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ORIGINAL ARTICLE

Association between Low Cognition and Low–income in Rural Pakistani Children

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ABSTRACT

Objective: Numerous studies have concluded relationship of the childhood poverty to the impaired academic performance ultimately contributing to low wages and income in the adult life. Objective of this study was to assess the association between household income and the cognitive potential of children.

Methodology: In this cross–sectional study, cognitive potential of 6 to 7 years old children (n=300) from a rural district of Pakistan was assessed through an indicator of the cognitive development called Intelligence Quotient (IQ) or Full Scale Intelligence Quotient (FSIQ) which was calculated by utilizing fourth edition of the Wechsler Preschool and Primary Scale of Intelligence (WPPSI–IV). Data on the sociodemographic profile was collected through mother's questionnaire.

Results: Low cognitive potential or IQ of the rural Pakistani children was found to be associated with the low–income of the household.

Conclusion: Early childhood development programmes in Pakistan ought to incorporate cognitive–stimulation strategies designed for the low–income children belonging to the rural place of residence in order to disrupt the transmission of poverty to the next generation.

Keywords: poverty, rural, IQ, children, productivity, Pakistan, cognition, low–income, socioeconomic

INTRODUCTION

A large number of studies, undertaken in a variety of countries around the world, have established that childhood poverty is associated with poor academic performance, which in turn contributes to low wages and income in adulthood, according to the findings. When compared to children from wealthy families, children from low-income families receive less nourishment and nutrition, experience higher levels of life stress, and receive less cognitive stimulation (1, 2). Specific brain regions associated with learning and educational functioning were found to be impaired in a multisite longitudinal study of children from low-income families (3). The most convincing evidence about the causal effect of parental financial resources on children's cognitive performance came from a study of adopted children in France, which gave the most persuasive data to date (4).

Pakistan has a rural population that accounts for 63.6 percent of the total population (5), and the poverty head count rate in rural Pakistan is twice as high as the rate in urban Pakistan. Since 2001-02, the poverty gap between rural and urban areas has remained practically stable at 36 percent vs 18 percent. Rural areas in Pakistan are significantly more disadvantaged in all aspects of service delivery, which has considerable negative effects for the important human development outcomes that together provide a road out of poverty, particularly in the early stages of development (6).

Accordingly, there is a dearth of cognitive development research on rural children in Asian countries (7), including Pakistan. As a result, the goal of this study was to examine the relationship between household income and the cognitive potential of 6 to 7 year olds in rural Pakistan with the ultimate goal of increasing their future productivity through evidence-based early childhood development interventions, should such an association be found to exist.

MATERIALS AND METHODS

In this cross-sectional study, Pakistani children from two rural tehsils (Gujar Khan and Kallar Syedan) in district Rawalpindi were randomly selected. Adopted children, twins or triplets, and children with mental, hearing, or physical disabilities and current acute sickness were all excluded from the study. The study included children aged 6 to 7 years old whose mothers were in good health and still alive.

Data on the household's sociodemographic makeup was gleaned from a mother's questionnaire, which asked about such things as the FSIQ/IQ (Full Scale Intelligence Quotient), the total monthly household income, and various categories like household debt and whether or not the children use computers in school. It was recorded in Pakistani currency "rupees/Rs" for the total monthly household income, but this variable was organised in accordance with the Household Integrated Economic Survey (HIES 2015–16) in order to show a relevant pattern (8). The first and second quintiles of the "Punjab Rural" in HIES 2015–16 were merged into low–income (up to Rs. 22,862/-) groups, while the third and fourth quintiles were combined into middle–income (from Rs. 22,863 to 32954/-) categories, according to HIES 2015. The fifth quintile was comprised of people with an annual income of between Rs. 32,955 and Rs. 100,000/-. (9).

