatisgarh	Rajnandgaon	Mahatma Gandhi Institute of Medical Sciences, Sevagram
Gujarat	Surendra Nagar	Indian Institute of Health Management Research, Jaipur
Himachal Pradesh	Solan	Christian Medical College, Ludhiana
Karnataka	Gulbarga	Sarojini Devi Eye Hospital, Hyderabad
Kerala	Pallakad	Lions Aravind Institute of Community Ophthalmology, Madurai
Madhya Pradesh	Dewas	Regional Institute of Ophthalmology, Ahmedabad
Maharashtra	Satara	NAB- LIONS Hospital, Miraj
Orissa	Dhenkanal	Vivekanand Mission Hospital,
Punjab	Bhatinda	Post Graduate Institute, Chandigarh
Rajasthan	Bharatpur	Rajendra Prasad Centre for Ophthalmic Sciences, AIIMS, New Delhi
Tamil Nadu	Sivaganga	Lions Aravind Institute of Community Ophthalmology, Madurai
Uttar Pradesh	Sultanpur	Rajendra Prasad Centre for Ophthalmic Sciences, AIIMS, New Delhi
West Bengal	Malda	Vivekanand Mission Hospital,

List of Abbreviations

AC	: Anterior Chamber
CSC	: Cataract Surgical Coverage
DBCS	: District Blindness Control Society
DPM	: District Programme Manager
DC	: District Collector
DH	: District Hospital
ECCE	: Extra capsular cataract extraction
EPI	: Expanded Programme on Immunization
ETDRS	: Early treatment of Diabetic Retinopathy Study
ICCE	: Intra capsular Cataract Extraction
IOL	: Intraocular lens
ICMR	: Indian Council for Medical Research
MIS	: Management Information System
NGO	: Non-Governmental Organization
NPCB	: National Programme for Control of Blindness
PC	: Posterior Chamber
PCO	: Posterior Capsular Opacification
PHC	: Primary Health Centre
PMOA	: Para Medical Ophthalmic Assistant
SICS	: Small Incision Cataract Surgery
VA	: Visual Acuity

Contents

1. Executive Summary

1.1 Background

- A nation wide survey on the magnitude and causes of blindness and cataract surgical outcomes was carried out in 15 randomly selected districts in 15 states in the country during the period 1998-2002. Two districts (Bharaptur district of Rajasthan and Sivaganga district of Tamil Nadu were covered in 1998-99 while the remaining districts were covered during 2001 - 2002.

- A total of 72044 50+ persons were enumerated and a total of 64343 persons were examined. Thus 89.3 per cent of the enumerated were subjected to a detailed eye examination. A total of 126674 eyes were available for examination. In 1002 persons (2004 eyes), visual acuity could not be recorded.

- The response rate was marginally higher in females (91.1%) compared to males(87.4%).

1.2 Demographic characteristics

- Nearly half (46.9%) respondents were aged 50-59 years while 19.3% were aged 70+.

- Only 3.1% respondents were educated to beyond high school. 71% respondents were illiterate.

- Overall, 84.6% respondents belonged to rural areas while 15.4% hailed from urban areas.

- More than half the respondents were either involved in housework/ unemployed (38.3%) or professed that they were too old to work.

1.3 Magnitude of Blindness and Low Vision

- The overall prevalence of economic blindness (vision < 6/60 – 3/60 in the better eye) was 3.2% (95% CI: 3.0 – 3.4). The prevalence of social blindness (vision < 3/60 in the better eye, which corresponds to the WHO definition of blindness) was 5.3% (95% CI: 5.1 – 5.6). There were wide inter district variations in the prevalence of both social and economic blindness.

- The overall prevalence of blindness as per the NPCB definition (presenting vision < 6/60 in the better eye) was 8.5% (95% CI: 7.1 – 9.9). High prevalence was

recorded in Gulbarga (13.7%), Rajnanadgoan(12.4%), Bharatpur (11.9%), Prakasam (10.9%) and Dhenkanal (10.8%).

- Low prevalence of blindness as per the NPCB criteria, among the 50+ population was observed in Palakkad district (4.3%), Solan district (5.4%), Vaishali district (6.0%) and Sivaganga district (6%). Except Sivaganga, all the other districts were in low prevalence States in 1986-89, and the same trend was observed in the present survey also.

- There was a higher prevalence of blindness in the States which were assisted by the World Bank in the present survey, except in Tamil Nadu, UP and Maharashtra. This was to be expected as all these States had a much higher prevalence of blindness compared to the other states in 1986-89, which was the basis for the World Bank assistance.

- Overall, based on the vision in the better eye, 632.5% individuals could be categorized as Near Normal, 23.8% as Low vision and 5.1% as Unilaterally blind. The proportion of normal individuals was highest in HP (74.6%) and Kerala (73%).

- After best correction, on an all India basis, 79.7% individuals could be categorized as Near Normal, 9.3% as Low Vision, 6.7% as Unilaterally Blind, 1% as economic blind and 3.4% as social blind. Therefore a significant difference could be observed after correction.

- Based on presenting vision in the better eye, females reported higher prevalence of blindness and low vision compared to males.

- The younger individuals (<55 years), had a lower prevalence of blindness and low vision compared to those aged 70+. This increase in prevalence rates was linear.

- The illiterates had a significantly higher prevalence of blindness and low vision compared to those educated to beyond high school. The difference was also evident in those who were educated even upto the primary level.

- Individuals residing in the rural areas had significantly higher rates of blindness an low vision compared to their counterparts staying in the urban areas.

- Individuals engaged in household work, those who were unemployed or those who stated that they were too old to do any work had the highest prevalence of blindness and low vision.

- Of the 128686 eyes where visual acuity was recorded, significant improvement could be seen in visual acuity after refraction. 70.2% of eyes with vision < 6/18-6/60 could be improved to >= 6/18 while 72.4% eyes with a presenting vision of < 6/60-3/60 could be improved to a better category. However 75.8% of eyes with a presenting vision < 3/60 could not be improved further by refraction.

1.4 Causes of Blindness

- Cataract (63.7%) was the commonest cause of economic blindness followed by uncorrected refractive errors (27.7%). In relation to social blindness, cataract was the responsible cause in 62%, uncorrected refractive errors in 15%, Glaucoma in 7.9%, posterior segment causes in 5.9%, surgical complications in 1.5%, corneal opacity in 1.2%, PCO (after cataract) in 1.2% and other causes in 5.4%.

- In unilateral blindness, cataract was found to be the attributable cause in 45.7% and uncorrected refractive errors in 12.6%.

- With respect to low vision, uncorrected refractive errors were the commonest cause (71.9%) followed by unoperated Cataract (24.5%).

1.5 Type of Cataract Surgery

- 10% respondents aged 50+ had undergone cataract surgery in one or both eyes. High rates of operated cataracts were found in Gujarat (20.1%), Punjab (17.6%), Tamil Nadu (14.7%), HP (13.8%) and Rajasthan (12.8%).

- In more than half the operated eyes (55.8%), ICCE was the method used. Any IOL implant was observed in 27.2%. More ICCE surgeries were undertaken in females.

- Nearly a quarter of the surgeries were undertaken in the government hospitals (24%), while 26.5% were done in operative eye camps. The remaining half, were undertaken in private hospitals or NGO institutions. Of these eyes, nearly half were undertaken on payment.

- Half the eyes (51.2%) were operated in the preceding five years prior to the survey.

- Determinants of IOL implant surgery included literacy(those educated to beyond high school), occupational status (those engaged in service or petty business), gender (males) and residence in urban areas.

1.6. Visual Outcomes after Cataract Surgery

- Only 28.2% operated individuals could be categorized as Near Normal based on their vision in the better eye. 16.6% of the individuals were socially blind after surgery.

- After refraction, 47% of the operated individuals could be categorized as Near Normal and the proportion of socially blind individuals could be reduced to 6.5%.

- A third of the operated eyes (33.6%) had a presenting vision < 6/60 after cataract surgery. Best correction reduced this to 15.5%.

- Nearly half (45.7%) of the operated eyes with a presenting vision <3/60 in the operated eye could not be improved further.

- Among those eyes with vision < 3/60 after surgery (after best correction), more than a fifth could be directly attributed to surgery while a significant proportion could be attributed to poor case selection as many of these eyes were suffering from incurable posterior segment pathology.

- Visual outcomes after cataract surgery were poorer among females, rural residents, older age at surgery (70+), individuals stating that they were too old to work and the illiterate.

1.7 Cataract Surgical Coverage

- The overall cataract surgical coverage (persons) was 65.7%. In Gujarat (84.3%), HP (82.4%), TN (82.8%), Punjab (81.7%) and Kerala (75.8%), the cataract surgical coverage was high. Poor surgical coverage was observed in Chatisgarh (44.4%), Orissa (42%), Bihar (49.2%) and Karnataka (49.2%).

- Cataract surgical coverage was significantly higher among males (70.1%) compared to females (62.4%), those educated to beyond high school (89.4%) compared to the illiterate(60.3%) and urban residents (77.6%) compared to rural residents (63.1%).

1.8 Common Surgical Complications

- Vitreous in the anterior chamber was the commonest complication observed after cataract surgery.

1.9 Ocular Morbidity

- Cataract was observed in 46.7% of respondents on examination, while anterior segment pathology was observed in 13.7% and posterior segment pathology in 8.5%.

Conclusions

1. The present survey was undertaken in a population aged 50+ years. More than a decade has elapsed since the last nation wide survey and it was expected that there would be major changes in the magnitude of blindness and causes of blindness in the country.

2. Though the present survey was confined to individuals aged 50+ as against the earlier survey (1986-89) which included all age groups, it is possible to extrapolate the data from the present study to the general population. Indications are that there is a perceptible change in the prevalence of blindness in the country.

3. As per the 1986-89 survey it was estimated that nearly 8% of individuals aged 50+ suffered from cataract blindness. There seems to be a significant change in this trend as the present survey shows that the prevalence of cataract blindness (as per the NPCB criteria) is only 5.32% (prevalence of blindness as per NPCB criteria is 8.5% and cataract is responsible for 62.6% of blindness as defined by NPCB). Therefore a sea change has occurred in the country over the past decade. It was also observed that even in the high prevalence States, the prevalence of cataract blindness was 6.02% now (prevalence of blindness as per NPCB criteria- 9.3%; cataract as a cause of bilateral blindness-64.7%). Therefore the World Bank assisted Cataract Blindness Control Project has been able to reduce the prevalence of cataract blindness significantly.

4. It is also evident that adequate attention to the other causes of blindness, in addition to cataract is urgently needed if the situation has to be completely redressed. A consolidation phase is now on the horizon and unless adequate funds and infrastructure are committed, the gains of the past decade can be frittered away, as has happened with many other public health interventions. This necessitates a return to the drawing board to have a fresh look at the alternative strategies, which need to be implemented for the consolidation phase. The current reality is that care of the aged is receiving less funding as it has to compete with diseases like HIV and TB. In such a context, there is a need for agencies like the Bank to continue to support blindness control activities because of the significant impact this cost effective intervention has in improving the quality of life of the affected individuals, families and communities.

5. Another major need for the consolidation phase is the setting up of an effective MIS to effectively monitor the changing trends and ring warning bells as and when the need arises. Such a function should be handled by an institution, which has expertise in this area. Adequate human resource and infrastructure support need to be provided for such an endeavor.

6. A finding of immense importance is that inspite of the improved infrastructure, follow up services have not been augmented. This is evident in the visual

outcomes after cataract surgery. Many of the operated individuals who could have benefited tremendously with an appropriate pair of spectacles continued to languish in the realms of blindness. Operational research to search for the appropriate strategy to provide need based affordable spectacles to the underprivileged populations is also of urgent concern.

7. A revolution in surgical techniques is now visible in the country. In many States, IOL implant surgery has now become the main surgical modality with far better visual rehabilitation than what was evident a few years ago. There is a snowballing effect and the next five years will sound the death kneel of antiquated surgical techniques. Also of great significance is the fact that more than a quarter of the population is willing to pay for services. This trend will allow the Government sector to play a facilitative role than to provide all services free of cost. The reduced number of surgeries at peripheral eye camps is also a trend worth mentioning as it means that more and more surgeons are moving to the confines of a safe and sterile operating room rather than compromise with the vagaries of nature.

8.

2. Introduction

Recent estimates of the World Health Organization suggest that there are nearly 40 million people who are blind, worldwide, and that more than 90 per cent of them reside in the developing countries. Nearly a fifth of them are in India. Using a visual acuity cut off of < 6/60 in the better eye (the definition used by the National Programme for Control of Blindness in India), the number of blind increase to approximately 13 million, in India alone. With three out of every four Indians, residing in the rural areas, there is a concentration of blindness in agriculture dependent communities in India. The only modality to reach out to this suffering mass of humanity till a decade ago was through the improvised eye camp approach. This approach was adopted by the NPCB in tackling the huge backlog of cataract related blindness in the Indian sub continent.

The Indian Council for Medical Research (ICMR) conducted a national survey in 1971-74. This survey indicated that the prevalence of blindness in the general population was 1.38 per cent. The survey also observed that more than half the blindness load in the country was solely due to cataract. This led the national government to initiate a comprehensive programme in 1976. The control of blindness was accorded priority and was one of the activities included in the Prime Minister's 20-point programme. Emphasis on the camp approach was one of the highlights of this programme.

A repeat survey was conducted in 1986-89, to review the gains made under the NPCB. This survey showed that there was a marginal increase in blindness to 1.49 per cent and that there was a steep decline in nutritional and infective causes of blindness in the country. As a proportion of all blindness, cataract had increased to more than 80 per cent. Seven States were responsible for 2/3 of the total blindness in the country. This led to a review of the strategies for blindness control in the country. The Govt. of India sought assistance of the World Bank for augmentation of blindness control activities in the country, with special emphasis on Cataract related blindness. This led to the initiation of the World Bank Assisted Cataract Control project in seven States – Rajasthan, Uttar Pradesh, Madhya pradesh, Andhra Pradesh, Orissa, Maharashtra and Tamil nadu. The International assistance to the project was to the tune of US $ 117.8 million. The objective of the programme, launched in 1994, was to reduce the backlog of cataract blindness, by nearly 50 per cent within a seven- year period. A major change in the programme management was the decentralization of the programme implementation to the district level through the DBCS. This step has resulted in increased participation of the NGO and private sector in blindness control activities.

Evaluation is a management tool, which helps in revising the strategies in the light of the observations on performance. MIS systems in the country today, deal mostly with surgical output and resource utilization. This does not reflect the impact of the activities on the community. Community based evaluation provides data on programme impact, which is crucial to programme managers. This helps the health system to be responsive to population needs and changing perceptions.

Earlier surveys undertaken in the country used methodologies, which could result in an overestimation of cataract as a cause of blindness as refraction or pinhole examination did not actually form a part of the survey process. Moreover, the validity of the enumeration process followed and the actual coverage of the population were never highlighted. For the first time, these aspects were carefully considered in the present series of surveys. Similar studies were conducted earlier in Nepal and China and revealed extremely useful information. In all these recent studies, an attempt has been made to follow a standard protocol. This will enable programme managers to compare data generated from different areas and thus provide more meaningful solutions to the alleviation of cataract blindness, in a global perspective.

3. Objectives

The National Survey was undertaken with the following objectives:

1. To estimate the prevalence of blindness in the population aged 50 years or above in the country.

2. To determine the prevalence of cataract related blindness.

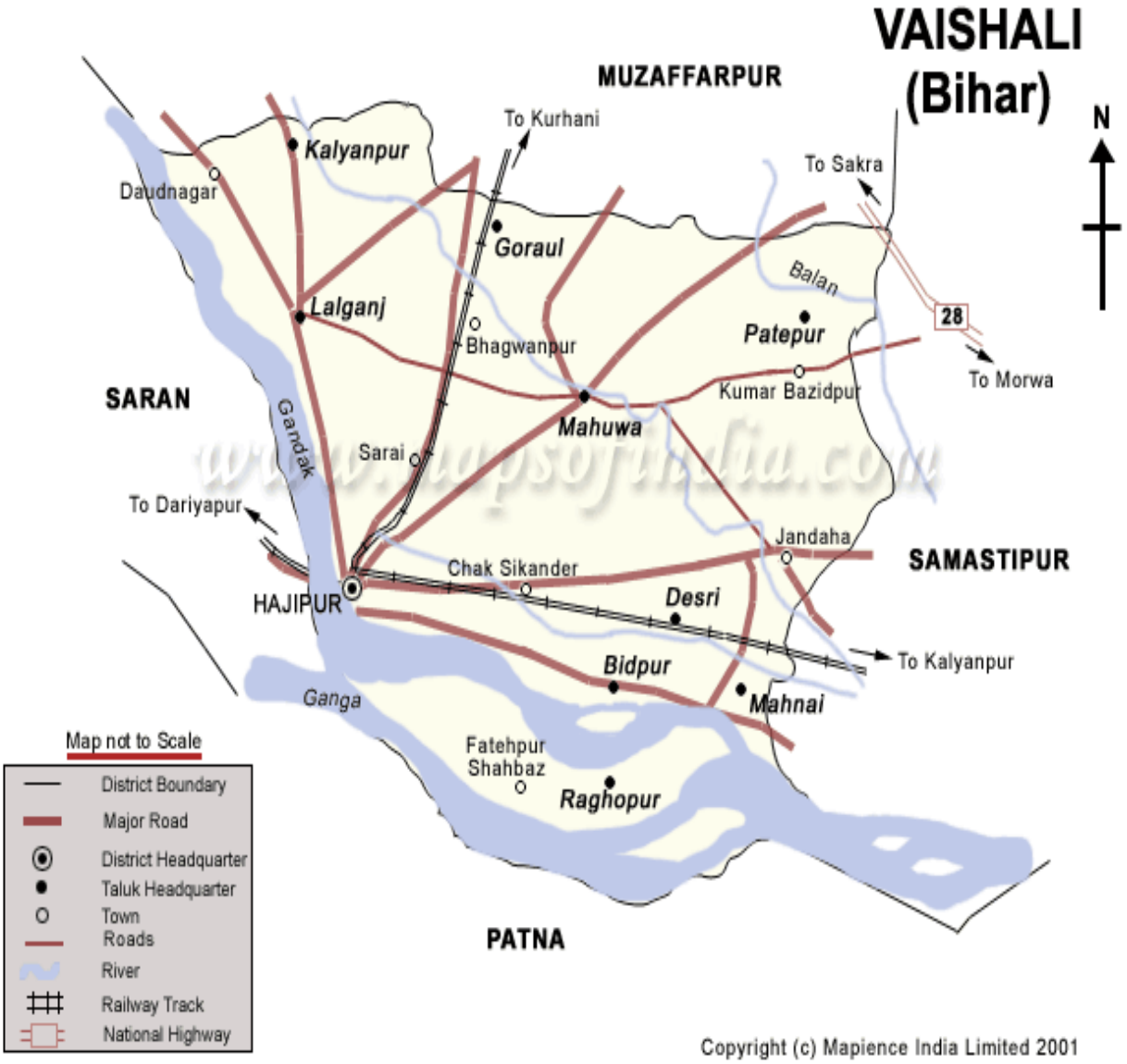
3. To estimate the cataract surgical coverage.

