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Socio-Economic Status and Intelligence Quotient of primary school-aged children with asthma

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Abstract

Objective: Intelligence Quotient is said to be more variable in childhood and is thought to be influenced by the socio-economic status of the families of children. This aim of this study was to determine the relationship between socio-economic class and Intelligence Quotient (IQ) of primary school children with asthma and to compare with those of children without.

Material and Methods: One hundred and twenty children with asthma (subjects) aged 5 – 11 years were consecutively recruited at the asthma clinic of University of Nigeria Teaching Hospital Ituku/Ozalla, Enugu State, Nigeria and their age- , sex and socio-economic class (SEC) - matched normal classmates were enrolled as controls from their schools. Their SEC was obtained using the tool described by Oyedeji while their academic performance was obtained from their schools using their scores over an academic session. Their Intelligence Quotient (IQ) was determined using the Draw-A-Person- test. The relationship between SEC and Intelligence Quotient of children with asthma was determined and was compared with that of the 120 controls.

Results: There was no significant difference between the IQ of the Subjects and Control in the different Socio-economic Classes. IQ has no significant correlation (Spearman's) with SEC in both Subjects ($r = 0.115$; $p = 0.21$) and Controls ($r = 0.082$; $p = 0.38$). No significant difference exists in the IQ of children with asthma across the different socio-economic classes.

Conclusion: The IQ of children with asthma is not influenced by their Socio-Economic status.

Key words: Social class, Intelligence, Asthma, Children, Schools.

Introduction

Asthma is one of the few diseases reported to be commoner in the higher social classes but atopic asthma and severe asthma are said to be commoner in the lower socio-economic classes (1, 2). Severe asthma with increased hospitalization and death has been linked to poverty, ethnic minorities, and urban living (1). Children with asthma from deprived areas are reported to be more likely to miss school than their more affluent peers, and minority ethnic children are also more likely to have poor school attendance (3).

Intelligence Quotient is said to be more variable in childhood and these variations are thought to be linked to the socio-economic status of the families of these children (4-9). Several studies have suggested that socioeconomic status (SES) modifies the heritability of children's intelligence and that children from disadvantaged family backgrounds score lower on intelligence tests than their high SES peers (10 – 13).

Turkheimer et al reported that in families with low SES, a greater percentage of the variance in IQ is accounted for by the shared environment, and that the contribution of genes is close to zero (11). They added that in affluent families however, the result is almost exactly the reverse. Similar findings were also reported by some other studies (4, 14).

However despite these studies the relationship between socio-economic class and intelligence quotient still remains a source of controversy as the moderating effect of SES on IQ in children is not consistently found as some other studies have divergent views to the extent that some report trends in the opposite direction- greater heritability of children's IQ in lower SES families (15-18).

Available studies on the relationship between SEC and IQ in children are all on otherwise stable children and to the best of my knowledge; no study has been done to find out the relationship between SES and IQ among children with asthma.

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There is also a paucity of information on this relationship in low income countries such as Nigeria. This study was therefore carried out to determine the relationship between socio-economic status and intelligence quotient among children with asthma. The results are expected to contribute to the existing body of knowledge.

Material and Methods

Ethical approval for the study was obtained from the Health Research Ethics Committee of the University of Nigeria Teaching Hospital, UNTH Ituku/Ozalla Enugu State (Protocol No: NHERC/05/01/2008B) dated 21st May 2012. All parents/caregivers of eligible children were informed of the purpose of the study, expected procedures and potential risks and benefits following which a written consent was obtained before data collection. It was a cross-sectional study conducted at the Asthma clinic of the University of Nigeria Teaching Hospital (UNTH), and the primary schools attended by these children with asthma within Enugu, Enugu state between July and December 2012.

Study Population

The study population comprised of 120 school children with asthma (subjects) aged 5-11 years living in Enugu metropolis. The control population (children without asthma) was made up of 120 healthy classmates of the children with asthma who are matched for age, sex and socio-economic class. The choice of classmates as controls was informed by the need to remove school-related bias and to control for class grade as suggested by Richard and Burlew (19).

Inclusion Criteria:

1. Children aged 5-11 years, attending primary school in Enugu metropolis.
2. Asthma diagnosed by a doctor (20, 21).
3. Attendance in the same school for at least one session before study enrolment.
4. Attendance at the asthma clinic for at least 12months.
5. Consent for the study given by care-giver.

Exclusion Criteria:

1. Out of school children.
2. Age less than five years or more than eleven years of.
3. Children with other chronic diseases such as sickle cell disease, diabetes mellitus, tuberculosis, congenital heart diseases or with history of neurologic illness like seizure disorders and cerebral palsy.
4. Children attending school outside Enugu metropolis.
5. Attendance of the present primary school for less than one session before enrolment.
6. Refusal of consent by care-giver.
7. Asthmatic children with incomplete data, since some of the information were obtained from the case notes.

