

Differentials and Correlates of Infants Mortality in Nigeria: A comparative analysis between North Eastern and South Western Nigeria

Abstract

Aims: Infant mortality rate (IMR) is not only a demographic measure, but also as an important health indicator of a society as well as a measure of its living standard worldwide. The Nigeria Demographic and Household Survey (NDHS) declared a wide difference in the IMR among geographical zones in Nigeria with widest gap between the North East (NE) and South West (SW). This study is aimed at assessing the differences in IMR vizaviz socio-demographic, sexual and reproductive factors and also to determine factors affecting the IMR in two zones.

Place of Study: Rural and Urban Nigeria

Study Design: We used a cross sectional data from the NDHS 2008 survey been a nationally representative. We focused the 23,995 and 11,546 births during five years preceding the data collection from women aged 15-49 years in NE and SW respectively.

Methods: We censored the children who have not had their first birthday as of the day of interview and analyzed the data using descriptive statistics, bivariate and multivariate cox regression models at 5% significance level.

Results: Almost 3 of every four children from either NE or SW are from urban areas while nearly 74% of children from NE are from uneducated mothers compared to 6.9% in the SW. The IMR among children from teenager mothers is 121 and 82 per 1000 live births in NE and SW respectively, 87 for urban NE, 52 for urban SW, 115 for rural NE, and 66 for rural SW. In the NE, children from rural areas are about 30% times more likely than children from urban areas before their first birthday while in the SW they were 40% times more likely to die.

Conclusion: Early marriage, illiteracy level, delayed initiation of breastfeeding, unemployment, low economic power among others have contributed to higher IMR in the two zones especially the NE.

Key word: Infant Mortality Rate, NDHS, Wealth index, early marriage, Nigeria,

Introduction

The infant mortality rate (IMR) is the number of infants among 1000 who die before their first birthday. Worldwide, infant and child mortality is used not only as a demographic measure, but also as an important health indicator of a society as well as a measure of its living standard. IMR and child mortality rate reflect a country's level of socioeconomic development and quality of life and are also used for monitoring and evaluating population and health programme and policies. Everyday about 29,000 under-five children die worldwide; the majority of these deaths occurs in developing world and is largely due to preventable causes (UNICEF, 2008). UNICEF has been able to identify those regions of the world as having inadequate or no progress towards reaching the Millennium Development Goal (MDGs) for a reduction by two-third in under-five mortality rate between 1990 and 2015. The NDHS (2008) has shown that about 75 infants in every 1000 live births in Nigeria died before their first birthday (i.e. 1 in 13 live births)[1]. The report further stated that under-five mortality rate is 157 per 1,000 live births for the five-year period immediately preceding the survey and also that the neonatal mortality rate is 40 per 1,000 births. Thus, almost half of childhood deaths occurred during infancy, with one-quarter of the deaths taking place during the first month of life.

Nigeria is Africa's most populous nation with an estimated population of 170 million by mid-2012 [2,3]. While the IMR for the entire world is 41 per 1000 live births, it is 5 for more developed countries, 67

for Africa, 72 for sub-Sahara Africa, 76 for West Africa and 77 for Nigeria. Although the rate in Nigeria is neck to neck with that of its neighboring countries, for instance Ghana is placed at 70, Cote D'ivoire at 73, Togo at 78, Benin 81, Mali 97 and Cameroun 62[3], the IMR in Nigeria remains undoubtedly high. Just as the fertility rate in Nigeria is above the worlds' average, the IMR too is above the world's average [4,5].

An in-depth analysis of IMR in the 6 geo-political zones of Nigeria according to the NDHS (2008) is as follows: North central (77), North east (109), Northwest (91), Southeast (95), South-south (84), Southwest (59) per 1000 live births, while the national IMR stands at 75/1000. The levels of infant mortality in all 3 Northern geo-political zones are higher than the national figure of 75 infant deaths per 1000 live birth [1]. This finding suggested differences in IMR across the zones, with the widest difference between the Northeast and Southwest Nigeria.

IMR and maternal mortality are not disconnected. Till date, Maternal and child health (MCH) outcomes in Nigeria are among the worst in the world [6,7]. Several studies have ascribed inadequate health facilities, lack of transportation to institutional care, inability to pay for services and resistance among some populations to modern health care as key factors behind the country's high rate of maternal, newborn and child morbidity and mortality[8,9].

