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Socio Economic Factors Affecting Ocular Morbidity among Industrial Workers: A Case Study of Coal Camp Enugu, Nigeria

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Abstract: **Ocular morbidity is a major cause of global visual impairment and blindness. The magnitude of global burden of visual impairment and blindness associated with industrial and occupational activities is of great public health importance. To a large extent, factors such as the state of the work environment, type of occupation, level of income and education, and patterns of socialization have considerable impacts on ocular health. The objective of this research was to study the socio-economic variables associated with ocular morbidity due to industrial activities. 150 volunteers presented themselves for this study. Non-probability sampling method was used. The research design used was a cross-sectional study, involving an on–site field screening of industrial workers. Morbidity was both reported and measured using clinical ocular examination procedures of the external eye and the posterior segment. Information on socio-demographic characteristics was obtained using interview-based examination administered by the examiner to each worker. Data obtained was presented using tables. Data was also tabulated and statistically analyzed. The tabular representation of data obtained was chosen for easy under-standing, interpretation and comparison of findings. Statistical package, χ2-test was employed for the analysis of data obtained. In this study, the prevalence of ocular morbidity was found to be 96.6%, with a significantly higher prevalence in males than females. The ocular morbidity observed was found to be significantly associated with levels of education, type of industrial activity, work environment, level of income, length of service (i.e. duration of work-related activity. Measures should be undertaken to render eye health education and creation of eye health awareness in industrial settings and in the community in general.**

Keywords: **Morbidity, Ocular, Morbidity Industrial, Incidence Rate, Prevalence Rate, Blindness, Disability, Impairment, Hazard, Health.**

1. INTRODUCTION

Manufacturing and production activities have contributed to societal problems, including morbidity and, even death. The industrial work environment has introduced problems that have had adverse impact on ocular health, in terms of diseases, visual impairment and blindness, resulting from industrial hazards that abound in the work environment. Industrial and occupational factors make an important contribution to morbidity rates, resulting in suffering and hardship for the worker and his family, as well as adding to the overall burden to the society in terms of lost productivity and increased use of medical and welfare services (Biswas*et.al.* 2014).

Ocular morbidity may be influenced by certain variables, such as social economic factors, including age, gender, type of occupation, level of income, amount of time (in years) a given worker has spent in the work environment as well as the provision of any type of eye protection from the these hazards that abound in the work environment .

Goldsmith *et al*., (2009) reported that occupational eye disorders represent a complex group of traumatic eye injuries, harmful exposures, uncorrected and undiagnosed ocular disease, eye strain and fatigue from poor lighting conditions, and other miscellaneous ocular complaints. Ocular morbidity due to industrial activities, particularly from those involving manufacturing, processing, construction and production is a common case of visual impairment and/or blindness (Parulekar*et al*., 2015).Population growth and rapid urbanization has created patterns of risk factors that are clinical etiologies of morbidity associated with industrialization. According to Abanobi, (2005), socio economic conditions are often reflected in an economic and sociological measure of an individuals or family's economic and social position in relationship to others, based on income, education and occupation. The risk of morbidity among industrial workers is increased by lower socioeconomic position. This is related to the levels of education. Higher levels of education are associated with better economic outcomes. Altindag*et al*., (2006) reported that there is a strong relationship between increasing levels of education and thought pattern and decision making. This shows that a fellow who has increasing levels of education will more likely show commitment to new levels of knowledge and therefore is exposed to important health information. He is now in a very good position to make positive decisions that will positively impact on his health and vision.

In this research work, the main factors affecting industrial ocular morbidity which were studied include: Type of occupation: In terms of increased exposures to hazards and risk factors, education: In terms of levels of educational attainment, as well as literary levels, level of Income and work environment

2. RESEARCH METHODOLOGY

The research design used was a cross-sectional study, involving on–site field screening of industrial workers. Morbidity was both reported and measured using clinical ocular examination procedures of the external eye and the posterior segment. Information on socio-demographic characteristics was obtained using interview-based examination administered by the examiner to each worker.

