Poverty, Household Characteristics and Child Health Care in Nigeria

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Abstract

Poverty is a household name in developing countries such as Nigeria and has been recognized as a major problem inhibiting economic growth and development. As such, this study examined poverty, household characteristics and child health care in Nigeria with the aim of finding out how poverty affects child health care considering host of household characteristics. The theoretical framework is based on household utility maximization derived from the human capital analysis, while logit regression estimation technique was adopted for our analysis. Parental education influenced children health status and also positively significant in child height for age. Also, household size and economic status are also significant factors in determining child health status. The study therefore recommends that government should put in place policies to reduce the identified constraints to child health care.

Keywords: poverty, households, child health, logit, health status

JEL Classification: I 15

1. Introduction

Poverty which is defined by World Bank (1990) as hunger, lack of shelter, being sick and not being able to see a doctor has become a household name in developing countries like Nigeria. Globally, poverty has been recognized as a major problem inhibiting development in both developed and developing nations. As such, all countries have been addressing it by putting up policies that can alleviate it. Since Nigeria independence, all regimes have identified one or more strategies in reducing the level of poverty in the country, such as Structural Adjustment Programme (SAP), Operation Feed the Nation (OFN), the poverty reduction strategy paper known as NEEDS and the current SURE-P Programme. A vivid examination of these documents showed the trends and profile of poverty and vulnerability in Nigeria, as observed by Okunmadewa et al (2010) but they do not provide the basic determinants of poverty. Thus, they argued that there is need to know what determines poverty; this will guide policy analysis and help in designing effective poverty reduction strategies (Okunmadewa et al, 2010).

A growing literature have investigated determinants of poverty in Nigeria (Okunmadewa et al 2010, Adato 2006, Attree 2006, Olaniyan 2003, Omonona 2000, Beall and Kanji 1999 and Ogwumike, 1987) All these studies are limited in scope and have not investigated how poverty affects child health care at the household level. Different criteria have been used to conceptualise poverty. Most analysis follows the conventional view of poverty as a result of insufficient income for securing basic goods and services which is restricted to rural sector of the economy. The World Bank (1990) recognized poverty as a rural phenomenon which shows that the rural dwellers are mostly affected by poverty.

Child health in developing nations, Nigeria inclusive, is threatened by Nutritional deficiencies and illnesses like malaria, diarrhea, acute respiratory infections (ARI) and vaccine diseases (VPD), all these are greatly responsible for the morbidity and mortality of childhood. These diseases however can be linked to poverty which is predominant among the rural dwellers which is the main sector in Nigeria that plays some fundamental role of job creation at relatively low unit costs (Olaniyan, 2003).

A vivid examination of the Millennium Development Goals (MDGs) (see table 1) shows that reduction of infant and child health is one of the eight MDGs, while child malnutrition is one of the goal one indicators. Goal four specifically intends to reduce child mortality by two-thirds between 1990 and 2015 the under-five mortality rate.

Table 1. Child health and nutrition in the development goals

	Target	Indicators
Goal 1: Eradicate extreme poverty and hunger	Target 2: Halve between 1990 and 2015, the proportion of people who suffer from hunger	Prevalence of underweight in children (under five years of age) proportion of population below minimum level of dietary energy consumption.
Goal 4: Reduce child mortality	Target 5: Reduce by two-thirds, between 1990 and 2015, the under-five mortality rate.	Under-five mortality rate Infant mortality rate Proportion of one year old children immunized against measles.

It is therefore important to examine how poverty affects household especially how it affects the child health and their nutritional status in Nigeria.

Child health which is among the child welfare indices is important and needs to be monitored because child contribution to the society in adulthood is determined to a large extent by their childhood health (Okpukpara, 2006). Olaniyan (2002) also sees improvement in child health and nutrition of poor children as an efficient way of improving school attendance and enhance economic growth which will translate into long run productivity.

This paper is organized into four sections. The next section is on poverty, health and nutritional status of children in Nigeria. The theoretical framework, methodology and data are presented in section 3. Section 4 essentially is the results of our estimation and section 5 is the conclusion and policy implications.