Attention to clean and hygiene delivery practices and the provision of essential care for the newborn such as thermal protection and early and exclusive breast-feeding, are important interventions which can improve health outcomes of all infants whether born at home or in a health facility [6,7,10–13]. Exclusive breastfeeding may not be insufficient; an early initiation with exclusive breastfeeding will reduce infant deaths. A 2006 study in rural Ghana showed that early initiation within the first hours of birth could reduce 22% of neonatal deaths, and initiation within the first day would prevent 16% of deaths. [14]. Similar findings were documented in a 2008 study in Nepal [15].

A recent study carried out in North Eastern part of Nigeria associated most of the diseases among infants and children in the Northern part of the country with poverty[16]. Also, an earlier South Western Nigeria study reported that low educational status of the mother and poor environmental sanitation may put children at risk of childhood diseases[17].

Socio-demographic and economic factors play important roles in determining child survival all over the world[18] just as mothers' education has an implicit effect on the health of children [19]. Early marriage was also identified in several studies to have affected both the socioeconomic condition and infant mortality [20–22]. An India study in 2010 showed that children born to mothers who were married before attaining the age of 18 were at a higher risk of stunting and underweight compared to children of women who had married at age 18 or older [23]. Several other factors have been ascribed to IMR [24–28].

Some studies have reported regional disparities in health service delivery and resource availability. Although, Southern states in Nigeria enjoy more health services than the northern states [6], but of much concern is the fact that most of the public health interventions by government and non-governmental agencies are majorly directed to the northern region of the country with minimal results been achieved in terms of IMR [1]. Therefore, there is need to identify possible factors responsible for the present situation so as to improve the understanding of the precise determinants of mortality of infant in the Northeast as compared to Southwest Nigeria thus enabling policy makers and donor agencies to direct resources towards mitigating the risk factors. The study will bring about an understanding and improvement on the infant mortality indicators in Northern Nigeria and the country in general thus enabling Nigeria to achieve the Millennium Development Goal 4 (reduction in child mortality).

Despite huge research focus given infant and early childhood mortality in developing countries in recent past, there is paucity of information on comparison of IMR across zones in Nigeria and only

very few studies have some of the correlates of infant and child mortality. Most of these studies have focused on indirect estimation of infant and child mortality levels [6,19,29].

In this study, we estimated IMR and assessed pattern of infant mortality in the NE and SW geopolitical zones of Nigeria viz-a-viz socio-demographic, health and reproductive factors, identified and compared the Socio-demographic, health and reproductive factors influencing infant mortality in the zones.

Methodology

We used the Nigeria Demographic and Household Survey [1] data to carry out a retrospective analysis of the recoded children data collected from a cross-sectional survey. Our analysis was based on the recoded children data which consist of 23,995 births from NE Nigeria and 11,546 births from SW Nigeria. The women supplied information of all the children they had within five years preceding the survey, whether the child was dead or alive. The NE states consist of Taraba, Adamawa, Yobe, Bornu, Gombe and Bauchi while the Southwest states consist of Lagos, Ogun, Oyo, Ondo, Osun and Ekiti (Figure). Details of the survey methodology has been reported [1].

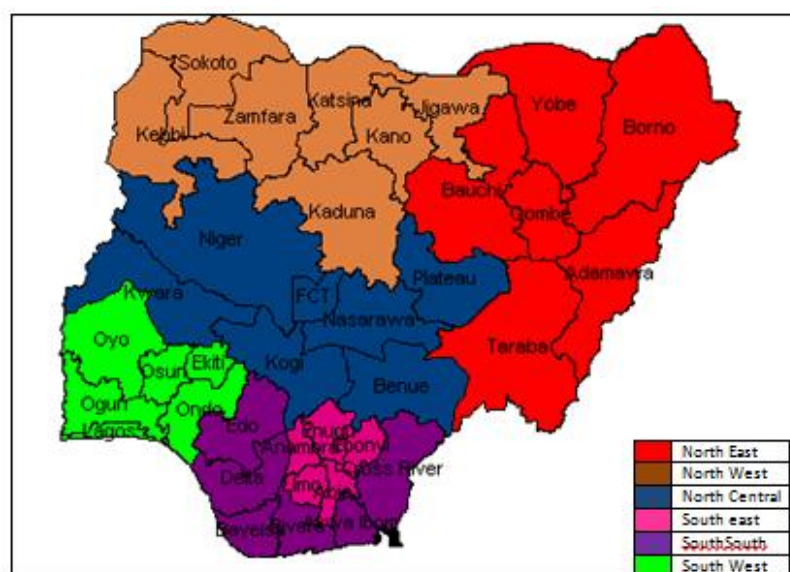


Figure 1: Map of Nigeria showing its 36 states, the federal capital territory and the geographical zones

Variables: The outcome measure is mortality in infants whose mothers (15-49yrs) are from NE and SW region of the country. The explanatory variables to be examined in this study include: Educational attainment of the mother, age of mothers, number of household members, wealth index, number of births within five years, type of place of residence and the source of drinking water, partners educational level and occupation, place of delivery, duration of breastfeeding, other intake apart from breast-milk, use of mosquito net, and post natal care, level of infant vaccination.