4. To assess vision and related outcomes after cataract surgery.

5. To assess the complications of cataract surgery and quality of surgical outcomes in the sample population.

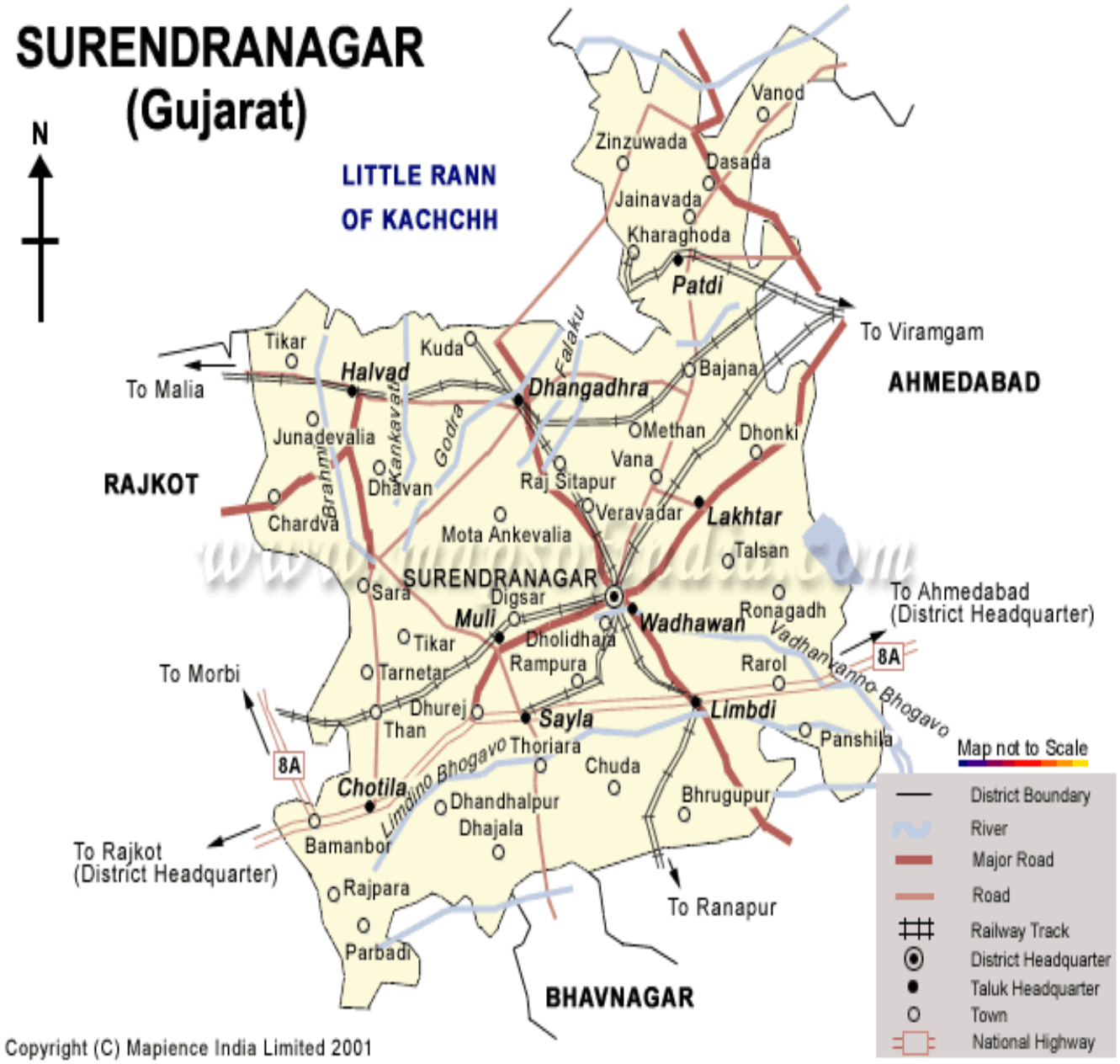
3. Background Information

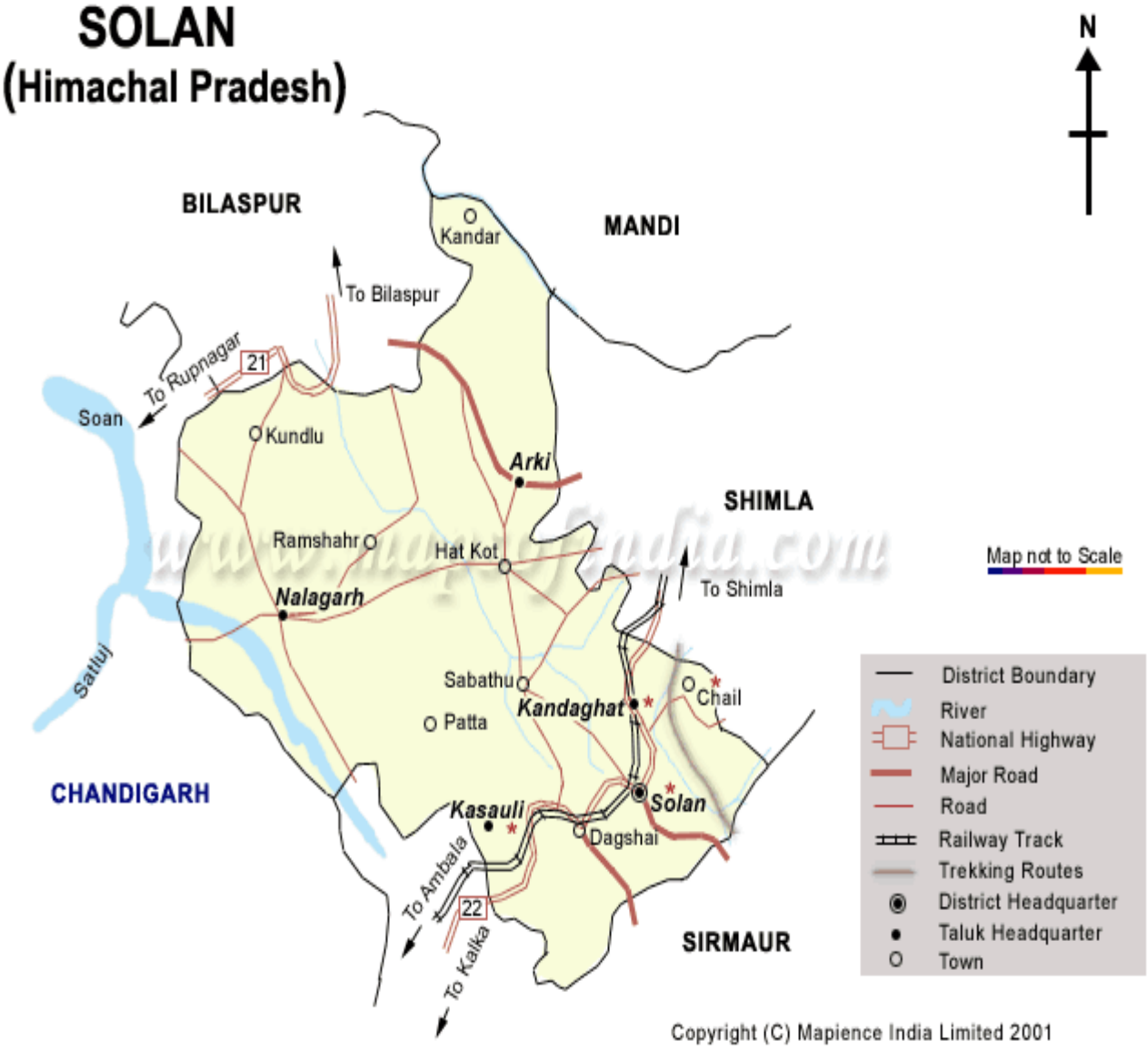
Districts Covered in Different States


VAISHALI
(Bihar)
N
MUZAFFARPUR
To Kurhani
To Sakra
Kalyanpur
Daudnagar
Goraul
Balan
Lalganj
Bhagwanpur
Patepur
28
To Morwa
Kumar Bazidpur
SARAN
Gandak
Mahuwa
Sarai
To Dariyapur
Jandaha
SAMASTIPUR
Chak Sikander
HAJIPUR
Desri
To Kalyanpur
Bidpur
Ganga
Mahnai
Fatehpur
Shahbaz
Raghopur
PATNA
Map not to Scale
District Boundary
Major Road
District Headquarter
Taluk Headquarter
Town
Roads
River
Railway Track
National Highway
Copyright (c) Mapience India Limited 2001


Raj Nandgaon
(CHHATTISGARH)
Kawardha
Bandeli
Madhya
Pradesh
Chhuikhadan
Khairagarh
Pandadah
Barhaitola
Gumka
Murhipar
Bhandarpur
To Gondia
To Durg
Paniajob
Dongargarh
Tilai
To Durg
Baghnadi
Bhanpur
Raj Nandgaon
6
Chichola
Arjuni
To Sakoli
Durg
Bendari
Dongargaon
Hat Banjari
Amgaon
Maharashtra
Bandha
Ambagarh
Chauki
Map not to Scale
Arajkund
Dangarh
Mohala
Gotatola
Boria Tibhu
Manpur
Sitagaon
Kanker
Anndhi
Parali
Copyright (c) Mapience India Limited 2001
N
District Boundary
River
National Highway
State Highway
Road
Railway Track
Trekking Routes
District Headquarter
Taluk Headquarter
Town

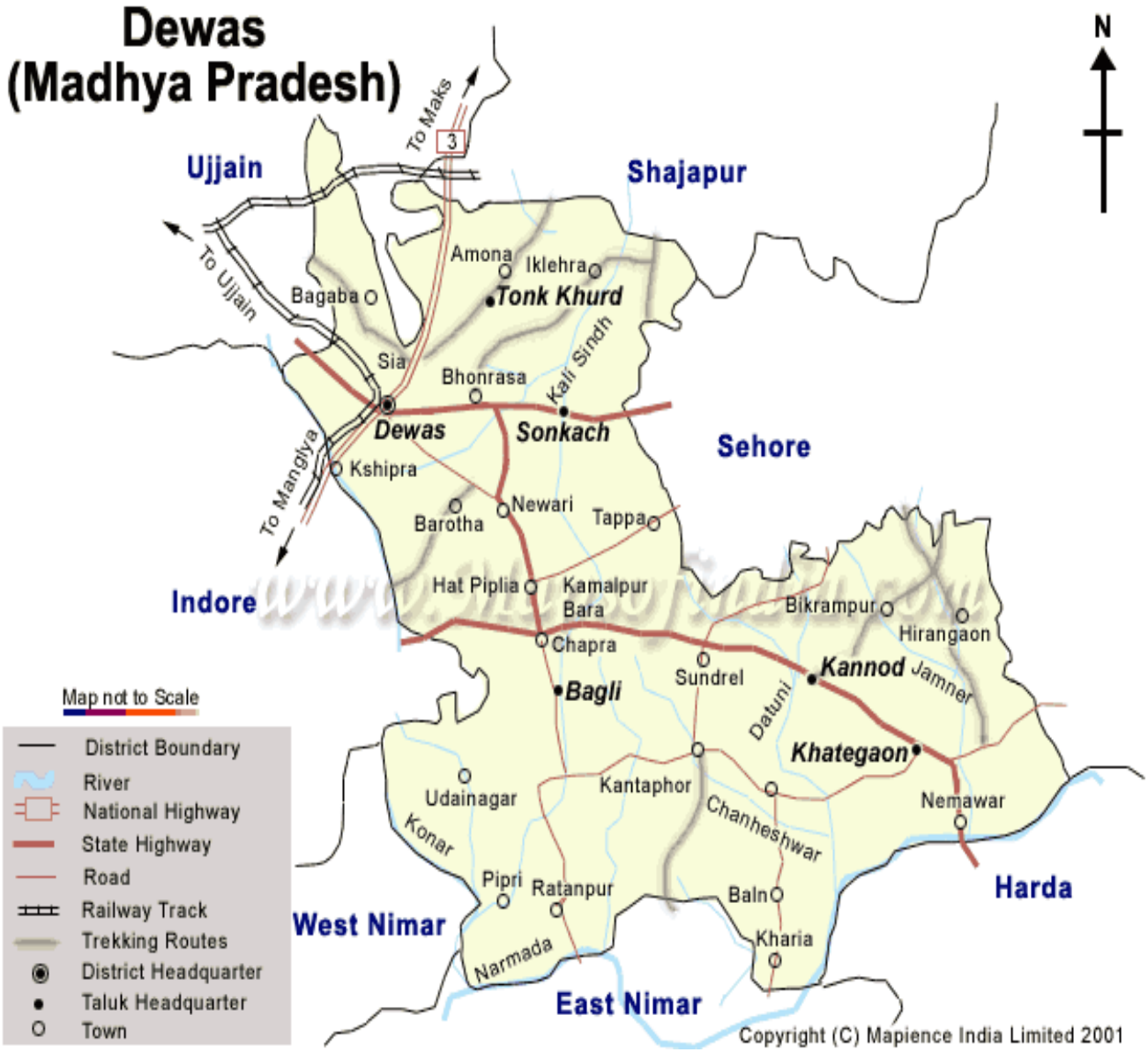

BHARATPUR
(Rajasthan)
N
HARYANA
Jurahra
Musepur
Pahari
Kaman
Gopalgarh
ALWAR
UTTAR PRADESH
Sikri Patti
Dig
Saimli
Panhori
Vahaj
To Mathura
Nagar
Qasba Au
Thun
Sinsini
Sabora
Kumher
Jagina
Nadbai
To Dausa
(District Headquarter)
BHARATPUR
Sewar
Chak Sana
11
To Agra
Luharu
Aghapur
Pathena
Uchen
To Agra
Helena
DAUSA
Kurka
Khanua
Bhasawar
Wer
Rupbas
To Mahwa leading to
district headquarter
Nithor
Rudawal
Vallabgarh
Bayana
Badalgarh Kot
Karsad
Dhurairi
To Hindaun
Bajna
KARAULI
Map not to Scale
District Boundary
Major Road
Road
Railway Track
District Headquarter
Taluk Headquarter
Town
Tourist Place
National Highway
River
Copyright (C) Mapience India Limited 2001


SURENDRANAGAR
(Gujarat)
N
LITTLE RANN
OF KACHCHH
Vanod
Zinzuwada
Dasada
Jainavada
Kharaghoda
Patdi
To Viramgam
AHMEDABAD
Tikar
Kuda
Halvad
To Malia
Falaku
Dhangadhra
Bajana
Junadevalia
Brahmani
Kankavati
Godra
Methan
Dhonki
Vana
RAJKOT
Dhavan
Raj Sitapur
Chardva
Veravadar
Lakhtar
Mota Ankevalia
Talsan
SURENDRANAGAR
Sara
Digsar
Muli
Wadhawan
Ronagadh
To Ahmedabad
(District Headquarter)
Tikar
Dholidhara
Vadhvan
8A
To Morbi
Tarnetar
Rampura
Rarol
Dhurej
Than
Sayla
Limbdi
Panshila
Thoriara
Limdino Bhogavo
Chuda
Map not to Scale
8A
Chotila
Dhandhalpur
Bhrugupur
Dhajala
Bamanbor
To Rajkot
(District Headquarter)
Rajpara
To Ranapur
Parbadi
BHAVNAGAR
District Boundary
River
Major Road
Road
Railway Track
District Headquarter
Taluk Headquarter
Town
National Highway
Copyright (C) Mapience India Limited 2001

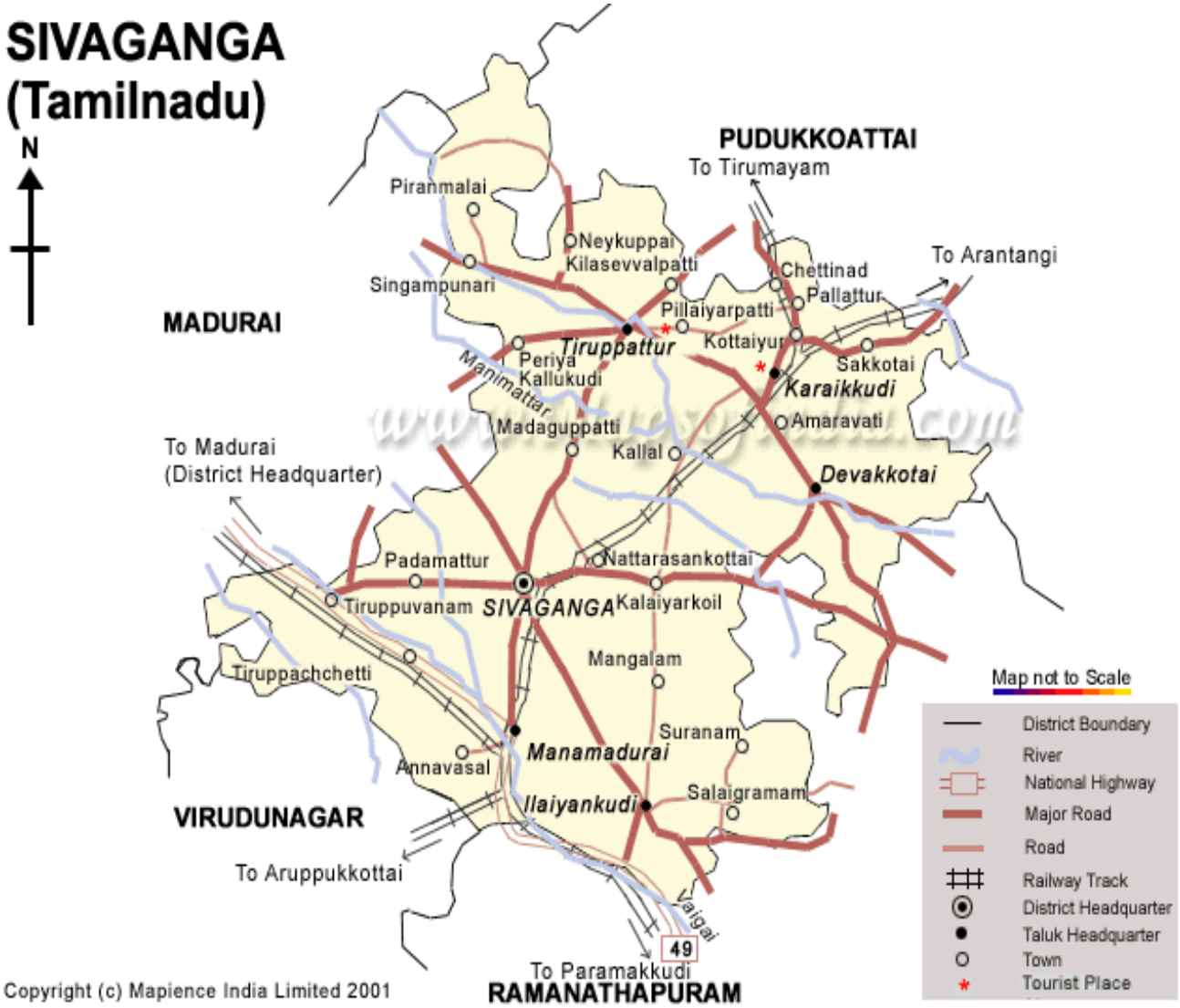

SOLAN
(Himachal Pradesh)
N
BILASPUR
MANDI
SHIMLA
CHANDIGARH
SIRMAUR
Kandar
To Bilaspur
To Rupnagar
21
Soan
Kundlu
Arki
Ramshahr
Hat Kot
Nalagarh
To Shimla
Sabathu
Kandaghat
Chail
Patta
Kasauli
Solan
Dagshai
To Ambala
22
To Kalka
Satluj
Map not to Scale
District Boundary
River
National Highway
Major Road
Road
Railway Track
Trekking Routes
District Headquarter
Taluk Headquarter
Town
Copyright (C) Mapience India Limited 2001


Gulbarga
(Karnataka)
N
Bidar
Maharashtra
Bijapur
Andhra Pradesh
Raichur
To Solapur
To Tandur
To Yermaras
Khajuri
Aland
Salgar
Bodhan
Ambalga
Kinhi
Sonath
Kamlapur
Mahagaon
Narona
Sargapur
Ratkal
Chincholi
Sulahper
Madana
Hipparga
Nimbarga
Kulali
Bhosga
Gulbarga
Kalgi
Nirgunda
Marhal
Karjgi
Mannur
Neeloor
Gobur
Buzurg
Tingli
Kogna
Atanur
Afzalpur
Gangapur
Farhatabad
Malkhaid
Shahabad
Sedam
Wadi
Chitapur
Adki
Mudhol
Korla
Firozabad
Nelogi
Jevargi
Handarki
Nalwar
Andola
Gajarkot
(Kotaraki)
Aralagundi
Ijeri
Yaragol
Gurmatkal
Yerdrami
Sirwal
Yadgir
Gugi
Doranahalli
Haligeri
Malla
Buzurg
Shahpur
Khanapur
Nandepalli
Kembhavi
Ajalapur
Sagar
Hattigudur
Agni
Wadagera
Saidapur
Shorapur
Tumkur
Kadechur
Hunasagi
Devapur
Tintani
Kakkera
Kodekal
Narayanpur
Map not to Scale
District Boundary
River
National Highway
Major Road
Road
Railway Track
District Headquarter
Taluk Headquarter
Town
Tourist Place
Copyright (C) Mapience India Limited 2001


Palakkad
(Kerala)
MALAPPURAM
Tamilnadu
N
Silent
Valley
Attappadi
Attappadi Estate
Pattivasal
MANNAARKKAAD
To Perintalmanna
Pulantod
To Coimbatore
Peradiyur
Vallappula
Kongad
Mundur
Malampuzha
47
Palakkad
Pattambi
OTTAPPALAM
City
PALAKKAD
Trittala
Shoranur
Ponnani
To Vadakkancheri
Chittur
Tattamangalam
Pudunagaram
Map not to Scale
Kollengode
ALATTUR
Nemmara
Kilakkettara
Gayatri
National Highway
District Boundary
River
State Highway
Road
District Headquarter
Taluk Headquarter
Town
Tourist Place
Railway Track
THRISSUR
To Thrissur
Pada Giri
Parambikulam
Wildlife Sanctuary
Copyright (C) Mapience India Limited 2001


Dewas
(Madhya Pradesh)
N
To Maks
3
Ujjain
Shajapur
To Ujjain
Amona
Iklehra
Bagaba
Tonk Khurd
Sia
Bhonrasa
Kali Sindh
Dewas
Sonkach
Sehore
To Mangliya
Kshipra
Barotha
Newari
Tappa
Indore
Hat Piplia
Kamalpur
Bara
Bikrampur
Hirangaon
Chapra
Sundrel
Kannod
Jamner
Bagli
Datuni
Khategaon
Udainagar
Kantaphor
Nemawar
Konar
Chanheshwar
Pipri
Ratanpur
Baln
Harda
West Nimar
Kharia
Narmada
East Nimar
Map not to Scale
District Boundary
River
National Highway
State Highway
Road
Railway Track
Trekking Routes
District Headquarter
Taluk Headquarter
Town
Copyright (C) Mapience India Limited 2001


BATHINDA
(Punjab)
N
MOGA
FARIDKOT
To Faridkot
(District Headquarter)
Jalal
Dialpura
Bhaika
Kotha
Guru
15
Bathinda Branch
Phul
To Barnala
SANGRUR
Nathana
Abti
Goniana
Jettuke
Lehra
Muhabbat
MUKTSAR
Rampura
Phul
To Malaut
BATHINDA
Daulakot
Bhai
Phus
Mandi
Bhuch
Balanwali
Chaoke
MANSA
Shergarh
Maur
Kotla Canal
Ram Tirath
Jaga
Raman
Malkana
To Mansa
(District
-Headquarter
To Dabwali
(Sirsa-Haryana)
HARYANA
To Sirsa
(District Headquarter-Haryana)
Copyright (C) Mapience India Limited 2001
Map not to Scale
District Boundary
Major Road
Road
Railway Track
District Headquarter
Taluk Headquarter
Town
Tourist Place
Canal
National Highway


SIVAGANGA
(Tamilnadu)
N
PUDUKKOATTAI
To Tirumayam
To Arantangi
MADURAI
VIRUDUNAGAR
RAMANATHAPURAM
To Madurai
(District Headquarter)
To Aruppukkottai
To Paramakkudi
Piranmalai
Neykuppai
Kilasevvalpatti
Singampunari
Chettinad
Pallattur
Pillaiyarpatti
Kottaiyur
Sakkotai
Tiruppattur
Periya
Kallukudi
Manimattar
Karaikkudi
Madaguppatti
Amaravati
Kallal
Devakkotai
Padamattur
Nattarasankottai
Tiruppuvanam
SIVAGANGA
Kalaiyarkoil
Mangalam
Tiruppachchetti
Suranam
Manamadurai
Annavasal
Salaigramam
Ilaiyankudi
Vaigai
49
Map not to Scale
District Boundary
River
National Highway
Major Road
Road
Railway Track
District Headquarter
Taluk Headquarter
Town
Tourist Place
Copyright (c) Mapience India Limited 2001


SULTANPUR
(Uttar Pradesh)
N
BARA BANKI
FAIZABAD
RAE BARELI
PRATAPGARH
JAUNPUR
Bazar Shukhi
Kishni
To Haidergarh
Satthin
Jagdishpur
Gomati
Haliapur
To Bikapur
Mayang
Isauli
Kurebhar
Dwarikaganj
Musafirkhana
Kurwar
Bhatgawan
Maniyari
Aliganj
Jaisinghpur
SULTANPUR
Dostpur
Gauriganj
Hasanpur
To Rae Bareli
Kadipur
Amethi
Bhada
Lambhua
Kakwa
Piparpur
Barkhari
Dehra
Trisundi
Chanda
Koiripur
56
To Pratapgarh
To Jaunpur
Map not to Scale
National Highway
District Boundary
River
State Highway
Road
Railway Track
District Headquarter
Taluk Headquarter
Town
Copyright (C) Mapience India Limited 2001

Table 3.1
District Populations (2001)

District	Total Population	Male	Female
World Bank Assisted States			
Prakasam	3,054,941	1,549,891	1,505,050
Rajnandgaon	1,281,811	633,292	648,519
Dewas	1,306,617	676,414	630,203
Satara	2,796,906	1,402,301	1,394,605
Dhenkanal	1,065,983	543,439	522,544
Bharatpur	2,098,323	1,130,010	968,313
Sivaganga	1,150,753	565,594	585,159
Sultanpur	3,190,926	1,611,936	1,578,990
Other States			
Vaishali	2,712,389	1,412,276	1,300,113
Surendranagar	1,515,147	787,785	727,362
Solan	499,380	269,451	229,929
Gulbarga	3,124,858	1,591,379	1,533,479
Palakkad	2,617,072	1,265,794	1,351,278
Bathinda	1,181,236	633,249	547,987
Maldah	3,290,160	1,689,409	1,600,751