Area of Study:

The area of study was Coal Camp, Enugu, Nigeria. Enugu lies at the base of Udi Hills at 6º 27, 9.60º N, 7.30º, 37.20 E, 6.452667º N and 7.5103333º E along the Benue River and in the Cross River Basin.

Sample Size:

Non-probability sampling method was used. The 150 sample was not selected by chance, but for reasons of practical convenience, and in order to include units with peculiar characteristics required in the study. Cluster sampling was also used to include certain categories of industrial activities, as well as other demographic variables for the study.

Selection Criteria:

All industrial workers present, and who are engaged in any type of industrial activity within Coal Camp. No participant who volunteered to be screened was excluded from the study.

Procedures/Methods for Data Collection:

A Case History was taken on each subject to determine their Ocular and Systemic Health Status. A note was also taken to obtain demographic information. Physical measurement of clinical parameters; (including external examination, BP measurement, visual acuity etc.) was conducted by the researcher and support personnel to obtain the required data on ocular pathology. An in-depth interview was conducted to ascertain an individual's demographic characteristics, attitude to eye safety and eye-care services utilization behavior.

Data Presentation:

Data obtained was presented using tables. Data was also tabulated and statistically analyzed. The tabular representation of data obtained was chosen for easy understanding, interpretation and comparison of findings. Statistical package, χ**2**-test was employed for the analysis of data obtained.

Rule for Interpretation of Result: If the sample findings are unlikely, given the Null Hypothesis; the Null Hypothesis is rejected. This involves comparing the χ**2calculated** to the χ**2 (n-1)(r-1)** and rejecting the Null Hypothesis, when the calculated value is greater than the tabulated value. Test statistics for the results -

$$\chi 2calculated = \Sigma \frac{(Or,c - Er, C)2}{Er, c}$$

Where ***Or***, **c** is the observed frequency counts at level r of variable A and level C of variable B.

For the decision rule, Ho is rejected if $\chi 2cal > \chi 2critical$ **H0** is accepted.

Suppose that variable A has r-levels, and variable B has c-levels. The Null Hypothesis states that knowing the level of variable A does not help predict the level of variable B.

Limitation of Study:

The major limitation of this study was that some of the industrial workers studied found it difficult understanding some of the questions they were asked and therefore their response was subject to possibility of errors. Secondly, though the data collection was carefully done, the problem of human errors and fallibility is a limitation.

3. RESULTS

The total number of workers studied was 150. This was made up of 138 males and 12 females (**92.0%** and **8.0%**respectively).There were eight categories of industrial related activity studied and these included Glass/Allied products, plastic/chemicals, mechanical, Auto-mechanic, electrical/electronic, wood/work/timber, auto-spare parts fabrication and foundry/metallurgy. Of these industrial activities Glass/Allied products had the least number of subjects, while wood work/timber had the highest number of subjects.

Table 1:

Male	138	92.0%
Female	**12**	**8.0%**
Total	**150**	**100%**

Table 2: below shows the distribution of age among workers in relation to the type of industrial activity.

	Occupation	17-24	25-32	33-40	41-48	49-56	57-64	>64	Total
1	**Glass/Allied**	**-**	**5**	**-**	**2**	**2**	**-**	**-**	**9**
2	**Plastic/chemicals**	**-**	**3**	**3**	**4**	**-**	**-**	**-**	**10**
3	**Mechanical**	**8**	**12**	**2**	**5**	**2**	**1**	**-**	**30**
4	**Auto-mechanic**	**5**	**5**	**5**	**5**	**-**	**-**	**-**	**20**
5	**Electrical/elect.**	**5**	**2**	**3**	**1**	**-**	**-**	**-**	**11**
6	**Woodwork/timber**	**4**	**6**	**5**	**10**	**5**	**3**	**2**	**35**
7	**Auto-spare parts fabrication**	**12**	**8**	**-**	**5**	**-**	**-**	**-**	**25**
8	**Foundry/metal.**	**-**	**3**	**2**	**2**	**3**	**-**	**-**	**10**
									150

The Age group 25-32 had the highest number of workers: 44 **(28%),** while age > 64 had the least number of workers: 2 (1.33%). Wood workers presented the highest number of workers: 35(**23.33%).** Glass workers were only 9 (**6%)** of the total number of workers studied. Mechanical workers were 30, workers who were involved in Auto spare parts Fabrication were 25 while Foundry workers were 10.

