Association between Visual Impairment and Socio-Economic Factors in Karachi Population

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Purpose: To determine a correlation between visual impairment and socioeconomic levels within the eye outpatient department (OPD) of Dow University Hospital, Ojha Campus, Karachi, Pakistan.

Study Design: Cross-sectional study.

Place and Duration of Study: Dow University Hospital Eye OPD, Karachi, From January 11th 2016 to August 5th 2016.

Material and Methods: A detailed history of each patient was first obtained, followed by an initial test for visual acuity and refraction by an optometrist using Snellen's chart and Auto Refractometer RM 8800, Model: 2005 TopCon. After dilating with 1% tropicamide solution, the anterior/posterior segments were evaluated. The evaluation was performed by an Ophthalmologist, who later subdivided the patients. Each patient were subdivided based on a modified WHO categorization of visual impairment.[1]Patients were organized into three groups; mild at 6/9 to 6/12, moderate at 6/18 to 6/24, and severe at 6/36 to 6/60.

Results: Among 350 patients, 182 (52%) were males and 168 (48%) were females. The mean age was 54.71 ± 11.83 years. A majority of patients had mild visual impairment (n = 257, 73.4%) whereas 43 (12.3%) had severe visual impairment. Socio-demographic characteristics such as age and education level were found to be significantly associated with visual impairment (p-value = 0.002) and (p-value = 0.024), respectively.

Conclusion: The results show a direct correlation between visual impairment and socioeconomic factors such as education, gender, and ethnicity.

Key Words: Visual Impairment. Socioeconomic Disparity. Ethnic Division.

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Income directly affects an individual's access to health care[2]. The purpose of this study is to evaluate the degree to which an individual's income and education plays a role in their visual health. Vision is an essential requirement for independent living. The eyes, more than any other sensory organ, can debilitate an individual's lifestyle[3]. Vision is the simple reception of a light reflex from surrounding objects[4]. Similar to the way other sensory organs behave, there are a number of physiological steps which convert light waves into chemical signals, sent through the visual pathway to be processed in the occipital lobe. It is estimated that 90% of the total population who suffer from impaired vision belong to low-income communities[4], something that was directly supported by our findings in this research. Furthermore, similar to other international communities, refractive errors and cataracts are the leading causes of impaired visual acuity[5]. The WHO definition of vision is based on four categories: normal 6/6, moderate 6/18, severe 6/60, and blind 3/60 to 1/60[6].

Karachi is the most populous city in Pakistan, located in the province of Sindh[5]. The Karachi population provides a diverse patient base, one that is representative of all ethnic groups found within the country[7]. This helps to ensure that the study remains unbiased and inclusive. Pakistan is the sixth most populous country, and defined as a developing country by the World Health Organization[5]. It is also classified as a low-income nation by the World Bank[8]. This in an important fact to be mindful about, since the core of this study is to show a direct correlation between income and visual health. This is important to recognize because the greater population is classified as low income, which means that the greater population is at risk for impaired vision. A 2007 research conducted by the Pakistani National Eye Survey Study Group – found the leading cause of impaired vision to be cataract and refractive errors[8]. This not only mirrors other international communities, but also helps to narrow down the scope and focus of this paper. The correlation between income and education vis-á-vis visual acuity in Pakistan, follow general trends as the rest of the international community. The data and research of this paper will further help support this correlation. It will be judicious of Pakistani physicians to follow solution similar to international standards.

Income inequality is an important factor to consider. In developed nations, the debate is often centered on the quality of education. In Pakistan this is not the case. Due to an under developed social environment, the main focus is instead on availability of education and gender disparity. The theories of human capital development by researchers such as Becker and Mincer also apply to Pakistan[9]. However, again due to lack of development in social infrastructure, it is difficult to come to a clear understanding. In recent years, a national study – Pakistan Integrated Household Survey – had made an attempt to fix and define the social sector by introducing new resources such as technical training and technology literacy[10]. This was meant to help increase the pool of information available for study, and to also allow those in Pakistan to use international methods of research such as the Mincerian method[10].

