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Short Communication

Rapid Report on Eye Care Service Use to Prevent Visual Impairment and Blindness in Rajasthan and Major Surrounding Indian States, 2012 to 2016

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ABSTRACT

Background: Poor eye health is prevalent in rural parts of India and in other parts of the developing world.
Objectives: The purpose of this report is to describe the use of eye care services--such as cataract surgery, dispensing spectacles to school-aged children, and the treatment of other eye conditions (glaucoma, diabetic retinopathy)--that prevent visual impairment and blindness among the population in Rajasthan, Gujarat, Madhya Pradesh, Uttar Pradesh, Haryana, and Punjab between 2012 to 2016.
Methods: Using data from the National Programme for the Control of Blindness, India, descriptive charts for the states were constructed for the number of services utilized in each category. Demographic and key program variables were examined for the states in 2016 using a correlation matrix.
Results: Rajasthan, Uttar Pradesh, and Haryana each had a low percentage of urban population and this may have impacted the use of eye care services in these states. Gujarat, Madhya Pradesh, and Uttar Pradesh had high levels of achievement, over a 4-year period, for both cataract operations and distributing free glasses to school children.
Conclusion: "Eye camps" for low socioeconomic population areas (emphasis on women and children) could be organized by public health, optometric, ophthalmic leaders in Rajasthan and the surrounding states to conduct vision screening, provide refraction services, distribute spectacles, provide community health education and medical referral. This report showed that Rajasthan and the surrounding states made progress in the delivery of cataract operations, distribution of glasses to children, and the provision of some additional eye care services.

Key Words: Visual impairments, eye care services, ecological study, Rajasthan

INTRODUCTION

Poor eye health is prevalent in rural parts of India (pop. 1,334,477,564 people, as of December 23, 2016) and in other parts of the developing world. Treatment offered in Indian public hospitals and private practices have been effective although different results were seen in the rural compared to urban parts of India. In some major Indian States such as Rajasthan, Maharashtra, Madhya Pradesh, Bihar, and Karnataka, eye care treatment results have reflected the real picture of the uptake of eye care services. Most of the states in rural India allocate a large amount of public finance to medical care services to meet medical needs, sometimes to include the treatment of cataracts, glaucoma, and refraction errors, while the actual uptake of these treatment services differs in the various Indian states. The purpose of this report is to describe the pattern in the use of

eye care services--such as cataract surgery, refraction and dispensing spectacles for school-aged children, and the treatment of other eye conditions (e.g., glaucoma, diabetic retinopathy, squint, etc.) - that could prevent visual impairment and blindness among the population in selected Indian States between 2012 to 2016.

Burden of Poor Eye Health in India

This report begins with a description of four, main causes of poor eye health in India. We summarize what is known about blindness, cataract, glaucoma, and refraction errors and the impact on India. This framework may facilitate an appreciation for the data findings pertaining to eye care services in selected Indian States for blindness prevention and implications for continued action.

Blindness

Blindness remains a major challenge in the rural parts of India and in most developing countries. A central reason is poverty: A large number of those who are blind in India were found to be poor with insufficient access to eye care services. [(1)] In the rural parts of India, for instance, research showed that visual outcomes following cataract surgery, a common cause of blindness, were less than optimal among women, poor, rural residents, and those who had the surgery at age 70 or older. [(1)] And while cataracts are the most common cause of blindness world-wide, other common causes include uncorrected refraction errors (19.7%), corneal blindness (0.90%), glaucoma (5.80%), surgical complications (1.20%), posterior capsular opacification (0.90%), and posterior segment disorders (4.70%). [(2)] In some parts of rural India, multivariate statistical adjustment showed that among those of lower socioeconomic status and increasing age that the prevalence of corneal blindness was significantly higher. [(3)] The impact of blindness caused by neglected diseases, such as leprosy, cannot be overlooked. On the Indian subcontinent, the blindness caused by leprosy numbered about 250,000. [(4)]