To measure cognitive development, the Wechsler Preschool and Primary Scale of Intelligence (WPPSI–IV) was used to generate the FSIQ/IQ. Rather of directly measuring mental entities, the WPPSI-IV quantifies the structure of the underlying construct, which is hierarchical. The general intelligence factor (g) sits at the top of the WPPSI-IV construct hierarchy, whereas more specialised cognitive talents are grouped lower down. The WPPSI-broad IV's cognitive domains include visual spatial, working memory, fluid thinking, verbal comprehension, and processing speed. Brain functions such as verbal expressiveness, analytical and discriminative abilities, and short- and long-term visual and auditory memory that are measured by subtests containing different verbal and pictorial elements (10).

The WPPSI–IV kit includes all the materials needed to administer the subtests, including blocks for the Block Design, location layouts and animal cards for the Zoo Location, 13 puzzles for the Object Assembly subtests. In addition, the WPPSI–maker IV's provides three response books, an ink dauber, and a stop watch for three subtests that examine the cognitive domain of Processing Speed (11). The WPPSI–IV kit also includes a manual for administering and scoring the test, as well as technical and interpretive materials, three stimulus books, and record forms.

For this study, a sample size of 300 children for the age group of 6–7 years was chosen since an adequate sample size for a subgroup is normally 256 subjects (12, 13). WPPSI–IV subtest data were analysed with SPSS 16th edition (Statistical Package for Social Sciences). An example of a graphical method for testing normalcy was the boxplot, while a numerical method was the skewness and kurtosis. The formal tests to ensure normalcy also included the Shapiro–Wilk and Kolmogorov–Smirnov tests.

Analysis of this study's FSIQ and IQ scores was done in accordance with the WPPSI-IV-recommended IV's qualitative categories (figure 1) in order to examine their correlation with the total monthly household income (HIES). Cross–tabulation of the data was done using the Chi–square test. In addition to Analyze and Non–parametric, Chi–square was used for the chi–square

tests, while Analyze and Crosstabs were used for cross–tabulation. A Chi-square test was used to compare the HIES categories of total monthly household income with the categories of household debt and computer use in school.

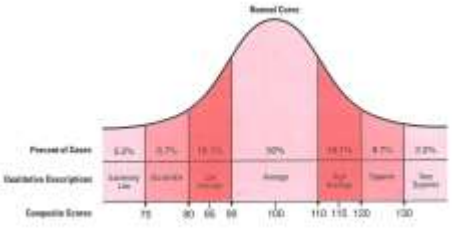

Figure 1: Recommended Qualitative WPPSI–IV Score Interpretation

The Institutional Ethical Review Committee of the Health Services Academy, Islamabad, approved this research. There was no need to make any special arrangements for the mother and child to be seen by the LHW (Lady Health Worker). The mother of the family was questioned about the family's socioeconomic status. Distractions were minimised by administering the WPPSI–IV at school or in the clinic of the local LHW. Steps were taken to safeguard the privacy of the survey participants and the collected information.

RESULTS

Minimum and maximum total monthly income of the household, recorded in this study, were Rs. 1500/- and Rs. 100,000/- respectively. Income of the low–income households was up till Rs. 22,862/- while earnings of the middle– and high–income groups ranged from Rs. 22,863 to 32954/- and Rs. 32,955 to 100,000/- in line with the HIES–categories. Eighty five percent (n=254) of the households, in our research, were found to be in the low–income group followed by 10% (n=30) in middle–income while 5% (n=16) in the high–income groups (figure 2).

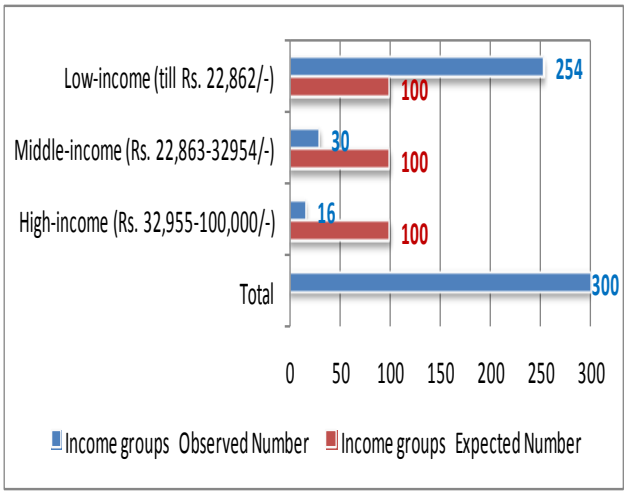

Figure 2: Household monthly income groups (in line with HIES 2015-16)