2. Poverty, Health and Nutritional Status of Children in Nigeria

Studies have shown that there is a very high correlation between poverty, health and nutritional status of children in Nigeria (Olaniyan 2003, Adeoti and Awoniyi 2009, Ogwunike 2010, Okumadewa et al, 2010).

The collapse of Nigeria economy since 1980 has led to an increase in poverty level where 65.5 percent of households live below the poverty line in 1996 (FOS, 1999). This has affected the health and sanitation conditions which are inputs of human capital (Olaniyan, 2003).

The increase in poverty level since the 1990s decade has brought a very difficult period for most Nigerian households. These economic shocks according to Ichoku and Leibbrandt (2003) led to rapid decline in most major macroeconomic indices. The economy that was growing at the rate of 7.5 percent in the 1970s recorded an average, zero growth for the greater part of the decade. Per capita income fell from $860 in the early 1980s to below $300. The national currency, the naira was devalued by more than 11,000 percent. External debt grew to over $30 billion or $200 per capital at the end of the 1990s (Green, 2001). This represented about 144 percent of 1993 GDP of the country (Kpakol, 2001). Political instability brought insecurity and social welfare to very high levels. It was estimated that about $100 billion left the country in form of capital flight due to political instability (Soludo, 2001). Social infrastructure and physical environment also deteriorated.

In the face of continued severe economic crises, many households could no longer afford the basic necessities of life for their members. The ability of households to cope with adverse economic conditions was strained. Life expectancy at birth was 43.3 years in 2008 (CBN, 2010). Difficult trade-offs continued to be made in an attempt to keep households afloat. Nutritional intake and other health-enhancing inputs into the household health production function, such as leisure and sports, have either been reduced or eliminated altogether from the households' schedule. These economic crises have led to the breakdown in the health of individuals, households and community. The Social indicator on Health and Nutrition (Table 2) shows that in 1998, only about 10% of Nigerian had access to essential drugs. This has further deteriorated to about 9.4% in 2002, physician per 100,000 people were fewer than 30; access to safe water in 1999 and 2002 were limited to about 50% and 53.5% of the population respectively, and less than 40% of the rural population had access to safe drinking water as against 80% in urban areas, among other set of indicators (Ichoku and Leibbrandt, 2003). The advances made against some of the communicable and preventable diseases during the period of economic growth of the 1970s and early 1980s were eroded (Pearce and Falola, 1994). As a result of the economic barriers, many households were not able to afford medical care. The reporting of illness is delayed until the illness becomes severe because the cost of medical care has to be weighed against other pressing household needs such as food and education.

Under conditions such as these, children are usually the most vulnerable group, given their physical weakness (Vogel, 1988). Infant mortality stood at an average of 75.1 per 1000 live births ranking among the highest in the world (CBN, 2008). It has been estimated that about 200,000 Nigerian children die every year from diarrhea

related illness.

The proportion of children fully immunized dropped from 30% in 1990 to 17% in 1999, rose partially to 19.5% in 2009 and almost 40% of the children in the later year had never received any vaccination.

