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Poverty and blindness in Pakistan: results from the Pakistan national blindness and visual impairment survey

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ABSTRACT

Objective To explore the association between blindness and deprivation in a nationally representative sample of adults in Pakistan.

Design Cross sectional population based survey.

Setting 221 rural and urban clusters selected randomly throughout Pakistan.

Participants Nationally representative sample of 16 507 adults aged 30 or above (95.3% response rate).

Main outcome measures Associations between visual impairment and poverty assessed by a cluster level deprivation index and a household level poverty indicator; prevalence and causes of blindness; measures of the rate of uptake and quality of eye care services.

Results 561 blind participants (<3/60 in the better eye) were identified during the survey. Clusters in urban Sindh province were the most affluent, whereas rural areas in Balochistan were the poorest. The prevalence of blindness in adults living in affluent clusters was 2.2%, compared with 3.7% in medium clusters and 3.9% in poor clusters (P<0.001). The highest prevalence of blindness was found in rural Balochistan (5.2%). The prevalence of total blindness (bilateral no light perception) was more than three times higher in poor clusters than in affluent clusters (0.24% *v* 0.07%, P<0.001). The prevalences of blindness caused by cataract, glaucoma, and corneal opacity were lower in affluent clusters and households. Reflecting access to eye care services, cataract surgical coverage was higher in affluent clusters (80.6%) than in medium (76.8%) and poor areas (75.1%). Intraocular lens implantation rates were significantly lower in participants from poorer households. 10.2% of adults living in affluent clusters presented to the examination station wearing spectacles, compared with 6.7% in medium clusters and 4.4% in poor cluster areas. Spectacle coverage in affluent areas was more than double that in poor clusters (23.5% *v* 11.1%, P<0.001).

Conclusion Blindness is associated with poverty in Pakistan; lower access to eye care services was one contributory factor. To reduce blindness, strategies targeting poor people will be needed. These interventions may have an impact on deprivation in Pakistan.

INTRODUCTION

The detrimental impact of visual disability on life expectancy and quality of life is well documented,[1 2] and blindness is categorised in the sixth of seven categories of increasing disability.[3] Clear evidence shows that some blinding eye diseases are a direct consequence of poverty,[4] whereas blindness can lead to financial insecurity and social isolation.[5]

The prevalence of blindness is three to four times higher in low income countries than in industrialised countries,[6] and more than 75% of global blindness is either preventable or treatable.[7] However, information

is lacking on how poverty influences the prevalence and cause of blindness in low income countries.[8] The aim of this study, using data collected between 2001 and 2004 during the national survey of blindness and visual impairment,[9] was to explore the association between blindness, access to eye care services, and poverty in Pakistan, a low income country.[10]

METHODS

Sampling strategy and sample size

We used multistage, stratified, cluster random sampling, with probability proportional to size procedures to select a nationally representative sample of adults aged 30 years or over. We selected a total of 221 clusters in rural and urban sites around the country. We enumerated all adults who were living in households until we reached the target number. We asked all eligible people to attend the examination station set up in their community.

Survey process

All participants had their height, weight, and distance visual acuity measured and their medical history recorded. We measured visual acuity unaided and then with distance correction, if usually worn. All participants had non-cycloplegic automated refraction followed by an ophthalmic examination by an ophthalmologist.

Definitions used in this analysis

We measured poverty at two levels—at cluster level and household level.

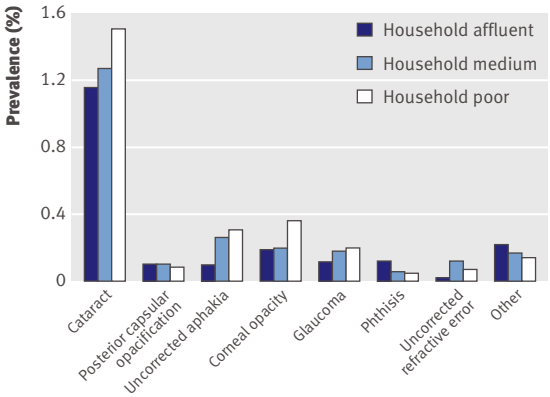
Deprivation index score—A deprivation index score at district level, stratified by urban/rural location, came from census data. The index derives a human poverty score from education, housing quality and congestion, residential services, and employment.[11] We categorised the degree of deprivation for each survey cluster into affluent (below 25th centile), medium (25th-75th centile), and poor (above 75th centile).

Household poverty—We created a household poverty variable by using a combination of occupation and literacy of people living in the house to give three categories for household poverty: non-manual and literate ("affluent households") > non-manual and illiterate plus manual and literate ("medium households") > manual and illiterate ("poor households").

