**COVER PAGE**

**Poverty and blindness in Nigeria: results from the national survey of blindness and visual impairment**

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**ABSTRACT**

Poverty can be a cause and consequence of blindness. Some causes only affect the poorest communities e.g. trachoma, and poor individuals are less likely to access services. In low income countries cataract blind adults have been shown to be less economically active, indicating that blindness can exacerbate poverty.

**Purpose:**

To explore associations between poverty and blindness using national survey data from Nigeria.

**Methods:**

Participants aged ≥40 years were examined in 305 clusters (2005-2007). Socio-demographic information, including literacy and occupation, was obtained by interview. Presenting visual acuity (PVA) was assessed using a reduced tumbling E log-Mar chart. Full ocular examination was undertaken by experienced ophthalmologists on all with PVA of <6/12 in either eye. Causes of visual loss were determined using World Health Organization guidelines. Households were categorized into three levels of poverty based on the literacy and occupation at household level.

**Results:**

569/13,591 participants were blind (PVA <3/60, better eye); blindness prevalence: 4.2% (95% confidence interval 3.8-4.6%). The prevalence of blindness was 8.5% (7.7-9.5%), 2.5% (2.0-3.1%), and 1.5% (1.2-2.0%) in poorest, medium and affluent households respectively (p=0.001). The cause specific prevalence of blindness from cataract, glaucoma, uncorrected aphakia and corneal opacities were significantly higher in poorer households. Cataract surgical coverage was low (37.2%), being lowest in females in poor households (25.3%). Spectacle coverage was three times lower in poor than affluent households (2.4% vs. 7.5%).

**Conclusion:**

In Nigeria blindness is associated with poverty, in part reflecting lower access to services. Reducing avoidable causes will not be achieved unless access to services improves, particularly for the poor and women.

**INTRODUCTION**

According to the World Health Organization (WHO), there are estimated to be 169 million blind and visually impaired people worldwide, 90% of whom live in developing countries (1). The prevalence is higher in the WHO regions which are poorer, and surveys in Asia and Africa show that over 70% of all causes are avoidable. Studies have also shown that blindness and visual impairment are higher among less privileged, rural and less educated communities who face greater barriers in accessing eye care services (2-12).

There are several reasons for the higher prevalence of blindness and visual impairment in poorer countries and communities. First, there are conditions which only occur in localities with certain climatic or environmental conditions, such as onchocerciasis and trachoma. ~~Trachoma, which used to be endemic in Europe and the USA, now principally only occurs in communities with inadequate water supplies and sanitation, where there is overcrowding and poor environmental hygiene~~ (13). Secondly, programmes for control of conditions such as measles have lower coverage in countries which have poor physical infrastructure and weak health systems, and lastly, health ~~care~~ systems ~~including those~~ ~~for~~ eye care, including sub-speciality ophthalmology, ~~services~~, are not well developed, particularly in rural areas. ~~Another factor is that sub-specialty ophthalmology is only available in large cities, which means that visual loss from conditions which occur everywhere are not as well managed as they might be (e.g. corneal opacity, glaucoma, conditions of the retina).~~ However, even when services are available, they are not accessed uniformly, with under representation by females (14, 15), ~~those who are not~~ the poorly educated and those living in rural poverty (2). Indeed, WHO has recently re-emphasized the critical importance of the social determinants of health, which apply to all countries (16), with cost frequently being cited as a barrier to accessing services both in developing countries (3, 17, 18) and among the disadvantaged in affluent societies (6). A recent review highlights inequalities in health seeking behavior, access to services and the prevalence of visual impairment and blindness by a range of social determinants, such as education and ethnicity, although their impact varies in different settings.(19)