To develop a functional modern state, both genders must be equally educated[11]. Currently this is not the case. Figures presented by UNESCO (as of 2004) show that only 60% of girls are enrolled in a primary school[10]. At the secondary level, the percentage drops much lower to 32%[18]. Lower

education has a negative impact on an individual's lifestyle and health. There clearly seems to be a direct correlation between education and income, supported by other research and publications as well[17], a factor that would affect a patient's physical and emotional well being.

MATERIAL AND METHODS

Data on the individuals with regard to factors and VI results were derived from our research. Our study comprises of a cross-sectional data of five ethnic groups. This is similar to the study conducted by Win Wah and Arul Earnest for the Singapore Epidemiology of Eye Disease program.[3]. In this study, three ethnic groups were focused on. The study was much larger compromising of a total 10,000 subject resulting in a comprehensive understanding of socio-economic and VI interplay[13]. In contrast to the Win Wah and Arul Earnest study, we divided our education level into four rather than three[13]. Patients visiting the eye OPD at Dow University Ojha Campus were tested for visual acuity by an Auto Refractometer RM 8800 Model: TopCon PS-61E385945- that was made in Japan, as well as a Snellen chart by an optometrist. All patients were above 30 years of age. Aside from age, no other factors were used to exclude any patients. 350 patients were randomly selected as they presented to the eye OPD and were surveyed. Those patients were divided into 5 ethnic groups because we wanted to study the level of education in each ethnic group. Patients were then further subdivided by gender, level of education, and household income. Education was categorized into four sections: NE (no education), primary, secondary, and higher. According to M.H. Emamian's article Gap of Visual Impairment between Economic Groups, visual impairment is more prominent in lower socioeconomic communites[14].

Each individual's visual acuity was categorized based on four levels; best at 6/6 to worst at 6/60. An ophthalmologist further examined patients that were between 6/9 and 6/60. Before examination, each patient's eye was dilated with 1% Tropicamide and left for 10-30 minutes. Afterwards, the anterior and posterior segment was examined with a slit lamp microscope (TopCon PS-61E385945- made in Japan). After the diagnosis was confirmed, each patient was asked if they would like to participate in a survey. Patients were informed about the survey and told about the anonymous nature of the research, with their information recorded with their consent. All

information was kept confidential and each patient's privacy was respected. Each individual was asked about his or her gender, age, education, household income, and ethnic background. After the collection of data, the information was categorized and grouped by the researcher.

Post-categorization, the sub-categories were analyzed and reviewed by a professor. This method was used to ensure the validity of the data from the collection and categorization process.

RESULTS

Among 350 patients, 182 (52%) were males and 168 (48%) were females, with a mean age of 54.71 ± 11.83 years. From our selected group, 114 (32.6%) patients were uneducated and 107 (30.6%) had attained higher education. According to UNESCO, the literacy for Pakistan is defined as "one who can read newspapers and write a simple letter, in any language"[15]. The literacy rate is applied to age 10 and above. The literacy rate stands at 32.6% (n = 114) uneducated and 30.6% (n = 107) had higher education. The literacy rate for both sexes is 43.92% total[15]. The literacy rate was categorized into four sections: NE (no education), primary (grades 1 – 5), secondary (grades 6 – 12), and higher (college graduate).

A similar proportion of participants 127 (36.3%) and 120 (34.3%) had a monthly household income of less than 20,000 PKR and between 21,000 to 40,000 PKR, respectively. A majority of patients had mild visual impairment (n = 257, 73.4%) whereas 50 (14.3%) and 43 (12.3%) had moderate and severe visual impairment, respectively (see Table 1).

Table 1: Baseline characteristics of the patients (n = 350).