Statistical Analysis: Descriptive statistics and Chi square test were used to analyze the data with statistical significance set at p-value = 0.05. We used the date of birth of children, whether the child was alive or not just before the first birthday, age at death for those dead to compute the infant mortality rate with life table using the west model. We censored the children who have not had their first birthday as of the day of interview. We specified both the failure time (the age when the child died) and the censoring time (the age of the child as at the time of the survey).

Life tables describe death rates in a given population over time. It also allows the examination of the empirical hazard function through aggregation. Let T_i be the individual failure or censoring times. The data are aggregated into intervals given by t_j , $j = 1; \dots; J$, and $t_{j+1} = \infty$ with each interval

containing counts for $t_j < \tau < t_{j+1}$. Let d_j and m_j be the number of failures and censored observations during the interval and N_j the number alive at the start of the interval. Define $n_j = N_j - m_j/2$ the adjusted number at risk at the start of the interval.

The product-limit estimate of the survivor function as given by [30] is

$$\hat{S}(t) = \begin{cases} 1 & \text{if } t < t_1 \\ \prod_{t_i \leq t} [1 - \frac{d_i}{n_i}] & \text{if } t \geq t_1 \end{cases}$$

With asymptotic variance is

$$\hat{V}[\hat{S}(t)] = \hat{S}(t)^2 \sum_{t_i \leq t} \frac{d_i}{Y_i(Y_i - d_i)}$$

The Cox proportional hazards regression assumes the relationship for one covariate where $h_0(t)$ is the baseline hazard function, x_i are the covariates and β_i are the coefficients.

$$h(t; x) = h_0(t) \exp(x\beta)$$

We also stratified Cox regression estimates. In the stratified estimator, the hazard at time t for a subject in group i is assumed to be

$$h_i(t) = h_{i0}(t) \exp(\beta_1 x_{i1} + \dots + \beta_k x_{ik})$$

That is, the coefficients are assumed to be the same, regardless of group, but the baseline hazard can be group specific. In our stratified Cox analysis, we tested whether the proportional-hazards assumption was violated using the significance of the hazard ratios and the Wald chi square statistics.

Variables significant in the bivariate cox were used in the multiple cox regression to assess association with outcome variable while controlling for confounders. Variables significant in the binary cox regression were compared across the two regions. Sampling weights were applied in our analysis. The weighting was based on the sampling fractions derived from the sample size and the total population of each state constituting Nigeria. We used the STATA (version 12) statistical analysis software for the analysis.

Ethical Considerations: Ethical approval was already obtained for the survey as documented in [1].

Results

Within five years before the survey, 23,995 and 11,546 children were born to the respondents from NE and SW respectively. About 22.0% of mothers in SW are aged 35-39 year. Almost 3 of every four children from either NE are from rural areas while the rural-urban ratio in SW is about 1 to 1. Nearly 78.0% of NE mothers had no formal education compared to 21.0% in the SW. All the socio-demographic variables of mothers we examined were found to be statistically different across the two zones (Table 1).

Over 75.0% of mothers from NE had had over four children compared with 49.0% from SW. About one tenth of NE children were very small at birth compared with 3.0% in the SW. About 45.0% NE children usually drink well water compared to 25.0% in the SW, also 87.0% of NE children were delivered at the homes of respondents or that of their relatives compared with 24.0% in the SW. All the sexual, reproductive and healthy living variables of mothers we examined were found to be statistically different across the two zones (Table 2).

The overall IMR in the NE is 108 per 1000 live births compared to 59 in the SW (Table 3, Table 4 and Figure 2). Figure 2 shows the survival curves of children in their first ten years of birth in the NE and SW Nigeria. The probability of a child from NE and SW surviving 1st year is estimated as 0.890 vs 0.940.

The IMR among children from teenager mothers is 121 and 82 per 1000 live births from NE and SW respectively, 115 and 57 for children whose mother was aged 20-24 years in NE and SW respectively. While the Urban IMR in NE is 87 per 1000 live births, SW Urban areas had 52. The IMR among children from NE poorest homes is 117 compared to 67 from the SW. The hazard ratio of a child in rural locations dying before their first birthday is higher than those in urban settlements in both NE (1.3) and SW (1.6). In both zones, education status of parents was significant independent predictors of infant mortality. In the NE children from mothers with higher education were about 60% less likely to die before attaining one year and about 90% less likely in the SW. Children from richer and richest homes in the NE were about 50% and 70% times less likely to die before first birthday respectively than those from poorest homes, but this wasn't significant in the SW. Ages of mothers, religions, ethnicity in both zones were not significant independent predictors of infant deaths (Table 3).