As well as being a cause of visual loss, poverty can also be exacerbated by blindness (20, 21). Poverty implies more than lack of financial resources, and encompasses loss of autonomy and control over one’s life, loss of status, authority and prestige, reduced opportunities to participate in work and household activities, stigma and social isolation. The impact can spread beyond the affected individual to other members of the household, who are assigned to care for the disabled person with consequent loss of productivity and depression, and in the case of children, lost opportunities for education. Thus a vicious cycle of poverty can become established. However, many of the interventions for the control of blindness are highly cost-effective, and can have a positive impact on visual function, quality of life (22) and improved economic status of households (20, 23, 24). Despite this positive impact, cataract surgical coverage is very low in Nigeria, ranging from 23.7% on the South South geopolitical zone to 47.2% in the South West which is where Lagos is situated (25).

Data have already been published on the prevalence and causes of blindness and low vision in Nigeria and on access to services for cataract surgery and refractive errors (25-28). The purpose of this paper is to report the association between indicators of poverty and the prevalence and causes of blindness and uptake of services, focusing on causes most amenable to treatment. Definitions and analysis are similar to those used in a similar paper from Pakistan (2).

**MATERIALS AND METHODS**

Field work for the Nigeria national blindness and visual impairment survey was undertaken by two highly trained clinical teams simultaneously between 2005 and 2007. A detailed description of the sampling methods, enumeration and ocular examination procedures has already been published (29).

**Sampling**

A sample size of 15,027 in 310 clusters was calculated based on an assumed blindness prevalence of 5% among those aged ≥40 years (presenting visual acuity (VA) of <3/60 in the better eye), a precision of 0.5%, 95% confidence intervals (CI), a design effect of 1.75 and an anticipated response rate of 85%. Multi-stage, stratified (by urban/rural residence and by geo-political zone), cluster random sampling with probability proportional to size methods were used to obtain a nationally representative sample. Clusters were identified in all 36 States and the Federal Capital Territory. Clinical examination sites were set up in each cluster. Each clinical team comprised two ophthalmologists, an optometrist and ophthalmic nurses.

After obtaining informed consent, the following data were collected: age, gender, ethnic group and religion. Information on occupational status, educational attainment and household sanitation (source of water, and type of sanitation) were also recorded. Anthropometric measurements such as height (to the nearest centimeter), and weight (in grams to nearest 100g) were taken for each participant (the equipment was calibrated daily, and the scale zero-error checked before each measurement).

All participants had their presenting visual acuity (PVA) measured using a reduced E Log-MAR chart; all had visual field screening (Humphrey Frequency Doubling Technology, Carl Zeiss Meditec AG Jena Germany), and all underwent a basic eye examination irrespective of PVA. Those with a PVA of <6/12 in one or both eyes underwent auto-refraction (Takagi ARKM-100, Takagi Seiko, Japan), best corrected VA testing, and a detailed examination by a second ophthalmologist. This included slit lamp examination (Zeiss SL 115 Classic Slit Lamp, Carl Zeiss Meditec AG Jena Germany) and dilated fundoscopy. Digital images of the posterior segment were also taken (Zeiss VISUCAM Lite Desk Top Fundus Camera, Carl Zeiss Meditec AG Jena Germany) and read by Moorfields Reading Centre. A cause of visual loss was assigned to each eye in participants with a presenting VA <6/12 in the better eye, and one cause was assigned to the individual using WHO guidelines (29).

**Definitions:**

Visual impairment: WHO categories were used, which use PVA in the better eye: blindness <3/60; severe visual impairment <6/60-3/60; visual impairment <6/18-6/60.

Household: A household was defined as all those living under the same roof who routinely ate from a common pot. If the household head had more than one wife who lived in different compounds they were treated as separate households (29).

Household poverty: A poverty variable was created using a combination of occupation and literacy(2). Occupations were grouped into non-manual (professional, managerial and technical, or skilled non-manual), manual (skilled manual, partly skilled manual, or unskilled manual), or other (retired, unemployed, or student). Household occupation was determined by the person with the highest status occupation. Literacy was defined as an ability to read or write, or both, using the highest level of literacy at household level. The 3 categories of occupations were combined with literacy to obtain the household poverty status: affluent household - non-manual and literate; medium household - non-manual and illiterate plus manual and literate; poor household - manual and illiterate.