Cataract and Glaucoma

Cataract is, also, known to be a common challenge in the rural parts among the people lining in these locations. Cataracts, refractive error, and optic atrophy were the leading cause of blindness in adult, Indigenous Australians living in remote areas. [(5)] In the rural parts of India, the progress that has been made in the provision of refractive services via small vision centers includes proper detection and referral of sight-threatening conditions, such as cataracts, for medical treatment. [(6)] And this seems to be consistent with an earlier finding by Ellwein et al [(7)] that found visual screening vans in central locations in rural Indian villages offered the greatest advantage of identifying individuals in a population that needed cataract surgery. There has been little success in the prevention of cataract and the use of surgery to restore vision is the primary intervention for those with cataracts. For example, there is a World Health Organization/ International Agency for the Prevention of Blindness goal to reduce visual impairments, including cataracts in the population, by facilitating access to cataract surgery to those in-need and tracking on a global and country-specific basis cataract surgical rates and cataract surgical coverage, including monitoring these metrics in India. [(8)]

Glaucoma remains a major challenge in the rural parts of India. In some rural areas of India, the prevalence of glaucoma was 3.79%. [(9)] The high rates of blindness in the adult population in India due to glaucoma is caused, in part, by a large amount of undiagnosed cases of this eye condition in the adult population. One study found 90% of cases of glaucoma identified at presentation to a research study. [(10)]

Refraction errors

Many other people in the rural India suffer from uncorrected refraction errors. Visual impairments associated with refraction errors continue to be more prevalent in the rural areas than in the urban centers in India. Globally, it was estimated that about 285 million people have

uncorrected refraction errors. [11] In India, this defect is the second highest cause of blindness, making up to 19.6% of blindness cases. [2] Refraction errors are known to cause economic and social challenges to individuals, regardless of their age, sex or race. As noted by Naidoo & Ravilla [12] there are many people in rural areas which do not get enough medical/optometric attention for this visual defect and this explained why there were more cases in the rural parts of India. It is estimated that in an area of India where the population count is around 50,000 people, [12] then the percentage demand for refraction error services could be 5% among school aged children (ages 6-20); 10% among adults (ages 21-45); 90% in adults with ages greater than 45 years, and a small but unknown percentage in pre-school children (ages 0-5). These groups may require different means for accessing the eye health/vision care system in India. Further research later showed among school-aged children (ages 7-15) in both rural and urban areas of India that the prevalence of refraction errors remaining uncorrected was 7.03% in both groups, and older children (age 13 to 15 years) attending urban schools were likely to have uncorrected myopia. [13]

The results of research are different for the northern and southern parts of the country. In Southern India, there are about 16% of visual impairments were the result of refraction errors in a particular population. [14] Again, the need for refraction error correction (specifically, presbyopia) is highest in the older age group. Among adults living in Delhi, there seemed to be more cases of this visual impairment among people ages 60-69 and 70+, women, and those with no formal education. [15]

Uptake of eye treatment services in rural India

The uptake of eye treatment services in the rural parts of India has been of concern. In research by Fletcher et al, [16] people have not been able to have timely access eye care services. The research included a total of 48 villages, out of which 94% were Hindu. Gender, lack of transportation, and caste system seemed to be predictive of low use of eye care services. Dandona, Dandona et al [17] found a difference in refraction error rates based on where a person lived (urban v rural); refraction errors were usually untreated among females living in rural areas.

Against this background, the National Programme for the Control of Blindness (NPCB), Ministry of Health and Family Welfare, Government of India, works with various state governments and other interested parties to undertake activities to reduce the burden of blindness and low vision within the population of India. NPCB does this, in part, by working with state governments to increase the number of cataract operations to those in-need; screen the vision of and distribute free glasses to children in-need, and make additional/other eye care services available to detect diabetic retinopathy, glaucoma, and other eye diseases and conditions. We briefly report on progress made in Rajasthan and neighboring, Indian states between 2012 to 2016.

METHODS

The question that underpins this report is a simple one: Is there a pattern in the use of eye care services (cataract surgery; refraction and spectacle dispensing for children; and other eye care services, such as glaucoma, diabetic retinopathy, etc.) to prevent blindness among the population in selected Indian States from 2012 to 2016? Additionally, we are interested in describing any association between key variables and demographic variables for each state in 2016.

From managerial epidemiology, an ecologic study design was employed in this project. [18] The Government of India's blindness prevention program classified the following major states: Andhra Pradesh, Bihar, Chhatisgarh, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Jharkhand, Karnataka, Kerala, Madhya

Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamilnadu, Telangana, Uttar Pradesh, Uttarakhand, and West Bengal. The major states surrounding Rajasthan include: Gujarat, Madhya Pradesh, Uttar Pradesh, Haryana, Punjab; these six states form the units of analysis. The data examined from the major states were published by the National Programme for the Control of Blindness, Ministry of Health and Family Welfare, Government of India.