Table 3: below shows the age-specific diagnosed ocular morbidity among industrial workers studied

Age groups (n = 150) (years)									
S/N	**Ocular Morbidity Seen**	**17-24**	**25-32**	**33-40**	**41-48**	**49-56**	**57-64**	**> 64**	**Total**
1	**Allergic conjunctivitis**	**0**	**4**	**5**	**10**	**0**	**2**	**0**	**21**
2	**Cataract**	**0**	**1**	**1**	**6**	**1**	**2**	**5**	**16**
3	**Ocular trauma/Injury**	**2**	**2**	**0**	**0**	**2**	**0**	**0**	**6**
4	**Pterygium**	**1**	**2**	**0**	**15**	**11**	**6**	**3**	**38**
5	**Uncorrected Ref. errors**	**2**	**4**	**5**	**0**	**4**	**1**	**0**	**16**

6	**Eyelid Problems**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**2**
7	**Uncorrected Presbyopia**	**0**	**0**	**5**	**12**	**15**	**0**	**2**	**34**
8	**Others (Post. Segment disorders)**	**0**	**1**	**2**	**0**	**0**	**5**	**0**	**8**
9	**No Abnormality detected**	**0**	**0**	**3**	**5**	**1**	**0**	**0**	**9**
									150

Pterygium showed the highest prevalence ***(*25.33%),** followed by presbyopia **(22.6%)**, Allergic conjunctivitis (**14.00%)** and Cataract (**10.6%**) in a descending order. Eyelid problems showed the least prevalence of all conditions observed **(1.33%).**

Ages 41-48 has the highest prevalence of ocular morbidity observed (**25.3%),** followed by age group, 49-56 (**22.6%),** 33-40 ***(*16%),** 25-32 **(12%)** in a descending order. Ages 17-24 and > 64 showed the least prevalence.

Ages 17-24 and 25-32 had No Abnormality Detected; while in others, a morbid condition was seen.

Table 4: below shows the Distribution of ocular morbidity in relation with level of education.

			FSLC	SSCE	OND/NCE	HND/BSc	Others	Total
1	**Allergic Conjunct.**	**5**	**18**	**9**	**6**	**0**	**0**	**38**
2	**Cataract**	**4**	**9**	**3**	**2**	**3**	**0**	**21**
3	**Ocular Trauma/Injury**	**0**	**1**	**2**	**0**	**0**	**0**	**3**
4	**Uncorrected Ref. errors**	**2**	**6**	**0**	**2**	**0**	**0**	**10**
5	**Pterygium**	**10**	**11**	**4**	**2**	**0**	**0**	**27**
6	**Eyelid Problems**	**1**	**2**	**0**	**0**	**2**	**0**	**5**
7	**Uncorrected Presbyopia**	**7**	**20**	**4**	**3**	**0**	**0**	**34**
8	**Others**	**2**	**3**	**2**	**0**	**0**	**0**	**7**
9	**NAD**	**2**	**2**	**1**	**0**	**0**	**0**	**5**
	Total	**33**	**72**	**25**	**15**	**5**	**0**	**150**

Among the industrial workers, *33 (***22%**) had (First School Leaving Certificate) FSLC, 72 (**48%**) had (Senior School Certificate) (SSCE WAEC/NECO), 25 (**16.6%**) had Ordinary National Diploma (OND/NCE) while the rest had both HND/BSc./B.Tech (10%) and a PG degree (**3.3%).**

In relationship to ocular morbidity, those with a primary and secondary levels of education had the highest prevalence **(22%)** and (**48%),** respectively; while those with higher levels of education had the least level of prevalence of ocular morbidity. Presbyopia was the highest ocular condition observed (**22.6%)**, and it occurred irrespective of levels of education.