Blindness—We used the World Health Organization's categories of visual impairment,[12] in which blindness is defined as a presenting visual acuity of less than 3/60 in the better eye.

Cause of blindness—We determined causes of visual loss according to WHO criteria. We selected a main cause for each eye, followed by selection of the main cause for the person.[13]

Calculation of coverage (cataract surgery and spectacles)—We calculated cataract surgical coverage, a measure of the uptake of services for cataract surgery, to assess the proportion of people with operable cataract who had had surgery. We determined wearing of spectacles for distance vision when participants attended the clinical examination. The "met need" were people with refractive errors who owned and were wearing their spectacles. "Unmet need" were adults with refractive errors who did not own spectacles or who owned spectacles of an incorrect prescription.



Cause specific prevalence of blindness at household level

Intraocular lens implantation rate—We analysed participants who had had cataract surgery to determine whether they had an intraocular lens implanted at the time of surgery.

Quality of life assessment—We administered a questionnaire on quality of life and visual function to selected participants, including those who were blind.[14]

Data analysis

We used χ^2 trend statistics to investigate associations. We used logistic regression with generalised estimating equations (to account for the clustered sampling) to estimate the effect of poverty on blindness. We built adjusted models by identifying significant explanatory variables in univariable analyses and then adding them in a forward stepwise manner. Other explanatory variables included age, body mass index, sex, hypertension, smoking status, and rural/urban dwelling.

RESULTS

In all, 16 507 participants were examined (95.3% response rate) in 221 clusters in 94 of Pakistan's 106 districts. Only 19.2% of participants in affluent clusters were living in poor households, compared with 39.7% of participants in poor clusters; 31.5% of participants lived in affluent households in affluent clusters, and 32.5% lived in poor households in poor clusters.

Poverty and prevalence of blindness—The survey identified 561 blind participants; the highest prevalence of blindness was in the poorest area, rural Balochistan (5.2%, 95% confidence interval 3.5% to 7.1%). The prevalence of blindness was higher in poor clusters than in affluent clusters among participants below the age of 50 years—1.1% (0.7% to 1.6%) in poor clusters, 0.8% (0.5% to 1.1%) in medium clusters, 0.4% (0.2% to 0.8%) in affluent clusters; P for trend=0.037—as well as among those aged 50 years and above—7.9% (6.7% to 9.3%), 7.3% (6.5% to 8.2%), 5.3% (4.2% to 6.6%); P for

trend=0.009. The prevalence of total blindness was more than three times higher in poor clusters than in affluent clusters (0.24% versus 0.07%; P<0.001). We found similar patterns at household level.

Poverty and causes of blindness—Cataract was the leading cause of blindness (n=289, 51.5%). The figure shows the cause specific prevalence of blindness for the different poverty levels in households. In adults with vision <6/18 to ≥6/60 (better eye), cataract was the leading cause in poor clusters (n=235, 47.0%) and medium clusters (n=478, 45.7%), whereas uncorrected refractive error was the leading cause in affluent clusters (n=259, 46.5%), followed by cataract (n=170, 36.0%).

Poverty and access to eye care services—At the household level, coverage for cataract surgery was higher in men than in women at all levels of poverty. In affluent clusters, 10.2% of adults presented wearing spectacles, compared with 6.7% in medium clusters and 4.4% in poor clusters (P<0.001 for affluent *v* poor). Six hundred and forty five people (850 eyes) had been operated on within three years of the survey and were included in the analysis of implantation rates. Three hundred and fifty eight (53.9%) adults had an intraocular lens implanted at the time of their cataract surgery; rates were higher among affluent participants. Spectacle coverage in affluent clusters was more than double that in medium and poor clusters (P<0.00 for affluent *v* poor), and women living in poor households had the lowest coverage (6.2%).

Quality of life—We administered the quality of life questionnaire to 337 blind participants. We found no association between household poverty status and quality of life scores.

Association analysis—The prevalence of blindness was significantly higher among elderly people (mean age among blind participants 65.4 years versus 46.7 years in others; P<0.001), those with low body mass index (mean 20.4 in blind participants versus 22.8 in others; P<0.001), those living in rural areas (3.8% versus 2.5%; P<0.001), and in women (after adjustment for age differences). Non-smokers were also more likely to be blind, but this association was confounded by sex differences in smoking habits in Pakistan. The table provides the point estimates and 95% confidence intervals for the univariable and adjusted models for the risk of blindness. We found no significant differences between the affluent and medium clusters (P=0.25) and households (P=0.55).