Control group

The child next to the asthma patient in the class register was selected as control if he/she met the following criteria:

1. Of same sex, age (within 6 months) and socio-economic class as the child with asthma.
2. Has been in the same primary school and class as the asthmatic child for at least one session before study enrolment.
3. Does not have any of the exclusion criteria as listed for the subjects

If the next child to the asthmatic in the class register did not meet the criteria, the most suitable child without asthma down the register who meets the criteria was chosen as control.

Selection and evaluation of the subjects

At the asthma clinic

On presentation at the clinic, the caregiver and the child with asthma were informed of the study and written informed consent obtained from the caregiver. Before enrollment, in order to ascertain eligibility, the asthmatic child's socio-demographic data was obtained. The information obtained was recorded in the proforma.

Children who meet the inclusion criteria were enrolled consecutively till the sample size was reached while those excluded were scheduled for consultation. The socio-economic status of the Subjects was determined using the method described by Oyedeji (22). This was determined using the occupation and educational attainment of the caregiver to get the socio-economic class. The socio-economic class was obtained by finding the mean score for the parents' educational attainment and occupation rounded off to the nearest whole number. Where any of the parents were dead, the social class of the child was assessed using that of the living parent. Socio-economic class I represent the highest socio-economic class and class V the lowest.

The Oyedeji SEC classified parental occupation as follows:

Class I. Senior public servants, Professionals, Managers, Large scale traders, Businessmen & Contractors.

Class II. Intermediate grade public servants, Senior School Teachers, Nurses and Technicians.

Class III. Junior School Teachers, Clerks, Auxiliary Nurses, Drivers and Mechanics.

Class IV. Petty traders, Laborers, Messengers and Similar Grades.

Class V. Unemployed, Full-time house wives, Students and Subsistence farmers.

While the parental educational attainment is classified as follows:

Class I: University graduates or equivalents.

Class II: School certificate holders (GCE or SSSC) who also has teaching or other professional training i.e. NCE.

Class III: School certificate or Grade II teachers' certificate Holders or equivalents.

Class IV. Junior secondary school certificate, Modern three and primary six.

Class V: Those that could not read or write or are illiterates.

Each parent is scored for parental occupation and educational attainment based on the class in which the parent belongs. For example; a parent whose educational attainment falls under class IV is scored 4 for educational attainment. Four scores are obtained from educational attainment and occupation of the 2 parents. The socio-economic class is obtained by the mean of aggregate of the 4 scores for the 2 parents. This is then rounded off to the nearest whole number to get the Socio-economic level of the subject. In a situation where only one parent is alive; occupation and academic attainment of the parent is scored and then divided by 2 before it is rounded to the nearest whole number to ascertain the SEC.

With the prevailing exchange rate of 360 Naira [(Nigerian currency to 1 United States Dollar (USD)]; parents with occupation in Oyedeji's socioeconomic class I earn > I, 390 USD; Class II earn between 100 and 1390 US dollars; Class III earn between 44.5 and 97.25 US dollars; Class IV earn between 30.5 and 41.75 US dollars while parents with occupation in Class V earns between 0 and 27.5 US dollars per month.

The level of asthma control was ascertained using the Childhood Asthma Control Test (C-ACT) (23). The C-ACT TM tool for children 4 to 11 years is made up of seven questions with a total score of 27 as the highest score obtainable. Each child, as much as possible, was allowed to answer the first four questions unaided while the care-giver answered the remaining three. A score of 19 and below signified poor control while scores above 19 indicate good control (24, 25).

The subjects were then given a sheet of paper and pencil and left alone with as much time as they needed with the instruction to draw a person (26, 27). Intelligence Quotient (IQ) was assessed using the Draw-A-Person Test (DAPT) (26). The IQ of the subjects was calculated using the validated Ziler criteria and the table of DAPQ by Ebigbo and Izuora (26). The total number of points scored is the Draw a Person Point (DAPP). DAPQ= DAPA/ Chronologic Age, where DAPA = (DAPP+ 3)/4. The DAPQ score obtained was compared with the expected DAPQ score for age and sex using the table for average DAPQ scores by Ebigbo and Izuora. A score of less than 75% for sex and age was regarded as mental dullness or backwardness (26).

The child with asthma was subsequently reviewed, complaints attended to and a future clinic appointment given. However, children with acute exacerbation of asthma were first managed in the Children Emergency Room of UNTH before evaluation for the study.

In the Schools

The clearance letter from the Ministry of Education was used to obtain permission for the study at the various schools. At the school/class of each enrolled asthmatic child, the head/class teacher was informed of the study in order to access the child with asthma and to enroll the child without asthma. Also the need to obtain the information with regards to the children's school performance was explained.