Table 2. Social indicator: health and nutrition

Sub-sector Indicator	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Population per Physician (No)	4977.0	4479.0	4529.0	3373.6	3190.3	3141.3	3100.0	3059.0	3321.0	3512.0	4512.0
Population Per Nursing Staff (No)	1044	906.0	920.0	1082.1	951.8	922.5	818.0	714.0	1112	1231	1332
Population per Hospital Bed (No)	1738	1564.0	1611.0	1651.6	1685.5	1722.7	1764.4	1806.0	1887.0	1911.0	1960.0
Life expectancy at Birth (Years)	54.0	54.0	54.0	54.0	54.0	54.0	840.0	84.0	54.0	54.0	54.0
Children Immunization											
(i)FullyImmunized (Overall)	55.1	51.9	72.7	73.3	75.0	75.0	75.0	75.0	75.0	75.0	75.0
(ii) Tuberculosis (%)	54.6	51.7	72.4	72.7	73.0	73.0	73.0	73.0	71	71	71
(iii) DPT (%)	55.3	53.8	75.3	67.1	70.0	70.0	70.0	70.0	68	68	68
(iv)Poliomyletitis(%)	57.5	51.8	72.5	61.0	68.0	68.0	68.0	68.0	67	67	67
(v) Measles	53.0	50.3	70.4	92.3	90.0	90.0	90.0	90.0	88	88	88
Health Institutions											
Primary Health Care	8958.0	8970.0	10149.0	10393.0	15266.0	17012.0	17752.0	18492	19102.0	19800	21321.0
Secondary Health Care	882.0	892.0	936.0	982.0	1976.0	2418.0	2509.0	2600	2701.0	2796.0	2834.0
Tertiary Health Care	51.0	51.0	51.0	51.0	219.0	221.0	221.0	221.0	244.0	244.0	244.0
Federal Government Budget Allocation to Health (₦' m)	11291.9	13737.3	17581.9	35422.0	40741.1	40741.1	40741.1	40741.1	55644.7	55644.7	55644.7
Percentage of Annual Federal Budget	4.6	4.5	2.7	3.9	4.7	4.7	4.7	4.7	5.0	5.0	5.0
Crude Birth Rate (Per1000 persons)	49.0	49.0	49.0	39.6	39.6	38.6	42.0	45.0	46.0	46.0	46.0
Crude Death Rate (Per1000 persons)	14.0	14.0	14.0	14.0	14.0	14.0	11.1	12.0	10.0	10.0	10.0
MaternalMortality (per1000 live births)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Infant Mortality (per1000 live births)	114.0	75.1	75.1	80.2	78.8	77.3	76.0	76.0	70.3	70.5	70.5
Total Fertility Rate	6.1	5.2	5.2	5.5	5.3	5.3	5.0	5.0	5.1	5.1	5.1

Source: CBN Annual Report and Statement of Accounting Various Issues; Human Development Report (2009); NBS Social Statistics (Various Issues)

Table 3. Indicators of child health in Nigeria

Year	Stunting	Wasting	Source(s)
1990	43.1	9.1	1990 National Demography and Health Survey (NDHS)
1993	52.3	10.9	1993 UNICEF Focused States Survey
1995	37.8	9.5	USAID 1995 Integrated Baseline Health Survey
1999	32.0	11.5	1999 Multiple indicator cluster survey
2002	35.3	15.1	WDHS (2008)
2006	39.5	17.4	NDHS (2008)
2010	42.0	18.0	WHO (2010)

Notes: Stunting is defined as standardized height for age of less than -2z scores reflecting long-term malnutrition, while wasting is defined as standardized weight for height of less than -2z scores reflecting short term malnutrition (Olaniyan, 2002)

A cursory examination of table 3 above shows that the level of malnutrition level of Nigerian children has been deteriorating in the last twenty years. The percent of pre-aged children stunted in 1990 was 43.1 percent; this improved to 32.0 in 1999 and has been on the increase since that period recording 42.0 percent in 2010. In the case of wasting, the percentage of Nigerian children wasted has been on the increase since 1990 till date, a whopping 18% was recorded in 2010. From this statistical data, it is obvious that Nigeria has a high level of malnutrition.

The height for age z scores and weight for height z scores, calculated by Olaniyan (2002), shows that the profile of wasted children is not significantly different from those of the stunted children except that the magnitude of wasted children is lower than those of stunted children. The high level of these two indicators is as a result of chronic poverty level being suffered by the households.

It needs be stressed that child and maternal nutrition and health status are often cited alongside the timing of shocks and interventions as the critical factors in determining the irreversibility of poverty transfers. Literature have found out that maternal malnutrition contributes to higher rates of maternal, infant and under five mortality (Adato et al 2006; Anderson 2000; Attree 2006; Beall and Kauji 1991 and Andrade et al, 2003). Studies have also found out that poor in utero nutrition also leads to low birth weight babies with higher risk of the children being stunted, and experiencing a permanent limit to their physical and cognitive development affecting schooling performance and completion (Beal and Kauji 1999; Anderson 2000).

Statistical evidence has shown that over 200 million children are stunted worldwide; more than 150 million of pre-school children are underweight. Stunting and wasting have long term repercussions which can influence a child's likelihood of becoming a poor adult (Alayande et al, 2000).