Characteristics	n	%
Gender		
Male	182	52.0
Female	168	48.0
Age (years)		
≤ 50	141	40.3
51 – 60	102	29.1
> 60	107	30.6

Ethnicity		
Urdu	124	35.4
Sindhi	94	26.9
Punjabi	39	11.1
Pashto	38	10.9
Balochi/Others	55	15.7
Education level		
No education	114	32.6
Primary	65	18.6
Secondary	64	18.3
Higher	107	30.6
Income ('000')		
≤ 20	127	36.3
21 – 40	120	34.3
> 40	103	29.4
Visual Impairment (BCVA)		
Mild	257	73.4
Moderate	50	14.3
Severe	43	12.3

Chi-square tests were run to check the association of patients' socio-demographic characteristics and their visual impairment. It was found that females (n = 25, 14.9%) were more likely to have severe visual impairment as compared to males (n = 18, 9.9%). Age was significant in association to visual impairment (p-value = 0.002). It was noted that patients who were > 60 years of age, 20 (18.7%) had moderate, and 22 (20.6%) had severe visual impairment (see Table 2).

Looking at socioeconomic characteristics such as education level and income, we found education level was significant in association to visual impairment (p-value = 0.024). Patients with no education were positively associated with severe impairment (n = 21, 18.4%), and only 9 (8.4%) patients who belonged to higher education group had severe visual impairment. While, only 9 (8.7%) of the patients who received > 40,000 PKR monthly household incomes had severe visual impairment. However, income was not significant in association to visual impairment (see Table 3).

Being an important and statistically significant

socioeconomic characteristic, further associations of education level were observed. It was found that female's proportion (n = 78, 46.4%) of being uneducated was comparatively higher than male's proportion (n = 36, 19.8%). It was also observed that the tendency of getting higher education was more prevalent in Urdu speaking patients (n = 61, 49.2%) when compared to other ethnic groups (see Table 4).

Table 2: Demographic characteristics of patients by visual impairment (n = 350).

| Characteristics | Total | Mild | Moderate | Severe | p-value* |
		n (%)	n (%)	n (%)	
Gender					
Male	182	137 (75.3)	27 (14.8)	18 (9.9)	0.363
Female	168	120 (71.4)	23 (13.7)	25 (14.9)	
Age (years)					
≤ 50	141	106 (75.2)	22 (15.6)	13 (9.2)	0.002
51 – 60	102	86 (84.3)	08 (7.8)	08 (7.8)	
> 60	107	65 (60.7)	20 (18.7)	22 (20.6)	
Ethnicity					
Urdu	124	90 (72.6)	20 (16.1)	14 (11.3)	0.790
Sindhi	94	68 (72.3)	14 (14.9)	12 (12.8)	
Punjabi	39	27 (69.2)	06 (15.4)	06 (15.4)	
Pashto	38	28 (73.7)	03 (7.9)	07 (18.4)	
Balochi/Others	55	44 (80.0)	07 (12.7)	04 (7.3)	

*p-value has been calculated using Chi-square test

Table 3: Socioeconomic characteristics of patients by visual impairment (n = 350).

| Characteristics | Total | Mild | Moderate | Severe | p-value* |
		n (%)	n (%)	n (%)	
Education level					
No education	114	77 (67.5)	16 (14.0)	21 (18.4)	0.024
Primary	65	41 (63.1)	15 (23.1)	09 (13.8)	
Secondary	64	53 (82.8)	07 (10.9)	04 (6.2)	
Higher	107	86 (80.4)	12 (11.2)	09 (8.4)	
Income ('000')					
≤ 20	127	91 (71.7)	19 (15.0)	17 (13.4)	0.549
21 – 40	120	84 (70.0)	19 (15.8)	17 (14.2)	
> 40	103	82 (79.6)	12 (11.7)	09 (8.7)	

*p-value has been calculated using Chi-square test

Table 4: Distribution of gender and ethnicity by education level (n = 350)