(Source: Census of India 2001)

Table 3.2
Area of districts covered during survey

District	State	Area (sq km)
World Bank Assisted States		
Prakasam	Andhra Pradesh	17626.0
Rajnandgaon	Chhatisgarh	8068.0
Dewas	Madhya Pradesh	7020.0
Satara	Maharashtra	10480.0
Dhenkanal	Orissa	4452.0
Bharatpur	Rajasthan	5066.0
Sivaganga	Tamil Nadu	4189.0
Sultanpur	Uttar Pradesh	4436.0
Other States		
Vaishali	Bihar	2036.0
Surendranagar	Gujarat	10489.0
Solan	Himachal Pradesh	1936.0
Gulbarga	Karnataka	16224.0
Palakkad	Kerala	4480.0
Bathinda	Punjab	3382.0
Maldah	West Bengal	3733.0

(Source: Census of India 2001)

Clusters Covered in Different Districts During the Survey

Table 3.3
Clusters Covered in Prakasam District (Andhra Pradesh)

	NAME OF VILLAGE/WARD	POPULATION
1	KOLUKULA-4	845
2	YENDRA PALLE-1	1045
3	GARLA PETA-1	1040
4	BAYYA VARAM+ NAMASSIVAYA PURAM-1	1685
5	TANGUTUR-21	850
6	KONIJEDU-5	907
7	LAKSHMI KOTA-2+ NADIM PALLE	1406
8	GANNEPALLI-3	900
9	KAKARLA-2	894
10	ALLINAGARAM-1	1011
11	RAYAVARAM-3	920
12	BHUPATHI PALLE-2	1118
13	THUMMAL CHERUVU	910
14	PEDA ALAVALA PADU-2	890
15	MANGINAPADU+CHENNIPADU	1502
16	PERNAMETTA-3	892
17	MADANPUR-7	946
18	K.BITRANGUTA	942
19	SAKHAVARAM-3	996
20	NASIKATRAYAMBAKAM+ INIMERLA-1	1378
21	BASIREDDY PALAM-1	1014
22	MARKAPUR(M) WARD IO-(2)	858
23	ONGOLE (M) WARD 24	1347
24	ONGOLE(M) WARD 51- (2)	1052
25	CHIRALA (UA) WARD 1- (30)	863

Table 3.4
Clusters Covered in Rajnanadgoan District (Chatisgarh)

Cluster No.	Villages
1	**Kusiyari;** Sutiya
2	Salgapat; Uraidabri; Sarangpur
3	Bhursatola; Etikasa; Khongha; Khapri Kalar
4	Renga Kathera
5	Bagnadi
6	Andi; Bhelwatola
7	Dundera
8	Bhagat Singh Ward
9	Bhendarwani; Bihavbod; Jhura Dabri
10	Bargahi; Dharmapur
11	Ravidas Ward
12	Thakur Pyarelal Singh Ward
13	Hiramoti Ward
14	Kesho Khairi; Ghothiya
15	Matrakhujji; Jamnara; Amkatta; Bawli Masulkasa
16	Bamhani; Gatapar
17	Darri; Bendarkuta
18	Salikjhitiya; Sukhri
19	Kaneri; Umarpal
20	Tado; Pusewada; Puswada; Dulki; Bodra
21	Fulkado
22	Kahadkasa; Raja Tola
23	Jade Tola; Khairi; Tate Kasa; Keshai Dabri
24	Pendarwani
25	Kanimera

Table 3.5
Clusters Surveyed in Dewas District (Madhya Pradesh)

Cluster No.	Name of Cluster	Population
18		1433
35		1089
71		1451
94		1192
125		1126
163		1007
191		1117
222		868
251		957
333		1381
352		1006
380		1326
394		1448
408		1260
418		858
446		1044
526		973
1014		1298
1098		1276
1132		1020
1144		1123
1152		1203
1154		1144
1193		1125
1208		871

Table 3.6
Clusters Covered in Maharashtra

Cl. No.	VILLAGE / WARD NAME	POPULATION
5	SATARA WARD No. 3A	1098
14	SATARA WARD No. 8A	1482
22	SATRA WARD No. 10E	1058
48	SATRA WARD No. 23B	1113
160	SHIVATHAR A	1260
244	NIGDULAL KAKAWALI TAKWAL SANDAWALI	1057
247	PARLI B	1114
269	VECHALE	1477
293	DEGAON A	1100
466	LOGADWADI	957
570	CHANDRAWADI+SANAKEA	1623
591	WATHAR STATION A	1309
593	WATHAR STATION C	1310
638	LASURNE B	1607
706	KUSUR + MALEWADI	1600
711	KOREGAON + KAPADGAON A	1083
814	PIMPRADA A	1354
876	GARDACHIWADI (WARUGAD) +	1384
977	BIDWAGHWADI + GHATEWADI	1648
1143	MHASIM WARD No. 2B	1185
1150	KARAD M. WARD No. 6A	1200
1172	MHASIM WARD No. 24	1452
1224	MANDAVE	1343
1704	SINGANWADI + MAJGAON A	1267
1947	GODAWALI B + KHENGHAR	1563

Table 3.7
Clusters Covered in Dhekanal District (Orissa)

Cluster No.	Name of Cluster	Population
19	Dhankanal Ward 10-A	1354
51	Bhuban Ward 9	1164
101	Naglapasi	1217
147	Kasiapada	
189	Bangurusinga B	1143
224	Sainbiri	1233
247	GovindaPRasad B	1272
264	Karamulpatana B	1068
307	Brahabiharipur	
340	Sapuajhar	
365	Sorisapada	
388	Galukateni	968
405	Bankia	1050
433	Pandua	
452	Kantapal B	1371
490	Pangathra B	1332
517	Anala	1264
525	Tipulei	
548	Ijamunakot B	1351
581	Kamarda	1533
602	Kalada	1243
653	Kumusia	1094
691	Nuapada	
736	Madhapur	951
774	Naukhari A	964

Table 3.8
List of Clusters Covered in Bharatpur District, Rajasthan

S. No.	Name of Cluster/ Villages	Population 50+
1	Nadbai Ward I	150
2	Kumher Ward 5	215
3	Bharatpur Ward 11	145
4	Bharatpur Ward 34	155
5	Pai	161
6	Baroli Dhau	200
7	Jalalpur	174
8	Nagla Maharaniya, Tankoli, Nagla Shripur	144
9	Bahaj	204
10	Gadhi Lodha; Songoan	236
11	Januthar	255
12	Kurwara	209
13	Dhormai	235
14	Chak Choaba; Chak Naswariya	161
15	Saindoli	163
16	Milkipura; Khangri	213
17	Jahaz	170
18	Samraya	192
19	Bayana Rural Out ward	173
20	Pali Dung	197
21	Samantgarh; Biasora; Singhrawali	174
22	Mahal; Bargah	208
23	Srinagar; Kanjoli	177
24	Rupvas	197
25	Pahadpur; Khori	220

Table 3.9
List of Clusters Covered in Sivaganaga district (Tamil Nadu)

Cluster No.	Name of Cluster/ Villages	Population
21	Manalur	198
25	Enadhi	176
4	Sivagangai Ward 6	165
6	Kallurani	264
14	Manmaduari Ward 5	186
16	Kalpiravu	172
13	Keelamangalam	249
22	Ulgampatti	211
19	Ilayangudi	156
18	Vandal	176
12	Poolangkurichi	160
3	Kathupattu	160
2	Kurunthani	282
24	Vertiyur	302
8	Aranmanaipati	164
1	Karaikudi Ward 32	154
11	Mavidathukottai	205
17	Thirukulakudi	242
5	Sirukoodalapatti	258
10	Melasemponmari	134
7	Devakottai Ward 4	180
9	Singampunari	131
15	Kulapadi	151
20	Teralapur	246
23	Karaikudi Ward 4	140

Table 3.10
List of Clusters Covered in Sultanpur District (Uttar Pradesh)

Cluster No.	Name of Cluster/ Villages	Population
1	Kapuripur; Purab Gaon	1511
2	Kachnaaw-2; Kisanpur-1	1559
3	Tanda-4; Bechu Garh urf Bechubad	1674
4	Hemnapur-1	1548
5	Katari-1	1443
6	Jamo-3	1172
7	Gopalipur; Sujanpur	1533
8	Sujavoor; Dhani Jalalpur; Basthan; Shahbajpur	1542
9	Madhopur-2	1287
10	Raipur Phulwari Dakshini	1510
11	Garaoli	1680
12	Dihdagapur – 1	1262
13	Nagaipur; Isur; Tamolipur	971
14	Goregaon	1115
15	Shadipur-1	983
16	Louhardaxin-3	1499
17	Lodipur; Satanpur	1187
18	Civil Lines Parkishganj-2	1158
19	Parsadanwa; Sajawanhar Nathpur; Rajapur; Baura Jugdishpur	1488
20	Sarai Kalyan; Pataulki	956
21	Sherpur Pars Ramppur; Pakari Kalan	985
22	Panari Khurd; Saitapur	881
23	Manapur	1148
24	Khatki Kast chiran; Bishnugopalpur; Marufpur; Kekarchor	1389
25	Babhanaiya Paschim	1134

Table 3.11
List of Clusters Covered in Vaishali District (Bihar)

Cluster No.	Name of Cluster/ Villages	Population
41	Malahi	903
82	Chak Khurdi urf Chak Fakharud -A	1439
131	Bishun Palli B	1599
158	Salempur A	1058
265	Upraul urf Dharampur Dharam	1668
347	Paharpur; Lalpura; Chak Salchurtlalpura	1359
377	Kiratpur Raja Ram -D	1674
487	Ramdaspur; Sundarpur; Dina	1647
537	Rasulpur; Kajrawan-D	1547
593	Shambhupur Kauri- B	1476
635	Jooj-B	1296
661	Shahpur	922
711	Rasalpur Mohiuddin urf Madhhoul-C	1294
775	Pachain Mahesh	899
859	Gobindpur-A	1029
893	Tayabpur-B	1092
946	Chak Faiz-B	1124
955	Dubha	1212
1009	Mayil-A	1163
1067	Kaithaulia – B	1327
1170	Sultanpur-B	1138
1195	Dayalpur Sapna-D	1562
1231	Paroha	991
1395	Ababakarpur-A	1523
1462	Saidpura; Raghopur Asidahi; Nirpur Bagh	1215

Table 3.12
Clusters Covered in Surendra Nagar (Gujarat

S.No	Cluster Code	Village Name
1	032	Zampodad A
2	055	Gundiyala B
3	076	Ranagadh B
4	109	Bhalgamda A
5	144	Hadala B
6	164	Chuda E
7	194	Chhalala B
8	238	Lakhavad A
9	278	Rupavati (Rajav)
10	314	Kherana
11	347	Danawada A
12	393	Khakharala
13	416	Ingorla
14	453	Charadva D
15	460	Sapkda A
16	483	Narali A
17	503	Baisabgadh
18	517	Rajcharadi A
19	637	Nana Goria
20	642	Pipli
21	030	Surendranagar
22	087	Wadhwan
23	133	Limbdi
24	186	Halvad
25	190	Dhrangadhra

Table 3.13
Clusters Covered in Solan District (HP)

S.No.	NAME OF WARD/ GRAM PANCHAYAT	POPULATION
13	SOLAN WARD 7 (1)	1540
29	NALAGARH WARD 6	861
34	BADDI WARD No. 2	1024
51	DAGSHAI WARD No.1+2	1008
11	KAWA-KALAN	862
23	JABAL JAMROT (2)	994
39	BAROTIWALA (4)	1200
43	CHAMMO	1000
65	JADLA (2)	1050
95	BAWA SAHNI (1)	939
101	JUKHADI (1)	1209
111	LEHI	1334
115	SUNERH (1)	940
130	PULASI KALAN	1688
144	BANGLEHARH (1)	996
154	KARSOLI	1357
163	MALON (1)	896
169	NAND (1)	1006
203	MAMLING (2)	856
210	SRI NAGAR (1)	1050
219	JHANJA	1048
227	PARNU 1	910
243	SARYOJ	1581
250	KUHAR (1)	887
285	CHAAKHAR	1253

Table 3.14
List of Clusters Covered in Gulbarga District Karnataka

S.No	CLUSTER CODE	NAME OF THE VILLAGE/TOWN
1	055	Chinmmgera
2	076	Yedrami
3	164	Aland (Rural)
4	194	Yatnoor
5	276	Kinnisultan
6	314	Telkur
7	357	Sirchand
8	393	Korhalli
9	416	Madan Hipperga
10	430	Sakkerga
11	517	Venkatapur
12	519	Mambapur+ Linganagar+Bhonaspur+Shivrampur
13	700	Halgera
14	728	Hosalli
15	784	Hayyal (K)
16	921	Machgundal
17	983	Hebbal
18	1108	Nandoor (B)
19	1144	Belura (J)
20	1238	Kamalapur
21	1370	Melkunda (B)
22	1387	Alipur
23	1483	Kattisangavi
24	1503	Jainapur (857) + Somnathhallli (311)
25	1550	Koulur

Table 3.15
List of Clusters Covered in Palakkad district (Kerala)

Cluster No.	Name of Cluster
1332	Sreekrishnapuram II
1352	Vallapuzha
1321	Muthuthala
1335	Kappur
1355	Vaniyamkulam
1258	Alanallur II
1327	Karimba II
1477	Kottoppadam II
1478	Kottopaddam III
1329	Mankara
1337	Peruvemba
1307	Elappully I
1308	Elapully II
1309	Elapully III
1310	Thathamangalam
1481	Vadakarapathy
1462	Vandithalvalam
1304	Pattancherry
1327	Vallanghy
1398	Nelliyampathy
1376	Muthalamada I
1416	Kavasseri I
1274	Pallakkad Ward XI
1202	Pallakkad Ward VIII
1357	Koduvayur Ward III

Table 3.16
Clusters Covered in Bhatinda district (Punjab)

S.No.	NAME OF VILLAGE/WARD	CLUSTER CODE
1	Bhatinda Tahsil Rampur Phul (M.C.) Ward 3	3A
2	Bhatinda Tahsil Rampur Phul (M.C.)Ward 8	8
3	Bhatinda Tahsil Goniana (M.C.)Ward 4	19
4	Bhatinda M.C. (N.F.L.)Ward 9	90A
5	Bhatinda M.C. (N.F.L.)Ward 17	98A
6	Bhatinda M.C. (N.F.L.)Ward 18	99C
7	Bhatinda M.C. (N.F.L.)Ward 23	104C
8	Talwandi Sabo Tahsil Raman (M.C.)Ward 8	109B
9	Talwandi Sabo Tahsil Raman (M.C.)Ward 9	110
10	Neor- Bhatinda-Raampura Phul-Phul	121
11	Gurusar - Bhatinda-Rampura Phul-Phul	129B
12	Ghanda Bana - Bhatinda-Rampura Phul-Phul	144A
13	Talwandi Sabo- Rampura	182G
14	Jajjal- Rampura	186A
15	Virk Khurd -Rampura	243 B
16	Ablu- Rampura	250C
17	Ganga- Rampura	257B
18	Nathana	282B
19	Nathana	282D
20	Chak Fateh Singh Wala -Nathana	294 A
21	Kotli Sabo- Nathana	317
22	Mehta- Nathana	330B
23	Bangher Mohabat Singh- Talwandi Sabo	364+365A
24	Maisar Khana -Talwandi Sabo	376B
25	Burj -Talwandi Sabo	386B

Table 3.17
Clusters Covered in Maldah District, West Bengal

SR.NO.	CLUSTER NO.	NAME OF CLUSTERS	POPULATION
1	8	MADHAIPUR, KHARAMPUR, DUMARKOLA	1145
2	57	BHINGOL	1059
3	196	DAULATPUR	1125
4	342	MATIHARPUR	1267
5	417	SIMULTALA	1383
6	604	ASHUTOLA	985
7	656	SIBNAGAR	976
8	837	KAILABAD	1199
9	917	DEOTALA	1016
10	1041	DHARMA DANGA	1654
11	1191	BUL BUL CHANDI	1273
12	1229	DAKSHIN CHANPUR	1042
13	1318	MEMWA	897
14	1334	SAHARPUR(NM)*1	937
15	1341	GONDHA, HATRA KANDAR, WARD NO 4	1353
16	1536	KANAKPUR, CHANDAN GAR, PASHIM NAZI R KHANI ARAZI, GANI BAHADUR KHAN ARAZI, KHIRKI	1427
17	1632	WARD NO 18	1054
18	1655	WARD NO 22	905
19	1674	PHUL BARI ARAZI	1624
20	2018	BIRODHI	966
21	2052	BAKHARPUR	907
22	2067	CHHOTA SUJAPUR	907
23	2089	BARASUJAPUR	907
24	2117	UTTAR DHARIA PUR	965
25	2298	PALGACHHI	1002

5. Materials and Methods

5.1. Overview

The Govt. of India decided to undertake comprehensive blindness surveys in 15 randomly selected moderately performing districts in 15 states in the country.

These surveys were meant to complement the rapid Assessment Surveys, which used the modified EPI cluster sampling methodology wherein the first 100 people who were encountered and were above the age of 50 years were examined in a cluster. The Paramedical Ophthalmic assistants did the examination. The procedure basically consisted of examination of visual acuity at a distance of 3 meters and 6 meters, coupled with torch light examination. No attempt was made to document the other causes of blindness.

It was felt that a more comprehensive eye examination, including full refraction would add much more valuable information and would also help in documenting the magnitude of other blinding conditions.

The Govt. of India developed the protocol with inputs from LAICO, R.P.Centre, AIIMS and the Technical Advisory Group.

5.2 Sampling procedures and sample size determination

Each State was sampled as an independent unit. The demographic data of the 1991 census was used as the sampling frame. The entire district(including the urban areas) was included in the sampling frame. The population size of each village/ urban ward in the district was recorded. A listing of all villages/ urban wards with their population, based on the census estimates (1991) was first undertaken. Sampling clusters were then created so as to yield a total population of 850 – 1700 persons per cluster. Such clusters were expected to provide 125 –250 persons above the age of 50 years. The sampling clusters were created by clubbing villages with less than 850 population as one cluster, and by subdividing villages with more than 1700 people into segments which would yield at least 850 persons. In clubbing villages together, geographical proximity of the villages was given prime importance.

For defining the actual geographical boundaries of clusters, help of the voter's lists and designated mohallas (lanes) was used. This was also supplemented by physical structures like schools, ponds, panchayat ghar etc. Each of the segmented clusters was identified before the actual sampling of the village clusters so as to reduce bias. The survey managers took the help of the District Programme Manger in this exercise of identification and labeling of the clusters and visited the villages along with the Enumeration Supervisor before the segmentation process.

Cluster sampling methodology was used for the survey. This procedure makes the survey more practical and also reduces the cost of the survey and improves the

response rate because of better rapport with the village population. The problem with cluster sampling is sampling inefficiency, which is called design effect. The design effect is an indication of the additional variation due to clustering. The sample size thus has to be adjusted for the cluster design effect. This is estimated by the ratio of the variance when cluster sampling is used to the variance when simple random sampling is used. A design effect of 2.0 was calculated to be sufficient for a cluster size of 200, with an anticipated response rate of 85 per cent.

In calculating the sample size, the following were considered:

a) estimated prevalence of cataract blindness (VA<6/60) : 8%; p=0.08
b) Confidence interval : 95 % (Z=1.96)
c) Error bound(precision)-e : 15 % of prevalence i.e. 0.08 x 15% = 0.012
d) Response rate anticipated = 85 % = 0.85

Sample size was then calculated using the following formula:

$N = z^2(1-p)p/e^2$

i.e. $\frac{(1.96)^2 (1-0.08)(0.08)}{(0.012)^2}$

Therefore the sample size required, for simple random sampling is 1963. Since cluster sampling was proposed, the sample size was multiplied by the design effect and divided by the response rate i.e.

1963 x2.0 / 0.85 = 4619 persons above the age of 50 years

Rounding off, the sample size required was 5000.

Since the proportion of the population aged 50 years and above in the Indian population was 13.03%(1991), the total population of all ages that required to be covered was 38,000. The number of clusters required to achieve precision was 25 and each cluster should have an average population of 1500 – 1600.

The sampling frame and the list of the sampling units was sent to the Central Ophthalmology Cell in New Delhi where the programme managers randomly identified the 25 clusters for each of the 15 States. This formed the final sample units to be covered.

5.3 Training

All the core members of the respective survey teams underwent training at R.P.Centre (for the North & Central Indian States) and at LIONS Aravind Institute of Community Ophthalmology(for South and Eastern Indian States). before starting the actual work in the field. All details of the fieldwork were explained and the core staff was made to read the operations manual both individually and collectively. The ophthalmologists and the Ophthalmic Assistants filled a sample of forms each during the training period. They were also familiarized with the equipment to be used in the survey and were exposed to a one day data collection in the field.. Issues regarding general maintenance of the equipment were also discussed.

5.4 Pilot surveys

After completion of the training, a pilot study was done in each of the sampled districts. Two days were spent on enumeration and two days on clinical examination in each village. An additional day was allocated for moping up operations. The experiences and results of the pilot were presented to the Technical Advisory Group and their comments were recorded. This was used for planning the final survey. The full dress rehearsal was extremely important to iron out problems in the field.

5.5. Enumeration

After the completion of the pilot survey, preliminary mapping, segmentation and enumeration were done. One person designated as the 'enumeration supervisor' led the enumeration team. The teams went to one village on a specified day and after taking the cooperation of the local leadership and health staff, did a complete house to house listing of all individuals aged 45+.

The purpose of the survey was explained and the tentative date for the visit of the clinical team was communicated. The District Collector wrote letters to all the Block Development Officers while the Chief Medical Officer directed all the health staff to help in the survey.

In the mapping exercise, delimitation of the cluster boundaries was given prime importance. All physical landmarks in the cluster like ponds, schools, panchayat ghars, ration shops, health centers, temples etc. were documented. The house numbers in each mohalla(lane) were also marked out. In larger villages, segmentation was done using the map and the electoral rolls. Sites where the clinical examination could be done were identified and marked out in the map. These generally included schools and health centers. Sometimes, if these facilities were too far from the village, other sites like panchayat ghars were identified.

Questions were asked to aid in the final verification of age. These included questions on whether the respondents were born at the time of independence, the age of the eldest child etc. All details enumerated at the house were entered in Form 2.