Evans (1991) identified household characteristics, household income, household and individual assets and household decision-making as those factors that influence poverty that could transmit into poor health care status for the children. Also important according to him are the systematic inequalities which can result in people within the same household having different choices, access to services and levels of well-being which will have profound and long-term implications for them and their children (He depicts the scenario with figure 1 below).

Evans (1991) findings notwithstanding, numerous studies worldwide have equally found household characteristic as the main drivers of persistent poverty (Aldaz-Carroll and Moran 2001; Deninger and Okidi 2001; Boggess and Corcoran 1999; Behrman et al, 2001).

Source: Kate Bird (2007)

3. Theoretical Framework and Methodology

The theoretical framework of this study is based on household utility maximization derived from the human capital analysis of Becker (1981). In these models the household maximizes utility:

$$U = U \ (NF_{it}, \ L_{it}, \ H_{it} \ [N(F_{it}, \ ---), \ H \ EXP_{it}, \ H \ TIME_{it} ---]) \tag{1}$$

Where: U = hh utility

NF = Consumption of non-food and non-health items

L = Leisure

H = Health status

N = Nutritional status and

F = Food consumption

it = person i in the household at time

It should be noted that utility maximization is inter-temporal, but we can drop t subscripts with no loss of generality.

HEXP = amount spent on healthcare for (not by) individual i.

HTIME = the time the household members devote to the healthcare for that individual.

N enters the utility function indirectly as a determinant of health status.

The household maximizes utility subject to the total labour constraint, any unearned income and the behavioural health and nutrition production functions. Therefore, we can specify these functions as:

$$H = H \ [(H_{t-i}, \ N, \ NEXP \ (Y, \ PH, \ C, \ ACCESS), \ HTIME \ (C, \ MED), \ ENV, \ MED \ ----] \tag{2}$$

H_{t-i} = health status in the previous period

Y = Household income per capital

PH = Price of health services and products.

C = a vector of child characteristics (sex, age, birth order etc),

ACCESS = a measure of the availability of health services,

MED = maternal education

ENV = a vector of environmental risk factor faced by the child.

$$N = H [F(Y, PF, PROD, -----), N_{t-i}, H, C, MED ----]$$ (3)

PF = Price of food

PROD = the value of agricultural production by the household.

Manipulation of (2) and (3) yields

$$H \text{ and } N = F (H_{t-i}, N_{t-i}, Y, PROD, PH, PF, C, ACCESS, MED, ENV)$$ (4)

It should be noted that income (Y) is determined by the labour allocation decision in the solution to the utility maximization problem, we then dropped income to avoid multicolinearity problem.

3.1 The Model

Follow the approach of Currie (2000), the empirical analysis of this study is based on household utility maximization of health discussed in the last section. In our model the household utility is assumed to be a function of non-food and non-health items (NF) and health status (H).

$$U = U (NF_{it}, H_{it})$$ (1)

Household utility will be maximized subject to a health production function of individual within the household and a budget constraint;

$$Hit = h (QH_{it}, OH_{it}, I_{it}, HC_{it}, CM_{it}, N_{it}, z)$$ (2)

$$NF_{it} = Y - P_{QH} QH - P_{XH} XH$$ (3)

QH = quality of health services or care

OH = other health inputs (sanitation, food consumption etc)

I = individual attributes (age, gender etc)

HC = Household characteristics

Y = exogenous income

$P_{qh} QH$ = Price of health consumption

$P_{XH} XH$ = Opportunity cost of time or price of non-health care

N = Nutritional status of individual

Z = Vector of choice or alternative specific attributes

it = person i in the household at time t.

By forming a composite function, we can then express utility function as:

$$U = U (h (QH, OH, I, HC, CM, N), Y - P_{QH} QH - P_{NA} NFF$$ (4)

The maximization of this problem then yields a set of reduced form equation below which is our estimated equation.

$$H_j = H_j (P_{HQ}, P_{NF}, I, HC, CM, U)$$ (5)

Equation (5) above is our reduced form demand function for health input j.

