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Patterns and Predictors of Mortality among Children Under-Five years in Nigeria

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ABSTRACT

Early childhood mortality remains a major public health problem in developing countries. Under-five mortality rate of 157 per 1000 live birth currently observed in Nigeria is one of the highest worldwide. Against the backdrop of limited childhood mortality research in Nigeria, this study identified predictors of child mortality. The study was a population based cross-sectional design where information was obtained from the Nigeria Demographic and Health Survey (NDHS) 2008 on childhood survival status from 28,647 mothers of reproductive age. It was a nationally representative sample. Chi Square and Cox proportional hazard regression, using forward likelihood ratio method were used in the analysis (α=0.05). Mean age of the women was 29.28yrs with standard deviation 7.078 and 11.2% had experienced childhood deaths in the last 5 years prior the survey. Among the identified predictors of under-five mortality were; age, religion, wealth index, cooking fuel type, preceding birth interval, type of toilet facility, household size. The hazard of under-five mortality was higher for children of mothers residing in the; South South (HR=2.03; C.I=1.27–3.24 , p<0.05), South West (HR=2.58; C.I=1.57–4.24, p<0.05), North East (HR = 2.90; C.I=1.88–4.48, p<0.05), South East (HR=4.54; C.I=3.03–6.79, p<0.05) and North West(HR=10.05; 95% C.I=6.67–15.16, p<0.05) than those in the North Central region. The risk of dying before the fifth birthday was higher for children whose mothers are Muslims (HR=2.34; C.I=1.41–3.90, p<0.05) than children whose mothers are Christians. Children from the mothers belonging to "Rich" wealth index had higher chances of surviving (HR=0.785; C.I=0.62–0.99, p<0.05) and those from the middle wealth class had twice the chance of surviving till their fifth birthday (HR=0.44; C.I=0.34–0.56, p<0.05) compared with children from relatively poor mothers. Children whose mothers attended postnatal clinic had better chances of surviving to their fifth birthday (HR = 0.76; C.I=0.62–0.92, p<0.05) compared with children whose mothers did not attend. Childhood mortality experienced by mothers in Nigeria is high and the predictors included both sociodemographic and health related factors. There is need to consider the identified predictors of childhood mortality when designing childhood mortality reduction strategies in Nigeria.

Keywords: *Child Mortality; Survival Analysis; Under-five Mortality*

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INTRODUCTION

Children represent the future of all societies, ensuring their healthy growth and development are prime concerns. Therefore, mortality among children under-five years, reflects a country's level of socio-economic development and quality of life (UNICEF, 2012). Child mortality level is a key indicator for planning and implementation of child survival interventions as well as for socio-economic development (UN Report, 2011). Nigeria, which constitutes 1% of the world's population accounts for 10% of the world's maternal and under-5 mortality rates (Ogunjimi et al, 2012). Under-five mortality studies in developing countries indicate that most of childhood deaths are from preventable causes such as diarrhea, pneumonia, measles, malaria and HIV/AIDS and suggest childhood mortality reduction by two-thirds by 2015 could be achieved if other factors are identified. Knowing these factors would assist in designing effective child survival intervention strategies (Morris S.S., 2003, Worku, Z., 2011,Faijer, Bay, & Miller, 2011). The mortality rate amongst children less than five years is widely recognized as an important indicator of development

It is also the broadest, and hence most inclusive, widely used measure of child survival.

Experts and researchers subtly implied that improved child survival prospects remain challenging in Africa given the HIV and AIDS pandemic, the impact of poverty, economic and political instability, famine and war. Sub-Saharan children who die before the age of five years are often characterized by poverty, illiteracy, the burden of communicable diseases, large family sizes, poor immunization coverage rates and poor access to basic health and socio-economic services. (UNAIDS,2009 World Bank, 2009). Other causes of death are prenatal conditions closely associated with poverty, diarrheal diseases, malaria, pneumonia and other lower respiratory tract conditions. Malnutrition increases the risk of dying from these diseases and contributes to more than half of all deaths of children younger than five years. Environmental and biological factors have also been said to be underlying factors associated to some of the under-five mortality reported in Nigeria. (Ogunjuyigbe, 2004).