The IMR among children whose mothers had sexual intercourse before age 13 is 115, compared to 107 among children of mothers who had it within 20 to 29 years of age in the NE. Also in the SW, the IMR of children from mothers with sexual debut at age lower than 13 years is 121 compared to 49 in the 20-29 years age bracket. The IMR among children born at respondents homes in the NE is 104 compared with 87 in public facilities and 97 in private facilities. In NE, children born in public hospitals were less likely to die before age one while in SW, only children born in private hospitals were less likely to have died before attaining age one year. Sources of drinking water was not a significant predictor of infant deaths in the NE but in the SW, children who were given water from wells and flowing rivers were more likely to die before age 1 than those drinking water from pipes, taps and boreholes (Table 4).

The most significant variables in the bivariate cox regression were not significant in the multivariate cox proportional hazard models fitted for the infant mortality. The rural-urban location, ethnicity, religion, mothers' and fathers' education, parents' marital status, wealth index and current employment status of mothers did not significantly influence infant mortality in the both zones. Children from mothers aged 13-19 years at first birth in the NE were less likely to die before first birthday than younger ones just as underweight (below average) children had higher hazard ratio of dying before age one than those with very large weights. Children given water from the well had higher chances of dying (HR=1.5) than those drinking cleaner water from taps, pipes and boreholes in the NE. SW children given water from the flowing streams had higher chances (HR=6.1) of dying than those drinking cleaner water from taps, pipes and boreholes. Children from mothers with over four children were about seven times more likely not to attain age one than those with one or two children.

Discussions

We found that the two zones significantly on the basis of the socio-demographical characteristics as well as reproductive and environmental indicators investigated. While rural-urban location, mothers' and fathers' education, parents' marital status, wealth index, child's weight at birth and place of child's delivery significantly influence infant mortality in the NE zone, rural-urban location, ethnicity, mothers' and fathers' education, parents' marital status, mothers age at first birth and first marriage, children ever born, source of drinking water and place of child's delivery are factors that significantly influence IMR in the SW zone. The estimated IMR of 108 and 59 for every 1000 live births in the NE and SW respectively is about the same with the reported 109 and 59 in NDHS (2008). Our IMR estimates across the variables in each zone are therefore reliable. The IMR in the NE zone is about twice and significantly higher than the IMR in the SW this means that infant death in NE would double infant deaths in SW before their first birthday.

The socio-demographic, sexual and reproductive factors as well as healthy living practices among mothers in the NE are significantly different from their counterparts in the SW. This is in agreement with those reported in previous studies [6,7]. The wide difference in the IMR between the two zones could be ascribed to the differentials in the mothers' characteristics. This is in consonance with

findings of previous researches which reported high percentage of early teenage marriages in Northern Nigeria and that most of these young mothers were illiterate housewives [31].

Children whose mothers and fathers had no education or had primary education were found to have higher chances of dying before their first birthday in the two zones studied and this chance is much higher in the NE. This is in consonance with reports in earlier researches that education has an implicit effect on the health of children, where health is interpreted in its broadest sense as complete physical, psychological, social, emotional, developmental and environmental well-being [32]. These educated women may also tend to live in more economically developed areas that are rich enough to have schools and access to good medical facilities[6,19,33]. This assertion is not unconnected with our findings that children in rural areas in both zones have higher likelihood of infant deaths compared with those from urban areas. Considering the wealth quintiles children belong, generally children from poor homes tend to have higher IMR than those from poorer homes, but interestingly, though the NE IMR was almost double that of SW, children from wealthiest homes in the NE had lower IMR than children from wealthiest homes in the SW. Wealth quintiles were not significant to IMR in SW.