Body mass index was categorized as lean: <18.5; normal: ≥18.5 to <25.0; overweight: ≥25.0 to <30.0; and obese: ≥30.0.

**Access to services:**

Cataract surgical coverage (CSC) measures the uptake of cataract surgical services and can be calculated at the person or eye level, and for varying degrees of visual loss. For this study person level CSC and blindness were used in the following formula ((x+y)/(x+y+z)) x 100, where x are people with unilateral pseudophakia/aphakia and blindness in other eye; y are people with bilateral pseudophakia/aphakia, regardless of the visual acuity; and z are people who are blind (one or both eyes) where cataract was the main cause of visual loss (25). Individuals who had undergone couching were excluded.

Spectacle coverage assesses access to spectacle correction by those with significant refractive error using the following formula: met need / (met need + unmet need) x 100. As with CSC, spectacle coverage can be measured for different levels of acuity. For this analysis we used the following definitions: met need are people who wore distance glasses and had VA < 6/12 in the better eye without correction but achieved 6/12 or better in their better eye with their present distance spectacle. Unmet need= individuals who did not wear spectacles and who had acuity <6/12 in the better eye without correction but could achieve 6/12 or more in the better eye with correction (28).

**Statistical analysis:**

Data were entered into Microsoft Access using custom-designed software and analysed using Stata 13.0 (Stata Corp, Texas, US). Blindness burden, cataract surgical coverage, IOL implantation rate and spectacle coverage are presented as numbers and percentages. We assessed the association between age groups, gender, place of residence, body mass index categories and poverty levels in univariable analyses. Multivariable logistic regression analysis was performed to assess factors associated with blindness burden and uptake of services. Factors significant at the 0.2 level in univariable analyses were included in multivariable analysis. P-values and 95% confidence intervals on the prevalence estimates and the odds ratios from the regression analyses were calculated taking into account of design effects due to multi-stage cluster sampling design. We used “svy” commands (Stata 13), which use linearized variance estimators based on first-order Taylor series linear approximation, to compute the SEs accounting for the clustering effect arising from sampling design. The Wald F-test was used to assess the pair-wise interactions between model variables in the multiple regression analyses. Missing data on body mass index (BMI) were assumed to be missing at random resulting in the exclusion of 192 participants (1.4%) in the final multivariable model. P-values <0.05 were considered statistically significant.

**Ethical approval**:

Ethical approval was obtained from the ethics committee of the London School of Hygiene & Tropical Medicine and permission from the Federal Ministry of Health and at all levels of government (States and Local Government Areas) was granted. Consent at community and household levels was also obtained and verbal informed consent sought and obtained at participant level.

**RESULTS:**

**Study population:**

13,591 of those enumerated (15,027) were examined in 305 clusters (response rate 89.9%)(Figure 1). Five of the 310 clusters were not visited due to civil unrest. 46.0% of participants included in the analysis were female, 22.5% were from urban clusters and 4,404 (32%), 4,702 (35%) and 4,485 (33%) participants were in affluent, medium and poor households respectively. Participants in poor households were older and had lower BMI.