3.2 Variables Description

Individual characteristics include; gender, age, marital status and educational status. Gender is measured as a dummy variable that takes the value of one when patient is male and zero otherwise. Age is measured as a continuous variable, while marital status is measured in the dummy categories as monogamous and once married. The forth category never married is the reference category. Household characteristics include; household size, per capital household expenditure and square of per capital household expenditure. Household size is measured as number of person in the household while per capital household expenditure is proxy by the logarithm of income of household head and the square logarithm of income of household head. Community characteristics comprises of location and geo-political zones. In line with Olaniyan (2002), we estimated two models, one for weight for height and the second height for age.

3.3 The Data

The data used for this study are sourced from the 2008 Nigerian Demographic and health survey (NDHS). This

survey covers all the states in Nigeria, while questionnaire used were divided into two, one for household and the other for children. Information collected on household members includes their sex, age, educational status, marital status, occupation, maternal mortality and a host of others. The children questionnaire was administered to the mother or the caretaker of the child and Information was collected on illness, immunization, breastfeeding, mother's nutritional status, vitamin A and child rights and anthropometry indices of nutritional status.

Table 4. Percentage distribution of children under 5 (covered in the survey) by background characteristics, Nigeria, 1999

	Percent	No of children
Male	49.6	9,861
Female	50.4	10,035
Total		19,896
Region		
S. West	19.07	3,795
S. East	9.79	1,947
N. West	27.58	5,488
N. East	15.56	3,097
N. Central	14.07	2,800
South South	13.95	2,769
Total		19,896
Residence		
Urban		6365
Rural		13,531
Total		19,896

Source: NDHS (2008)

Table 5. Definition of variables in estimation

1	WHZ	Z- score weight for height
2	HAZ	Z- score height for age
	CHILD CHARACTERISTICS	
3	AGE	Age of child in months
4	AGE^2	Squared age of child in months
5	GENDER	1 if female, 0 otherwise
6	B-ORD	BIRTH ORDER
	HOUSEHOLD RESOURCES	
7	FATHERDU	Years of education of father
8	MOTHERDU	Years of education of mother
9	FATHERDU^2	Squared years of father's education
10	MOTHERDU^2	Squared years of mother's education
11	FATHAGE	Father's age in years
12	MOTHAGE	Mother's age in years
13	Assets	Inputed value
14	HHSIZE	Number of household members
15	KID 0 -5	The no of children less than 6 years old
16	FEMALE HEAD	1 if head of household is female, 0 otherwise
17	SPOUSE PRESENT	118 spouse lives with the household head
18	COMMUNITY RESOURCES	
19	Community safe water	

20	Private safe water	
21	ACCESS	1 if local health centre is within the locality, 0 otherwise
22	REGION	
23	S. WEST	1 if household is in the S.West zone of the country, 0 elsewhere
24	S. EAST	1 if household is in the S. East zone of the country, 0 otherwise
25	N. WEST	1 if household is in the N. West zone of the country, 0 otherwise
25	N. EAST	1 if household is in the N. East zone of the country, 0 otherwise
27	S. SOUTH	1 if household is in the S. South zone of the country, 0 otherwise
	N. CENTRAL	1 if household is in the North Central zone of the country, 0 otherwise.

The data from the individual, community and the household were merged together so as to give a very robust multi-level data base for our empirical analysis to find out the impact of poverty, and household characteristics on child health in Nigeria.

4. Results Interpretation

Weight for height and height for age of 0-5 children are our dependent variables which are expressed on Z scores. It needs be pointed out however that our independent variables comprises of; the characteristics of the children; community characteristics; household resources and interaction variables.

From our results (see tables 6-9), it is evident that parental education is a significant determinant of children health status. In essence, we found out that child whose parents are educated have the probability of having a better health status compared to children whose parents are not educated. This finding is in line with Olaniyan (2002) and Ifeanyi, et al (2009).

Also, we found out a positive relationship between parental education and child height for age. The higher the number of years spent in school by Parents the greater the height for age z scores for the under 5 children. However, the effects of father's education in the rural areas is more significant than that of the mother, but this is not so in the urban area. This also confirms the result of Kanjilal et al (2010) on Nutritional status of children in India.