Basic demographic data were collected for the six, major states included in this report. Then, administrative aggregate data counts for 4 years (2012-2013, 2013-2014, 2014-2015, and 2015-2016) were collected from the National Programme for the Control of Blindness in India pertaining to the number of cataract surgeries performed, spectacles dispensed to children following refraction, and the use of additional/other eye care services such as the screening and treatment of glaucoma, diabetic retinopathy, etc,; this value was used as the numerator. The data, also, included a value labeled "Target"; this value was used as the denominator for each of the three categories of eye care services. Collectively, the data were organized by state and year for each eye care service category. Descriptive charts for each state were constructed for the number of services utilized in each category from 2012-2016. Then, using a correlation matrix, we examined key variables and demographic variables for the states in 2016. Reporting for the "Additional/Other Eye Care Services: Diabetic Retinopathy, Glaucoma, etc." began in the 2013-2014 time frame. AcaStat, version 10.1.9 (USA, 2016) was the statistical software package used in the correlational analysis.

RESULTS

Table 1. Demographic Information for Major States Surrounding Rajasthan, India, 2016

	Population	Female Population (%)	Literacy Rate (%)	Urban Population (%)
Rajasthan	68,621,012	48.13	67.06	24.89
Gujarat	60,383,628	47.89	79.31	42.58
Madhya Pradesh	75,597,565	48.21	70.63	48.21
Uttar Pradesh	199,581,477	47.71	77.08	22.28
Haryana	25,353,081	46.77	76.64	24.25
Punjab	27,704,236	47.23	76.68	37.49