Although, source of drinking water is not significant to IMR in the NE, the situation is however in the contrary in the SW where IMR is lower among children drinking water from well, stationary or flowing sources compared to those drinking water either from piped or borehole sources. Although not statistically significant children who had postnatal care were less likely in the two zones to live beyond their first birthday. This finding is in agreement with the argument by a previous research that both provisions of good prenatal and postnatal cares are essential for child's health even if the mother are teenagers[34]. We found that young maternal age of mothers affect children survival as IMR reduced considerably as maternal age increased in both NE and SW though IMR among NE children whose mothers had first birth at age 30 years or more were significantly higher than those who had it before age 13 years. This finding disagreed with a report that young maternal age was not an independent risk factor for adverse birth outcomes where they attributed increased risky child health to other factors that were related to teenage pregnancy such as: unmarried status, low socioeconomic status, inadequate prenatal care, low education level etc[35]. This could be attributed to the fact that most (> 75%) mothers in the NE had either married or had child before attaining age 19 years compared with less than half in the SW. This is closely related to the finding that IMR was higher among teenage mothers who constituted most of the mothers. However, earlier studies which examined the effect of age at first birth on child survival emphasized that adolescent women are less likely to provide adequate care for their infants and children, because they often lack the maturity, education and resources to do so [36,37].

We found that IMR was distinctly high among NE and SW children delivered at either mothers' or relatives' homes compared with those delivered at public and health care facilities. This was in agreement with findings that delivery at a health care facility was associated with subsequent reductions in neonatal, infant and under-five mortality, they submitted that places of delivery have clear beneficial effects on reducing infant and under-five mortality [6,7]. The strong cultural beliefs and practices on child birth and characteristics in Northern Nigeria could have influenced the high infant mortality rate compared to Southern Nigeria.

Conclusion

Beside the factors identified to have contributed significantly to infant mortality in this study, previous researches have suggested that efforts should be made to improve child survival through timely medical attention, childhood immunization, malaria and diarrheal prevention and treatment, and HIV/AIDS prevention. This they ascribed to the fact that fever, cough and dehydration from diarrhea are important contributing causes of childhood morbidity and mortality in less developed countries.

Measures should be directed at improving the socioeconomic circumstance of the entire population. These include employment, sound education as well as health education and promotion to reduce

IMR. Proper and timely effort should be made at improving the health indicators in Nigeria, especially in the NE so that MDG 4 (reduction in child mortality) can be achieved. These efforts should also be extended to strategies of attaining MDG 1 (poverty) and MDG 3 (gender inequality). Until the trend of health indicator of preventable diseases in Northern Nigeria is adequately controlled, IMR will continue to soar.

Limitations

The data is from a retrospective survey which is associated with memory recall problems such as the detailed information collected in the pregnancy history. In addition, the information we used include events that may be difficult and painful for the children to recount such as death of their children. In this part of the world, mothers don't always list all their dead children and this may lead to underreporting of such events.

Authors Contribution: AFF and OA conceived and designed the study and wrote the methodologies, AFF analysed the data and wrote the result, all authors contributed to the introduction and the discussion. All authors proofread and agreed on the final manuscript.

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364 Table 1: Socio demographic characteristics of respondents from North East and South West Nigeria

Variable		NE: N=23995 %	SW: N=11546 %	p-value
Age of Mothers	<i>Mean</i>	34.7±8.3	37.1±7.6	<0.001*
	<i>15-19 years</i>	2.2	0.7	
	<i>20-24 years</i>	8.7	4.9	
	<i>25-29 years</i>	17.0	15.1	
	<i>30-34 years</i>	17.7	18.9	
	<i>35-39 years</i>	20.1	22.0	
	<i>40-44 years</i>	16.9	18.7	
	<i>45-49 years</i>	17.4	19.8	
Locality	<i>Urban</i>	24.8	52.6	<0.001*
	<i>Rural</i>	75.2	47.4	
Ethnicity	<i>Yoruba</i>	0.3	75.8	<0.001*
	<i>Hausa/Fulani</i>	44.0	3.6	
	<i>Igbo/Ibibio</i>	0.2	7.9	
	<i>Others</i>	55.6	12.7	
Religion	<i>Catholic</i>	1.3	4.8	<0.001*
	<i>Other Christian</i>	14.6	55.9	
	<i>Islam</i>	82.0	37.7	
	<i>Traditionalist</i>	1.3	1.2	
	<i>Others</i>	0.8	0.4	
Highest level of	<i>No Education</i>	77.8	20.9	<0.001*
	<i>Primary</i>	14.8	31.6	
	<i>Secondary</i>	6.2	37.1	
	<i>Higher</i>	1.2	10.4	
Father's Highest	<i>No Education</i>	69.1	16.7	<0.001*