The household size was found to be a significant factor in determining child health status in the urban area, while it is not a significant factor for rural dwellers. Kasirye et al (2004) reported a similar result for South Africa.

With respect to Economic status which we used assets as proxy, empirical evidence revealed that child health status increases with household economic status in both urban and rural areas. Kanjilal reported a similar finding for children in India.

Empirical evidence on the household head reveals that it is a significant factor in the rural and urban areas of Nigeria. However, we found the effect to be more significant in the urban areas than rural areas. This is in contrast with the finding of Olaniyan (2002), where the effect is stronger in the rural areas than urban areas.

Mother's age rather than father's age is significant in rural areas for height and not significant in urban areas. The simple explanation for this is that women are assumed to be much more involved in child health care and also that the older the mother, the more the care for the child.

Community factors are also significant factor in determining child health and nutritional status. However, specific location that an individual is residing was not found to be a significant factor that influences the probability of seeking health care for the child. Residency in South East, South West and South –South are significant less likely to affect child health compared to their counterparts in North Central. By contrast, residency in the North –West, North-East of the Country is more likely to affect child health relative to their counterpart in the North Central.

5. Conclusion and Policy Implications

This study yields a number of insights into the effects of poverty level and household characteristics on child health in Nigeria. It was found out that residency in any of the geo-political zones is a significant determinant of child health.

Age, sex, education, household size and resources are also significant factors affecting child's health.

From our findings, it is therefore imperative that government puts in place domestic policies to reduce the

various constraints on child health care such as; encouraging investment in education, health education on birth control, immunization and HIV/AIDS. Also, programmes should be put in place towards poverty alleviation; this will help in improving the resources available to the household, which will then have a multiplier effect on the nutritional status of the children in the household.

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Appendix

Appendix 1. Regression results: weight for height for urban children

WHZ	Model 1		Model 2	
	Co-efficient	P Value	Co-efficient	P Value
Age	-0.135	0.0012	-0.152	0.001
Age^2	0.196	0.000	0.210	0.033
Gender	-0.322	0.004	-0.043	1.522
B-ORD	0.342	0.125	0.121	0.010
Father Edu.	0.614	0.000	0.327	0.011
Mother Edu.	1.523	0.214	1.746	0.029
Father Edu^2			-1.247	0.002
Mother Edu^2			-1.945	0.145
Father Age	0.034	0.112	0.524	0.022
Mother Age	0.013	0.178	0.321	0.165
Assets	0.043	0.024	0.075	0.021
H-H Size	0.027	0.000	0.241	0.000
Kid 0-5	0.245	0.321	0.654	0.136
Female Head	0.342	0.010	1.758	0.014
Spouse			1.821	0..005
Comm. water	1.211	0.001	1.320	0.000
Private water	0.421	0.052	0.120	0.045
Access	1.652	0.000	2.211	0.001
S. west	0.311	0.142	0.326	0.130
S. East	0.375	0.321	0.054	0.054
N. West	0.345	0.000	0.225	0.040
N. East	0.251	0.004	0.128	0.006
S. South	0.325	0.148	1.240	0.015
N. Central (excluded)				
Test of Joint sis.				
All H-H Variables	358			368
P Vales	0.000			0.000
Community variables	258			538
P value	0.000			0.000
All covariates				
P value	0.000			0.000
R^2	0.428			0.3421
F Statistics	18.75			19.98

Source: Calculated from NDHS (2009)