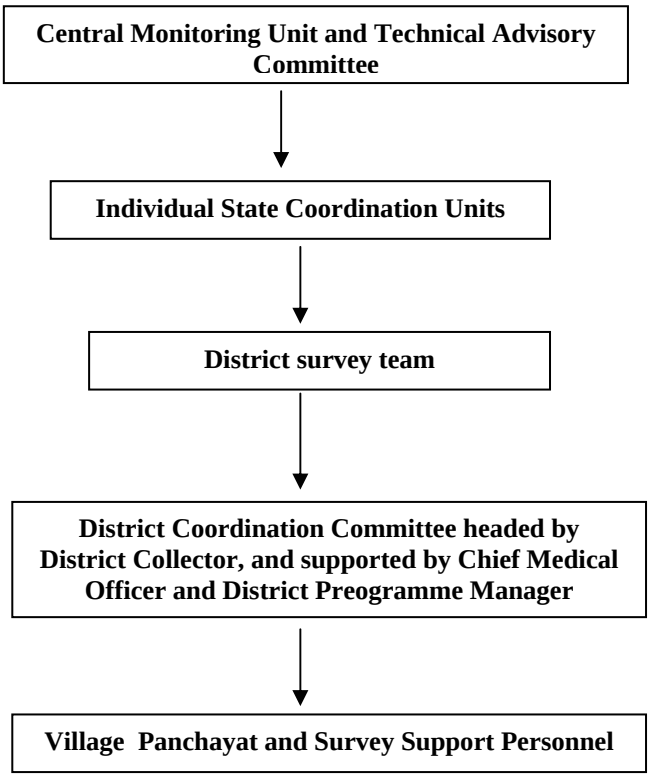
The preliminary enumeration was completed in a period of 5 weeks. A second round of enumeration was done a day prior to the visit of the clinical team and the morning when the clinical team arrived in the village. At this time, age verification was done again and the presence or absence of family members recorded. Moreover, attempts were made to see that nobody had been left out in the first phase of enumeration.

5.6 Final Survey Procedures Adopted in Villages

On reaching the village, the team contacted the local contact person who had already been identified during the initial phase of enumeration. The clinical team proceeded to

set up the clinical examination stations while the enumeration team went into the village.

Flowchart depicting staff utilization for survey



The enumeration team went from house to house and updated the personal details recorded earlier. Special emphasis was placed on verification of age and place of actual residence. Once the enumeration team was satisfied, a patient referral slip was handed over to the patient. Verbal consent was obtained from all the participants by reading out the specially prepared verbal consent form.

The enumerators verified the patient coverage details from the coordinator of the clinical team at regular intervals.

When the patient arrived at the clinical site, the coordinator collected the referral slip from the patient and once again verified the patient's age. Details of the persons were updated on Form 2. Patients who appeared to be below 50 years of age were sent directly for an examination with a blank slip. Identification particulars of all persons aged 50 years and above were completed on form 2 and these persons were then sent to the waiting area, and asked to wait till their name was called out.

Each person who came for examination was first sent for a vision assessment. Vision was tested using the ETDRS optotypes. The optotypes were mounted on a specially designed wooden box with retro illumination. Three 20W fluorescent mercury lamps provided retro illumination. Vision was tested for each eye separately as per procedures listed out in the manual. If the vision could not be assessed, the reason for the same was recorded on the form.

After vision examination, persons with a visual acuity of < 6/18 in any eye were sent to the refraction counter while the others were sent up to the ophthalmologist. No dilation was done for refraction. All operated patients had details regarding the place and time of operation filled out by the coordinator and all such persons, irrespective of their presenting vision, were refracted.

The ophthalmologist then conducted a detailed eye examination and recorded all the relevant findings. Aphakic patients were provided with a pair of spectacles on the spot. This was done using the best spherical equivalent for dispensing the glasses. Before the examinee left the site, the forms were checked up by the ophthalmologist and counter signed. This was done to minimize the risk of missing important details.

All patients were provided with necessary medication and those requiring cataract surgery/ other surgery was given a referral slip with details of the date of the eye camp and the venue.

On the last day of the examination at a particular site, if persons failed to come to the examination site after repeated attempts, they were visited at home. For home visits, an ETDRS chart was used. However, there was no retro illumination in this case. No refraction was done at home. However, aphakic patients were subjectively dispensed a pair of spectacles. Such forms were marked as 'examined at home'.

The survey cluster form (Form 1) was completed at the end of the day and all details recorded. All the forms were cross- checked and packed. Forms for absent persons were packed in a separate bundle.

Temporary dark rooms were set up in all examination sites. These were prepared from PVC pipes and black curtains stitched on three sides. After the infrastructure was set up using PVC pipes with metal T-junctions, the black curtain was simply mounted on the infrastructure and pinned at the edges. This created an excellent dark room ambience. The dark rooms were dismantled every evening and packed in specially prepared steel boxes for transportation. Table lamps were provided to the refraction cabins. Electricity was ensured using a portable generator.

Every morning all equipment was tested and calibrated wherever necessary. In the evenings after returning to the base station, all the equipment was dusted and cleaned. The drugs and other consumables for the next day were then packed and all instruments and stationery were also packed. Late in the evenings, all the forms were checked once again and put in order.

Patients who were blind and improved significantly after refraction were told that they would also be provided with a free pair of spectacles. Lists of such patients with their prescriptions were given to the DBCS. The DBCS delivered the spectacles to such patients through the PMOAs posted in the nearby PHCs.

All logistics were supported by the DBCS. This included sending out DO letters to all the PHCs and block officials, procuring drugs, arranging for kerosene oil supplies for the generator, providing mineral water, providing DBCS vehicle whenever required, printing of stationery and interaction with village officials.

6. Results

6.1 Demographic particulars

A total of 64343 persons were available for examination from 72044 persons who were enumerated in the 15 districts. Thus the cumulative coverage was 89.3 per cent. The coverage ranged from a minimum of 82.0 per cent to a maximum of 96.3 per cent. The district wise coverage particulars are indicated in Table 6.1.

The coverage was higher among females (91.1%), compared to males (87.4%).

Table 6.1
Distribution of Coverage, Response Rates and Gender distribution of respondents

States	Males			Females			Total		
	Enum	Exam	%	Enum	Exam	%	Enum	Exam	%
World Bank Assisted States									
AP	2143	2020	94.3	2466	2309	93.6	4609	4329	93.9
Chatisgarh	2016	1940	96.2	2155	2075	96.3	4171	4015	96.3
MP	2145	1797	83.8	2181	1941	89.0	4326	3738	86.4
Maharashtra	2570	2158	84.0	2845	2460	86.5	5415	4618	85.3
Orissa	2585	2199	85.1	2397	2029	84.7	4982	4228	84.9
Rajasthan	2402	2139	89.1	2326	2145	92.2	4728	4284	90.6
TN	2369	2116	89.3	2712	2526	93.1	5081	4642	91.4
UP	2820	2642	93.7	2841	2754	96.9	5661	5396	95.3
Other States									
Bihar	3140	2460	78.3	3018	2588	85.8	6158	5048	82.0
Gujarat	2176	1689	77.6	2345	2047	87.3	4521	3736	82.6
HP	1551	1311	84.5	1661	1545	93.0	3212	2856	88.9
Karnataka	1533	1353	88.3	2078	1912	92.0	3611	3265	90.4
Kerala	2568	2325	90.5	3064	2886	94.2	5632	5211	92.5
Punjab	2567	2273	88.5	2616	2415	92.3	5183	4688	90.4
West Bengal	2223	1984	89.2	2531	2305	91.1	4754	4289	90.2
WB assisted	19050	17011	89.3	19923	18239	91.5	38973	35250	90.4
Other States	15758	13395	85.0	17313	15698	90.7	33071	29093	88.0
All India	**34808**	**30406**	**87.4**	**37236**	**33937**	**91.1**	**72044**	**64343**	**89.3**

The age distribution of the examined population is depicted in Table 6.2. 46.9 per cent respondents were aged 50 – 59 years. Only 19.3 per cent were aged 70+

Table 6.2
Age distribution of examined population

States	50-54 y		55-59 y		60-64 y		65-69 y		70+	
	N	%	N	%	N	%	N	%	N	%
World Bank Assisted States										
AP (4329)	994	23.0	844	19.5	981	22.7	511	11.8	999	23.1
Chatisgarh (4015)	1097	27.3	918	22.9	927	23.1	525	13.1	548	13.6
MP (3738)	1032	27.6	627	16.8	734	19.6	519	13.9	826	22.1
Maharashtra (4618)	950	20.6	854	18.5	839	18.2	928	20.1	1047	22.7
Orissa (4228)	1080	25.5	992	23.5	964	22.8	550	13.0	642	15.2
Rajasthan (4284)	1234	28.8	833	19.4	795	18.6	643	15.0	779	18.2
TN (4642)	1263	27.2	961	20.7	919	19.8	609	13.1	890	19.2
UP (5396)	1491	27.6	1147	21.3	1048	19.4	733	13.6	977	18.1
Other States										
Bihar (5048)	1602	31.7	1042	20.6	819	16.2	634	12.6	951	18.8
Gujarat (3736)	1024	27.4	714	19.1	727	19.5	483	12.9	788	21.1
HP (2856)	696	24.4	471	16.5	543	19.0	386	13.5	760	26.6
Karnataka (3265)	957	29.3	768	23.5	746	22.9	404	12.4	390	11.9
Kerala (5211)	1200	23.0	1093	21.0	997	19.1	781	15.0	1140	21.9
Punjab (4688)	1155	24.6	761	16.2	942	20.1	733	15.6	1097	23.4
West Bengal (4289)	1452	33.9	901	21.0	853	19.9	502	11.7	581	13.5
WB assisted (35250)	9141	25.9	7176	20.4	7207	20.4	5018	14.2	6708	19.0
Other States (29093)	8086	27.8	5750	19.8	5627	19.3	3923	13.5	5707	19.6
All India (64343)	17227	26.8	12926	20.1	12834	19.9	8941	13.9	12415	19.3

A significant proportion of the respondents were illiterate (71.0%) (Table 6.3). Only 3.1 per cent were educated to beyond class 10. Lowest proportion of respondents educated to beyond class 10 was observed in Karnataka.

Table 6.3
Literacy Status of Examined Respondents in Different Districts

States	Illiterate		<= Primary		6-10th		10+	
	N	%	N	%	N	%	N	%
World Bank Assisted States								
AP (4329)	3623	83.7	421	9.7	183	4.2	102	2.4
Chatisgarh (4015)	2858	71.2	849	21.1	222	5.5	86	2.1
MP (3738)	3115	83.3	453	12.1	92	2.5	74	2.0
Maharashtra (4618)	2887	62.5	1062	23.0	429	9.3	123	2.7
Orissa (4228)	2242	53.0	1705	40.3	223	5.3	58	1.4
Rajasthan (4284)	3201	74.7	543	12.7	352	8.2	188	4.4
TN (4642)	2582	55.6	1197	25.8	566	12.2	297	6.4
UP (5396)	4036	74.8	682	12.6	462	8.6	216	4.0
Other States								
Bihar (5048)	3839	76.1	596	11.8	505	10.0	107	2.1
Gujarat (3736)	2959	79.2	535	14.3	187	5.0	51	1.4
HP (2856)	2196	76.9	285	10.0	271	9.5	104	3.6
Karnataka (3265)	3066	93.9	119	3.6	55	1.7	24	0.7
Kerala (5211)	2546	48.9	1530	29.4	909	17.4	220	4.2
Punjab (4688)	3254	69.4	505	10.8	696	14.8	219	4.7
West Bengal (4289)	3296	76.8	648	15.1	173	4.0	140	3.3
WB assisted (35250)	24544	69.6	6912	19.6	2529	7.2	1144	3.2
Other States (29093)	21156	72.7	4218	14.5	2796	9.6	865	3.0
All India (64343)	45700	71.0	11130	17.3	5325	8.3	2009	3.1

Literacy status was not recorded among 179 respondents. These included 117 from Maharashtra, 32 from West Bengal, 14 from Punjab, 6 from Kerala, 4 from Gujarat and one each in Bihar and Karnataka.

Table 6.4
Residential Status of examined populations in different districts

States	Urban		Rural	
	N	%	N	%
World Bank Assisted States				
AP (4329)	478	11.0	3851	89.0
Chatisgarh (4015)	781	19.5	3234	80.5
MP (3738)	1004	26.9	2734	73.1
Maharashtra (4618)	1085	23.5	3533	76.5
Orissa (4228)	448	10.6	3780	89.4
Rajasthan (4284)	600	14.0	3684	86.0
TN (4642)	730	15.7	3912	84.3
UP (5396)	457	8.5	4939	91.5
Other States				
Bihar (5048)	0	0.0	5048	100
Gujarat (3736)	827	22.1	2909	77.9
HP (2856)	371	13.0	2485	87.0
Karnataka (3265)	533	16.3	2732	83.7
Kerala (5211)	699	13.4	4512	86.6
Punjab (4688)	1572	33.5	3116	66.5
West Bengal (4289)	355	8.3	3934	91.7
WB assisted (35250)	5583	15.8	29667	84.2
Other States (29093)	4357	15.0	24736	85.0
All India (64343)	9940	15.4	54403	84.6

15.4 % respondents hailed from urban areas (Table 6.4). The proportions were similar between World Bank assisted and the other States. There were no urban respondents in the sample from district Vaishali in Bihar.

Table 6.5
Occupational Status of Examined Respondents in Different Districts

States	Land owners		Labor		Buss/ Service		Household/ Unemployed		Too Old		Others	
	N	%	N	%	N	%	N	%	N	%	N	%
World Bank Assisted States												
AP (4329)	421	9.7	1735	40.1	161	3.7	1284	29.7	699	16.2	29	0.7
CHAT (4015)	1485	37.0	567	14.1	223	5.6	709	17.7	920	22.9	111	2.8
MP (3738)	1028	27.5	333	8.9	264	7.1	1643	44.0	449	12.0	21	0.6
MAHA (4618)	1293	28.0	112	2.4	305	6.6	2256	48.9	639	13.8	13	0.3
ORI (4228)	1422	33.6	207	4.9	202	4.8	1862	44.0	500	11.8	35	0.8
RAJ (4284)	1041	24.3	228	5.3	253	5.9	1687	39.4	1044	24.4	31	0.7
TN (4642)	961	20.7	1081	23.3	368	7.9	1647	35.5	579	12.5	6	0.1
UP (5396)	1577	29.2	440	8.2	311	5.8	2329	43.2	732	13.6	7	0.1
Other States												
BIH (5048)	1356	26.9	485	9.6	323	6.4	2495	49.4	378	7.5	11	0.2
GUJ (3736)	712	19.1	404	10.8	157	4.2	968	25.9	1457	39.0	38	1.0
HP (2856)	1034	36.2	54	1.9	205	7.2	1312	45.9	247	8.6	4	0.1
KAR (3265)	1114	34.1	254	7.8	66	2.0	1330	40.7	484	14.8	17	0.5
KER (5211)	660	12.7	1034	19.8	467	9.0	1754	33.7	1183	22.7	113	2.2
PUNJ (4688)	685	14.6	347	7.4	573	12.2	1720	36.7	1325	28.3	38	0.8
WBEN (4289)	594	13.8	595	13.9	286	6.7	1639	38.2	1132	26.4	43	1.0
WB assist (35250)	9228	26.2	4703	13.3	2087	5.9	13417	38.1	5562	15.8	253	0.7
Other States (29093)	6155	21.2	3173	10.9	2077	7.1	11218	38.6	6206	21.3	264	0.9
All India (64343)	15383	23.9	7876	12.2	4164	6.5	24635	38.3	11768	18.3	517	0.8

Nearly a quarter (23.4%) of the respondents were cultivators(farmers)(Table 6.5). A fifth (18.3%) stated that they were too old to be engaged in any work. More respondents were economically productive in AP and Tamil Nadu.

6.2.Prevalence of Blindness

For the purpose of the survey, vision categories(persons) were defined as follows:
NORMAL(NN): One eye > = 6/18; Fellow eye >=6/60

LOW VISION (LV): One eye between 6/18 – 6/60; Fellow eye < 6/18- NPL

UNILATERAL BLIND/One Eye Blind (UL): One eye < 6/60; Fellow Eye = > 6/18

ECONOMIC BLIND (EB): One eye < 6/60 – 3/60; Fellow eye < 6/60-NPL

SOCIAL BLIND (SB): Both eyes < 3/60 – NPL

NPCB BILATERAL BLIND (NPCB) : Both eyes < 6/60- NPL

The overall prevalence of economic blindness was 3.2 per cent (95% Confidence Intervals: 3.0 – 3.4) while the prevalence of social blindness (comparable with the WHO criteria for blindness was 5.3% (95% CI: 5.1 – 5.6). The prevalence of blindness as per the NPCB criteria (presenting vision less than 6/60 in the better eye) was 8.5 per cent (95% CI: 7.1 – 9.9) (Table 6.6).

The prevalence of both economic and social blindness was higher in the World Bank assisted States compared to the other States. The differences between the World Bank and non Bank assisted States in terms of blindness as defined by WHO was statistically significant (X2: 62.6847; p < 0.001).

Considering both economic and social blindness together, the highest prevalence was observed in Gulbarga district of Karnataka (13.7%) followed by Rajnandgoan district of Chatisgarh (12.4%), Bharatpur district of Rajasthan (11.9%). Other districts which reported a prevalence higher than 10% were Prakasam(AP)- 10.9% and Dhenkanal (Orissa) – 10.8%. Low prevalence was reported from Palakkad district (Kerala) – 4.3%, Solan district (HP) – 5.4%, Vaishali district (Bihar) – 6.0% and Sivaganga district (Tamil Nadu) – 6.0%. It was generally observed that with the sole exception of Gulbarga district in Karnataka, the prevalence of blindness in the other States which were not supported by the Bank were lower compared to the States assisted by the Bank. This corroborates findings of the earlier surveys(1986-89) about a higher prevalence in the States which were assisted by the Bank before the project started.

Table 6.6
Prevalence of Blindness in Different States (Districts)

States	Economic Blindness (< 6/60 – 3/60 in better eye)		Social Blindness (< 3/60 in better eye)	
	Prevalence	95% CI	Prevalence	95% CI
World Bank Assisted States				
AP	4.4	3.3 – 5.5	6.5	5.1 – 7.9
Chatisgarh	5.9	4.9 – 6.9	6.5	5.2 – 7.7
MP	2.5	1.8 – 3.2	6.4	5.4 – 7.5
Maharashtra	2.5	1.9 – 3.1	4.8	3.8 – 5.8
Orissa	4.9	4.2 – 5.7	5.9	5.0 – 6.8
Rajasthan	3.1	2.3 – 3.8	8.9	7.3 – 10.4
TN	2.0	1.4 – 2.7	3.9	3.5 – 4.4
UP	2.2	1.6 – 2.8	5.0	4.3 – 5.6
Other States				
Bihar	2.2	1.3 – 3.0	3.8	3.2 – 4.5
Gujarat	3.6	2.9 – 4.4	4.5	3.6 – 5.5
HP	1.8	1.2 – 2.4	3.6	2.9 – 4.3
Karnataka	6.4	5.4 – 7.4	7.3	6.3 – 8.3
Kerala	2.1	1.6 – 2.7	2.1	1.6 – 2.7
Punjab	1.8	1.3 – 2.3	6.0	5.0 – 7.0
West Bengal	3.2	2.6 – 3.8	6.0	5.2 – 6.8
World Bank Assisted	3.4	3.1 - 3.7	5.9	5.5 – 6.3
Other States	2.9	2.7 – 3.1	4.7	4.3 – 5.0
All India	**3.2**	**3.0 – 3.4**	**5.3**	**5.1 – 5.6**

Table 6.7
Presenting vision categories of examined persons in different districts (States)

States	NN		UL		LV		EB		SB		Miss	< 6/60
	N	%	N	%	N	%	N	%	N	%		
World Bank Assisted States												
AP (4318)*	2048	47.4	169	3.9	1632	37.8	189	4.4	280	6.5	11	469 (10.9)
Chatisgarh (4008)	2238	55.8	95	2.4	1177	29.4	238	5.9	260	6.5	7	498 (12.4)
MP (3110)	2029	65.2	147	4.7	657	21.1	78	2.5	199	6.4	628	277 (8.9)
Maha (4610)	3163	68.6	303	6.6	806	17.5	115	2.5	223	4.8	8	338 (7.3)
Orissa (4157)	2430	58.5	140	3.4	1136	27.3	205	4.9	246	5.9	71	451 (10.8)
Rajasthan (4280)	2447	57.2	281	6.6	1041	24.3	131	3.1	380	8.9	4	511 (11.9)
TN (4629)	2720	58.8	314	6.8	1317	28.5	95	2.1	183	4.0	13	278 (6.0)
UP (5388)	3304	61.3	283	5.3	1414	26.2	120	2.2	268	5.0	8	388 (7.2)
Other States												
Bihar (5036)	3512	69.7	143	2.8	1078	21.4	109	2.2	194	3.9	12	303 (6.0)
Gujarat (3736)	2255	60.4	222	5.9	953	25.5	136	3.6	170	4.6	0	306 (8.2)
HP (2780)	2073	74.6	216	7.8	340	12.2	50	1.8	101	3.6	76	151 (5.4)
Karnataka (3213)	1621	50.5	176	5.5	976	30.4	205	6.4	235	7.3	52	440 (13.7)
Kerala (5187)	3788	73.0	231	4.5	946	18.2	111	2.1	111	2.1	24	222 (4.3)
Punjab (4663)	3049	65.4	363	7.8	885	19.0	85	1.8	281	6.0	25	366 (7.8)
W Bengal (4222)	2914	69.0	175	4.1	746	17.7	135	3.2	252	6.0	69	387 (9.2)
WB assist (34500)	20379	59.1	1732	5.0	9179	26.6	1171	3.4	2039	5.9	750	3210 (9.3)
Other States (28837)	19212	66.6	1526	5.3	5924	20.5	831	2.9	1344	4.7	256	2175 (7.5)
All India (63337)	39591	62.5	3258	5.1	15103	23.8	2002	3.2	3383	5.3	1006	5385 (8.5)

* Figures include only respondents, whose vision was recorded and excludes missing values; Percentages exclude missing values

Overall 62.5% of respondents (Table 6.7) could be categorized as Near Normal based on their presenting vision in the better eye. The highest proportion of near normal respondents were observed in Kerala (73%). The overall prevalence of unilateral

blindness was 5.1% while the prevalence of low vision was 23.8%. Overall low vision as observed to be 2.8 times the prevalence of blindness as per the NPCB criteria.