With the help of the class teacher, the non-asthmatic child, next to the study Subject in the class register, who was of the same age (+ or – 6 months) and sex as the child with asthma was selected. The child was then informed of the study and given the consent form for the caregiver to fill. The consent form was retrieved on a subsequent visit to the school. The non-asthmatic child whose caregivers gave consent was then interviewed for eligibility for the study and the socio-economic status determined as described for the subjects. The selected control was then enrolled and the questionnaire administered.

The control was also given a sheet of paper and pencil and left alone with as much time as needed with the instruction to draw a person and was scored using the validated Ziler criteria by Ebigbo and Izuora (26). The DAPQ was also ascertained just as was done for the subjects.

Information obtained from the participants was recorded in the questionnaire and subsequently transferred into the data editor of Statistical Package for Social Sciences (SPSS) software for Windows® version 19.0 (IBM Inc Chicago Illinois USA, 2011) for analysis. Descriptive statistics such as mean ± (SD) and median were obtained for continuous variables while categorical variables were summarized using frequencies and percentages. The comparison of the means of IQ which was normally distributed was done using Student's t-test, ANOVA and the Duncan Multiple Comparison test while Socio-economic class which was not normally distributed was compared using the Mann-Whitney U test. The significance of the association between categorical variables was determined using chi-square. All the tests were taken as significant at $p < 0.05$. Results are presented in tables and prose.

Results

The age range of the study participants was 5 to 11 years and the overall mean age ± SD was 8.20 ± 1.92 years. Sixty-nine (57.5%) of the 120 subjects and controls were in early primary school age (5-8years) while fifty-one (42.5%) were in late primary school age (9–11 years). The mean age ± SD for males and females was 8.07± 1.73 and 8.47 ± 2.26 years, respectively. The difference in the mean age of males and females was not statistically significant (t= 1.47, p:0.143). Table I shows the age and sex distribution of the study participants (Table 1).

The mean IQ scores for subjects and controls were 123.28 ± 21.45 and 118.41 ± 19.87, respectively. The difference was not statistically significant (t = 1.83; p:0.07). Thirty (25%) of the subjects were from socio-economic class I and sixty (50%) from socio-economic class II while only twelve (10%) were from socio-economic class III and eighteen (15%) from class IV. No subject or control studied was from socio-economic class V.

Thirty out of the 120 subjects (25%) had poor asthma control while 90 (75%) had good asthma control. Similarly, the difference in the median overall academic scores for the subjects (79.04%) and controls (80.01%) were also not statistically significant (U= 6804, p:0.46). There was no significant difference in the IQ of the Subjects and Control across the different Socio-economic Classes. None of the study participants (subjects and controls) were in socio-economic class V (Table 2).

No significant correlation exist between SEC and IQ in Subjects (r= 0.115; p: 0.21) and Controls (r = 0.082; p:0.38). There was no significant difference in IQ between children with poor and good asthma control across the different socio-economic classes. There was also no significant different between the IQ of children with poor asthma control and those of children with good asthma control (Table 3).

Intelligence Quotient has a significant but weak correlation (Spearman's) with socioeconomic class among children with poor asthma control (r= 0.403; p:0 .03) but not among those with good asthma control (r= 0.047; p:0.66).There was no significant difference in the IQ of children with asthma (Subjects) with respect to socio-economic class. However among controls a significant difference in IQ is noted among controls in SEC II compared to the IQ of controls in other Socioeconomic classes (F= 5.572, p:0.001) (Table 4).

Table I: Age and sex distribution of the subjects and controls.

	Subjects		Controls	
Age (years)	Male (%)	Female (%)	Male (%)	Female (%)
5 – 8	45 (55.6)	24 (61.5)	45 (55.6)	24 (61.5)
9 – 11	36 (44.4)	15 (38.5)	36 (44.4)	15 (38.5)
Total	81 (100.0)	39 (100.0)	81 (100.0)	39 (100.0)

$\chi^2 = 0.39$, d.f = 1, p < 0.535

Table 2: Comparison of IQ between subjects and controls across Socio-economic classes

SEC	Subjects Mean ± SD	Control Mean ± SD	T	P value
1	121.69 ± 18.82	112.88 ± 15.87	1.961	0.055
2	127.53 ± 23.74	125.26 ± 21.01	0.553	0.581
3	117.65 ± 5.26	113.16 ± 13.73	1.056	0.302
4	115.54 ± 22.09	108.27 ± 18.19	1.078	0.289

Table 3: Comparison of IQ between poor and good asthma control groups with respect to SEC

SEC	Poor Asthma Control Mean ± SD	Good Asthma Control Mean ± SD	T	P value
1	121.36 ± 3.82	118.47 ± 19.37	0.254	0.801
2	129.93 ± 20.26	125.72 ± 23.83	0.614	0.541
3	114.28 ± 11.96	118.02 ± 6.17	0.681	0.511
4	110.73 ± 13.66	114.31 ± 24.57	0.329	0.746

Table 4: Socio-economic class specific comparison of IQ.