In this study, non–normal distribution of the cognitive potential represented by the FSIQ (Full Scale Intelligence Quotient) scores was seen with a mean of 84 (95% CI=82.17 – 85.10) and standard deviation of 13 points. According to recommended qualitative interpretation of the WPPSI–IV scores (figure 1), 35% (n=106) of rural Pakistani children in our research had FSIQ/IQ/cognitive potential scores in the 'borderline' (IQ from 70 to 80) category (figure 3) relative to children in the United States normative sample.

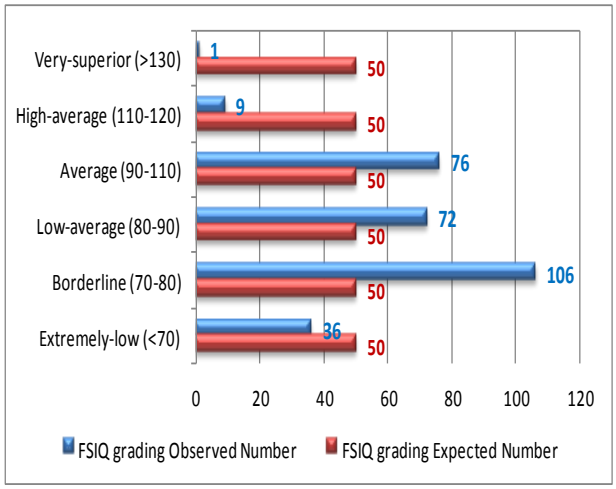

Figure 3: Qualitative categories of the FSIQ scores

Statistically significant association ($p<0.05$ with 95% CI=0.00–0.01) between HIES–categories of household total monthly income and qualitative–categories of the FSIQ was found in the Chi–square test. Hence, null hypothesis of "no association" was rejected on the basis of p value lower than the significance level set at 0.05 and the non–inclusion of zero/null in the confidence interval.

Additionally, crosstabulation concluded less–than–expected observed number of rural children in the 'borderline' (IQ from 70 to 80) and "extremely–low" (IQ<70) categories of the cognitive potential from the high– and middle–income households in contrast to more–than–expected observed number in both the afore–mentioned categories of children from the low–income households. Statistically significant association was found between HIES–categories of the household's monthly income and categorical variables regarding "debt on the household" ($p<0.05$ with 95% CI=0.00–0.01) and "computer–use by children at school" ($p<0.05$ with 95% CI=0.00–0.01) utilizing the Chi–square test.

Table I: Cross–tabulation of HIES–income groups with computer–use by children at school and debt on the household

Household Integrated Economic Survey (HIES)–income groups					
Computer–use by children at school					
		Did not use computer	Used computer	Total	
Low–income (count)	Observed	174	80	254	
	Expected	165	89	254	
Middle–income (count)	Observed	14	16	30	
	Expected	19	11	30	
High–income (count)	Observed	6	10	16	
	Expected	10	6	16	
Total expected count		194	106	300	
Total observed count		194	106	300	
Debt on the household					
		No debt on household	Debt on household	Did not know	Total
Low–income (count)	Observed	97	147	10	254
	Expected	108	138	8	254
Middle–income (count)	Observed	20	10	0	30
	Expected	12	17	1	30
High–income (count)	Observed	10	6	0	16
	Expected	7	8	1	16
Total expected count		127	163	10	300
Total observed count		127	163	10	300

Furthermore, in cross–tabulation (table I), more–than–expected observed number of children used computer at school from the high– and middle–income households while reverse was true for the low–income households. In this research, more–than–expected observed number of low–income households was found to be under debt in contrast to the middle– and high–income households.