A number of studies have identified a negative relationship between per capita income and mortality rate (UNAIDS 2009). There is a clear association between low household income and high mortality rate. As household income increases, the mortality rate amongst under-five children decreases. In most sub- Saharan African countries, poverty and under-five mortality are positively correlated (Worku, 2011). In a similar way as with income, urbanization and illiteracy affect the mortality rate amongst children less than five years in the expected direction. The higher the percentage of the population living in urban areas, the lower the mortality rate amongst children younger than five years, and the lower the percentage of illiterate women, the lower is the mortality rate amongst children younger than five years. The rapid growth of the urban poor population in Africa has renewed interest in rural-urban and intra-urban differences in health and development indicators (Harpham 2009; Montgomery 2009; UN-Habitat 2003). In his review of trends in rural-urban differences in child mortality in Africa, Gould (1998) argued that rural mortality has remained higher than urban mortality for more than a century after the arrival of the immigrant colonial settlers. This urban health advantage, coupled with the fact that most Africans live in rural areas, has led to a focus on rural areas in development planning and poverty reduction. However, with rapid urbanization in Sub-Saharan Africa, a new picture is emerging. Between 1980 and 2000, the region's urban population grew by about 4.7% per year, compared with 3.5% for the developing countries as a whole (United Nations Population Division 2006). Rapid urbanization in Africa is caused by a high natural increase in urban areas and the influx of mostly young adults migrating rural areas to cities in search of better livelihood opportunities. While the region has been experiencing rapid urban population growth, per capita gross domestic product (GDP) fell by an annual average of 0.8% between 1980 and 2000 (World Bank 2004). As a consequence of the sluggish economic performance and increasing levels of urbanization, large proportions of the urban population in many African countries are living in abject poverty and in overcrowded housing structures that do not have basic amenities, such as safe drinking water, sanitation, and garbage disposal services (APHRC 2014; Montgomery 2009; United Nations Human Settlements Programme [UN-Habitat] 2003). Nigeria is yet to achieve good and affordable health care and overcome harsh economic condition including poverty spread. This has implication on childhood survival in the country. Socio-cultural issues centered most especially on religion, ethnicity and region of residence constitute great challenge to health care access also pose threat to childhood survival in Nigeria. These situations makes Nigeria lag behind other developing countries in the pace of childhood mortality reduction.

This research has sought out to determine factors that affect survival of children under-five years in Nigeria. Factors such as sanitation and environmental health, place of residence, region, birth order and spacing between pregnancies and other socio-demographic factors were also accessed.

MATERIALS AND METHODS

This study uses data from the Nigeria Demographic and Health Survey (NDHS) 2008. The 2008 NDHS was a nationally representative survey of 33,385 women aged 15 to 49yrs randomly selected across the six geo-political zones in Nigeria. It was designed to capture information from 37 states (36 states plus the Federal Capital Territory, Abuja) of Nigeria. The sampling frame used was the 2006 Population and Housing Census of the Federal Republic of Nigeria provided by the National Population Commission (NPC). Sample was selected using a stratified two-stage cluster design consisting of 888 clusters, 286 in the urban and 602 in the rural areas. Also, an average of 41 households was selected in each cluster, by equal probability systematic sampling. All women aged 15-49 years who were either permanent residents of the households in the 2008 NDHS sample or visitors present in the households on the night before the survey were eligible to be interviewed. However, the current analysis focused on women who had live birth at any time in the previous five years before the survey.

Variables and Variable definitions: The outcome variable was childhood survival status denoted by Y. It has only two possible outcomes: death or alive at the end of age of 5 years. The event Y= 1 denotes death, 0 if otherwise. The independent variables, (X_1, X_2, ... , X_P), consisted socio-economic, demographic and environmental factors.

Frequency tables were used to present relevant variables. Descriptive statistics were used to summarize quantitative variables, while categorical variables were summarized with proportions and percentages. Pearson's Chi-square test of association was used to investigate association between childhood survival status and the independent variables. Survival of children was analyzed using Cox Regression Model. Hazard ratios and 95% confidence intervals were presented. The Cox regression was conducted using the Forward Likelihood Ratio method and the model was terminated after 10 iterations given a final model with 10 variables included.