Source: mapsofindia.com/states; Accessed: 24 December 2016

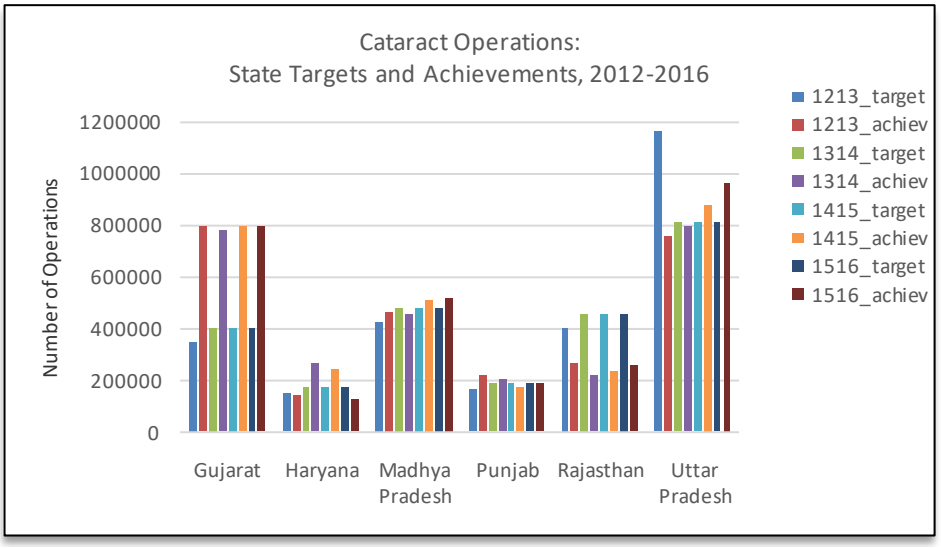

Chart 1: Cataract Operations in Selected States, 2012-2016

Source: National Programme for Control of Blindness, Government of India

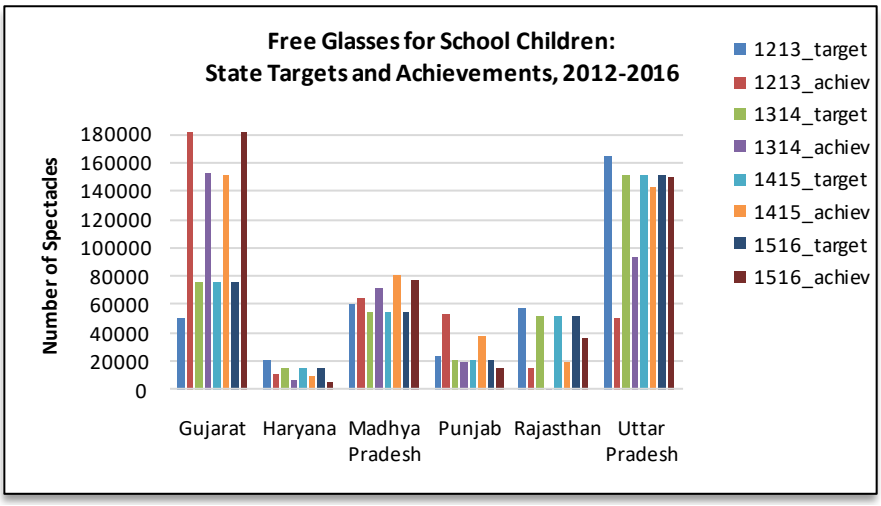

Chart 2: Free Glasses for School Children in Selected States, 2012-2016

Source: National Programme for Control of Blindness, Government of India

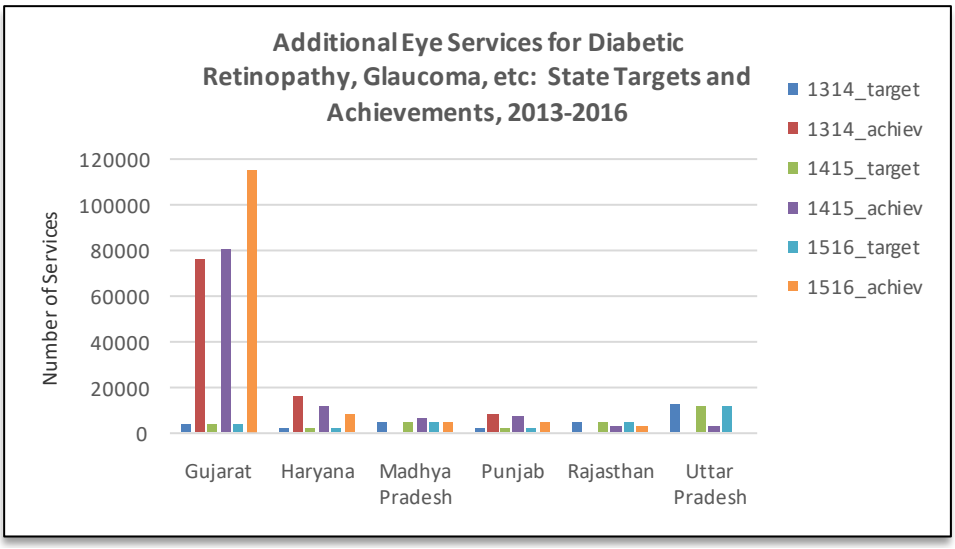

Chart 3: Additional Eye Services in Selected States, 2013-2016

Source: National Programme for Control of Blindness, Government of India

Matrix 1: Association of Demographic and Eye Care Services Report Variables, 2016

Coeff Cases P <	**Correlation Matrix**					
	Literacy Rate	**Female Rate**	**Urban Rate**	**Cataract Operation**	**Glasses for Children**	**Add. Eye Care Services**
Literacy Rate	1.000 6 0.000	-0.371 6 0.468	0.257 6 0.623	0.829 6 0.042	0.543 6 0.266	0.371 6 0.468
Female Rate	-0.371 6 0.468	1.000 6 0.000	0.257 6 0.623	0.143 6 0.787	0.543 6 0.266	-0.314 6 0.544
Urban Rate	0.257 6 0.623	0.257 6 0.623	1.000 6 0.000	0.314 6 0.544	0.543 6 0.266	0.657 6 0.156
Cataract Operation	0.829 6 0.042	0.143 6 0.787	0.314 6 0.544	1.000 6 0.000	0.886 6 0.019	0.200 6 0.704
Glasses for Children	0.543 6 0.266	0.543 6 0.266	0.543 6 0.266	0.886 6 0.019	1.000 6 0.000	0.143 6 0.787
Additional Eye Care Services	0.371 6 0.468	-0.314 6 0.544	0.657 6 0.156	0.200 6 0.704	0.143 6 0.787	1.000 6 0.000

Correlation: Spearman rho coefficients (pooled-data). AcaStat, version 10.1.9 (USA, 2016)