**Blindness and level of household poverty:**

569 participants were blind. The prevalence of blindness was highest in the North East and North West geopolitical zones (GPZs) 6.1% (95% CI: 4.7-8.0%) and 4.8% (95% CI: 4.1-5.8%)(p <0.001) respectively (Table 1) (27). In affluent and medium households the prevalence of blindness was higher in the northern GPZs compared with the southern GPZs, but this trend was less apparent in poorer households. The prevalence of blindness was significantly higher in poor households: 8.5% (95% CI: 7.7-9.5%) than medium 2.5% (95% CI: 2.0-3.1%) and affluent households 1.5% (95% CI: 1.2-2.0%)(p<0.001 for both) and this also applied to the prevalence of visual impairment (data not shown). The prevalence of blindness and visual impairment amongst those aged 40-49 years and 50 years or above by household status are shown in Figure 2. In multivariable analysis, people living in poor households were 2.7 times more likely to be blind than those living in affluent households (Odds Ratio 2.7; 95% 2.0-3.7, p=0.001) (Table 2). Other significant risk factors were age and BMI. There were no urban/rural or gender differences.

**Cause specific prevalence of blindness:**

Cataract was the leading cause of blindness and severe visual impairment overall (n=244/569, 42.9% and n=92/203, 45.3% respectively)(Figure 3). Participants from poor households were 6 times more likely to be blind from cataract than those in affluent households (3.7% vs 0.57%, p=0.001). Associations were similar for uncorrected aphakia (0.69% vs 0.16%), corneal opacity (1.03% vs 0.16%) and glaucoma (1.54% vs 0.20%) which are statistically significant (p=0.001).

**Access to services by poverty level and gender:**

Uptake of services for cataract and spectacles were very low overall: CSC per person at the <3/60 level for Nigeria was only 37.2%(4) and spectacle coverage only 3% (25, 28). Females in poor households had lower access to cataract surgical services than males (CSC at the <3/60 level: 25.3% females vs 48.8% males, p=<0.001) but females in poorer households had higher rates of IOL implantation than males (50.9% females vs. 28.8% males, p=0.026). Within the different levels of affluence, males were more likely to have spectacles. Participants in poor households were three times less likely to present with spectacle correction than those living in affluent households (2.4%; 95% CI: 1.1%-4.8% vs 7.5%; 95% CI: 4.5% – 11.2%, p = 0.001)(Table 3). Level of poverty was not associated with CSC at any level of visual acuity at the person level, nor in the proportion of cataract operated eyes that had IOL surgery.

**DISCUSSION:**

Data from the National Bureau for Statistics, which defines poverty as the proportion of the population living on less than $1.25 a day at 2005 international prices, show that poverty levels rose in Nigeria during the time of the survey from 54.7% in 2004 to 60.9% in 2011 despite greater GDP. The North West and North East GPZs were poorer (70.0% and 69.0% respectively) than the South West GPZ (49.8%). However, there are no agreed standards for assessing the economic status of households(30) which is particularly challenging in subsistence farming populations and where a large diaspora send remittances home. Indeed the World Bank estimated remittances to Nigeria to be $21 billion in 2013 (31). Approaches for assessing household economic status include assessing income, inventories of assets, household expenditure and self-ranking in relation to other households in the community. All of these methods are time consuming and were not possible within the constraints of a large scale national blindness survey. In this study we used a combination of education and occupation as proxy measures for economic status, as this was feasible. Requesting information on income might have aroused suspicion and led to non-participation. Similar parameters were used in the analysis of data from the Pakistan national blindness survey(2).

The findings from this large national survey confirm the findings of other large and smaller scale population based surveys that there is wide variation in the prevalence of blindness between and within countries. For example, in Pakistan the prevalence of blindness was 2.2%, 3.7% and 3.9% in affluent, medium and poor households respectively. The association between poverty/deprivation and blindness and visual impairment was also reported in the Baltimore eye survey in the United States of America, where socioeconomic status was an important determinant of the severity of visual loss (32). In several other studies, lower levels of education have been associated with a higher prevalence of visual impairment. i.e., in Australia and Taiwan (33) and blindness, in India and China (19, 34, 35). These findings indicate that the WHO’s strategy of addressing the social determinants of health also applies to the prevention of blindness (16).