DISCUSSION

Children from low- and middle-income homes in rural areas were found to have lesser cognitive capacity than those from more affluent areas. According to another study conducted in a rural Pakistani district, the cognitive potential of 4-year-old rural children was linked to the socioeconomic status (SES) of their families (14). Children from low-income families have been found to suffer from intellectual disabilities in various studies (3). Before and during adolescence, more than 5000 children were tested for their IQ (Intelligence Quotient). Kids from better- and lower-socioeconomic-status homes had IQs that were 13 points higher in adolescence, respectively (4).

More low–income households were found to be in debt compared to middle– and high–income families in this study. Having been brought up in poverty might have long-term consequences. Evidence from neuroscience shows that poverty is linked to poor cognitive, scholastic, and behavioural outcomes. neural tube abnormalities, underweight and undersized births, and developmental delays or impairments can all be caused by nutritional inadequacies before conception and throughout pregnancy (7, 15).

In this study, it was discovered that rural students from low-income families were less likely to be exposed to computers in the classroom. A study conducted in the United States found that living in a rural area was associated with lower FSIQ scores in one of its cognitive areas, perhaps as a result of the lower levels of visual stimulation encountered on a daily basis. Children in rural areas had distinct working memory profiles compared to those in urban areas. Poor rural children performed worse on the visual spatial working memory test than they did on the verbal working memory test, indicating that cognitive resources in rural and urban poverty are different (16).

Approximately 250 million children under the age of 5 in low- and middle-income countries (LMIC) are at danger of not developing to their full potential. The proxy indicators of poverty and stunting used to arrive at this estimate are standardised across countries and regions around the world (15). Due to the fact that most of the instruments used to evaluate children's cognition have been created and standardised in western contexts, a direct population–level assessment of cognitive potential was not possible (14, 17). Furthermore, the standardisation and procurement of IQ tests are expensive and time-consuming, limiting their application in resource-poor countries around the world (18). These scores were used to produce reference values or norms for the administration and scoring manual of the WPPSI–IV, which was standardised on a normative sample of 1,700 children aged 2:6–7:7 in the United States (10).

In this study, the cognitive potential of rural Pakistani children was calculated in relation to a standardised sample of American English-speaking children because there were no reference values for Pakistan (18). The WPPSI–IV standardisation samples are used to obtain IQ scores with a bell-shaped normal distribution (11). The standard deviation (SD) for the Wechsler intelligence tests is set at a hundred and fifteen points (19).

The non-normally distributed FSIQ in this study had a mean of 84 and a standard deviation of 13. For example, the mean FSIQ of rural Pakistani children was found to be in the "low–average" category, with most children's scores falling into this category, according to a recommended WPPSI–IV score interpretation figure (figure 1). (figure 3). Using the third edition of the WPPSI, a research in Sindh's Naushero Feroze district found a mean IQ of 75.56 and a standard deviation (SD) of 7.56, indicating similar IQ score dispersion (14). The upper limit for mental impairment, as determined by Wechsler IQ scores, is 70. (20).

Research on rural Pakistani children's "low–average" IQ to "borderline" IQ shows that the standardisation of the WPPSI did not account for the discrepancies between urban and rural Pakistani children and poverty-related disadvantages in the developing world. The normative data for cognitive development tests developed and standardised in a developed country should be used with caution in a developing country, according to empirical evidence, because living conditions and educational systems in the two countries are so vastly different in those countries (21). a child's cognitive capacity in rural Pakistan is predicted by their grade in school, then by their parents' educational attainment (18).

CONCLUSION

Early childhood development programmes in Pakistan ought to incorporate cognitive–stimulation strategies designed for the low–income children belonging to the rural place of residence in order to disrupt the transmission of poverty to the next generation. Assessment of cognitive potential through reliable measures enables integration of the risk factors into the design of early childhood development interventions. Health sector has an extensive reach to children; hence, linkage of child health services to nutrition and education is mandatory to promote learning while coordination with social and child protection services is inevitable to reach the most vulnerable populations.

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