Appendix 2. Regression results: weight for height for rural children

WHZ	Model 1		Model 2	
	Co-efficient	P Value	Co-efficient	P Value
Age	-0.156	0.003	-0.163	0.014
Age^2	0.184	0.000	0.320	0.000
Gender	-0.243	0.000	0.875	0.527
B-ORD	0.126	0.421	0.375	0.031
Father Edu.	0.104	0.004	0.485	0.040
Mother Edu.	0.065	0.010	0.318	0.012
Father Edu^2			-0.152	0.013
Mother Edu^2			-0.008	0.016
Father Age	0.143	0.322	0.624	0.412
Mother Age	0.045	0.215	0.015	0.325
Assets	0.124	0.164	0.757	0.003
H-H Size	0.752	0.620	0.426	0.026
Kid 0-5	0.124	0.002	0.929	0.002
Female Head	0.647	0.145	0.824	0.031
Spouse			0.052	0.023
Comm. water	0.324	0.104	0.714	0.521
Private water	0.623	0.015	0.233	0.058
Access	0.245	0.018	0.167	0.031
S. west	0.425	0.023	0.789	0.051
S. East	0.324	0.008	0.345	0.024
N. West	0.517	0.001	0.412	0.035
N. East	0.216	0.002	0.929	0.143
S. South	0.625	0.763	0.846	0.010
N. Central (excluded)				
Test of Joint sis.				
All H-H Variables	345.0			326.0
P Value	(0.00)			(0.00)
Community variables	475.6			425.8
P value	(0.00)			(0.00)
All covariates	14,524.014			11,628.234
P value	(0.00)			(0.00)
R^2	0.361			0.374
F Statistics	5.236			6.422

Appendix 3. Regression results: height for age equation for urban children

WHZ	Model 1		Model 2	
	Co-efficient	P Value	Co-efficient	P Value
Age	-0.150	0.000	-0.062	0.000
Age^2	0.281	0.004	0.311	0.000
Gender	0.123	0.103	0.124	0.524
B-ORD	1.014	0.012	0.216	0.020
Father Edu.	0.821	0.056	0.015	0.124
Mother Edu.	0.623	0.014	0.925	0.321

Father Edu^2			0.825	0.124
Mother Edu^2			0.926	0.020
Father Age	1.231	0.040	0.916	0.126
Mother Age	0.426	0.164	0.014	0.025
Assets	0.826	0.007		0.008
H-H Size	0.779	0.026		0.007
Kid 0-5	0.925	0.006		0.014
Female Head	0.524	0.110		0.016
Spouse			0.528	0.027
Comm. water	0.423	0.043	0.724	0.003
Private water	0.215	0.022	0.681	0.009
Access	0.125	0.041	0.022	0.023
S. west	0.824	0.023	0.155	0.047
S. East	0.627	0.018	0.803	0.345
N. West	0.925	0.724	0.724	0.004
N. East	0.214	0.614	0.617	0.124
S. South	0.728	0.014	0.719	0.625
N. Central (excluded)				
Test of Joint sis.				
All H-H Variables	286.12		264.12	
P Value	(0.00)		(0.00)	
Community variables	428.10		326.0	
P value	(0.00)		(0.00)	
All covariates	16,214.420		13,221.12	
P value	(0.00)		(0.00)	
R^2	0.421		0.468	
F Statistics	38.164		36.127	

Source: Calculated from NDHS (2009)

Appendix 4. Regression results: height for age equation for rural children

	Model 1		Model 2	
WHZ	Co-efficient	P Value	Co-efficient	P Value
Age	-0.745	0.034	-0.764	
Age^2	0.728	0.211	0.698	
Gender	0.987	0.711	0.124	
B-ORD	0.624	0.098	0.127	
Father Edu.	0.904	0.014	0.723	
Mother Edu.	0.454	0.093	0.651	
Father Edu^2			-0.752	
Mother Edu^2			-0.625	
Father Age	0.745	0.025	0.017	
Mother Age	0.824	0.051	0.126	
Assets	0.925	0.050	0.721	
H-H Size	0.998	0.136	0.522	
Kid 0-5	0.897	0.051	0.422	
Female Head	0.272	0.135	0.128	
Spouse			0.889	

Comm. water	0.898	0.000	0.160
Private water	1.230	0.002	0.122
Access	0.928	0.030	0.435
S. west	1.245	0.000	0.327
S. East	1.426	0.000	0.145
N. West	1.015	0.004	0.214
N. East	1.167	0.124	0.659
S. South	1.954	0.012	0.524
N. Central (excluded)			
Test of Joint sis.			
All H-H Variables	364.120		248.270
P Value	(0.00)		(0.00)
Community variables	525.14		423.62
P value	(0.00)		(0.00)
All covariates	16,424.50		12,725.120
P value	(0.00)		(0.00)
R^2	0.312		0.289
F Statistics	39.012		38.241

Source: Calculated from NDHS (2009)