Characteristics	Total	No education	Primary	Secondary	Higher
		n (%)	n (%)	n (%)	n (%)
Gender					
Male	182	36 (19.8)	40 (22.0)	40 (22.0)	66 (36.3)
Female	168	78 (46.4)	25 (14.9)	24 (14.3)	41 (24.4)
Ethnicity					
Urdu	124	12 (9.7)	22 (17.7)	29 (23.4)	61 (49.2)
Sindhi	94	46 (48.9)	14 (14.9)	10 (10.6)	24 (25.5)
Punjabi	39	8 (20.5)	13 (33.3)	8 (20.5)	10 (25.6)
Pashto	38	24 (63.2)	6 (15.8)	6 (15.8)	2 (5.3)
Balochi/Others	55	24 (43.6)	10 (18.2)	11 (20.0)	10 (18.2)

Demographic characteristics such as gender, age (categorized into three classes, 50 years, 51 – 60 years and 60 years), ethnicity, education level, and income (categorized into three classes, 20,000 PKR, 21,000 – 40,000 PKR and 40,000 PKR) were treated as independent variables. The response variable was visual impairment (VI), which was generated by measuring the best-corrected visual acuity (BCVA) of the patient. BCVA was categorized into mild, moderate, and severe. It was considered mild if BCVA was between 6/9 and 6/12, moderate if BCVA was between 6/18 and 6/24, and severe if BCVA was between 6/36 and 6/60.

Descriptive analysis involved frequency distributions and percentages of all the categorical variables. Inferential analysis involved Chi square tests, which were used to check significant association between the outcome variable and independent variables. All test results having p-value less than or equal to 0.05 level were considered statistically significant. Statistical Package for Social Sciences (SPSS) version 16.0 was used for analysis.

DISCUSSION

In this cross-sectional study, patients older than 30 years of age were used to determine any correlation between visual acuity/eye health and various factors such as gender and income. The outcome was that 58% of males and 48% of females were found to have impaired vision. This finding stands in stark contrast to other study where females make up a greater population. Anna Kuis-Ulldemolns conducted one such study. In her 2012 study of Social Inequalities in Blinds and Visual Impairment, she also found that male were greater in numbers when visually impaired. Yet, she also believed that genetic and hormonal factors could lead to a greater risk for visual impairment in women. Our study also found that women are at a greater risk. Not only because of genetic/hormonal factors but also due to lack of education and income inequality[12].

Our study found that 18.4% (n=21) patients with no education had severe visual impairment while only 8.4% (n = 9) of patients with higher education had severe visual impairment. Although not conclusive, it is evident that higher education does play a role in improving overall visual health[16]. This correlates with a Korean study published in 2014 by Tyler H.T. Rim et al titled, *Prevalence and Risk Factors of Visual Impairment and Blindness in Korea*, which had parallel findings with our study. This study went further and looked into other variables as well, such as employment and marital status[17]. It found that lower-class educated singles from the rural areas had an increased risk for visual impairment. Although our study did not take into account urban/rural settings and marriage, it would not be a surprise to find similarities in Pakistan.

This is in contrast with a 2015 study conducted by Keri L. Norris et al in the greater Atlanta area in United States, titled *Association of Socioeconomic Status with Eye Health Among Women with/without Diabetes*. She found that factors such as income and education did not have any statistically significant impact on visual impairment[18]. It is important at this point to be

mindful of the different locations of each study, and their respective impact on the result. Nonetheless, it is beyond any doubt that factors such as income and education plus gender play a role in the overall visual health of a patient.