$$h(t\,|\boldsymbol{x},\boldsymbol{x},\ldots,\boldsymbol{x})) = h_0\,(t)\exp\left(\beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_p x_p\right)$$

$$h(t,\boldsymbol{X}) = h_0\,(t)\,exp^{\sum_{i=1}^{p}\beta_i X_i}$$

$$Where\ \boldsymbol{X} = (X_1, X_2, \ldots . X_p)$$

All analyses were conducted at the 5% level of significance using SPSS 15.0

RESULTS

Of the 28647 children, 14604 (51.0%) were males and 14043 (49.0%) were females. A total of 3201(11.2%) of the 28647 children had died prior to their fifth birthday. Majority of the children were from households in urban areas (73.4%). About 12% of children born in the rural environment did not survive until their fifth birthday compared with 8.3% from the urban area. A larger proportion of children were from the North West region (27.7%) compared with 8.6% from the South east. (Table 1). The mean age of mothers was 29 years with standard deviation 7.078. About 50% of the mothers were between the ages of 25 and 34 years, 50% had no formal education and about 27% had secondary education and above. Under-five mortality increased as the women advanced in age; 12.5% among mothers that were 35 years and above, 11.9% between 20-24 years and 10.1% for 25-34. (Table 1). About half (56.8%) of the mothers were Muslims.

The distribution of households according to household conditions showed that 60% of 28647 respondents had household size greater than 5, and 12.8% of children born into such homes died before their fifth birthday ($\chi 2 = 49.274$; $p<0.05$) (Table 2). Furthermore, 51.2% and 45.2% had good floor and wall condition respectively. Of the 3159 children who died before their fifth birthday; 1342 (9.3%) were born to mothers who reported they have good wall condition against 1817 (13.2%) who reported a poor flooring condition. ($\chi 2 = 108.273$; $p<0.05$) About 67% had access to basic toilet facilities and 11099 had access (39.1%) to electricity. Under-five mortality proportion was lower 1310 (9.8%) among those who reported controlled source of drinking water compared with 1889 (12.4%) who reported uncontrolled source. (Table 2). About half (50.5%) of the households were in the lowest wealth category A total of 502(3.5%) children who died before their fifth birthday were from poor homes compared with 678(21.1%) from middle income homes and 2021(23.6%) from rich homes. (Table 2).

Table 1:
Distribution of General Characteristics of Mothers by Child Mortality

Variables		CHILD IS ALIVE		TOTAL	χ^2	P
		Yes (%)	No (%)	N (%)		
Age Category	<20 years	1396 (88.1)	188 (11.9)	1584 (5.5)		
	20-24 years	4991(88.1)	674(11.9)	5665(19.8)		
	25-34 years	12684(89.9)	1427(10.1)	14111(49.3)	32.984	p<0.05
	≥ 35 years	6375 (87.5)	912 (12.5)	7287(25.4)		
	Total	**25446(88.8)**	**3201 (11.2)**	**28647(100.0)**		
	Mean(SD)	29.28 (7.078)				
Education	Secondary& above	7064(92.0)	618(8.0)	7677(26.8)	124.628	p<0.05
	Primary	5831 (89.0)	721(11.0)	6552(22.9)		
	None	12551(87.1)	1867(12.9)	14418(50.3)		
	Total	**25446 (88.8)**	**3201(11.2)**	**28647(100.0)**		
Residential Area	Urban	6980 (91.7)	633 (8.3)	21034(73.4)	85.401	p<0.05
	Rural	18466(87.8)	2568 (12.2)	7613(26.6)		
	Total	**25446(88.8)**	**3201 (11.2)**	**28548(100.0)**		
Religion	Christianity	8993 (76.6)	2745 (23.4)	11738(41.3)	3018.968	p<0.05
	Islam	15763(97.6)	389 (2.4)	16152(56.8)		
	Traditional	503 (92.0)	44 (8.0)	547(1.9)		
	Total	**25259(88.8)**	**3178 (11.2)**	**28437(100.0)**		
Working Status	Not working	8322 (92.1)	713 (7.9)	9035 (31.5)	143.292	p<0.05
	Working	17123 (87.3)	2488 (12.7)	19611 (68.5)		
	Total	**25445 (88.8)**	**3201(11.2)**	**28646 (100.0)**		
Region	North Central	4511 (90.0)	501(10.0)	5012 (17.5)	125.379	p<0.05
	North East	5714 (87.5)	817(12.5)	6531 (22.8)		
	North West	6888 (86.8)	1047 (13.2)	7935 (27.7)		
	South East	2145 (88.7)	272 (11.3)	2417 (8.4)		
	South West	2924 (90.1)	323 (9.9)	3247 (11.7)		
	South South	3078 (93.4)	218(9.9)	3296 (11.8)		
	Total	**25446(88.8)**	**3201 (11.2)**	**28647 (100.0)**		
Working where	Home	8793 (92.9)	675 (7.1)	9468 (48.6)	25.540	P<0.05
	Away	8191 (81.9)	1810 (18.1)	10001 (51.4)		
	Total	**16984 (87.2)**	**2485 (12.8)**	**19469 (100.0)**		