Table 6.8
Best corrected vision categories among examined respondents in different districts

States	NN		UL		LV		EB		SB		<6/60	Miss
World Bank Assisted States												
AP (4318)	2788	64.6	204	4.7	958	22.2	131	3.0	237	5.5	368 (8.5)	11
Chatis (4008)	3012	75.1	154	3.8	611	15.2	80	2.0	151	3.8	231 (5.8)	7
MP (3110)	2635	84.7	224	7.2	140	4.5	9	0.3	102	3.3	111 (3.6)	628
Mahar (4610)	3755	81.5	397	8.6	212	4.6	57	1.2	189	4.1	246 (5.3)	8
Orissa (4157)	3432	82.6	216	5.2	366	8.8	28	0.7	115	2.8	143 (3.4)	71
Raj (4280)	3136	73.3	363	8.5	499	11.7	43	1.0	239	5.6	282 (6.6)	4
TN (4629)	3831	82.8	414	8.9	246	5.3	22	0.5	116	2.5	138 (3.0)	13
UP (5388)	4181	77.6	369	6.8	662	12.3	17	0.3	159	2.8	176 (3.3)	8
Other States												
Bihar (5036)	4233	84.1	222	4.4	417	8.3	41	0.8	123	2.4	164 (3.3)	12
Gujarat (3736)	3010	80.6	271	7.3	328	8.8	39	1.0	88	2.4	127 (3.4)	0
HP (2780)	2253	81.0	232	8.3	194	7.0	25	0.9	76	2.7	101 (3.6)	76
Karnat (3213)	2294	71.4	279	8.7	420	13.1	49	1.5	171	5.3	220 (6.8)	52
Kerala (5187)	4560	87.9	272	5.2	249	4.8	23	0.4	83	1.6	106 (2.0)	24
Punjab (4663)	3692	79.2	429	9.2	327	7.0	29	0.6	186	4.0	215 (4.6)	25
W Beng (4222)	3656	86.6	206	4.9	242	5.7	21	0.5	97	2.3	118 (2.8)	69
WB assist (34500)	26770	77.6	2341	6.8	3694	10.7	387	1.1	1308	3.8	1695 (4.9)	750
Other States (28837)	23698	82.2	1911	6.6	2177	7.5	227	0.8	824	2.9	1051 (3.6)	256
All India (63337)	50468	79.7	4252	6.7	5871	9.3	614	1.0	2132	3.4	2746 (4.3)	1006

* Figures include only respondents, whose vision was recorded and excludes missing values;
Percentages exclude missing values

It was observed that after best correction, a significant proportion of respondents moved from a poorer vision category to a better vision category (Table 6.8). Near normal respondents

increased from 62.5% based on presenting vision to 79.7% after best correction. The prevalence of economic blindness could be reduced by 3 times while the prevalence of social blindness could be reduced by 1.5 times based on the overall estimates. A significant proportion of respondents with a presenting vision less than 3/60 in the better eye suffer from incurable blindness and therefore would not improve with correction. Low vision could be reduced from a prevalence of 23.8% on presenting vision to 9.3 per cent after correction. There were wide inter district variations in prevalence of the different vision categories but a significant improvement could be observed after correction in all States.

Table 6.9

Distribution of Gender and prevalence of blindness and low vision (presenting vision)

States	Males						Females					
	Econ Blind (< 6/60-3/60)		Soc Blind (< 3/60)		Low Vision (6/18-6/60)		Econ Blind (< 6/60 – 3/60)		Soc Blind (< 3/60)		Low Vision (< 6/18-6/60)	
	N	%	N	%	N	%	N	%	N	%	N	%
World Bank Assisted States												
AP	73	3.6	116	5.8	761	37.8	116	5.0	164	7.1	871	37.8
Chatisgarh	93	4.8	87	4.5	571	29.5	145	7.0	173	8.4	606	29.3
MP	32	2.1	61	4.1	304	20.2	46	2.9	138	8.6	353	22.0
Maharashtra	44	2.0	89	4.1	380	17.6	71	2.9	134	5.5	426	17.3
Orissa	106	4.9	102	4.7	615	28.2	99	5.0	144	7.3	521	26.3
Rajasthan	59	2.8	144	6.7	514	24.1	72	3.4	236	11.0	527	24.6
TN	45	2.1	61	2.9	546	25.9	50	2.0	122	4.8	771	30.6
UP	46	1.7	102	3.9	646	24.5	74	2.7	166	6.0	767	27.9
Other States												
Bihar	50	2.0	80	3.3	539	21.9	59	2.3	114	4.4	539	20.9
Gujarat	50	3.0	58	3.4	374	22.1	86	4.2	112	5.5	579	28.3
HP	27	2.1	37	2.9	161	12.5	23	1.5	64	4.3	179	12.0
Karnataka	74	5.5	82	6.1	412	30.8	131	7.0	153	8.2	564	30.1
Kerala	31	1.3	33	1.4	354	15.3	80	2.8	78	2.7	592	20.6
Punjab	36	1.6	112	4.9	371	16.3	49	2.0	169	7.0	514	21.5
West Bengal	75	3.8	88	4.5	357	18.2	60	2.7	164	7.3	389	17.2
WB assisted	498	3.0	762	4.6	4337	26.0	673	3.8	1277	7.2	4842	27.2
Other States	343	2.6	490	3.7	2567	19.3	488	3.1	854	5.5	3357	21.6
All India	841	2.8	1252	4.2	6904	23.0	1161	3.5	2131	6.4	8199	24.6

The prevalence of blindness and low vision was correlated with socio demographic variables like gender, age, literacy, occupational status and place of usual residence. Females had a higher prevalence of both social and economic blindness, as well as low vision compared to males (Table 6.9). The prevalence of economic blindness was 3.5% amongst females compared to 2.8% among males while the prevalence of social blindness was 6.4% amongst females compared to 4.2% among males. 24.6% females compared to 24% males were suffering from low vision at the time of the survey. The differences between males and females with regard to prevalence of blindness as defined by NPCB (vision less than 6/60 in the better eye) were statistically significant (X2: 169.2457; p < 0.0001).

Table 6.10

Relationship of current age with prevalence of blindness and low vision (presenting vision)

States	50-54 y			55-59 y			60-64 y			65-69 y			70+		
	EB	SB	LV	EB	SB	LV	EB	SB	LV	EB	SB	LV	EB	SB	LV
World Bank Assisted States															
AP	1.1	2.1	20.4	2.7	2.4	28.7	3.7	5.4	44.7	6.3	8.6	42.5	8.8	14.3	53.6
Chatis	2.4	1.5	17.0	3.5	4.3	25.4	7.1	6.7	35.3	8.0	8.0	42.6	13.2	18.6	38.2
MP	0.8	2.0	8.5	1.7	2.4	15.6	2.8	4.4	23.3	3.7	6.5	31.1	4.7	18.3	35.3
Maha	0.6	0.7	7.7	1.3	2.0	10.0	2.5	3.6	17.6	2.6	3.7	22.1	5.1	13.0	28.4
Orissa	2.4	1.8	13.4	3.0	3.9	22.6	5.9	6.9	32.3	6.3	8.5	39.1	9.7	12.6	40.9
Raj	1.2	1.4	13.4	1.6	3.7	20.8	3.1	6.9	26.2	4.4	12.1	33.8	6.4	25.6	35.8
TN	0.9	1.3	18.1	1.7	1.6	25.4	1.9	3.8	32.6	2.8	5.4	34.9	3.8	9.5	37.8
UP	0.6	1.4	13.0	1.6	2.9	18.6	2.5	4.0	29.3	3.6	5.5	34.2	4.2	13.6	46.2
Other States															
Bihar	0.4	1.3	7.1	1.2	1.3	14.3	2.5	3.7	24.9	2.5	4.6	30.9	5.7	10.7	44.1
Guj	1.3	0.6	13.5	1.3	1.7	20.3	3.3	2.3	27.5	4.8	4.8	34.1	8.5	14.2	38.8
HP	0.1	0.6	5.4	0.4	0.9	6.3	0.9	1.9	10.3	2.9	3.2	14.3	4.3	9.9	23.0
Karnat	2.6	2.7	15.9	4.5	3.8	26.9	9.4	6.8	38.2	10.4	11.4	44.3	9.5	22.8	43.9
Kerala	1.0	0.7	7.6	0.7	0.4	11.9	1.5	1.3	17.8	2.8	1.4	22.0	4.8	6.7	33.5
Punjab	0.9	1.9	9.9	0.7	2.4	12.9	1.8	4.0	19.2	2.1	4.5	23.2	3.5	15.7	29.9
WBen	1.4	2.2	8.2	2.0	3.1	16.7	4.4	5.5	21.9	4.7	8.1	26.2	6.6	18.9	29.9
WB assisted	1.2	1.5	14.1	2.1	2.9	21.2	3.7	5.2	30.8	4.5	7.0	34.0	6.6	15.3	39.8
Other States	1.1	1.5	9.5	1.5	1.9	15.8	3.4	3.7	22.9	3.9	5.0	27.2	5.7	12.9	34.3
All India	1.2	1.5	11.9	1.9	2.5	18.8	3.6	4.5	27.3	4.2	6.1	31.0	6.2	14.1	37.3

It was observed that the prevalence of low vision, economic blindness and social blindness was lowest at younger ages and increased with age (Table 6.10). Economic blindness was 5 times higher while social blindness was 9.5 times higher amongst those aged 70+ compared to those aged 50 – 54 years. Similarly the prevalence of low vision increased by 3 times as age increased from 50-54 years to 70+ years. The differences in blindness as defined as NPCB between the different age categories was observed to be statistically significant (X2: 3234.1908; p < 0.0001).

Table 6.11
Relationship of literacy and prevalence of blindness and low vision

States	Illiterate			< = Primary			6th – 10th class			10th class +		
	EB	SB	LV	EB	SB	LV	EB	SB	LV	EB	SB	LV
World Bank Assisted States												
AP	4.7	7.3	39.8	3.8	2.6	35.4	1.6	2.2	15.8	1.0	1.0	16.7
Chatis	6.8	8.1	32.1	4.6	3.1	25.8	1.8	1.4	15.8	0	0	10.5
MP	2.7	7.3	22.0	1.0	3.0	19.0	2.5	0	12.7	3.8	0	7.5
Maha	3.3	6.8	19.5	0.8	1.1	15.2	0.7	1.2	9.1	0.8	1.6	7.3
Orissa	5.8	8.3	29.4	4.1	3.7	27.4	1.8	0.5	12.2	5.2	0	5.2
Raj	3.8	10.9	26.2	1.1	3.3	23.0	0.3	2.6	17.0	1.1	2.7	9.0
TN	2.9	5.4	35.4	1.3	2.7	24.5	0.9	1.6	16.1	0	1.0	7.8
UP	2.4	5.9	28.7	2.6	3.4	24.7	1.1	1.3	14.8	0.5	1.4	9.8
Other States												
Bihar	2.4	4.4	23.0	1.5	2.5	19.8	0.8	1.6	14.1	2.8	0.9	9.3
Guj	4.3	5.5	26.6	1.9	1.1	25.2	1.6	0.5	12.3	0	0	15.7
HP	2.2	4.4	13.8	0.7	2.1	9.2	0.7	0.4	6.3	0	0	3.8
Karnat	6.6	7.8	31.0	4.2	0.8	21.8	0	0	18.2	8.3	0	25.0
Kerala	3.6	3.1	23.9	0.9	1.8	16.4	0.7	0.4	8.7	0	0	5.0
Punjab	2.2	7.7	21.8	1.2	3.0	19.9	0.7	1.9	9.8	0.9	1.4	6.4
Wbeng	4.7	9.5	26.0	3.1	3.3	16.1	2.3	2.3	10.5	0	1.5	8.8
WB assist	4.0	7.5	29.4	2.6	2.9	24.2	1.1	1.5	14.3	0.9	1.2	9.2
Other States	3.5	5.8	23.0	1.5	2.2	18.0	0.9	1.1	10.2	0.8	0.7	7.5
All India	3.8	6.7	26.4	2.2	2.6	21.8	1.0	1.3	12.2	0.9	1.0	8.5

Respondents educated to beyond high school (Class 10th) had lowest prevalence of blindness and low vision compared to other respondents (Table 6.11). The illiterates had the highest prevalence of both blindness as well as low vision. In Chatisgarh, MP, Orissa, Gujarat, HP, Karnataka and Kerala, no individuals were suffering from social blindness among those educated to beyond high

school. This underlines the importance of literacy in health interventions as literate individuals tend to seek attention much earlier due to their increased awareness and need for good vision for gainful employment. The differences in the prevalence of NPCB by literacy were observed to be statistically significant (X2: 788.4472; p < 0.001).

Table 6.12
Prevalence of blindness and low vision in relation to place of residence

States	Urban						Rural					
	Econ Blind (< 6/60-3/60)		Soc Blind (< 3/60)		Low Vision (6/18-6/60)		Econ Blind (< 6/60 – 3/60)		Soc Blind (< 3/60)		Low Vision (< 6/18- 6/60)	
	N	%	N	%	N	%	N	%	N	%	N	%
World Bank Assisted States												
AP	18	3.8	24	5.0	149	31.2	171	4.5	256	6.7	1483	38.6
Chatis	25	3.2	29	3.7	183	23.4	213	6.6	231	7.2	994	30.8
MP	18	2.3	44	5.5	166	20.8	60	2.6	155	6.7	491	21.2
Mahar	21	1.9	50	4.6	188	17.3	94	2.7	173	4.9	618	17.5
Orissa	17	3.9	22	5.0	109	24.9	188	5.1	224	6.0	1027	27.6
Rajasthan	8	1.3	32	5.3	114	19.0	123	3.3	348	9.5	927	25.2
TN	4	0.6	34	4.7	142	19.5	91	2.3	149	3.8	1175	30.1
UP	8	1.8	18	3.9	98	21.5	112	2.3	250	5.1	1315	26.7
Other States												
Bihar	0	0	0	0	0	0	109	2.2	194	3.9	1078	21.4
Gujarat	29	3.5	17	2.1	245	29.6	107	3.7	153	5.3	708	24.3
HP	2	0.5	10	2.7	47	12.8	48	2.0	91	3.8	293	12.1
Karnataka	24	4.6	43	8.2	156	29.8	181	6.7	192	7.1	820	30.5
Kerala	11	1.6	17	2.4	91	13.0	100	2.2	94	2.1	855	19.0
Punjab	18	1.2	56	3.6	262	16.8	67	2.2	225	7.3	623	20.1
W Bengal	10	2.8	19	5.4	66	18.8	125	3.2	233	6.0	680	17.6
WB assisted	119	2.2	253	4.7	1149	21.4	1052	3.6	1786	6.1	8030	27.6
Other States	94	2.2	162	3.7	867	20.0	737	3.0	1182	4.8	5057	20.6
All India	213	2.2	415	4.3	2016	20.8	1789	3.3	2968	5.5	13087	24.4

Urban respondents had lower prevalence of economic and social blindness as well as low vision compared to rural respondents (Table 6.12). The differences in prevalence of NPCB defined

blindness were statistically significant when the urban respondents were compared with rural respondents (X2: 60.1269; p < 0.001).

Table 6.13
Relationship of occupational categories with prevalence of blindness and low vision

States	Cultivators			Service / Petty business			Labor			House work / Unemployed			Report too old to do any work		
	EB	SB	LV	EB	SB	LV	EB	SB	LV	EB	SB	LV	EB	SB	LV
World Bank Assisted States															
AP	2.4	4.5	41.3	0.6	1.9	22.4	3.4	5.3	38.0	4.8	6.9	38.9	7.8	10.2	36.4
Chatis	5.0	4.4	27.7	0.9	0.4	15.7	4.9	3.9	29.5	3.9	4.4	26.1	11.1	15.0	37.2
MP	2.0	3.3	19.0	0.9	1.4	16.4	1.5	3.3	18.8	2.4	7.5	20.6	6.3	15.3	33.6
Maha	1.8	3.2	18.8	0.0	1.0	6.9	1.8	1.8	16.2	2.2	4.0	17.9	6.3	13.4	19.0
Orissa	4.6	3.3	29.4	2.5	1.5	12.4	5.8	5.4	30.2	4.3	6.1	25.1	8.7	14.7	35.2
Raj	1.9	2.9	21.2	1.6	3.6	10.7	2.6	3.9	26.7	2.4	5.4	22.3	5.8	22.7	33.8
TN	1.8	1.6	26.9	0.3	0.5	14.2	2.8	1.9	32.0	1.8	4.1	27.1	3.1	13.6	37.3
UP	1.6	2.1	23.6	0.3	1.9	11.2	1.1	2.0	22.3	2.4	4.6	25.7	4.4	15.4	42.1
Other States															
Bihar	2.0	2.1	22.1	0.3	0.6	11.8	1.4	2.3	19.6	2.2	3.8	18.7	5.0	13.5	47.2
Guj	1.0	3.1	17.1	1.9	1.3	19.1	2.7	2.2	17.8	1.4	1.5	25.3	6.9	8.4	32.9
HP	2.0	2.9	11.9	0.5	1.0	4.4	1.8	3.7	11.1	1.2	3.3	11.4	5.3	11.4	25.4
Karnat	4.8	5.4	30.4	6.1	1.5	25.8	4.0	3.6	26.2	5.9	5.8	28.7	13.0	18.6	38.0
Kerala	1.5	1.1	15.5	0.4	0.2	8.6	2.2	0.8	17.0	1.4	1.5	14.3	4.2	5.6	30.4
Punjab	1.6	2.3	12.7	1.0	1.2	9.4	1.4	2.6	16.5	1.6	3.4	17.7	2.6	14.4	28.7
Wbeng	2.7	2.0	17.3	1.7	2.5	8.1	3.9	3.2	14.0	2.4	4.5	14.7	4.7	12.6	26.7
WB assist	2.8	3.1	25.0	0.8	1.5	13.1	3.1	3.8	31.5	2.9	5.3	24.8	6.8	15.6	34.6
Other States	2.3	2.9	19.1	1.1	1.1	10.2	2.5	2.1	17.5	2.3	3.5	18.2	5.4	11.1	31.4
All India	2.6	3.0	22.6	0.9	1.3	11.6	2.9	3.1	25.9	2.6	4.4	21.8	6.0	13.2	32.9

The highest prevalence of blindness and low vision was observed among respondents who stated that they were too old to undertake any type of work (Table 6.13), while the lowest prevalence was observed amongst those who were either engaged in the service sector or were petty businessmen. Statistically significant differences were observed between the occupational categories in relation to blindness as defined by NPCB (X2: 2218.5660; p < 0.0001).

6.3 Vision status of examined eyes

In addition to the analysis based on the vision in the better eye (persons), the presenting and best corrected vision in relation to each eye was also undertaken (Table 6.14, 6.15). 61.2% of eyes had vision better than 6/18 on presentation. 14.3% eyes had vision less than 6/60 on presentation. Only 8.3% eyes had vision less than 6/60 on presentation in Kerala.

Table 6.14
Distribution of presenting vision of examined respondents (eyes)

States	>= 6/18	< 6/18-6/60	< 6/60-3/60	< 3/60	< 6/60	missing
World Bank Assisted States						
AP (8636)	4014 (46.5)	3182 (36.8)	408 (4.7)	1032 (11.9)	1440 (16.7)	22
Chatisgarh (8016)	4314 (53.8)	2331 (29.1)	518 (6.5)	853 (10.6)	1371 (17.1)	14
MP (6220)	3978 (63.9)	1344 (21.6)	157 (2.5)	741 (11.9)	898 (14.4)	1256
Maharashtra (9220)	6341 (68.8)	1685 (18.3)	236 (2.6)	958 (10.4)	1194 (12.9)	16
Orissa (8314)	4669 (56.2)	2296 (27.6)	495 (6.0)	854 (10.3)	1349 (16.2)	142
Rajasthan (8560)	4764 (55.7)	2154 (25.2)	275 (3.2)	1367 (16.0)	1642 (19.2)	8
TN (9258)	5431 (58.6)	2662 (28.7)	239 (2.6)	929 (10.0)	1168 (12.6)	23
UP (10776)	6535 (60.6)	2820 (26.2)	241 (2.2)	1082 (10.0)	1423 (13.2)	16
Other States						
Bihar (10072)	6818 (67.7)	2201 (21.9)	257 (2.6)	796 (7.9)	1053 (10.5)	24
Gujarat (7472)	4331 (58.0)	2006 (26.8)	341 (4.6)	794 (10.6)	1135 (15.2)	0
HP (5560)	4063 (73.1)	839 (15.1)	127 (2.3)	531 (9.6)	658 (11.8)	152
Karnataka (6426)	3155 (49.1)	1907 (29.7)	420 (6.5)	947 (14.7)	1367 (21.3)	101
Kerala (10374)	7482 (72.1)	2035 (19.6)	276 (2.7)	581 (5.6)	857 (8.3)	48
Punjab (9326)	5880 (63.0)	2051 (22.0)	200 (2.1)	1195 (12.8)	1395 (15.0)	50
West Bengal (8444)	5733 (67.9)	1559 (18.5)	312 (3.7)	842 (10.0)	1154 (13.7)	132
WB assisted (69000)	40046 (58.0)	18474 (26.8)	2569 (3.7)	7916 (11.5)	10485 (15.2)	1497
Other States (57674)	37462 (64.9)	12598 (21.8)	1933 (3.4)	5686 (9.9)	7619 (13.2)	507
All India (126674)	**77508 (61.2)**	**31072 (24.5)**	**4502 (3.6)**	**13602 (10.7)**	**18104 (14.3)**	**2004**

Compared to presenting vision, best corrected vision could be improved to normal category in a fifth of the eyes (Table 6.15). After correction only 9.3% eyes had vision less than 6/60. Best corrected vision less than 6/60 was greater than 10% of the examined eyes in only 5 states.

These included AP (13.6%), Maharshtra (10.5%), Rajasthan (13.4%), Karnataka (13.8%) and Punjab (10.9%). In Kerala, only 5.5% eyes had vision less than 6/60 after correction.