Education and visual acuity play a complex role, which is impacted by variables beyond our scope of research such as gender and ethnic background. This complexity was best highlighted in a recent article written by Alison Bruce titled *Impact of Visual Acuity on Developing Literacy at Age 4 – 5 years*. The main focus of the study was to understand the relationship between visual acuity and literacy around the city of Bradford[19]. The objective of her study, along with the goals set, apply to Pakistan. Dr. Alison Bruce points out that early literacy is an important factor in the future of an educated individual, who in turn will have a higher standard of living and better health. Education is directly impacted by visual acuity, and poor acuity will lead to poor education, resulting in lower social standards and lower health. Alison Bruce's study takes a positive step into bringing statistical evidence to support and confirm this theory[19]. Furthermore, the article strives to also quantify the impact of vision and literacy with socioeconomic factors[19]. The finding of the study was able to demonstrate that poor visual acuity is associated with reduced early development.[19] Another very important finding of the study was that the overall low visual acuity of children in the city of Bradford was not related to their ethnic background[19]. The groups covered by the study – i.e. Whites, Pakistanis and others – all had similar visual acuity, rendering ethnicity as an insignificant factor. It goes on to isolate socioeconomic factors as the leading cause of low visual acuity, which in turn lowers the overall standard of living and health of an individual[19]. In a country such as Pakistan, where ethnic tension has caused instability in the past, it is very important and enlightening to learn that ethnic background plays no role in the visual acuity and overall ability of children to learn[19]. Access to a health care professional as well as education can, and will allow all children to have a better health and lifestyle. Hein T.V. Vu found in his study, *Impact of Unilateral and Bilateral Vision Loss on Quality of Life*, those with uncorrected vision had a significantly poorer social and emotional function. Although, this article focused solely on uni/bilateral vision loss; it is nonetheless representative of the difficulties brought to living by lower visual health/vision loss[20].

Our study had certain limitations, which narrowed the focus of our research. It was focused on only a single center in Karachi, and only a small sample size was used. The strength of the study was that people of various economic backgrounds were included. An extensive study with a greater number of patients would have had provided more extensive data from which better conclusions could have been reached. We recommend further studies to be conducted in the future with a much larger sample size and many more centers for more accurate results.

CONCLUSION

The results show a direct correlation between visual impairment and socioeconomic factors such as education, gender, and ethnicity.

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REFERENCES

1. World Health Organization classification of visual impairment and blindness. Eye Care in Developing Nations, Fourth Edition, 2007: 223-25.
2. **Marmot M.** The influence of income on health: views of an epidemiologist. Health affairs, 2002 Mar 1; 21 (2): 31-46.
3. **Schmall VL.** Sensory changes in later life. [Corvallis, Or.]: Oregon State University Extension Service;

[Olympia, Wash.]: Washington State. University Cooperative Extension; ;[Moscow, Idaho]: University of Idaho Cooperative Extension System; [Washington, DC]: US Dept. of Agriculture; 1991.

4. **Naz S.** Study on Binocular Vision Assessment and Refraction in Patients of Anterior Segment Corneal Dystrophies: The Pakistani Hospital Based Study. South Asian Journal of Life Sciences, 2015; 3 (1): 1-5.

5. The World Factbook: PAKISTAN (Internet). Central Intelligence Agency. Central Intelligence Agency; 2017 (cited 2017Aug3). Available from: https:cia.gov/library/publications/the-worldfactbook/geos/pk.html#

6. Visual impairment and blindness fact sheet (internet). World Health Organization; 2014 August (cited 2017 8 August). Available from: http://www.who.int/mediacentre/factsheets/fs282/en/

7. **Mathew Joseph C,** editor. Understanding Pakistan: Emerging Voices from India. Manohar Publishers & Distributors; 2015.

8. **Dineen B, Bourne R, Jadoon Z, Shah S, Khan M, Foster A et al**. Causes of blindness and visual impairment in Pakistan. The Pakistan national blindness and visual impairment survey, 2007.

9. **Becker GS.** Investment in human capital: A theoretical analysis. Journal of political economy, 1962 Oct 1; 70 (5, Part 2): 9-49.

10. **Memon G.** Education in Pakistan: The Key issues, Problems and the New Challenges. Journal of Management and Social Sciences, 2007; 3 (1): 47-55.