Table 5: below shows the distribution of ocular morbidity in relation with level of income/year.

Level of Income (₦ /years)				
S/N	**Ocular Morbidity**	**<₦ 10,000**	**₦10,000 -₦50,000**	**> ₦ 50,000**
1	**Allergic Conjunctivitis**	**5**	**12**	**0**
2	**Cataract**	**8**	**5**	**3**
3	**Ocular Trauma/Injury**	**0**	**3**	**0**
4	**Uncorrected Ref. errors**	**10**	**3**	**5**
5	**Eyelid Problems**	**0**	**3**	**0**
6	**Uncorrected Presbyopia**	**10**	**20**	**5**
7	**Others**	**5**	**12**	**0**
8	**NAD**	**3**	**5**	**10**
9	**Pterygium**	**10**	**10**	**3**
	Total	**51**	**73**	**26**
				150

Table 5 above shows the distribution of ocular morbidity in relation with level of income **₦** /year.

Workers who earned between ₦10,000 and ₦ 50,000/year had the highest number of conditions observed (34%) and (48.6%), while those who earned higher had a lower prevalence (17.33%). Ocular morbidity occurred in all levels of income studied, but was significantly higher in workers who earned less

4. DISCUSSION

The total number of workers identified with eye disorders was 145 (96.6%). This is consistent with findings in similar studies conducted among workers engaged in occupations that are related to industrial activities (Omoti *et al.*, 2014) and (Sithole *et al*., 2009). In these two studies as well as other studies reviewed, ocular morbidity prevalence was high, i.e. the overall prevalence among industrial workers was high (Biswans*et al.*, 2014).

Ocular morbidity was significantly higher among industrial workers who are on the lower level of income **(<₦ 10,000 – ₦50,000/year), $\chi 2$ (16, 0.05) = 26.30.**

Studies conducted in the past to ascertain the representation of an empirical relationship between health states and per capital income have found that a consistent link exists between health states and income levels. This means that at low levels of per capital income, health outcomes are at low levels, and at high levels of income, there is an associated positive change in life expectancy. Abanobi (2005), have postulated that income adds to the total impact on an individual's health, with regards to the incidence and prevalence of visual impairment. An increase in income is associated a similar effect on health, regardless of the point in time, this occurs (Ecob*et al*., 1999).It is evident that people with higher levels of income have lower rates of many diseases compared to those with lower income levels (Ross *et al*, 2006). People who are in low socioeconomic levels(in terms of levels of income) tend to under-utilize eye care services needed by them to prevent eye diseases, to become and remain well, primarily because of financial and monetary constraints and barriers; as well as inability to pay for expensive and quality eye care (Abanobi, 2005) and Sule*et al.*, 2008). Zang*et al.*, (2008) reported that the influence of income has been found to influence the use of eye care services; including the use of eye protection and safety.

The prevalence of ocular morbidity was seen across all the levels considered. This can be explained by the fact, that other factors are associated with poor health states, including the interplay between lifestyle and behavior and the use of eye protection equipment while engaging in any industrial activity. The findings of this study showed that ocular morbidity among industrial workers depend heavily on their level of income. Low income earners tend to suffer ocular morbidity more. (***α = 0.05,) χ2cal = 26.30).***

Ocular morbidity was found to be significantly higher among the industrial workers who had the lowest level of education. (FSLC:22%; SSCE:48%). Those with higher levels of education had a lower prevalence of (10% and 3.3% respectively). In the present study, ocular morbidity was found to be significantly associated with level of education. The mechanism by which education influences ocular health are complex, and are likely to include the inter-relationship between a learned appreciation for the importance of good health behaviors.

Altindag*et al*., (2006) reported that there is a strong relationship between increasing levels of education and thought pattern and decision making. This shows that a fellow who has increasing levels of education will more likely show commitment to new levels of knowledge and therefore is exposed to important health information. He is now in a very good position to make positive decisions that will positively impact on his health and vision.