Table 2:
Distribution of Household Conditions and Child Mortality

Variables		CHILD IS ALIVE		TOTAL	χ^2	P
		Yes (%)	No (%)	N (%)		
Household Size	≤5	10082 (87.2)	1475 (12.8)	11557 (40.3)		
	>5	15364 (89.9)	1726 (10.1)	17090 (59.7)	49.274	p<0.05
	Total	**25446(88.8)**	**3201 (11.2)**	**28647 (100.0)**		
Condition of Floor	Good	13141 (90.7)	1342 (9.3)	14483 (51.2)		
	Poor	11985(86.8)	1817 (13.2)	13802 (48.8)	108.273	p<0.05
	Total	**25126 (88.8)**	**3159 (11.2)**	**28285 (100.0)**		
Condition of wall	Good	11573(91.1)	1124 (8.9)	12697 (45.2)		
	Poor	13360 (86.9)	2019 (13.1)	15379 (54.8)	127.903	p<0.05
	Total	**24933 (88.8)**	**3143 (11.2)**	**28076 (100.0)**		
Availability of Toilet facility	Basic types	16768 (88.6)	2151 (11.4)	18919 (66.5)		
	None	8492 (89.2)	1027 (10.8)	9519 (33.5)	2.150	p>0.05
	Total	**25260(88.8)**	**3178 (11.2)**	**28438 (100.0)**		
Availability of Electricity	Yes	10094(90.9)	1005 (9.1)	11099 (39.1)		
	No	15099 (87.4)	2167 (12.6)	17266 (60.9)	83.127	p<0.05
	Total	**25193 (88.8)**	**3172 (11.2)**	**28365 (100.0)**		
Source of Drinking Water	Controlled	12076 (90.2)	1310 (9.8)	13386 (49.7)		
	Uncontrolled	13361(87.6)	1889 (12.4)	15250 (53.3)	48.583	p<0.05
	Total	**25437 (88.8)**	**3199 (11.2)**	**28636 (100.0)**		
Category of Cooking Fuel Material	Non-Biomass Fuel	22855 (93.2)	1663 (6.8)	24518 (86.4)		
	Biomass Fuel	2359 (61.2))	1497 (38.8)	3856 (13.6)	3456.166	p<0.05
	Total	**25214 (88.9)**	**3160 (11.1)**	**28374 (100.0)**		
Wealth Index	Poor	13973(96.5)	502 (3.5)	14475 (50.5)		
	Middle	4931 (87.9)	678 (21.1)	5609 (19.6)	2203.176	
	Rich	6542 (76.4)	2021 (23.6)	8563 (29.9)		p<0.05
	Total	**25466 (88.8)**	**3201 (11.2)**	**28647 (100.0)**		

Table 3:
Distribution of Child Mortality by Size of Baby at Birth, Child Spacing and Health Care Factors

Variables		CHILD IS ALIVE		TOTAL	χ^2	P
		Yes (%)	No (%)	N (%)		
Place of Delivery	Hospitals	8724 (90.3)	2268 (11.9)	9657 (33.7)		
	Others	16722 (88.1)	933 (9.7)	18990 (66.3)	33.580	p<0.05
	Total	**25446 (88.8)**	**3201 (11.2)**	**28647 (100.0)**		
Size of Baby at Birth	Less than Average	3643 (85.9)	596 (14.1)	4239 (15.1)		
	Average	9602 (85.9)	1130 (10.5)	10732 (38.4)		
	Above Average	11759 (90.4)	1253 (9.6)	13012 (38.4)	66.223	p<0.05
	Total	**25004 (89.4)**	**2979 (10.6)**	**27983 (100.0)**		
Preceding Birth Interval	≥ 2 years	16220 (90.7)	1660 (9.3)	17880 (76.9)		
	< 2 years	4427 (82.4)	948 (17.6)	5375 (23.1)	289.596	p<0.05
	Total	**20647 (88.8)**	**2608 (11.2)**	**23255 (100.0)**		
Number of Antenatal Visit	None	6711 (95.7)	302 (4.3)	7013(42.1)		
	1-3	1825 (93.0)	138 (7.0)	1963 (6.9)	451.309	p<0.05
	More than 4	16026 (86.8)	2427(13.3)	18453 (67.3)		
	Total	**24562 (89.5)**	**2867 (10.5)**	**27429 (100.0)**		
	Median	3				
	Range	50				
Postnatal Visit within 2months	Yes	1243(84.7)	224 (15.3)	1467 (12.4)		
	No	9810(94.5)	572 (5.5)	10382 (87.6)		
	Total	**11053 (93.3)**	**796 (6.7)**	**11849 (100.0)**	195.377	P<0.05