Univariable and multivariable analysis of the risk of blindness (<3/60)

	Univariable		Multivariable	
	Odds ratio (95%CI)	P value	Odds ratio (95%CI)	P value
Levels of poverty				
Cluster:				
Affluent	1		1	
Medium	1.69 (1.33 to 2.15)	<0.001	1.18 (0.88 to 1.58)	0.253
Poor	1.81 (1.39 to 2.35)	<0.001	1.43 (1.08 to 2.02)	0.03
Household:				
Affluent	1		1	
Medium	1.12 (0.86 to 1.47)	0.88	0.91 (0.67 to 1.30)	0.549
Poor	2.14 (1.67 to 2.73)	<0.001	1.53 (1.17 to 2.01)	0.002
Other variables				
Age* (years)	1.08 (1.07 to 1.09)	<0.001	1.08 (1.07 to 1.09)	<0.001
BMI† (kg/m^2)	0.89 (0.87 to 0.91)	<0.001	0.93 (0.89 to 0.97)	0.002
Sex:				
Female	1		1	
Male	0.97 (0.82 to 1.14)	0.725	0.66 (0.45 to 0.96)	0.033
Dwelling:				
Urban	1		Dropped	
Rural	1.55 (1.27 to 1.88)	<0.001		
Smoker:				
Yes	1		Dropped‡	
No	1.47 (1.1 to 1.95)	0.007		
Hypertensive:				
Yes	1		Dropped	
No	0.93 (0.62 to 1.39)	0.3		

*8% increase in odds of blindness for each year increase in age.
†7% decrease in odds of blindness for each unit increase in body mass index (BMI).
‡Smoking confounded by sex.

DISCUSSION

The prevalence of blindness was significantly higher in poor clusters and in poor households in this study. The prevalence of blinding cataract was lower among affluent participants, which may partly be explained by the finding that poor participants had lower rates of cataract surgery. Poor households were also more likely to have had less than optimal cataract surgery (that is, without intraocular lens implantation). Spectacle coverage was low overall and was particularly low in poor households and clusters and in women. The finding of a higher prevalence of blindness due to glaucoma among poor people is not surprising, as preventing blindness from glaucoma requires early presentation and diagnosis followed by either surgery or long term topical drugs, all of which incur costs. The prevalence of corneal blindness was also higher among poor participants, which is also not surprising, given that trachoma is still endemic in Pakistan[15] and keratitis after superficial trauma is common in agricultural workers.

Strengths of our study include the large sample size, which provided a nationally representative sample of the adult population. A limitation of the study is that we did not collect information on monthly income and expenditure or on household assets and household size. At household level, we used occupation combined with literacy as a measure of poverty, which may not capture many of the complex aspects of poverty. At cluster level, we used a district level indicator, which may not apply evenly across districts. The dynamic processes and temporal associations underlying the blindness-poverty cycle are better explored in longitudinal studies, so caution is needed when interpreting results from this cross sectional study.

One explanation for our findings is that a significantly higher incidence of blinding eye diseases exists among poor people. However, differences in the

WHAT IS ALREADY KNOWN ON THIS TOPIC

Blindness and visual impairment are more common in developing countries than in industrialised countries, but information on associations with poverty is limited

Cataract is the most common cause of blindness in Pakistan, and cataract surgery is a highly cost effective intervention

WHAT THIS STUDY ADDS

Poverty, measured at household and cluster levels with composite indices, was significantly associated with blindness in Pakistan

Lower uptake of eye care services and poorer quality services contribute to the higher rates of blindness among poor people

uptake of eye care services suggest that inequity of access is an important contributory factor. Lower uptake suggests that services are not available in poorer areas or that considerable barriers to access exist. In this survey, cost was cited as an important barrier to cataract surgery.[16] The presence of blindness due to cataract among affluent participants also indicates that other barriers exist, such as fear of treatment.

Studies in the United States and India have shown associations between reduced income and visual impairment.[17 18] Other studies have showed that illiteracy and lower class of employment were associated with higher rates of visual impairment, lower cataract surgical coverage, poorer outcomes after cataract surgery, and lower spectacle coverage.[19-23]

Globally, cataract is responsible for almost half of all blindness.[6] Data from Pakistan indicate that approximately 900 000 people still have operable cataract, and evidence from this study shows that poor people have lower access to high quality cataract surgical services.[24] The economic case for cataract surgery is strong: an economic evaluation of the eye care programme in Gambia between 1986 and 1997 showed an internal rate of return of 10%.[25] The challenges are to ensure that poor people, particularly women, have the potential to benefit.

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