(Cutter and Illeras-Muney, 2007) found out that the more educated an individual is, he is less likely to engage in risky-health behavior. Wolf *et al.*, (2006) reported that patients with limited literacy were three times less likely to correctly understand a drug prescription label. Increasing levels of education influences the types and pattern of lifestyle preferences, behavior, and altitudes. Hygiene, balanced diet, exercise, use of eye protection is closely related to levels of education.

Overall, there is considerable evidence that education is strongly related to health, and is a determinant of health, such as health behavior, risky behavior and preventive service use.

Ocular morbidity was seen in all types of industrial activities that the industrial workers studied were engaged in, (**2*cal* = *133.40* and 2crit. = 74.7**) and was significantly higher in auto mechanical construction and repairs, and in the mechanical workshop; (13% and 6.6%) as compared to 0.1% in Glass/Allied workers and 2% in chemical and plastic industry.

As seen in similar studies conducted among industrial workers, especially in the reports by Omoti*et al.*, (2009), in a study of ocular disorders in a petroleum industry in Nigeria, this present study shows that ocular morbidity depends significantly on the type of industrial activity.

Mechanical workshops produce a great deal of industrial hazards, including chemical irritants, paints used in spraying metals for anti-rust, (e.g. lead oxide etc), intense heat, dust and intense UV-radiation from industrial arc welding. Industrial workers are constantly exposed to heat, steam, asbestos and radioactive materials. In the absence of any protection, these are etiological factors for the incidence of ocular disorders (Abiose and Otache, 1980).

Of the total number of participants involved in the study, 67.3% reported never wearing any form of eye protection at all, while 8% reported always wearing some form of eye protection while engaging in their daily activities.

5. CONCLUSION AND RECOMMENDATION

The different eye problems observed among industrial workers from Coal Camp, Enugu include Pterygium, allergic Conjunctivitis, cataract, uncorrected refractive errors, eyelid problems, ocular trauma and uncorrected presbyopia. There was a significant relationship between certain variables and the prevalence of ocular problems. Some were independent, while the others were not.

As observed, ocular morbidity is significantly independent of the ages of the industrial workers. Ocular morbidity occurred in all age groups but had variations in the pattern of prevalence observed. While some conditions were significantly higher in one age group, the others conditions were lower in certain age groups:

(χ^2calculated< 38.23, χ^2critical= 48, 0.05), the ages of industrial workers do not determine ocular morbidity.

The findings of this study showed that ocular morbidity among industrial workers depend heavily on their level of income. There was a persistent relationship between levels of income and the incidence of ocular morbidity (**χ^2cal = 16,>χ^2crict. = 26.30)**. Low income earners tend to suffer ocular morbidity more.

It was also seen that ocular morbidity was found to be significantly higher among the industrial workers who had lower levels of education. Ocular morbidity is dependent on level of income. Increasing levels of education was directly proportional to a decrease in the prevalence of ocular morbidity, and vice-versa

(χ^2cal = 37.45 <χ^2crictical= 46.19).

In relationship with the duration of work-related activity, it was found to be significant, and was directly proportional to ocular morbidity. As the length of work (in years) increased, ocular morbidity increased. Therefore ocular morbidity is significantly dependent on duration of work (in years).

(χ^2cal34.42, <χ^2 = 36.42)

Ocular morbidity seen in these workers depends significantly on the type of industrial activities the workers are involved in. Ocular morbidity occurred in all types of industrial activity irrespective of other factors.

(χ^2cal = 34.42<χ^2crict. = 36.42

In this study, the prevalence of ocular morbidity was found to be 96.6%, with a significantly higher prevalence in males those females. The ocular morbidity observed was found to be significantly associated with levels of education, type of industrial activity level of income, length of service (i.e. duration of work-related activity) and use of eye care protection.

Based on the findings from this study, we therefore make the following recommendations: Measures should be undertaken to render eye health education in the work environment through necessary policy legislations, reduction of poverty through government and private capital intervention, improvement of access to social and health care infrastructure and creation of health awareness in industrial settings and in the community in general.

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