The largest proportion of the 28647 children whose records were present in the survey were given birth to in facilities other than the hospital (66.3%) compared with 33.7% whose delivery took place in the hospital. About 85% of the children were above average size at birth and about 77% were born at least 2 years after the previous birth. Out of the aforementioned, 9.3% did not survive to their fifth birthday compared with 17.6% from children born with less than 2 years preceding birth interval (Table 3). About 42.1% of 23255 mothers did not go for antenatal care clinic. The median for number of antenatal visits was 3 (Range = 50), 6.9% visited less than four times, 67.3 % went more than four times. Mothers who attended antenatal care more than four times during their pregnancy periods reported more children surviving till their fifth birthday that women who attended less than 4 times or not all.. ($\chi 2$ =451.309; $p<0.05$). However, only 12.4% visited the clinic for postnatal attention within the first two months of birth. ($\chi 2$ =195.377; $p<0.05$) (Table 3)

Results from Survival Analysis: The hazard ratio for under-five mortality by region of residence showed that mortality was about two times higher for children of mothers residing in the South South (HR=2.031; 95% C.I= 1.272 – 3.243 , $p<0.05$) and 10 times higher for children residing in the North Western region (HR = 10.053; 95% C.I= 6.665– 15.162, $p<0.05$) compared with children from mothers in the North Central region (Table 5). The risk experiencing mortality before the fifth birthday was higher for children whose mothers are Muslims (HR = 2.343; 95% C.I= 1.407 – 3.903, $p<0.001$) and lower for children whose mothers are traditional worshipers (HR = 0.053; 95% C.I= 0.030 – 0.095, $p<0.001$) compared with children whose mothers are Christians (Table 4). Children from the mothers belonging to "Rich" wealth index category had lower odds of experiencing mortality (HR = 0.785; 95% C.I= 0.620 – 0.996, p=0.046) and those from the middle category of wealth indices had lower risk of mortality before their fifth birthday (HR = 0.435; 95% C.I= 0.337 – 0.563, $p<0.001$) compared with children from relatively poor mothers.

Furthermore, the odds of surviving was higher for children with mothers from homes with basic toilet facilities and household size less than five than from mothers from homes without any toilet facility(HR = 0.776; 95% C.I= 0.628 – 0.958, p=0.019) and household size greater than 5 respectively (HR = 0.810; 95% C.I= 0.678 – 0.969, p=0.021). The risk of mortality was about two times higher for children whose mothers use biomass cooking materials than children of mothers who use non-biomass cooking materials.(HR = 0.448; 95% C.I= 0.354 – 0.567, $p<0.001$). Children whose mothers attended postnatal clinic within the first 2 months of birth had better chances of not experiencing mortality before their fifth birthday (HR = 0.755; 95% C.I= 0.620 – 0.920, p=0.005) compared with children whose mothers did not go for the postnatal visits (Table 4).

TABLE 4:
COX Proportional Hazard Regression of Under-Five Mortality

Variable		B	Hazard Ratio	95% Confidence Interval	
				Lower	**Upper**
Region of Residence	North East	1.066	2.903*	1.879	4.484
	North West	2.308	10.053*	6.665	15.162
	South East	1.512	4.536*	3.030	6.790
	South West	0.947	2.579*	1.568	4.242
	South South	0.708	2.031**	1.272	3.243
	North Central		1		
Religion	Islam	0.852	2.343*	1.407	3.903
	Traditional Christianity	-2.937	0.053*	0.030	0.095
			1		
Wealth Index	Middle	-0.831	0.435*	0.337	0.563
	Rich	-0.242	0.785***	0.620	0.996
	Poor		1		
Household Size	≤ 5	-0.210	0.810***		
	> 5		1	0.678	0.969
Availability of Toilet Facility	Basic Types	-0.254	0.776***	0.628	0.958
	None		1		
Condition of Floor	Good	-0.468	1.596*	1.297	1.963
	Poor		1		
Cooking Fuel Material	Non Biomass	-0.803	0.448*	0.354	0.567
	Biomass				
Size of Baby at Birth	Small	0.539	1.284*	0.464	0.734
	Large	0.322	0.725**	0.575	0.914
	Average		1		
Preceding Birth Interval	<2	-0.454	0.635*	0.530	0.761
	≥2		1		
Postnatal Visit within 2 months	**Yes**	-0.281	0.755**	0.620	0.920
	No		1		