DISCUSSION

The previous results showed several interesting findings. First, we saw demographic factors that may have influenced the use of eye care services to prevent blindness in Rajasthan and the surrounding states (Table 1). Rajasthan, Uttar Pradesh, and Haryana, for example, each have a low percentage of urban population and this could have impacted the use of eye care services in these states. Second, the three charts (Charts 1, 2, and 3) showed the performance of specific states in terms of selected, eye care services. Notice the height of the "achievement" bars for the years in question from each state: Gujarat, Madhya Pradesh, and Uttar Pradesh had high levels of achievement, over a 4-year period, for both cataract operations and distributing free glasses to school children; however, over a 3-year period, the states showed uneven performance in the use of additional/other eye care services to address conditions such as diabetic retinopathy, glaucoma, etc. Finally, in the correlation matrix (Matrix 1) we found interesting associations between demographic variables and specific eye care services. Higher literacy rates in the states seemed to be associated with cataract operations; the higher proportion of females in a state seemed to be associated with the distribution of glasses to school children. In terms of the proportion of urban population in a state, there appeared to be a similar association with the distribution of glasses for children and the use of additional eye care services, respectively.

These findings point to what is known about the causes and implications of visual impairment from a global perspective: [19]

- Uncorrected refractive errors account for 43% of visual impairment.
- Uncorrected cataracts account for 33% of visual impairment.
- Untreated glaucoma accounts for 2% of visual impairment.
- Eighty percent (80%) of all visual impairment can be prevented and cured.

Given the global perspective, do we find a similar pattern in terms of visual impairment in Rajasthan and the surrounding Indian States? Perhaps, but we have no current estimate on the prevalence of these causes of visual impairment or related eye conditions for the six Indian States. The last published paper on visual impairments in Rajasthan was offered by Murthy GV et al (2001). [20] There appears to be a critical need to update this survey for Rajasthan and the surrounding states and, also, to conduct a systematic assessment of eye care services in these same states; there are some useful approaches. [21] Public health action to address issues of visual impairment and blindness in Rajasthan and the surrounding areas should be based on current evidence, where available.

"Vision 2020" provides a general framework for action to reduce visual impairment and blindness that can be adapted for use in Rajasthan and the surrounding Indian States. [22] After consultation with the NCPB, six state governments, community leaders, and public health and health professional leaders, it might be possible to identify an India-specific survey instrument to collect data and measure visual impairment and blindness in the population of the six states included in this report. And, again, working with the NCPB, it might be possible to identify and use another India-specific, assessment tool to collect data and measure eye care service capacity in the same six, states; rapid assessment methods for India should be considered. [23] (The World Health Organization has developed both types of instruments if Indian-specific instruments [24, 25] cannot be identified.) These data could be collected in the six states and sent to an Indian public health school in the region for analysis, interpretation, and dissemination back to the six states.

"Eye camps" are a common occurrence in India. [12] "Eye camps" for low socioeconomic population areas (with

special emphasis on mothers and children) could be organized by public health and optometric leaders in Rajasthan and the surrounding states to conduct vision screening, provide refraction services, distribute spectacles, and provide community health education and prevention programs. Encouraging women and children to get vision screenings could be a way to bring the entire family into the health care system. Cases of untreated cataracts, severe glaucoma, diabetic retinopathy, and other eye conditions/diseases that cannot be treated by local optometrists would be referred to near-by ophthalmologists for medical follow-up and treatment. Collectively, these actions are consistent with the definition of optometry and the scope of practice for an optometrist as promulgated by the World Council of Optometry. [(26)] Updates could, then, be provided to the partners involved in these types of activities on a regular basis.

Limitations: The results of this report had a few limitations that must be identified. First, the process used to establish the "target" numbers for the three, eye care services included in this report may need to be confirmed. Second, there may be unintended, instrumentation error in some of the data reports (see data reported in Chart 3). Third, the "Additional/Other Eye Care Services" category (ibid) may need to be further specified to account for specific categories of eye care services. These limitations could impact results.

CONCLUSION

Globally, nearly all visual impairment and blindness can be prevented or cured. In the rural parts of India and other developing countries, there is a low uptake, availability, and coordination of eye care services. Despite this, the results presented in this report showed that Rajasthan and the surrounding states made progress in the delivery of cataract operations, distribution of glasses to school children, and the provision of some additional eye care services. It is very likely that these states will continue to take steps to reduce visual impairment and blindness by providing increased eye care services to their populations.

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