Table 6.15
Distribution of best corrected vision of examined respondents (eyes)

States	>= 6/18	< 6/18-6/60	< 6/60-3/60	< 3/60	< 6/60	Missing
World Bank Assisted States						
AP (8636)	5567 (64.3)	1890 (21.9)	278 (3.2)	901 (10.4)	1179 (13.6)	22
Chatisgarh (8016)	5935 (73.9)	1310 (16.3)	186 (2.3)	585 (7.3)	771 (9.6)	14
MP (6220)	5368 (86.3)	326 (4.4)	29 (0.5)	497 (8.0)	526 (8.5)	1256
Maharashtra (9220)	7770 (84.3)	478 (5.2)	122 (1.3)	850 (9.2)	972 (10.5)	16
Orissa (8314)	6844 (82.3)	857 (10.3)	71 (0.9)	542 (6.5)	613 (7.4)	142
Rajasthan (8560)	6276 (73.3)	1136 (13.3)	102 (1.2)	1046 (12.2)	1148 (13.4)	8
TN (9258)	7837 (84.6)	634 (6.8)	61 (0.7)	729 (7.9)	790 (8.5)	23
UP (10776)	8404 (78.0)	1449 (13.4)	53 (0.5)	870 (8.1)	923 (8.6)	16
Other States						
Bihar (10072)	8477 (84.2)	878 (8.7)	97 (1.0)	620 (6.2)	717 (7.1)	24
Gujarat (7472)	6019 (80.6)	798 (10.7)	140 (1.9)	515 (6.9)	655 (8.8)	0
HP (5560)	4504 (81.0)	540 (9.7)	70 (1.3)	446 (8.0)	516 (9.3)	152
Karnataka (6426)	4683 (72.8)	842 (13.1)	106 (1.6)	798 (12.2)	904 (14.1)	101
Kerala (10374)	9157 (88.3)	646 (6.2)	75 (0.7)	496 (4.8)	571 (5.5)	48
Punjab (9326)	7462 (80.0)	843 (9.0)	78 (0.8)	943 (10.1)	1021 (10.9)	50
West Bengal (8444)	7342 (86.9)	583 (6.9)	51 (0.6)	470 (5.6)	521 (6.2)	132
WB assisted (69000)	54001 (78.3)	8080 (11.7)	902 (1.3)	6020 (8.7)	6922 (10.0)	1497
Other States (57674)	47644 (82.6)	5130 (8.9)	617 (1.1)	4288 (7.4)	4905 (8.5)	507
All India (126674)	**101645 (80.2)**	**13210 (10.4)**	**1519 (1.2)**	**10308 (8.1)**	**11827 (9.3)**	**2004**

Overall, 70.2% eyes with a presenting vision less than 6/18 but better than 6/60 could be improved to better than 6/60 after correction (Table 6.16). Among eyes with presenting vision less than 6/60 but better than 3/60, 72.4% could be improved by refraction. However 75.8% of eyes with presenting vision < 3/60 could not be improved further after refraction.

Table 6.16
Comparison of presenting and best corrected vision (eyes)

Presenting Vision	Best Corrected Vision					
	=> 6/18	=>6/60	=>3/60	< 3/60	Missing	Total
= > 6/18	100% (77508)					77508
=> 6/60	70.2% (21814)	29.8% (9256)				31070
=> 3/60	25% (1127)	47.4% (2136)	27.5% (1239)			4502
< 3/60	8.8% (1196)	13.4% (1818)	2.2% (280)	75.8% (10308)		13602
Missing					100% (2004)	2004
Total	101645	13210	1519	10308	2004	128686

6.4 Causes of Bilateral / Unilateral blindness / low vision

For all individuals, the most probable cause of bilateral blindness was assessed. For arriving at the underlying cause of blindness, the pathology in both eyes of a bilaterally blind person were considered. If one eye had a treatable cause and the other eye had an incurable cause, precedence was given to the treatable cause of blindness as the underlying cause responsible for the person's blindness. A hierarchy of causes was considered, ranging from an easily treatable cause to an incurable cause. Therefore refractive errors were considered as the underlying cause if one eye of a bilaterally blind person had a refractive error and the other eye had any other curable/ incurable cause. Cataract was placed next in the hierarchy of causes responsible for bilateral blindness. The same methodology was adopted for low vision and unilateral blindness also.

Considering economic blindness, overall in 63.7%, cataract was the attributable cause for blindness. The next common cause was uncorrected refractive error (27.7%) (Table 6.17).Wide inter district variations were observed in the causes of blindness. In AP, cataract was the attributable cause for economic blindness in 90.5% while in MP cataract was observed to be the attributable cause in only 37.2%.

Considering social blindness (Table 6.18), 62% of blindness could be attributed to Cataract while only 15% could be attributed to Uncorrected Refractive Errors. Unlike economic blindness, 7.9% of social blindness could be attributed to Glaucoma and 5.9% to posterior segment pathology. Surgical complications were responsible for 1.5% of bilateral social blindness. This proportion is directly related to the quality of cataract surgical services. A high proportion of surgical complications as the cause for social blindness was observed in HP (6%), Punjab (3.2%), MP

(2.5%) and UP (2.1%). Quality surgical outcomes are the most important motivating factor for increased cataract surgical coverage in any community and this needs to be addressed carefully.

Table 6.17
Causes of Bilateral Economic Blindness (persons)

States	Uncorrected Refractive Errors	Cataract	Posterior Capsular Opacification	Corneal Opacity	Glaucoma	Posterior Segment causes	Surgical Compli-cations	Others
World Bank Assisted States								
AP (189)	5.8	90.5	0.0	0.0	1.1	2.1	0.5	0.0
Chatisgarh (238)	15.1	73.1	0.0	0.4	1.7	5.5	0.4	3.8
MP (78)	60.3	37.2	0.0	0.0	1.3	0.0	0.0	1.3
Maharashtra (115)	36.5	46.1	0.0	1.7	6.1	5.2	0.0	4.3
Orissa (205)	42.4	53.2	0.0	0.0	1.0	1.9	0.5	1.0
Rajasthan (130)	30.8	53.8	0.0	0.8	6.1	3.8	0.8	3.8
TN (95)	41.0	56.8	1.1	0.0	1.1	0.0	0.0	0.0
UP (120)	13.3	80.8	0.8	0.0	1.7	2.5	0.0	0.8
Other States								
Bihar (108)	19.4	75.0	0.0	0.0	1.9	2.8	0.0	0.9
Gujarat (133)	24.8	56.4	0.7	0.7	3.8	10.5	0.7	2.3
HP (50)	16.0	70.0	0.0	0.0	6.0	2.0	6.0	0.0
Karnataka (205)	24.4	65.4	2.0	1.0	2.4	1.0	1.0	2.9
Kerala (111)	31.5	65.8	0.0	0.0	0.9	0.0	0.0	1.8
Punjab (85)	25.9	62.3	0.0	1.2	2.3	1.2	2.3	4.7
West Bengal (132)	50.0	47.7	0.0	0.0	1.5	0.0	0.8	0.0
WB assisted (1170)	27.2	64.7	0.2	0.3	2.3	3.0	0.3	2.0
Other States (824)	28.5	62.4	0.6	0.5	2.4	2.5	1.1	1.9
All India (1994)	27.7	63.7	0.3	0.4	2.4	2.8	0.6	2.0

Table 6.18
Causes of Social Blindness (Persons)

States	Uncorrected Ref Err	Cataract	PCO (After-cataract)	Corneal Opacity	Glaucoma	Posterior Segment	Surgical Comp	Others
World Bank Assisted States								
AP (280)	4.3	79.6	1.8	1.1	5.7	4.3	0.7	2.5
Chatisgarh (260)	6.5	70.0	0.8	0.0	4.2	6.9	1.9	9.6
MP (199)	23.6	51.8	0.0	1.5	6.5	3.5	2.5	10.5
Maharashtra (223)	7.2	75.8	0.9	1.3	6.7	2.2	1.3	4.5
Orissa (246)	23.2	63.8	0.8	0.8	2.8	4.1	0.8	3.7
Rajasthan (380)	14.2	55.8	3.9	2.4	14.5	6.3	0.0	2.9
TN (180)	33.3	48.9	4.4	0.0	2.8	10.0	0.0	0.6
UP (268)	6.3	69.0	0.0	0.7	11.2	2.2	2.2	8.2
Other States								
Bihar (193)	10.9	73.6	0.5	0.0	3.6	6.2	1.5	3.6
Gujarat (169)	18.9	38.5	0.0	1.2	11.8	20.7	1.2	7.7
HP (100)	5.0	49.0	3.0	3.0	12.0	14.0	6.0	8.0
Karnataka (235)	6.4	71.1	0.9	1.7	9.4	3.0	2.1	5.5
Kerala (111)	18.0	63.1	0.0	0.0	5.4	6.3	0.0	7.2
Punjab (281)	16.4	47.0	0.4	2.8	16.7	6.8	3.2	6.8
West Bengal (246)	35.0	58.9	0.0	0.4	0.4	1.6	0.4	3.2
WB assisted (2036)	13.7	64.8	1.7	1.1	7.5	4.9	1.1	5.2
Other States (1335)	16.8	57.7	0.5	1.3	8.6	7.3	1.9	5.7
All India (3371)	15.0	62.0	1.2	1.2	7.9	5.9	1.5	5.4

Table 6.19
Causes of Blindness as defined by NPCB (presenting vision < 6/60 in better eye)

States	Uncorrected Refractive Errors	Cataract	Posterior Capsular Opacification	Corneal Opacity	Glaucoma	Posterior Segment causes	Surgical Compli-cations	Others
World Bank Assisted States								
AP (469)	4.9	84.0	1.1	0.6	3.8	3.4	0.6	1.5
Chatis (498)	10.6	71.5	0.4	0.2	3.0	6.2	1.2	6.8
MP (277)	33.9	47.7	0.0	1.1	5.1	2.5	1.8	7.9
Maha (338)	17.2	65.7	0.6	1.5	6.5	3.3	0.9	4.4
Orissa (451)	31.9	59.0	0.4	0.4	2.0	3.1	0.7	2.4
Raj (510)	18.4	55.3	2.9	2.0	12.4	5.7	0.2	3.1
TN (275)	36.0	51.6	3.3	0.0	2.2	6.5	0.0	0.4
UP (388)	8.5	72.7	0.3	0.5	8.2	2.3	1.5	5.9
Other States								
Bihar (301)	14.0	74.1	0.3	0.0	3.0	5.0	1.0	2.7
Gujarat (302)	21.5	46.4	0.3	1.0	8.3	16.2	1.0	5.3
HP (150)	8.7	56.0	2.0	2.0	10.0	10.0	6.0	5.3
Karnat (440)	14.8	68.4	1.4	1.4	6.1	2.0	1.6	4.3
Kerala (222)	24.8	64.4	0.0	0.0	3.2	3.2	0.0	4.5
Punjab (366)	18.6	50.5	0.3	2.5	13.4	5.5	3.0	6.3
W Beng (378)	40.2	55.0	0.0	0.3	0.8	1.1	0.5	2.1
WB assist (3206)	18.6	64.7	1.1	0.8	5.6	4.2	0.8	4.0
Other States (2159)	21.3	59.5	0.6	1.0	6.2	5.5	1.6	4.3
All India (5365)	19.7	62.6	0.9	0.9	5.8	4.7	1.2	4.1

The commonest cause for unilateral blindness was cataract (45.7%) (Table 6.20). In 12.6%, uncorrected refractive errors were responsible while corneal opacity was responsible for 9.4%, posterior segment causes for 6.6% and other causes like amblyopia, trauma etc. for 18.5%.

Table 6.20
Causes of unilateral blindness among examined individuals

States	Uncorrected Ref Error	Cataract	PCO	Corneal Opacity	Glaucoma	Posterior Segment	Surgical Comp	Others
World Bank Assisted States								
AP (169)	4.1	53.3	2.4	9.5	5.9	4.1	3.0	17.7
Chatisgarh (95)	6.3	37.9	0.0	5.3	3.2	10.5	3.2	33.7
MP (147)	13.6	35.4	0.0	17.0	4.1	5.4	1.4	23.1
Maharashtra (302)	12.2	45.4	0.7	8.3	3.3	8.9	3.0	18.2
Orissa (140)	19.3	40.0	1.4	7.1	2.9	5.0	0.0	24.3
Rajasthan (276)	15.2	41.3	3.6	14.9	6.9	6.9	0.7	10.5
TN (305)	19.7	58.4	2.9	2.0	5.9	5.2	1.6	4.3
UP (283)	3.2	47.3	0.3	9.9	2.5	5.3	2.5	29.0
Other States								
Bihar (135)	7.4	40.7	0.0	12.6	3.7	10.4	3.0	22.2
Gujarat (217)	16.1	30.4	1.4	9.7	0.5	11.5	3.2	27.2
HP (215)	7.0	52.6	0.9	9.3	3.3	7.0	4.6	15.3
Karnataka (175)	9.7	48.6	2.3	13.1	2.3	2.9	4.0	17.1
Kerala (231)	12.1	56.7	0.4	5.2	1.3	5.6	2.6	16.0
Punjab (360)	12.2	43.3	0.3	10.3	2.5	6.4	3.9	21.1
West Bengal (171)	28.1	40.4	0.0	9.9	1.8	5.3	1.2	13.4
WB assisted (1717)	12.1	46.4	1.6	9.1	4.5	6.3	1.9	18.0
Other States (1504)	13.2	44.8	0.7	9.8	2.1	6.9	3.3	19.1
All India (3221)	12.6	45.7	1.2	9.4	3.4	6.6	2.6	18.5

Contrary to cataract being the predominant attributable cause for blindness, uncorrected refractive errors were the commonest cause for low vision (Table 6.21). Nearly three out of every four individuals suffering from low vision (71.9%) had an uncorrected refractive error as the underlying cause. In nearly a fourth (24.5%) of low vision individuals, cataract could be attributed as the cause for low vision.

Table 6.21
Causes of low vision among examined respondents

States	Uncorrected Ref Error	Cataract	PCO (After cataract)	Corneal Opacity	Glaucoma	Posterior Segment	Surgical Comp	Others
World Bank Assisted States								
AP (1632)	46.3	48.1	0.2	0.0	1.3	2.8	0.6	0.7
Chatisgarh (1177)	65.8	29.6	0.1	0.0	1.3	1.8	0.2	1.3
MP (657)	89.6	8.8	0.0	0.0	0.6	0.9	0.0	0.0
Maharashtra (805)	77.5	20.0	0.1	0.0	0.5	0.7	0.1	1.0
Orissa (1136)	81.9	17.5	0.0	0.0	0.2	0.3	0.0	0.2
Rajasthan (1039)	66.8	27.6	0.4	0.5	2.0	2.1	0.0	0.6
TN (1308)	89.1	9.7	0.1	0.0	0.1	0.8	0.0	0.2
UP (1413)	66.4	30.1	0.1	0.1	0.6	1.5	0.3	0.9
Other States								
Bihar (1053)	68.6	29.1	0.0	0.1	0.3	1.2	0.2	0.6
Gujarat (933)	76.4	16.3	0.8	0.3	1.3	3.4	0.8	0.8
HP (337)	53.4	40.1	0.9	0.3	1.5	1.2	2.4	0.3
Karnataka (971)	72.3	25.1	0.0	0.1	0.9	0.2	0.3	1.0
Kerala (946)	78.8	19.1	0.4	0.0	0.3	1.1	0.0	0.3
Punjab (882)	71.7	21.3	0.5	0.9	1.9	1.7	1.0	1.0
West Bengal (731)	86.2	12.4	0.0	0.1	0.8	0.1	0.0	0.3
WB assisted (9167)	70.6	26.1	0.1	0.1	0.8	1.5	0.2	0.6
Other States (5853)	73.9	22.2	0.3	0.3	0.9	1.3	0.5	0.6
All India (15020)	71.9	24.5	0.2	0.1	0.9	1.4	0.3	0.6

6.5 Characteristics of Cataract Surgery

Overall of the 64343 individuals examined, 10% had either one or both eyes operated for cataract. Cataract surgery appears to be one of the commonest surgical procedures undertaken amongst the 50+ population in the country. There were wide inter district variations in the reported cataract surgery (Table 6.22). In Gujarat, a fifth of the 50+

population had already been operated for cataract as against only 4.3% in Bihar and 4.6% in Orissa. It is therefore likely that in Gujarat a significant proportion of cataract surgeries are being undertaken before the individuals go blind while in Orissa and Bihar, many of the bilaterally blind may be waiting for surgery.

Table 6.22
Distribution of persons and eyes operated for cataract in the country

States	Persons with at least one eye operated for cataract			No. of eyes operated for cataract surgery		
	Persons examined	Persons operated	%	Eyes Examined	Eyes Operated	%
World Bank Assisted States						
AP	4329	459	10.6	8658	615	7.1
Chatisgarh	4015	284	7.1	8030	392	4.9
MP	3738	241	6.4	7476	332	4.4
Maharashtra	4618	483	10.5	9236	664	7.2
Orissa	4228	193	4.6	8456	264	3.1
Rajasthan	4284	549	12.8	8568	723	8.4
Tamilnadu	4642	682	14.7	9284	939	10.1
UP	5396	408	7.6	10792	520	4.8
Other States						
Bihar	5048	216	4.3	10096	285	2.8
Gujarat	3736	752	20.1	7472	1133	15.2
HP	2856	393	13.8	5712	561	9.8
Karnataka	3265	291	8.9	6530	364	5.6
Kerala	5211	447	8.6	10422	604	5.8
Punjab	4688	824	17.6	9376	1159	12.4
West Bengal	4289	214	5.0	8578	281	3.3
WB Assisted	35250	3299	9.4	70500	4449	6.3
Other States	29093	3137	10.8	58186	4387	7.5
All India	64343	6436	10.0	128686	8836	6.9

One of the main objectives of the NPCB is that bilaterally blind individuals should have their vision restored for which if one eye is operated or treated, sight can be restored. It was observed that as against 10% persons being operated for cataract, only 6.9% eyes underwent surgery. This therefore means that many people were only getting one eye operated. If this be the case, sight restoration rate would be more efficient for the same quantum of surgery if one eye of a blind individual is operated compared to both eyes of an individual.

Table 6.23
Distribution of type of cataract surgery among operated eyes

States	ICCE		Any IOL implant		ECCE		OTHERS*	
	No.	%	No.	%	No.	%	No.	%
World Bank Assisted States								
AP (615)	341	55.4	193	31.4	69	11.2	12	1.9
Chatisgarh (392)	166	42.3	61	15.6	149	38.0	16	4.1
MP (332)	151	45.5	81	24.4	66	19.9	34	10.2
Maharashtra (664)	49	7.4	181	27.3	414	62.3	20	3.0
Orissa (264)	181	68.6	43	16.3	18	6.8	22	8.3
Rajasthan (723)	655	90.6	40	5.5	16	2.2	12	1.7
TN (939)	508	54.1	336	35.8	79	8.4	16	1.7
UP (520)	418	80.4	77	14.8	5	1.0	20	3.8
Other States								
Bihar (285)	180	63.2	71	24.9	12	4.2	22	7.7
Gujarat (1133)	574	50.7	451	39.8	77	6.8	31	2.7
HP (561)	289	51.5	108	19.3	152	27.1	12	2.1
Karnataka (364)	230	63.2	80	22.0	41	11.3	13	3.6
Kerala (604)	163	27.0	378	62.6	48	7.9	15	2.5
Punjab (1159)	812	70.1	269	23.2	53	4.6	25	2.2
West Bengal (281)	212	75.4	37	13.2	13	4.6	19	6.8
WB assisted (4449)	2469	55.5	1012	22.7	816	18.3	152	3.4
Other States (4388)	2460	56.1	1394	31.8	396	9.0	138	3.1

All India (8836)	4929	55.8	2406	27.2	1212	13.7	289	3.3

*Others include undetermined and missing type of surgery

Intracapsular cataract extraction or extra capsular extraction without an Intra Ocular Lens Implant were reported in 69.5% of the operated eyes (Table 6.23). The lowest proportion of ICCE was in Maharashtra where only 7.4% eyes were operated by this technique.

Table 6.24
Gender distribution of type of cataract surgery

States	ICCE		ANY IOL		ECCE		OTHERS*		TOTAL	
	M	F	M	F	M	F	M	F	M	F
World Bank States										
AP	157 (53.6)	184 (57.1)	103 (35.1)	90 (27.9)	29 (9.9)	40 (12.4)	3 (1.0)	4 (1.2)	293	322
Chatis	63 (33.3)	103 (50.7)	37 (19.6)	24 (11.8)	78 (41.3)	71 (35.0)	9 (4.8)	5 (2.5)	189	203
MP	46 (39.3)	105 (48.8)	39 (33.3)	42 (19.5)	17 (14.5)	49 (22.8)	10 (8.5)	15 (7.0)	117	215
Maha	28 (8.5)	21 (6.3)	91 (27.5)	90 (27.0)	202 (61.0)	212 (63.7)	7 (2.1)	6 (1.8)	331	333
Orissa	103 (67.8)	78 (69.6)	28 (18.4)	15 (13.4)	8 (5.3)	10 (8.9)	10 (6.6)	6 (5.4)	152	112
Raj	291 (87.4)	364 (93.3)	28 (8.4)	12 (3.1)	6 (1.8)	10 (2.6)	8 (2.4)	4 (1.0)	333	390
TN	203 (50.9)	305 (56.5)	151 (37.8)	185 (34.2)	36 (9.0)	43 (8.0)	9 (2.2)	7 (1.3)	399	540
UP	201 (78.5)	217 (82.2)	43 (16.8)	34 (12.9)	2 (0.8)	3 (1.1)	5 (1.9)	7 (2.6)	256	264
Other States										
Bihar	96 (63.1)	84 (63.1)	40 (26.3)	31 (23.3)	1 (0.6)	11 (8.3)	12 (7.9)	4 (3.0)	152	133
Gujarat	227 (45.8)	347 (54.5)	230 (46.4)	221 (34.7)	30 (6.0)	47 (7.4)	5 (1.0)	11 (1.7)	496	637
HP	137 (48.9)	152 (54.1)	65 (23.2)	43 (15.3)	70 (25.0)	82 (29.2)	5 (1.8)	4 (1.4)	280	281
Karnat	92 (65.2)	138 (61.9)	32 (26.9)	48 (21.5)	12 (8.5)	29 (13.0)	0 (0.0)	2 (0.9)	141	223
Kerala	66 (24.7)	97 (28.8)	168 (62.9)	210 (71.2)	25 (9.4)	23 (6.8)	7 (2.6)	7 (2.1)	267	337
Punjab	348 (69.2)	464 (70.7)	124 (24.6)	145 (22.1)	22 (4.4)	31 (4.7)	5 (1.0)	6 (0.9)	503	656
W Beng	98 (69.5)	114 (81.4)	26 (18.4)	11 (7.8)	7 (5.0)	6 (4.3)	8 (5.7)	4 (2.8)	141	140
WB assist	1092 (52.7)	1377 (57.9)	520 (25.1)	492 (20.7)	378 (18.3)	438 (18.4)	80 (3.9)	72 (3.0)	2070	2379
Other States	1064 (53.7)	1396 (58.0)	685 (34.6)	709 (29.4)	167 (8.4)	229 (9.5)	64 (3.2)	73 (3.0)	1981	2407

All India	2156 53.2	2773 57.9	1205 29.7	1201 25.1	545 13.4	667 13.9	144 3.5	145 3.0	4050	4786

Overall, 27.2% of eyes had an intra ocular lens implant after cataract surgery. This included the conventional ECCE+ PC-IOL as well as Phaco or Small Incision surgery with an IOL implant. The highest proportion of surgeries with an IOL implant were reported from Kerala (62.6%) followed by Gujarat (39.8%) and Tamil Nadu (35.8%). Low proportion of IOL implant surgeries were reported from Rajasthan (5.5%), West Bengal (13.2%), UP (14.8%), Chatisgarh (15.6%) and Orissa (16.3%). In the case of Rajasthan and Tamil Nadu, the proportion of IOL surgery currently is estimated to be much higher as the surveys in these two States were undertaken in 1998-1999, when the surge for IOL surgery had not yet begun.