	<i>Primary</i>	13.5	28.3	
	<i>Secondary</i>	10.1	39.1	
	<i>Higher</i>	5.6	14.8	
	<i>Don't Know</i>	1.4	1.1	
Wealth Index	<i>Poorest</i>	48.8	5.0	<0.001*
	<i>Poorer</i>	24.7	13.2	
	<i>Middle</i>	15.5	16.0	
	<i>Richer</i>	8.5	23.4	
	<i>Richest</i>	2.5	42.4	
Marital Status	<i>Never Married</i>	0.3	0.9	<0.001*
	<i>Currently Married</i>	96.3	94.5	
	<i>Formerly Married</i>	3.4	4.6	
Currently Working	<i>No</i>	36.3	9.6	<0.001*
	<i>Yes</i>	63.7	90.4	
	Total	52.1	47.9	

365

366 Table 2: Sexual, Reproductive & Health characteristics of Mothers in North East & South West Nigeria

Variable	Categories	North East (%) N=23995	South West (%) N=11546	Significance
Age of Mothers at 1st Intercourse	<13 years	10.5	2.0	<0.001*
	13-19 years	83.3	67.2	
	20-29 years	6.2	30.4	
	30 years & Above	0.0	0.3	
Median: NE: 15 SW: 18				
Age of Mother at first birth	<13 years	3.4	0.9	<0.001*
	13-19 years	73.8	42.0	
	20-29 years	22.0	53.7	
	30 years & Above	0.8	3.4	
Median: NE: 17 SW: 20				
Age of Mother at 1 st marriage	Unmarried	0.3	0.9	<0.001*
	<15	47.9	10.0	
	15-19	41.8	41.6	
	20-23	7.1	29.3	
	Over 23 years	3.0	18.3	
Median: NE: 15 SW: 19				
Total Children Ever Born	1 or 2 Children	8.2	15.6	<0.001*
	3 or 4 Children	17.1	35.8	
	Over 4 Children	74.7	48.6	
Births in last 5 years	0	22.8	36.2	<0.001*
	1	29.3	33.1	
	2	39.0	26.0	
	3	8.3	4.1	
	4	0.6	0.6	
Size of Child at Birth	Very Large	15.5	16.8	<0.001*
	Above Average	22.4	35.7	
	Average	40.2	34.8	
	Below Average	9.7	8.0	
	Very Small	10.7	2.8	
Given milk other than breast in 1 st 3	No	78.6	97.8	<0.001*
	Yes	21.4	2.2	
When child was put to breast	Immediately	24.8	35.0	<0.001*
	Within 24 hours	24.4	41.7	
	2-3 days	20.4	7.8	
	After 3 days	30.4	15.5	
Completed Vaccination	No	98.4	87.3	<0.001*
	Yes	1.6	12.7	
Child sleeps under net	No	86.1	88.9	<0.001*
	Yes	13.9	11.1	
Drinking water source	Pipe/Tap/Borehole	24.8	41.8	<0.001*
	Well	45.3	24.9	
	Surface/flowing	26.8	24.7	
	Rain	0.1	2.2	
	Others	3.1	6.5	
Had postnatal care	No	87.2	72.7	<0.001*
	Yes	12.8	27.3	
Place of child's deliverv	Homes	86.5	23.7	<0.001*
	Public	11.8	39.1	
	Private	1.0	30.4	
	Others	0.7	6.8	
	Total	52.1	47.9	