IQ	Socio-economic class Class I Mean ± SD	Class II Mean ± SD	Class III Mean ± SD	Class IV Mean ± SD	F	P value
Subjects	121.69 ± 18.82	127.53 ± 23.74	117.65 ± 5.26	115.54 ± 22.09	1.940	0.127
Controls	112.88 ± 15.87	*125.26 ± 21.01	113.16 ± 13.73	108.27 ± 18.19	5.572	0.001
Poor asthma control	121.36 ± 3.82	129.93 ± 20.26	114.28 ± 11.96	110.73 ± 13.66	2.410	0.090
Good Asthma control	118.47 ± 19.37	125.72 ± 23.83	118.02 ± 6.17	114.31 ± 24.57	1.201	0.314

*Duncan multiple comparison test indicating means significantly different

Discussion

In this study of the relationship between socio-economic class and IQ among primary school children with asthma, the IQ of the subjects was comparable with that of controls across the various Socio-economic classes. IQ was not associated with Socio Economic Status in both Subjects and Controls.

Majority of the subjects belonged to the higher socio-economic classes I and II and none of the subjects were in socio-economic class V. This is in keeping with earlier reports that noted asthma to be one of the few diseases that are more common in the higher socio-economic classes (1,2). The reason could be due to life style encounters like early use of formula feeds, canned foods with additives and other social factors that are more common among people of higher socio-economic class compared to those in the lower socio-economic classes and can predispose to airway hypersensitivity. It could also indicate that more parents in the socio-economic classes I and II, compared to those in the socio-economic classes III and IV, avail themselves of the specialized services offered by the teaching hospital (28). Furthermore the finding of more children with asthma among the higher socio-economic class lends support to the hygiene hypothesis proposed by Strachan (29).

Although children from higher Socio-economic classes had higher IQ scores in this study, their IQ was not significantly higher than those of children from lower SEC in both Subjects and controls. On the contrary, a number of studies have suggested that IQ is significantly higher among children from higher SEC compared to those from lower SEC and reasons proffered included greater exposure, absence of poverty and the moderating effect of environmental factors on genes in favour of children from higher SEC (4, 10-14). Turkheimer et al found that in families with low SES, 60% of the variance in IQ is accounted for by the shared environment, and the contribution of genes is close to zero; however in affluent families, the result is almost exactly the reverse (11). The moderating effect of SES on IQ in children however is not consistently found as some other studies report trends in the opposite direction- greater heritability of children's IQ and higher IQ in children from lower SES families (15-18). The variation in the findings of these studies is still an object of controversy and the reason(s) for the variation is still unclear. However, it may be due to the different SES and IQ tools used, the age of the children studied and the prevailing socioeconomic conditions in the areas where the studies are done. The SES tool by Oyedeji (22) used in this study may be criticized on a number of issues including the changes in the economic situation within the area this SES classification tool is used. For example an artisan who was previously considered to be a low income earner and is placed low in the SES tool by Oyedeji currently could earn same or more income than a newly employed medical doctor or university lecturer. Again a good number of people with graduate/ post-graduate certificates, due to high level of unemployment; take up jobs that were hitherto considered by Oyedeji to be low income jobs. These issues could be affecting results from the use of this tool; hence there may be a need for a review of the Oyedeji SES classification tool.

The DAPT though non-verbal; is appealing to children and has been shown to demonstrate a high correlation with the Stanford-Binet which relies heavily on verbal items and Wechsler's Intelligence Scale for Children (WISC) tests which is both a verbal and performance IQ test but is lengthy requiring two sittings (26, 27). The DAPT has been standardized and validated for use in Nigerian children; the Stanford-Binet and WISC tests for IQ have not been validated for use in our environment.

IQ had a significant correlation with SEC in children with poor asthma control but not in those with good asthma control. The reason for this finding among children with asthma is unclear. However, the unequal distribution of children with good asthma control compared to those with poor asthma control across the various socio-economic classes may have influenced this result. The age of the study participants may also have contributed to these findings as differences in intelligence have been shown to be more variable in childhood, with some children showing substantial gains in intelligence and others considerable losses between infancy and adolescence (4-6) but highly stable from early adolescence to late adulthood (30). Further research is therefore needed on the relationship between SES and IQ among children with asthma.

Conclusion

According to our findings, the Intelligence Quotient of primary school-aged children with asthma is not influenced by their Socio-economic status.

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Author's Contributions: NOC: Data Collection, Literature Search, Preparation of the article, statistical analysis, manuscript revision

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