In the Nigeria survey the overall prevalence of blindness was 4.2%, and 84% of causes were avoidable with cataract, glaucoma, uncorrected aphakia, corneal opacities being the principal avoidable causes (26). In this study individuals living in poor households were almost three times more likely to be blind than individuals living in affluent households, and twice as likely to be blind as those in medium households. The mechanisms which lead to this variation are likely to be complex and inter-related, encompassing greater exposure to risk factors as well as differences in the availability of eye care services and health seeking behavior. With regard to the former, data from the Nigeria survey have been analyzed by ecological zone (Figure 1)(36), showing that trachoma and other causes of corneal scarring were responsible for a higher proportion of blindness in the Sudan savannah belt across the northern regions of Nigeria (17.4%) than in the Guinean forest savannah (8.6%), the rain forest (6.8%) and delta regions (6.8%) in the centre and south of the country (36). The Sudan savannah is characterized by a dry, hot climate and trachoma is endemic.

In terms of provision of eye care services, the majority of eye units in Nigeria~~, be they government, non-government or private for profit, are in the south and centre of the country, being~~ are concentrated in the major cities. The services they provide are also not always as good as they might be, and are often under-utilized (37, 38). The much lower prevalence of blindness in affluent households in the south west and south-south GPZs indicates that when services are available they are accessed, but this may ~~On the other hand, this may~~ also reflect lower exposure to risk factors or wealthier ~~associated with visual loss as well as the fact that many wealthy~~ Nigerians accessing private eye care outside Nigeria. Some eye care providers ~~hospitals and departments~~ in Nigeria run surgical outreach services ~~providing surgery in local facilities~~ as a means of increasing access (37), which may explain lack of differences between men and women and between urban/rural dwellers in univariate analysis. Lack of gender differences have also been reported in a Rapid Assessment of Avoidable Blindness survey in Cameroon (39) and in a peri-urban sample in Ghana (40). Without these activities the discrepancy between affluent and poor households may well have been even greater. Another factor to consider is that couching is widespread in Nigeria, particularly in the north, often with very poor visual outcomes (9, 41). In the Nigeria survey almost half of the eyes that had undergone a procedure for cataract had been couched, and almost three quarters of these eyes were blind. ~~Similar findings have been reported from other smaller population based surveys in Nigeria.~~

It is likely that the higher prevalence of glaucoma blindness in poorer households reflects lack of awareness of the condition and/or lack of acceptance and/or adherence to treatment (42). It is likely that greater levels of literacy combined with higher status occupations lead to with greater income as well as awareness and hence differences in health seeking behavior. However, this is not the whole story as females had lower CSC and spectacle coverage at all levels of household poverty than males, suggesting that the eye health needs of females are not being prioritized within households.  ~~to the same extent as those of males.~~ Indeed, a recent study in the North West GPZ showed that unmarried, cataract blind women, mainly widows, were less likely to access services and were willing to pay significantly less for cataract surgery than married women or men (43). However, the very low overall CSC in Nigeria (38.3%), is amongst the lowest in the world indicating a great need to improve the quantity and quality services for all sectors of the community.

Uncorrected refractive errors are an important cause of visual impairment(44) and the need for services is great in many countries. The Nigeria survey highlighted extremely low spectacle coverage overall, and once again, uptake of services was lower in poorer households. It has been estimated that over 2 million Nigerians need spectacle correction to improve their distance acuity, a third of which could be met by low-cost off-the-shelf spectacles (28). The very low spectacle wearing rates are likely to reflect a combination of provider as well as consumer factors: there are an inadequate number of optometrists in Nigeria, and most are located in urban areas.

A possible limitation of our study is that we used an aggregate poverty index at household level, an approach used in other national surveys in low income settings (45). This is justifiable in an African context where decisions are usually taken at household level on health seeking behavior as well as on how limited financial resources are to be allocated. Both are likely to be influenced by the highest occupation level and the highest level of literacy of household members. This applies particularly to women living in subsistence farming communities. Information on smoking was not obtained as cigarette smoking is very uncommon in Nigeria and questioning may have caused offence in some communities.