367 CEB Children Ever Born, ^Number of Children, All frequencies were weighted

368

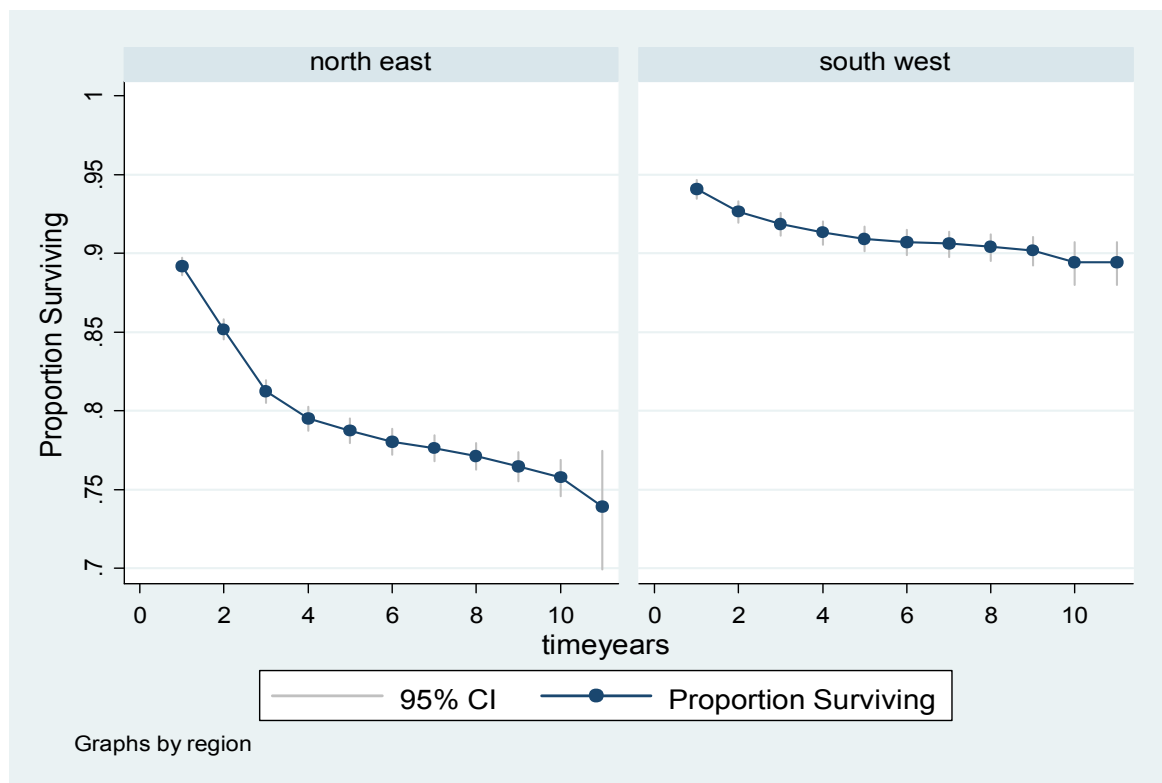


Figure 2: Survival curves of Children for the first ten years of birth in North East and South West Nigeria

373 Table 3: Estimated IMR across Socio demographic characteristics of mothers from North East and South West Nigeria

Variable	Estimated Infant Mortality Rates per 1000 live		Bivariate hazard ratios of the strata of the variables			
	N East	S West	HR(95%CI)	p-value	HR(95%CI)	p-value
			North East		South West	
Age of Mothers						
15-19 years	121	82	Ref	1.000	Ref	1.000
20-24 years	115	57	1.1(0.7-1.6)	0.716	0.6(0.2-1.9)	0.397
25-29 years	89	54	0.7(0.5-0.9)	0.050	0.5(0.2-1.4)	0.163
30-34 years	103	53	0.8(0.5-1.2)	0.246	0.4(0.1-1.2)	0.122
35-39 years	115	58	1.1(0.7-1.6)	0.802	0.6(0.2-1.7)	0.301
40-44 years	133	66	0.9(0.6-1.5)	0.723	0.3(0.1-1.2)	0.094
45-49 years	132	83	1.1(0.6-1.8)	0.809	0.3(0.1-1.8)	0.193
Locality						
Urban	87	52	Ref	1.000	Ref	1.000
Rural	115	66	1.3(1.1-1.6)	0.023	1.6(1.1-2.4)	0.016
Ethnicity						
Yoruba	32	57	Ref*	1.000	Ref*	1.000
Hausa/Fulani	98	63	1.5(0.2-10.7)	0.679	1.4(0.5-3.7)	0.549
Igbo/Ibibio	48	56	xxx		0.5(0.3-1.2)	0.129
Others	116	73	1.7(0.2-12.1)	0.591	1.6(0.9-2.5)	0.049
Religion						
Catholic	137	53	Ref*	1.000	Ref	1.000
Other Christian	101	54	1.4(0.6-3.5)	0.448	1.3(0.5-3.1)	0.558
Islam	108	68	1.2(0.5-3.0)	0.625	1.5(0.6-3.6)	0.386
Traditionalist	151	63	1.6(0.6-4.8)	0.361	1.0(0.1-8.7)	0.980
Others	250	xxx	2.1(0.6-6.9)	0.222	Xxx	
Highest Education						
No Education	114	73	Ref	1.000	Ref	1.000
Primary	104	66	0.9(0.8-1.2)	0.801	0.9(0.6-1.6)	0.803
Secondary	76	55	0.6(0.4-0.8)	0.008	0.6(0.4-1.1)	0.084
Higher	29	32	0.4(0.2-0.9)	0.045	0.1(0.0-0.5)	0.004
Father's Education						
No Education	115	67	Ref	1.000	Ref	1.000
Primary	109	69	0.9(0.8-1.2)	0.744	1.2(0.7-2.2)	0.521
Secondary	103	56	0.8(0.7-1.1)	0.272	0.8(0.4-1.4)	0.356
Higher	63	45	0.4(0.2-0.6)	0.000	0.4(0.2-0.9)	0.024
Wealth Index						
Poorest	117	67	Ref	1.000	Ref	1.000
Poorer	119	74	1.0(0.8-1.2)	0.958	1.9(0.7-5.2)	0.229
Middle	95	63	0.9(0.7-1.2)	0.564	2.3(0.9-6.4)	0.095
Richer	84	53	0.5(0.3-0.8)	0.001	1.5(0.5-4.0)	0.438
Richest	37	55	0.3(0.2-0.8)	0.013	0.9(0.3-2.4)	0.830
Marital Status						
Never Married	25	53	Ref	1.000	Ref*	1.000
Currently Married	109	59	2.5(0.6-10.5)	0.205	0.4(0.2-1.0)	0.055
Formerly Married	102	69	4.4(1.1-19.6)	0.049	0.5(0.1-2.3)	0.402
Currently Working						
No	98	53	Ref*	1.000	Ref*	1.000
Yes	116	60	1.1(0.9-1.3)	0.406	1.0(0.6-1.8)	0.892
Total	108	59				