DISCUSSION

Nigeria, like many developing countries, is currently undergoing rapid demographic, economic and population health transitions. However, there are still disparities within the different regions within the country in the growths and improvement of infrastructures and probably policies that affect public health in general. Our findings showed that survival of children to their fifth year in South west Nigeria was better than those residing in the North central. This difference between the north and south may be associated with spatial inequality and variations; in social development in the community , population density, regional development, political, as well as economic resources across Nigeria. (Kayode et al, 2012, Adebayo et al, 2002). Adedini et al in their study also reported that the Yoruba tribe are the most educated in the country which could improve their knowledge on the risk of high-fertility. Furthermore, a smaller proportion of the Yoruba children were from household with high-parity and the culture of seeking medical attention was more ingrained in the tribe while the northerners were not as educated and practice early motherhood with high fertility rate (Adedini et al, 2015).

This study also revealed that children from poor mothers had higher U5MR and good toilet facilities at home can reduce mortality among Under 5. Previous studies have shown that , ownership of flush toilets is a reliable indicator of wealth and social status. and children from parents who do not have access to flush toilet facility are more likely to die before celebrating their fifth birthday. (Maluleke and Worku 2009, Worku (2011) Size of child at birth had been shown to be associated with high U5MR. Our findings also support this fact as more than one in every ten preterm babies in Nigeria do not survive to their first birthday. (Uthman, 2008) A possible explanation for this can be that preterm births due to the immaturity of their organs, have more difficulty adapting to extra-uterine life. Most premature babies are prone to have sepsis which is one of the major causes of Under 5 Mortality. (Kayode et al, 2012).

Under five mortality has also been linked to large household size. Possible reasons for this might be competition for food, basic infrastructures and other resources which are essential for child survival. This phenomenon can be explained based on the fact that as family size increases, intra-familiar competition for foods and other essential services require for child survival also increases. Parental attention might also decrease with increase in household size. Amankwaa (1996),

Antenatal and postnatal care also affects child survival Studies have shown that these services reduced under-five mortality (Becher et al, 2004). It has also been reported that postnatal care helps prevent complications after childbirth. (NDHS Report 2008) It is common knowledge that children whose mothers are in the habit of seeking medical attention will allow their children to have the privilege of receiving proper and necessary immunization and treatment of preventable diseases which includes polio, DPT, Hepatis B, HPV, Rotavirus e.t.c.

Similarly, it was revealed that child mortality was higher in homes using biomass fuel materials such as charcoal, wood crop residue, dung, straw and lignite. This is in agreement with a previous study on exposure to indoor air pollution (IAP) from the combustion of solid fuels. This has been an important cause of mortality in developing countries. Ezzati M et al, (2002)

However, the association of good flooring conditions with high U5M is inconsistent with previous UNICEF (2001) report. This might be due to the fact that mothers with good flooring conditions are probably more educated and report childhood illness and mortality better than mothers who are not so educated and with poorer flooring conditions.

The reliability of mortality estimates depends on the sampling variability of the estimates and on non-sampling errors. Non sampling errors depend on the completeness with which child death are recalled and reported, and the accuracy of the date of birth information for living children, and the age at death information for deceased children provided by the mother.

Typically, the most serious source of non-sampling errors in a survey like this that collects retrospective information on births and death is the underreporting of births and deaths for children who were not living at the time of the survey. Several DHS studies show evidence of downward bias in reporting child death (Jacoby & Wang, 2003). For example, mothers may be reluctant to talk about their dead children either because it brings back sad memories or because their culture discourages mention of the dead. Even if a respondent is willing to talk about a dead child, she may forget events that happened in the more distant past, particularly if a child was alive only for a short time.

This study has shown that region of residence, bio demographic and environmental factors and other socio demographic factors are important determinant of Under-five Survival in Nigeria. Therefore, there is a need to focus on improving child survival particularly in the Northern region. In addition, educating mothers on the danger of several births to reduce household size, awareness on the danger of using biomass materials for cooking, improving housing conditions and the importance of postnatal visits for checkups should be encouraged. It will make a great difference and it would be of great benefit if proper considerations are given to improve child survival in Nigeria.

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