A higher proportion of males compared to females had an IOL implant (Table 6.24) while a higher proportion of females underwent ICCE compared to males. Palakkad district in Kerala was the only district in the entire country where a higher proportion of females compared to males underwent an IOL implant surgery. The male female differentials in uptake of IOL surgery were more marked in some States like West Bengal. However, IOL implant surgery was not the routine practice in most States as observed in the survey, ICCE still being the commonest surgical technique to which a significant proportion of the respondents were exposed.

There were no significant differences in the choice of place of surgery (Table 6.25). Around a fourth of the respondents were operated at eye camps (26.5%), government hospitals (24.0%), NGO/ private hospitals(free surgery) (21.6%) and NGO/ private hospitals (paid surgery) (24.6%). More free surgeries in the NGO/ private sector were reported in the World Bank assisted states compared to the non Bank assisted States. More than half the cataract surgeries were paid surgeries in the districts of AP (56.7%) and Maharashtra (51.8%). In Punjab (47.4%) and Kerala (38.4%) also a significant proportion of respondents reported utilizing paid services. Government hospitals were rarely resorted to in Punjab (8.8%) and West Bengal (11.7%). Operative eye camps were the predominant source in Orissa (62.5%), Rajasthan (60.9%), West Bengal (55%) and Chatisgarh (50%).

Analysis of cataract surgery was also done in relation to the duration since surgery (Table 6.26). It was observed that nearly half the eyes were operated within the past five years preceding the survey. This trend was observed in all in the States. This could be due to two major reasons. Firstly, the evidence points to a significant increase in surgery in the past five years. Secondly, attrition due to death in the population aged 50+ is an important parameter and this could be more acute at the older ages (65+).

It was observed that the proportion of IOL implant surgeries increased with increasing literacy (Table 6.27). This trend was observed in all the States. In fact in States with a low prevalence of IOL implant surgery, the literacy differentials had a greater impact on IOL implant surgery. Kerala reported the highest proportion of IOL implant surgeries in all literacy categories, including the illiterates. In fact the proportion of

IOL implant surgery amongst the illiterates in Kerala was higher than the IOL implant surgery rates among the better literate in many other States.

Table 6.25
Distribution of place of surgery in different districts

States	Govt. Hospitals		NGO/Pvt. - Free		NGO/Pvt.-Paid		Eye Camps	
	N	%	N	%	N	%	N	%
World Bank Assisted States								
AP (615)	157	25.5	67	10.9	349	56.7	37	6.0
Chatisgarh (392)	95	24.2	61	15.6	39	9.9	196	50.0
MP (332)	82	24.7	84	25.3	69	20.8	73	22.0
Maharashtra (664)	200	30.1	17	2.6	344	51.8	91	13.7
Orissa (264)	57	21.6	17	6.4	22	8.3	165	62.5
Rajasthan (723)	115	15.9	66	9.1	46	6.4	440	60.9
TN (939)	202	21.5	586	62.4	106	11.3	35	3.7
UP (520)	159	30.6	143	27.5	55	10.6	161	31.0
Other States								
Bihar (285)	58	20.4	100	35.1	45	15.8	62	21.8
Gujarat (1133)	500	44.1	327	28.8	126	11.1	146	12.9
HP (561)	198	35.3	69	12.3	28	5.0	256	45.6
Karnataka (364)	90	24.7	33	9.1	106	29.1	109	29.9
Kerala (604)	76	12.6	277	45.9	232	38.4	15	2.5
Punjab (1159)	102	8.8	51	4.4	549	47.4	402	34.7
West Bengal (281)	33	11.7	14	5.0	54	19.2	156	55.5
WB assisted (4449)	1067	24.0	1041	23.4	1030	23.2	1198	26.9
Other States (4388)	1057	24.1	871	19.8	1140	26.0	1146	26.1
All India (8836)	2124	24.0	1912	21.6	2170	24.6	2344	26.5

Table 6.26
Distribution of operated eyes with respect to duration since surgery

States	Operated in preceding 5 years before survey		Operated 6- 10 years before survey		Operated > 10 years before survey	
	N	%	N	%	N	%
World Bank Assisted States						
AP (615)	331	53.8	161	26.2	123	20.0
Chatisgarh (392)	233	59.4	108	27.6	51	13.0
MP (332)	161	48.5	107	32.2	64	19.3
Maharashtra (664)	350	52.7	191	28.8	123	18.5
Orissa (264)	133	50.4	78	29.5	53	20.1
Rajasthan (723)	398	55.0	224	31.0	101	14.0
TN (939)	494	52.6	293	31.2	152	16.2
UP (520)	281	54.0	155	29.8	84	16.2
Other States						
Bihar (285)	144	50.5	100	35.1	41	14.4
Gujarat (1133)	544	48.0	340	30.0	249	22.0
HP (561)	245	43.7	175	31.2	141	25.1
Karnataka (364)	191	52.5	99	27.2	74	20.3
Kerala (604)	347	57.5	140	23.2	117	19.4
Punjab (1159)	531	45.8	313	27.0	315	27.2
West Bengal (281)	144	51.2	95	33.8	42	14.9
WB assisted (4449)	2381	53.5	1317	29.6	751	16.9

Other States (4388)	2146	48.9	1262	28.8	979	22.3
All India (8836)	4527	51.2	2579	29.2	1730	19.6

Table 6.27
Distribution of literacy status in relation to IOL implant surgery

States	Illiterate		= < Primary		6th – 10th class		10th class +	
	No. catops	% IOL	No. catops	% IOL	No. catops	% IOL	No. catops	% IOL
World Bank States								
AP (615)	520	30.0	63	36.5	25	44.0	7	42.9
Chatisgarh (392)	276	10.5	85	23.5	20	35.0	11	45.4
MP (332)	274	19.7	46	39.1	4	75.0	6	66.7
Maharashtra (664)	416	21.9	147	32.6	51	45.1	21	66.7
Orissa (264)	152	15.1	102	16.7	7	42.9	3	66.7
Rajasthan (723)	590	2.0	68	7.3	36	27.8	29	44.8
TN (939)	554	26.9	253	41.5	89	60.7	43	65.1
UP (520)	383	10.2	76	22.4	37	29.7	24	41.7
Other States								
Bihar (285)	207	17.9	43	37.2	31	51.6	4	50.0
Gujarat (1133)	920	36.2	154	46.7	48	75.0	11	90.9
HP (561)	477	14.5	39	35.9	34	47.1	11	81.8
Karnataka (364)	347	21.3	13	30.8	4	50.0	0	0.0
Kerala (604)	279	42.3	175	63.4	116	75.9	33	81.8
Punjab (1159)	886	16.5	138	56.5	105	45.7	28	67.8
West Bengal (281)	227	9.7	26	11.5	11	18.2	14	57.1
WB assisted (4449)	3465	15.9	840	30.1	269	45.3	144	53.5

Other States (4388)	3343	24.9	588	46.6	349	59.6	101	74.2
All India (8836)	6508	21.3	1428	36.9	618	53.4	245	62.0

Table 6.28
Relationship between occupational status and IOL implant surgery

States	Cultivators		Service/ petty business		House work/ Unemployed		Labor		Too Old to work	
	Catop	% IOL	Catop	% IOL	Catop	% IOL	Catop	% IOL	Catop	% IOL
World Bank States										
AP	55	25 45.5	11	6 54.5	221	58 26.2	188	67 35.6	127	38 29.9
Chatisgarh	89	9 10.1	17	8 47.1	60	18 30.0	36	9 25.0	177	13 7.3
MP	52	15 28.8	19	7 36.8	165	40 24.2	13	4 30.8	82	19 23.2
Maharashtra	129	38 29.5	18	9 50.0	305	89 29.2	5	2 40.0	204	45 22.1
Orissa	62	15 24.2	15	5 33.3	97	13 13.4	10	2 20.0	73	9 12.3
Rajasthan	96	1 1.0	30	10 33.3	197	12 6.1	10	0 0.0	386	17 4.4
TN	120	51 42.5	48	28 58.3	359	152 42.3	136	50 36.8	274	55 20.1
UP	101	18 17.8	21	12 57.1	215	42 19.5	26	1 3.8	156	10 6.4
Other States										
Bihar	75	16 21.3	9	3 33.3	129	37 28.7	24	6 25.0	48	9 18.8
Gujarat	121	50 41.3	26	15 57.7	189	92 48.7	59	25 42.4	729	262 35.9
HP	183	32 17.5	21	11 52.4	217	47 21.7	15	5 33.3	125	13 10.4
Karnataka	122	29 23.8	6	4 66.7	130	31 23.8	9	1 11.1	92	15 16.3
Kerala	64	41 64.1	41	27 65.9	215	152 70.7	49	32 65.3	228	124 54.4
Punjab	78	18 23.1	67	36 53.7	342	97 28.4	38	4 10.5	629	114 18.1
West Bengal	27	4 14.8	14	8 57.1	87	6 6.9	17	5 29.4	128	12 9.4
WB assisted	704	171 24.4	179	81 47.5	1619	419 26.2	424	134 31.8	1479	201 13.9
Other States	670	190 28.4	184	104 56.5	1309	462 35.3	211	78 37.0	1979	549 27.7
All India	1374	361 26.3	363	185 52.1	2928	881 30.3	635	212 33.5	3458	750 21.8

It was observed that overall, a higher proportion of IOL implant surgery was observed amongst individuals engaged in service or petty business (Table 6.28). This was followed by the occupational category of labor while the lowest IOL rates were reported amongst those who stated that they were too old to work.

Table 6.29
Impact of Residential Status on IOL implant surgery rates

States	Urban					Rural				
	Catops	Any IOL		Others		Catops	Any IOL		Others	
		N	%	N	%		N	%	N	%
World Bank Assisted States										
AP	78	27	34.6	51	65.4	537	166	30.9	371	69.1
Chatisgarh	120	33	27.5	87	72.5	272	28	10.3	244	89.7
MP	129	43	33.3	86	66.7	203	38	18.7	165	81.3
Maharash	221	70	31.7	151	68.3	443	111	25.1	332	74.9
Orissa	36	7	19.4	29	80.6	228	36	15.8	192	84.2
Rajasthan	113	24	21.2	89	78.8	610	16	2.6	594	97.4
TN	172	66	38.4	106	61.6	767	270	35.2	497	64.8
UP	57	12	21.1	45	78.9	463	65	14.0	398	86.0
Other States										
Bihar	0	0	0	0	0	285	71	24.9	214	75.1
Gujarat	290	141	48.6	149	51.4	843	310	36.8	533	63.2
HP	75	27	36.0	48	64.0	486	87	17.9	399	82.1
Karnataka	70	14	20.0	56	80.0	294	66	22.4	228	77.6
Kerala	124	75	60.5	49	39.5	480	303	63.1	177	36.9
Punjab	433	148	34.2	285	65.8	726	121	16.7	605	83.3
West Bengal	27	5	18.5	22	81.5	254	32	12.6	222	87.4
WB assisted	926	282	30.4	644	69.5	3523	730	20.7	2793	79.3
Other States	1019	410	40.2	609	59.8	3368	984	29.2	2384	70.8
All India	1945	692	35.6	1253	64.4	6891	1714	24.9	5177	75.1

Higher IOL implant surgery rates were reported from urban areas compared to rural areas (Table 6.29). These differences in IOL implant surgery rates were statistically significant (X2: 87.72; p < 0.0001). The only exception was Kerala where the IOL implant surgery rate in rural areas (63.1%) was higher than that reported from the urban areas (60.5%).

6.6. Visual Outcomes after cataract surgery

Table 6.30

Presenting Vision Categories of Persons Operated for Cataract

States	Presenting Visual Acuity in better eye (%)				
	NN	UL	LV	EB	SB
World Bank Assisted States					
AP (454)	27.1	21.1	35.2	3.1	13.4
Chatisgarh (284)	20.4	13.0	32.4	7.0	27.1
MP (203)	25.6	20.7	27.1	0.5	26.1
Maharashtra (481)	33.5	27.9	24.9	4.6	9.1
Orissa (191)	14.7	22.0	22.5	8.4	32.5
Rajasthan (549)	15.7	23.1	27.5	6.9	26.8
TN (681)	37.4	30.5	18.2	2.2	11.6
UP (408)	22.1	27.0	32.1	3.4	15.4
Other States					
Bihar (216)	19.9	24.1	29.6	3.2	23.1
Gujarat (752)	28.5	15.6	37.6	5.4	12.9
HP (376)	36.2	23.9	22.9	4.0	13.0
Karnataka (283)	13.4	22.6	32.5	9.9	21.5
Kerala (445)	47.6	28.3	17.1	0.7	6.3
Punjab (817)	31.9	24.1	25.7	2.6	15.7
West Bengal (210)	17.6	35.2	16.7	3.8	26.7
WB assisted (3251)	26.2	24.5	26.9	4.3	18.0
Other States (3099)	30.4	23.2	27.3	4.0	15.1
All India (6350)	28.2	23.9	27.1	4.1	16.6

* Only persons with recorded vision included

After cataract surgery, cumulating across the 15 districts it was observed that 16.6% remained as socially blind while an additional 4.1% were economically blind (Table 6.30). Only 28.2% of the operated individuals could be classified as near normal. The proportion of near normal was the lowest in Chatisgarh (13.0%), Karnataka (13.4%), Orissa (14.7%) and Rajasthan (15.7%).

Table 6.31
Best corrected vision categories of operated persons

States	Best corrected Visual Acuity in better eye (%)				
	NN	UL	LV	EB	SB
World Bank Assisted States					
AP (454)	38.1	24.7	27.7	2.0	7.5
Chatisgarh (284)	39.8	19.4	25.7	4.6	10.6
MP (203)	46.3	31.5	12.3	1.0	8.9
Maharashtra (481)	51.1	34.5	6.9	1.9	5.6
Orissa (191)	48.7	29.8	17.8	0.5	3.1
Rajasthan (549)	34.4	33.0	20.8	1.6	10.2
TN (681)	58.0	33.2	4.0	0.4	4.4
UP (408)	36.5	32.3	23.8	1.2	6.1
Other States					
Bihar (216)	33.3	38.4	20.8	0.9	6.5
Gujarat (752)	58.0	19.1	16.6	2.1	4.1
HP (376)	48.7	25.3	14.1	2.4	9.6
Karnataka (283)	24.0	37.1	28.3	2.5	8.1
Kerala (445)	64.5	28.5	4.3	0.2	2.5
Punjab (817)	49.0	28.4	14.6	0.6	7.5
West Bengal (210)	40.0	39.0	12.4	1.9	6.7
WB assisted (3251)	44.7	30.5	16.3	1.6	6.9
Other States (3099)	49.4	28.0	15.1	1.4	6.1
All India(6350)	47.0	29.3	15.7	1.5	6.5

* Only persons with recorded vision included

After providing best correction, the proportion of socially blind was reduced to 6.5% and that of economic blindness to 1.5% (Table 6.31). The normals could be improved to 47%. This could be due to a large number of persons operated by ICCE technique were either not using their aphakic glasses or were not provided a pair of the same.

Table 6.32
Presenting Visual Acuity of Operated Eyes of Examined Respondents

State	>=6\18	<6\18 - 6\60	<6/60 – 3/60	<3/60	VA missing	% <6/60
World Bank Assisted States						
AP (615)	250 (41.1)	174 (28.6)	14 (2.3)	170 (28.0)	7	184 (30.3)
Chatisgarh (392)	107 (27.3)	103 (26.3)	30 (7.6)	152 (38.8)	0	182 (46.4)
MP (332)	106 (38.4)	62 (22.5)	3 (1.1)	105 (38.0)	56	108 (39.1)
Maharashtra (664)	326 (49.2)	154 (23.3)	26 (39.3)	156 (23.6)	2	182 (27.5)
Orissa (264)	62 (23.7)	41 (15.6)	8 (3.0)	151 (57.6)	2	159 (60.7)
Rajasthan (723)	228 (31.5)	176 (24.3)	42 (5.8)	277 (38.3)	0	319 (44.1)
TN (939)	565 (60.3)	122 (13.0)	11 (1.2)	239 (25.5)	2	250 (26.7)
UP (520)	226 (43.5)	135 (26.0)	18 (3.5)	141 (27.1)	0	159 (30.6)
Other States						
Bihar (285)	105 (36.8)	68 (23.8)	9 (3.2)	103 (36.1)	0	112 (39.3)
Gujarat (1133)	369 (32.6)	386 (34.1)	63 (5.6)	315 (27.8)	0	378 (33.4)
HP (561)	241 (45.0)	137 (25.6)	20 (3.7)	137 (25.6)	26	157 (29.3)
Karnataka (364)	88 (24.9)	94 (26.6)	25 (7.1)	146 (41.3)	11	171 (48.4)
Kerala (604)	398 (66.2)	105 (17.5)	4 (0.7)	94 (15.6)	3	98 (16.3)
Punjab (1159)	507 (44.2)	289 (25.2)	32 (2.8)	320 (27.9)	11	352 (30.7)
West Bengal (281)	118 (42.9)	41 (14.9)	3 (1.1)	113 (41.1)	6	116 (42.2)
WB assisted (4449)	1870	967	152	1391	69	1543
Other States (4387)	1826	1120	156	1228	57	1384
All India (8836)	3696 (42.4)	2087 (24.0)	308 (3.5)	2619 (30.1)	126	2927 (33.6)

* Percentages calculated excluding the missing values

Analysis of the operated eyes showed that a third (33.6%) had a presenting vision < 6/60 (Table 6.32). The best outcome (vision = > 6/18) in operated eyes was observed in Kerala (66.2%) and Tamil Nadu (60.3%), while the poorest outcome was observed in Orissa where 57.6% eyes had a vision < 3/60 after surgery.

Table 6.33
Best Corrected visual acuity in operated eyes

State	>=6\18	<6\18 - 6\60	<6/60 – 3/60	<3/60	VA missing	% <6/60
World Bank Assisted States						
AP (615)	329 (54.1)	169 27.8)	12 (2.0)	98 (16.1)	7	110 (18.1)
Chatisgarh (392)	197 (50.3)	108 (27.5)	18 (4.6)	69 (17.6)	0	87 (22.2)
MP (332)	195 (70.6)	32 (11.6)	3 (1.1)	46 (16.7)	56	49 (17.7)
Maharashtra (664)	504 (76.1)	54 (8.1)	10 (1.5)	94 (14.2)	2	104 (15.7)
Orissa (264)	179 (68.3)	48 (18.3)	3 (1.1)	32 (12.2)	2	35 (13.3)
Rajasthan (723)	425 (58.8)	180 (24.9)	14 (1.9)	104 (14.4)	0	118 (16.3)
TN (939)	792 (84.5)	48 (5.1)	4 (0.4)	93 (9.9)	2	97 (10.3)
UP (520)	321 (61.7)	128 (24.6)	10 (1.9)	61 (11.7)	0	71 (13.6)
Other States						
Bihar (285)	183 (64.2)	56 (19.6)	4 (1.4)	42 (14.7)	0	46 (16.1)
Gujarat (1133)	740 (65.3)	231 (20.4)	38 (3.3)	124 (10.9)	0	162 (14.3)
HP (561)	320 (59.8)	103 (19.2)	12 (2.2)	100 (18.7)	26	112 (20.9)
Karnataka (364)	175 (49.6)	94 (26.6)	9 (2.5)	75 (21.2)	11	84 (23.8)
Kerala (604)	518 (86.2)	32 (5.3)	7 (1.2)	44 (7.3)	3	51 (8.5)
Punjab (1159)	772 (67.2)	187 (16.3)	9 (0.8)	180 (15.7)	11	189 (16.5)
West Bengal (281)	197 (71.6)	39 (14.2)	4 (1.4)	35 (12.7)	6	39 (14.2)
WB assisted (4449)	2942 (67.2)	767 (17.5)	74 (1.7)	607 (13.8)	69	671 (15.3)
Other States (4387)	2905 (67.1)	710 (16.4)	64 (1.5)	600 (13.9)	57	683 (15.8)
All India (8836)	5847 (67.1)	1477 (16.9)	138 (1.6)	1207 (13.8)	126	1354 (15.5)

* Percentages exclude the missing values

Eyes with presenting vision < 6/60 could be halved by best correction (Table 6.33). Eyes with vision => 6/18 increased to 67.1%. Outcomes in Orissa could be dramatically

improved from 57.6% < 3/60 to only 12.2% < 3/60 after correction. This could mean that a significant proportion of the ICCE operated in Orissa were not using aphakic correction.

Table 6.34

Presenting and Best Corrected vision in operated eyes

Presenting Vision	Best Corrected Vision					
	=> 6/18	=>6/60	=>3/60	< 3/60	Missing	Total
= > 6/18	3696 100.0%					3696
=> 6/60	1229 58.9%	858 41.1%				2087
=> 3/60	113 36.7%	117 38.0%	78 25.3%			308
< 3/60	809 30.9%	534 20.4%	79 3.0%	1197 45.7%		2619
Missing					126 100.0%	126
Total	5847	1509	157	1197	126	8836

Overall, 45.7% of eyes with presenting vision < 3/60 after cataract surgery could not be improved by best correction (Table 6.34). This is a cause for concern as it means that nearly half the socially blind individuals did not benefit from surgery or were blind as a consequence of surgery.

The causes of blindness among operated eyes after providing best correction is depicted in Table 6.35.

A fifth of the eyes had poor vision after surgery due to surgical complications. Phthisis / disorganized / absent globe can also be attributed mainly to surgical intervention in these individuals. If these are also clubbed together, a third (33.7%) of the poor outcomes can be directly attributed to surgery.

Though IOL implant surgery has increased providing a technological breakthrough in the country, support services like YAG laser have not kept pace in terms of accessibility. This is reflected in the survey where 5% individuals were blind due to a curable cause like PCO.

Poor case selection for surgery is also evident with a significant proportion of poor outcomes attributable to Macular Degeneration and Optic Atrophy.

Table 6.35
Causes of vision < 3/60 in operated eyes after best correction

Causes of vision < 3/60 after correction	Frequency	%
Surgical Complications	232	19.4
Optic Atrophy	142	11.9
Corneal Opacity	136	11.4
Phthisis / Disorganized globe	107	8.9
Macular Degeneration	105	8.8
Primary / Secondary Glaucoma	81	6.8
Absent Globe	65	5.4
PCO	63	5.3
Retinal Detachment	61	5.1
Others	202	16.9
Undetermined	4	0.3
Total operated eyes < 3/60 after correction	1197	

Visual outcome after cataract surgery was also correlated with gender (Table 6.36), place of residence (Table 6.37), and age at surgery (Table 6.38), Occupational categories (Table 6.39) and literacy (Table 6.40).

It was observed that females (36.2%) had more adverse outcomes (vision < 3/60) compared to males (30.5%) after cataract surgery. These differences were statistically significant (X2: 31.11; p < 0.0001). The trends were similar across the different districts covered in the survey, though in some states like Chatisgarh and MP, the adverse outcomes in females were 1.3 – 1.7 times higher than amongst their male counterparts.