11. **Aikman S, Unterhalter E,** editors. Beyond access: Transforming policy and practice for gender equality in education. Oxfam; 2005.

12. **Lansingh V, Carter M, Uldemonllins A, Valencia L, Eckert K.** Social inequalities in blindness and visual impairment: A review of social determinants. Indian Journal of Ophthalmology, 2012; 60 (5): 368.

13. **Wah W, Earnest A, Sabanayagam C, Cheng C-Y, Ong MEH, Wong TY, et al**. Composite Measures of Individual and Area-Level Socio-Economic Status Are Associated with Visual Impairment in Singapore. Plos One. 2015 Oct; 10 (11).

14. **Emamian M, Zeraati H, Majdzadeh R, Shariati M, Hashemi H, Fotouhi A.** The Gap of Visual Impairment between Economic Groups in Shahroud, Iran: A Blinder-Oaxaca Decomposition. American Journal of Epidemiology, 2011; 173 (12): 1463-1467. As cited by Dineen B, Bourne R, Jadoon Z, Shah S, Khan M, Foster A et al. Causes of blindness and visual impairment in Pakistan. The Pakistan national blindness and visual

impairment survey. British Journal of Ophthalmology, 2007; 91 (8): 1005-1010.

15. **Rahman AU, Uddin S.** Statistical Analysis of Different Socio Economic Factors Affecting Education of NW. FP (Pakistan). Journal of applied quantitative methods, 2009; 4 (1): 88-94.

16. **Bergan A.** Personal Income Distribution and Personal Savings in Pakistan. Growth and Inequality in Pakistan, 1972: 208-23.

17. **Rim THT, Nam JS, Choi M, Lee SC.** Prevalence and risk factors of visual impairment and blindness in Korea: The Fourth Korea National Health and Nutrition Examination Survey in 2008-2010. Acta Ophthalmologica. 2014; 92 (4).

18. **Norris KL, Beckles GL, Chou C-F, Zhang X, Saaddine J.** Association of Socioeconomic Status with Eye Health Among Women With and Without Diabetes. Journal of Women's Health, 2016; 25 (3): 231-6.

19. **Bruce A, Fairley L, Chambers B, Wright J, Sheldon TA.** Impact of visual acuity on developing literacy at age 4-5 years: a cohort cross-sectional study. BMJ Open. 2016; 6 (2).

20. **Vu HTV,** Impact of unilateral and bilateral vision loss on quality of life. British Journal of Ophthalmology, 2005 Jan; 89 (3): 360-3.

21. **Alkhairy S, Siddiqui F, Ul-Hassan M.** Orbitofacial Anthropometry in a Pakistani Population. Pakistan Journal of Ophthalmology, 2016; 32 (1): 41-47.

22. **NazS Butt A.** Study on binocular vision assessment and refraction in patients of anterior segment corneal dystrophies. South Asian journal of life sciences, 2015; 3 (1): 1-5.

23. **Ahmad K, Zwi AB, Tarantola DJM, Soomro AQ, Baig R, Azam SI**. Gendered Disparities in Quality of Cataract Surgery in a Marginalised Population in Pakistan: The Karachi Marine Fishing Communities Eye and General Health Survey. Plos One, 2015; 10 (7).

24. **Bernabeo E, Holmboe E.** Patients, Providers, and Systems Need to Acquire a Specific Set of Competencies to Achieve Truly Patient-Centered Care. Health Affairs, 2013; 32 (2): 250-258.

25. **Cosgrove D, Fisher M, Gabow P, Gottlieb G, Halvorson G, James B et al**. Ten Strategies To Lower Costs, Improve Quality, And Engage Patients: The View From Leading Health System CEOs. Health Affairs, 2013; 32 (2): 321-327.

26. **Lansingh V, Spivey B, Furtado J, Winthrop K.** Training of an ophthalmologist in concepts and practice of community eye health. Indian J Ophthalmology, 2012; 60 (5): 365.