The public cost of blindness is enormous: in sub-Saharan Africa and parts of Asia it is estimated that it will be equivalent to 0.5% of the GDP by 2020. Greater advocacy is needed for the allocation of scarce resources for eye care services, emphasizing that the interventions are highly cost effective and have considerable economic impact on individuals and households (20, 24, 46). The Gambian eye care program provides an example, where the economic rate of return over a 10 year period of program implementation was over 10% (47). Indeed, the elimination of avoidable blindness effort must go beyond blindness prevention to initiatives that embrace socio-economic development.

Data from the National Bureau of Statistics suggest that inequity may be increasing in Nigeria, which means that even greater efforts will be needed to increase provision of eye care services, and steps taken to improve access for the poor, particularly women (48). The new health financing scheme currently being introduced in Nigeria, Results-Based Financing (49, 50), together with health sectors reforms, offer opportunities to ensure that affordable eye care is an integral part of service provision in every State, from primary level through to tertiary level subspecialty services. This will require advocacy for policies of relevance to eye health, including budgetary allocation to ensure that eye care is included in health financing mechanisms.

**Conclusion**Data from this large-scale national survey indicate that poverty at household level is strongly associated with blindness. The findings are likely to be mediated by greater exposure of the poor to risk factors for visual loss as well as lack of access to services, particularly for cataract and glaucoma. However, the very low overall CSC in Nigeria (38.3%)(25), is amongst the lowest in the world, indicating a great need to improve the quantity and quality services for all sectors of the community.

**Legends for Figures**

**Figure 1. Map of Nigeria showing boundaries of geopolitical zones, ecological zones and location of each cluster visited during the national survey**

**Figure 2. Prevalence of blindness and visual impairment, by household level of poverty and age group.**

**Figure 3: Cause specific prevalence of blindness, by level of household poverty**

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**Table 1: Prevalence of blindness by geopolitical zone and level of household poverty in Nigeria**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Affluent households** | | **Medium households** | | **Poor**  **households** | | **All**  **households** | |
|  | **%** | **95% CI** | **%** | **95% CI** | **%** | **95% CI** | **%** | **95% CI** |
| North East | 2.2 | 1.0-4.7 | 3.5 | 1.6-7.5 | 9.7 | 7.9-11.8 | 6.1 | 4.7-8.0 |
| North West | 2.3 | 1.5-3.5 | 3.5 | 2.4-5.2 | 8.7 | 7.0-10.71 | 4.8 | 4.1-5.8 |
| South East | 1.8 | 1.1-3.0 | 2.3 | 1.4-3.9 | 14.0 | 10.7-18.2 | 4.6 | 3.6-6.0 |
| North Central | 2.1 | 1.0-4.7 | 1.7 | 1.1-2.8 | 7.0 | 5.1-9.4 | 3.8 | 2.0-4.8 |
| South South | 0.6 | 0.2-1.6 | 2.5 | 1.4-4.3 | 9.8 | 6.8-14.0 | 3.2 | 2.4-4.5 |
| South West | 0.8 | 0.4-1.8 | 1.3 | 0.7-2.4 | 6.0 | 4.6-7.8 | 2.8 | 2.3-3.5 |
|  |  |  |  |  |  |  |  |  |
| Nigeria | 1.5 | 1.2-2.0 | 2.5 | 2.0-3.1 | 8.5 | 7.7-9.5 | 4.2 | 3.8-4.6 |