Table 6.36
Visual Outcomes in operated eyes in relation to gender

State	Male		Female		Total	
	Catops	VA <6/60	Catops	VA <6/60	Catops	VA <6/60
AP	288	85 (29.5)	320	99 (30.9)	608	184 (30.3)
Chatisgarh	189	74 (39.2)	203	108 (53.2)	392	182 (46.4)
MP	94	25 (26.6)	182	83 (45.6)	276	108 (39.1)
Maharashtra	330	90 (27.3)	332	92 (27.7)	662	182 (27.5)
Orissa	151	86 (57.0)	111	73 (65.8)	262	159 (60.7)
Rajasthan	333	132 (39.6)	390	187 (47.9)	723	319 (44.1)
TN	399	112 (28.1)	538	138 (25.7)	937	250 (26.7)
UP	256	67 (26.2)	264	92 (34.8)	520	159 (30.6)
Bihar	152	57 (37.5)	133	55 (41.4)	285	112 (39.3)
Gujarat	496	138 (27.8)	637	240 (37.7)	1133	378 (33.4)
HP	270	63 (23.3)	265	94 (35.5)	535	157 (29.3)
Karnataka	141	63 (44.7)	212	108 (50.9)	353	171 (48.4)
Kerala	267	39 (14.6)	334	59 (17.7)	601	98 (16.3)
Punjab	502	141 (28.1)	646	211 (32.7)	1148	352 (30.7)
West Bengal	139	52 (37.4)	136	64 (47.1)	275	116 (42.2)
WB assisted	2040	671 (32.9)	2340	872 (37.3)	4380	1543 (35.2)
Other States	1967	553 (28.1)	2363	831 (35.2)	4330	1384 (32.0)
All India	4007	1224 (30.5)	4703	1703 (36.2)	8710	2927 (33.6)

* Percentages do not include eyes where vision was not recorded

Rural residents (36.2%) had a higher proportion of adverse outcome compared to urban residents (24.5%). The rural residents had 1.5 times poorer outcome compared to their urban counterparts. These differences were statistically significant (X2: 90.71; p < 0.0001). In Uttar Pradesh, the outcomes were better among rural respondents, this being the only exception in the entire country. However the number of surgeries in urban areas were fewer in Bihar, Orissa, West Bengal and UP. The differentials were

the maximum in Chatisgarh where rural residents had twice the rate of adverse outcomes compared to the urban residents (Table 6.37).

Table 6.37
Visual Outcomes in operated eyes in relation to usual residence

State	Urban		Rural		Total	
	Catops	VA <6/60	Catops	VA <6/60	Catops	VA <6/60
World Bank Assisted States						
AP	78	19 (24.4)	530	165 (31.1)	608	184 (30.3)
Chatisgarh	120	33 (27.5)	272	149 (54.8)	392	182 (46.4)
MP	99	28 (28.3)	177	80 (45.2)	276	108 (39.1)
Maharashtra	221	54 (24.4)	441	128 (29.0)	662	182 (27.5)
Orissa	36	15 (41.7)	226	144 (63.7)	262	159 (60.7)
Rajasthan	113	28 (24.8)	610	291 (47.7)	723	319 (44.1)
TN	172	37 (21.5)	765	213 (27.8)	937	250 (26.7)
UP	57	21 (36.8)	463	138 (29.8)	520	159 (30.6)
Other States						
Bihar	0	0 (0.0)	285	112 (39.3)	285	112 (39.3)
Gujarat	290	76 (26.2)	843	302 (35.8)	1133	378 (33.4)
HP	72	18 (25.0)	463	139 (30.0)	535	157 (29.3)
Karnataka	68	31 (45.6)	285	140 (49.1)	353	171 (48.4)
Kerala	124	17 (13.7)	477	81 (17.0)	601	98 (16.3)
Punjab	426	84 (19.7)	722	268 (37.1)	1148	352 (30.7)
West Bengal	27	5 (18.5)	248	111 (44.8)	275	116 (42.2)
WB assisted	896	235 (26.2)	3484	1308 (37.5)	4380	1543 (35.2)
Other States	1007	231 (22.9)	3323	1153 (34.7)	4330	1384 (32.0)
All India	1903	466 (24.5)	6807	2461 (36.2)	8710	2927 (33.6)

*Eyes where vision was not recorded have been excluded in calculation of percentages.

Age at surgery rather than current age was related to visual outcomes. Eyes operated after 70 years (39.2%) had a poorer outcome compared to eyes operated before 60

years (33.3%). These differences were also statistically significant (X2: 49. 37; p < 0.0001)(Table 6.38).

Table 6.38
Visual Outcome in operated eyes in relation to age at surgery

State	< 60 y		61-70 y		> 70 y	
	Catops	VA <6/60	Catops	VA <6/60	Catops	VA <6/60
World Bank Assisted States						
AP	209	28.2	255	31.0	144	31.9
Chatisgarh	111	48.6	169	42.0	112	51.8
MP	71	40.8	105	35.2	100	42.0
Maharashtra	116	22.4	301	22.9	245	35.5
Orissa	96	62.5	101	61.4	65	56.9
Rajasthan	285	44.2	282	42.6	150	48.7
TN	447	28.4	356	22.8	134	31.3
UP	120	34.2	202	23.3	198	35.9
Other States						
Bihar	84	34.5	109	37.6	92	45.7
Gujarat	258	24.4	425	32.0	450	39.8
HP	90	35.6	200	21.0	245	33.9
Karnataka	168	46.4	125	47.2	60	56.7
Kerala	124	14.5	238	15.1	113	38.9
Punjab	209	23.4	434	29.3	505	34.9
West Bengal	93	38.7	103	38.8	79	50.6
WB assisted	1455	35.9	1771	32.0	1148	39.7
Other States	1026	29.7	1634	29.4	1544	38.7
All India	2481	33.3	3405	30.7	2692	39.2

*Eyes where vision was not recorded have been excluded in calculation of percentages.

The outcomes were better among those engaged in service or working as petty businessmen(16.2% < 3/60) compared to all other occupational categories where vision <

3/60 in operated eyes was more than 30%. These differences were also statistically significant (X2: 63.22; p <0.0001)(Table 6.39).

Table 6.39

Visual Outcomes in operated eyes in relation to occupational categories

State	Cultivator		Service/ Petty business		House work/ unemployed		Labor		Too old to work	
	Catops	VA < 6/60	Catops	VA < 6/60	Catops	VA < 6/60	Catops	VA < 6/60	Catops	VA < 6/60
World Bank Assisted States										
AP (615)	55	23.6	11	9.1	219	26.0	17	33.7	123	35.8
Chatisgarh (392)	39	51.7	17	17.6	50	36.7	36	38.9	177	41.8
MP (332)	44	40.9	15	20.0	136	44.1	13	23.1	68	35.3
Maha (664)	128	28.9	18	5.6	305	23.6	5	0.0	203	35.5
Orissa (264)	62	51.6	15	26.7	97	68.0	10	50.0	71	66.2
Rajasthan (723)	96	34.4	30	33.3	197	44.2	10	60.0	386	46.6
TN (939)	120	27.5	48	18.8	359	25.6	136	27.9	272	28.7
UP (520)	101	23.8	21	19.0	215	32.6	26	23.1	156	34.6
Other States										
Bihar (285)	75	29.3	9	22.2	129	41.9	24	41.7	98	24.5
Gujarat (1133)	121	34.7	26	0.0	189	23.8	59	33.9	729	36.9
HP (561)	177	28.8	21	19.0	208	31.3	15	33.3	114	28.1
Karnataka (364)	121	47.1	6	33.3	124	50.0	9	33.3	88	47.7
Kerala (604)	64	17.2	41	9.8	214	14.5	49	18.4	226	18.6
Punjab (1159)	78	32.1	57	14.9	340	28.5	38	36.8	620	33.1
West Bengal (281)	27	37.0	14	7.1	87	40.2	17	47.1	122	49.2
WB assisted (4449)	695	34.0	175	20.0	1588	33.1	423	31.9	1456	39.4
Other States (4387)	663	32.9	184	12.5	1291	30.1	211	32.7	1997	33.8
All India (8836)	1358	33.4	359	16.2	2879	31.8	634	32.2	3453	36.1

*Eyes where vision was not recorded have been excluded in calculation of percentages.

Literacy and adverse outcomes after surgery were inversely related. Adverse outcomes were lowest amongst those educated to 10+ (14.3%) compared to the illiterates (37.6%).

These differences were also statistically significant (X2: 241.66; p < 0.0001)(Table 6.40).

Table 6.40
Visual Outcomes after cataract surgery in relation to literacy status

States	Illiterate		< = Primary		6th – 10th class		10th class +	
	Catops	VA < 6/60	Catops	VA < 6/60	Catops	VA < 6/60	Catops	VA < 6/60
World Bank Assisted States								
AP (615)	520	32.5	63	15.9	25	20.0	7	0.0
Chatisgarh (392)	276	55.1	85	29.4	20	20.0	11	9.1
MP (332)	274	38.0	46	8.7	4	0.0	6	0.0
Maharashtra (664)	416	30.8	147	22.4	72	11.1	21	14.3
Orissa (264)	155	66.4	102	52.9	7	14.3	3	33.3
Rajasthan (723)	590	47.6	68	29.4	36	27.8	29	27.6
TN (939)	554	31.6	253	21.7	89	15.7	43	13.9
UP (520)	383	33.9	76	21.0	37	21.6	24	20.8
Other States								
Bihar (285)	207	46.4	43	13.9	31	25.8	4	50.0
Gujarat (1133)	920	37.1	154	20.1	48	10.4	11	9.1
HP (561)	477	29.1	39	28.2	10	60.0	11	9.1
Karnataka (364)	347	47.8	13	38.5	4	0.0	0	0.0
Kerala (604)	279	20.4	175	17.1	116	6.9	33	9.1
Punjab (1159)	886	34.0	138	21.0	105	17.1	28	14.3
West Bengal (281)	227	47.1	26	30.8	11	9.1	14	0.0
WB assisted (4449)	3168	39.2	840	25.8	290	17.2	144	16.7
Other States (4387)	3343	36.1	588	20.4	325	14.1	101	10.9
All India (8836)	6511	37.6	1428	23.6	615	15.6	245	14.3

*Eyes where vision was not recorded have been excluded in calculation of percentages.

6.7. Cataract Surgical Coverage

Cataract surgical coverage is an excellent indicator of the availability and accessibility of cataract surgical services in a given area. In computing this rate, both the operated persons as well as the unoperated cataract blind individuals are considered.

The rate is calculated as follows:

Cataract Surgical Coverage(persons) =

$$\frac{\text{No. of individuals with one or both eyes operated for cataract (A)}}{\text{A + Persons bilaterally blind due to cataract and remaining Unoperated(B)}} \times 100$$

The Cataract Surgical Coverage in the different districts is depicted in Table 6.41. The overall surgical coverage in the country was 65.7% meaning that 2 out of every 3 cataract blind individuals in the country were rehabilitated with surgery. Coverage rates above 75% were observed in Gujarat (84.3%), HP (82.4%), TN (82.8%), Punjab (81.7%) and Kerala (75.8%). Coverage rates below 50% were observed in Chatisgarh (44.4%), Orissa (42.0%), Bihar (49.2%) and Karnataka (49.2%).

The cataract surgical coverage was also determined in relation to different socio - demographic variables. Surgical coverage was significantly higher among males (70.1%) compared to females (62.4%) (X^2: 63.45; $p<0.0001$). There were wide inter state variations though the trend was in favor of males in all the States (Table 6.42).

Surgical coverage in relation to current age (Table 6.43) was similar across different age groups However younger respondents had a marginally higher coverage compared to those aged 70+, though these differences were not statistically significant (X^2: 7.37; $p=0.1174$; Not significant).

Literacy was an extremely important determinant of cataract surgical coverage in populations in these 15 districts (Table 6.44). Nearly 90% of those suffering from cataract blindness and educated to beyond high school had already been operated. This was in contrast to the illiterates where only 60% of the eligibles had been covered. These differences were found to be statistically significant (X^2: 306.00; $p< 0.0001$).

Respondents hailing from urban areas (77.6%) had a significantly higher cataract surgical coverage compared to those hailing from rural areas (63.1%)(Table 6.45). These differences were statistically significant (X^2: 131.33; $p <0.0001$). In states like Tamil Nadu, Gujarat and HP, more than 80% cataract surgical coverage was achieved even in the rural areas, therefore making surgical services easily accessible in these States.

Table 6.41
Cataract Blindness Load and Cataract Surgical Coverage (Persons)

States	No.Cataract Operated Persons (A)	No. Cataract Blind (bilaterally blind) (B)	Cataract Surgical Coverage (%) (A/A+B x 100)
World Bank Assisted States			
AP	459	394	53.8
Chatisgarh	284	356	44.4
MP	241	133	64.4
Maharashtra	483	222	68.5
Orissa	193	266	42.0
Rajasthan	549	282	66.1
TN	682	142	82.8
UP	408	282	59.1
Other States			
Bihar	216	223	49.2
Gujarat	753	140	84.3
HP	393	84	82.4
Karnataka	291	301	49.2
Kerala	447	143	75.8
Punjab	824	185	81.7
West Bengal	214	208	50.7
WB assisted	3299	2077	61.4
Other States	3138	1284	71.0
All India	6437	3361	65.7

Table 6.42
Cataract Blindness Load and Surgical Coverage by Gender (Persons)

States	Male			Female		
	Operated Cataract	Cataract Blind	Coverage %	Operated Cataract	Cataract Blind	Coverage %
World Bank Assisted States						
AP	217	152	58.8	242	242	50.0
Chatisgarh	132	128	50.8	152	228	40.0
MP	87	45	65.9	154	88	63.6
Maharashtra	241	89	73.0	242	133	64.5
Orissa	108	97	52.7	85	169	33.5
Rajasthan	252	115	68.7	297	167	64.0
TN	296	47	86.3	386	95	80.2
UP	192	97	66.4	216	185	53.9
Other States						
Bihar	111	93	54.4	105	130	44.7
Gujarat	329	49	87.0	424	91	82.3
HP	188	38	83.2	205	46	81.7
Karnataka	113	93	54.9	178	208	46.1
Kerala	197	39	83.5	250	104	70.6
Punjab	353	81	81.3	471	104	81.9
West Bengal	104	80	56.5	110	128	46.2
WB assisted	1525	770	66.4	1774	1307	57.6
Other States	1395	473	74.7	1743	811	68.2
All India	2920	1243	70.1	3517	2118	62.4

Table 6.43
Cataract Blindness Load and Surgical Coverage by Current Age (Persons)

States	50-54 year			55-59 year			60-64 years			65-69 years			70+ years		
	Ops	Cat	Cov %	Ops	Cat	Cov %	Ops	Cat	Cov %	Ops	Cat	Cov %	Ops	Cat	Cov %
World Bank Assisted States															
AP	30	27	52.6	43	39	52.4	104	74	58.4	71	62	53.4	211	192	52.4
Cha	26	26	50.0	40	45	47.1	68	89	43.3	45	63	41.7	105	133	44.1
MP	22	5	81.5	17	10	63.0	27	23	54.0	42	20	67.7	133	75	63.9
Maha	22	6	78.6	28	17	62.2	80	28	74.1	106	38	73.6	247	133	65.0
Ori	21	25	45.7	24	33	42.1	46	74	38.3	37	49	43.0	65	85	43.3
Raj	40	15	72.7	55	24	69.6	91	38	70.5	119	61	66.1	244	144	62.9
TN	63	7	90.0	88	11	88.9	141	27	83.9	116	27	81.1	274	70	79.7
UP	31	23	57.4	51	34	60.0	70	49	58.8	80	45	64.0	176	131	57.3
Other States															
Bihar	25	19	56.8	30	13	69.8	45	32	58.4	34	40	45.9	82	119	40.8
Guj	49	9	84.5	74	11	87.1	145	21	87.3	120	20	85.7	365	79	82.2
HP	20	2	90.9	28	3	90.3	65	6	91.5	68	15	81.9	212	58	78.5
Karn	32	32	50.0	51	37	58.0	74	85	46.5	44	63	41.1	90	84	51.7
Ker	28	7	80.0	42	7	85.7	74	17	81.3	87	16	84.5	216	96	69.2
Punj	57	11	83.8	64	10	86.5	140	25	84.8	155	24	86.6	408	115	78.0
WBen	31	21	59.6	29	22	56.9	42	43	49.4	35	34	50.7	77	88	46.7
WB assist	255	134	65.6	346	213	61.9	627	402	60.9	616	365	62.8	1455	963	60.2
Oth State	242	101	70.6	318	103	75.5	585	229	71.9	543	212	71.9	1450	639	69.4
All India	497	235	67.9	664	316	67.8	1212	631	65.8	1159	577	66.8	2905	1602	64.5

Table 6.44
Cataract Blindness Load and surgical Coverage by Literacy (Persons)

States	Illiterate			< = Primary			6th – 10th class			10th class +		
	Ops	Cat	Cov %	Ops	Cat	Cov %	Ops	Cat	Cov %	Ops	Cat	Cov %
World Bank Assisted States												
AP	393	363	52.0	44	23	65.7	17	6	73.9	5	2	71.4
Chatisgarh	204	298	40.6	60	52	53.6	14	6	70.0	6	0	100
MP	203	126	61.7	29	6	82.9	4	1	80.0	4	0	100
Maharashtra	308	193	61.5	105	13	89.0	34	5	87.2	15	2	88.2
Orissa	112	206	35.2	74	59	55.6	5	1	83.3	2	0	100
Rajasthan	455	255	64.1	48	15	76.2	27	6	81.8	19	6	76.0
TN	101	120	45.7	187	16	92.1	65	5	92.9	29	1	96.7
UP	307	247	55.4	59	28	67.8	25	5	83.3	17	2	89.5
Bihar	162	191	45.9	28	17	62.2	23	11	67.6	3	4	42.9
Gujarat	613	130	82.5	101	7	93.5	32	3	91.4	7	0	100
HP	335	75	81.7	28	7	80.0	21	2	91.3	9	0	100
Karnataka	277	297	48.3	11	2	84.6	3	0	100	0	0	-
Kerala	210	111	65.4	131	26	83.4	81	6	93.1	24	0	100
Punjab	634	165	79.3	92	11	89.3	77	8	90.6	20	1	95.2
West Bengal	172	178	49.1	23	23	50.0	9	3	75.0	8	2	80.0
WB assisted	2083	1808	53.5	606	212	74.1	191	35	84.5	97	13	88.2
Other States	2403	1147	67.7	414	93	81.7	246	33	88.2	71	7	91.0
All India	4486	2955	60.3	1020	305	77.0	437	68	86.5	168	20	89.4

Table 6.45
Cataract Blindness Load and Surgical Coverage by Residence (Persons)

States	Urban			Rural		
	Cat ops	Cat b/l blind	Cat Surg Cov (%)	Cat ops	Cat b/l blind	Cat surg coverage (%)
World Bank Assisted States						
AP	53	33	61.6	406	361	52.9
Chatisgarh	82	37	68.9	202	319	38.8
MP	90	30	75.0	151	103	59.4
Maharashtra	151	43	77.8	332	179	65.0
Orissa	26	28	48.1	167	238	41.2
Rajasthan	83	27	75.5	466	255	64.6
TN	126	23	84.6	556	119	82.4
UP	45	14	76.3	363	268	57.5
Bihar	0	0	0.0	216	223	49.2
Gujarat	184	28	86.8	569	112	83.6
HP	51	10	83.6	342	74	82.2
Karnataka	51	46	52.6	240	255	48.5
Kerala	88	18	83.0	359	125	74.2
Punjab	293	37	88.8	531	148	78.2
West Bengal	21	15	58.3	193	193	50.0
WB assisted	656	235	73.6	2643	1842	58.9
Other States	688	154	81.7	2450	1130	68.4
All India	1344	389	77.6	5093	2972	63.1

6.8 Recorded Surgical Complications in Operated Eyes

Overall, 38.8% eyes were observed to have some post surgical problem (Table 6.46). Vitreous in the anterior chamber was the commonest complication observed.

Table 6.46
Observed Complications in cataract operated eyes

Complications	n	%
Vitreous in Anterior Chamber	1636	18.5
Corneal Decompensation	554	6.3
CME	542	6.1
Pupillary capture by IOL	188	2.1
Iris prolapse	172	1.9
Post-operative glaucoma	143	1.6
Uveitis	116	1.3
Endophthalmitis	52	0.6
Subluxated IOL	25	0.3
Any surgical complication	3428	38.8

6.9 Observed Ocular Morbidity

During the course of the survey, a detailed eye examination was carried out wherein all morbid conditions were looked for. The presence of a specific condition in one or both eyes was recorded as "person-morbidity".

Overall, anterior segment morbidity was diagnosed in 13.7% individuals. Higher anterior segment morbidity was seen in AP and Rajasthan compared to the other States (Table 6.47). 8.5% of the examined individuals had some posterior segment condition in one or both eyes while 46.7% had a lenticular opacity, which was significantly or completely obliterating the red reflex. More than 50% of the persons were diagnosed to be suffering from cataract in AP(69.5%), Orissa (56.5%), HP (55.7%), Chatisgarh (54.2%) and Uttar Pradesh (53.7%).

Table 6.47
Ocular Morbidity Among Examined Respondents (Persons)

State	Any Anterior Segment Morbidity	Any Posterior Segment Morbidity	Cataract
World Bank Assisted States			
AP (4329)	888 20.5	469 10.8	3010 69.5
Chatisgarh (4015)	474 11.8	377 9.4	2175 54.2
MP (3738)	453 12.1	87 2.3	1691 45.2
Maharashtra (4618)	699 15.1	269 5.8	1790 38.8
Orissa (4228)	410 9.7	588 13.9	2388 56.5
Rajasthan (4284)	107 25.01	507 11.8	1916 44.7
Tamil Nadu (4642)	352 7.6	262 5.6	2230 48.0
U Pradesh (5396)	557 10.3	675 12.5	2357 53.7
Other States			
Bihar (5048)	579 11.5	302 6.0	2115 41.9
Gujarat (3736)	632 16.9	524 14.0	960 25.7
HP (2856)	431 15.1	122 4.3	1590 55.7
Karnataka (3265)	456 14.0	133 4.1	1818 55.7
Kerala (5211)	601 11.5	710 13.6	1754 33.7
Punjab (4688)	631 13.5	239 5.1	2194 46.8
West Bengal (4289)	567 13.2	217 5.1	2038 47.5
WB assisted (35250)	4904 13.9	3234 9.2	17557 49.8
Other States (29093)	3897 13.4	2247 7.7	12469 42.9
All India (64343)	8801 13.7	5481 8.5	30026 46.7

- Presence of a lenticular opacity partially or completely obliterating the red reflex was labeled as Cataract
- Presence of a morbidity in one or both eyes was considered as person morbidity