**Table 2. Univariate and multivariable analysis of risk factors for blindness~~, by level of household poverty~~**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | **Univariate Analysis** | | | **Multivariate Analysis** | | |
|  | **N** | **%** | **Odds Ratio** | **95% CI** | **P value** | **Odds Ratio** | **95% CI** | **P value** |
| **Poverty level** |  |  |  |  |  |  |  |  |
| Affluent | 4,404 | 1.5 | 1.00 |  |  | 1.00 |  |  |
| Medium | 4,702 | 2.5 | 1.64 | 1.16-2.32 | 0.005 | 0.99 | 0.68-1.43 | 0.949 |
| Poor | 4,485 | 8.5 | 5.95 | 4.52-7.84 | 0.001 | 2.71 | 2.00-3.67 | 0.001 |
| **Age (years)** |  |  |  |  |  |  |  |  |
| 40-49 | 4,889 | 0.8 | 1.00 |  |  | 1.00 |  |  |
| 50-59 | 3,577 | 1.6 | 2.09 | 1.35-3.21 | 0.001 | 1.98 | 1.27-3.10 | 0.003 |
| 60-69 | 2,773 | 4.7 | 6.50 | 4.44-9.53 | 0.001 | 5.52 | 3.66-8.30 | 0.001 |
| 70-79 | 1,653 | 11.0 | 16.22 | 11.05-23.82 | 0.001 | 12.23 | 8.03-18.63 | 0.001 |
| 80+ | 699 | 23.3 | 39.88 | 26.68-59.60 | 0.001 | 24.01 | 15.45-37.33 | 0.001 |
| **Gender** |  |  |  |  |  |  |  |  |
| Male | 6,246 | 4.0 | 1.00 |  |  |  |  |  |
| Female | 7,345 | 4.4 | 1.11 | 0.94-1.31 | 0.238 |  |  |  |
| **Residence** |  |  |  |  |  |  |  |  |
| Urban | 3,051 | 3.8 | 1.00 |  |  |  |  |  |
| Rural | 10,540 | 4.3 | 1.12 | 0.88-1.44 | 0.352 |  |  |  |
| **BMI** |  |  |  |  |  |  |  |  |
| Lean | 1,502 | 9.1 | 2.41 | 1.94-3.00 | 0.001 | 1.55 | 1.24-1.94 | 0.001 |
| Normal | 8,182 | 4.0 | 1.00 |  |  | 1.00 |  |  |
| Heavy | 2,597 | 2.7 | 0.67 | 0.52-0.88 | 0.003 | 0.83 | 0.63-1.09 | 0.173 |
| Obese | 1,118 | 1.0 | 0.24 | 0.13-0.44 | 0.001 | 0.33 | 0.18-0.62 | 0.001 |
| Missing | 192 |  |  |  |  |  |  |  |

BMI = body mass index

**Table 3. Access to cataract and refractive services, by level of household poverty**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Cataract Surgical Coverage (person level)** | **N** | **n** | **%** | **95% CI** | **p-value** |
| **<3/60** |  |  |  |  |  |
| Affluent | 46 | 21 | 45.7 | 31.7-60.3 | 0.14 |
| Medium | 88 | 38 | 43.2 | 32.1-55.0 |  |
| Poor | 240 | 80 | 33.3 | 27.9-40.5 |  |
| **IOL rate** |  |  |  |  |  |
| Affluent | 42 | 20 | 47.6 | 33.5-62.2 | 0.20 |
| Medium | 52 | 29 | 55.8 | 41.2-69.4 |  |
| Poor | 107 | 43 | 40.2 | 30.7-50.5 |  |
| **Spectacle Coverage** |  |  |  |  |  |
| Affluent | 307 | 23 | 7.5 | 4.9-11.2 | 0.001 |
| Medium | 486 | 4 | 0.8 | 0.3-2.2 |  |
| Poor | 466 | 11 | 2.4 | 1.1-4.8 |  |

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**Figure 1. Map of Nigeria showing boundaries of geopolitical zones, ecological zones, location of each cluster visited during the national survey and estimate of number of blind adults in each geopolitical zone**

**Figure 2. Prevalence of different levels of visual impairment, by household level of poverty and age group.**

**Figure 3: Cause specific prevalence of blindness, by level of household poverty**