374 Hr Hazard Ratio, xxx No convergence due to insufficient sample size

375

376 Table 4: Pattern of Infant Mortality vizaviz across Sexual and Reproductive characteristics of Mothers from North East
377 and South West Nigeria

Variables	Estimated Infant Mortality Rate per 1000 live births		Bivariate association between mortality and variables			
	N East	S West	HR(95%CI)	P-value	HR(95%CI)	p-value
			North East		South West	
Age of Mothers at 1st intercourse						
<13 years	115	121	Ref	1.000	Ref	1.000
13-19 years	107	57	0.9(0.7-1.2)	0.459	1.8(0.4-7.3)	0.437
20-29 years	107	49	1.0(0.7-1.5)	0.836	1.0(0.2-4.4)	0.981
30 years & Above	xxx	xxx	xxx		xxx	
Age of Mother at first Birth						
<13 years	102	217	Ref *	1.000	Ref	1.000
13-19 years	110	67	0.8(0.5-1.4)	0.457	0.4(0.1-1.7)	0.219
20-29 years	103	52	0.9(0.5-1.4)	0.551	0.2(0.1-1.1)	0.066
30 years & Above	133	61	1.2(0.5-2.9)	0.611	0.2(0.0-0.9)	0.049
Age of Mother at 1 st marriage						
Unmarried	25	53	Ref	1.000	Ref	1.000
<15	120	84	2.8(0.7-11.8)	0.153	0.5(0.2-1.6)	0.231
15-19	100	64	2.2(0.5-9.01)	0.293	0.6(0.2-1.6)	0.293
20-23	103	55	3.1(0.7-13.3)	0.122	0.3(0.1-0.8)	0.013
Over 23 years	89	48	3.2(0.7-14.0)	0.130	0.2(0.1-0.7)	0.008
Total Children Ever Born						
1 or 2 Children	87	34	Ref *	1.000	Ref	1.000
3 or 4 Children	83	45	0.1(0.7-1.3)	0.800	1.9(1.1-3.2)	0.023
Over 4 Children	102	94	1.2(1.0-1.5)	0.126	3.3(2.0-5.6)	0.000
Births in 5 years before survey						
0	160	72	Ref	1.000	Ref	1.000
1	91	39	0.6(0.1-2.6)	0.453	0.5(0.1-3.8)	0.496
2	93	56	0.8(0.2-3.5)	0.754	0.8(0.1-6.2)	0.859
3	182	152	1.7(0.4-7.6)	0.508	2.1(0.3-15.8)	0.479
4	179	206	1.7(0.3-8.1)	0.534	3.4(0.4-29.9)	0.269
Size of Child at Birth						
Very Large	90	30	Ref	1.000	Ref	1.000
Above Average	65	44	0.8(0.6-1.0)	0.087	1.4(0.7-2.7)	0.286
Average	83	61	0.8(0.6-1.1)	0.115	1.7(0.9-3.3)	0.088
Below Average	92	84	1.2(0.9-1.7)	0.243	0.9(0.3-2.4)	0.840
Very Small	118	104	1.0(0.7-1.5)	0.822	1.7(0.5-5.4)	0.363
Given milk other than breast in 1 st						
No	48	27	Ref *	1.000	Ref	1.000
Yes	53	0	1.1(0.8-1.5)	0.632	xxx	xxx
Period child was put to breast						
Immediately	89	52	Ref*	1.000	Ref	1.000
Within 24 hours	93	53	0.9(0.7-1.1)	0.315	0.8(0.5-1.2)	0.272
2-3 days	101	34	0.9(0.7-1.2)	0.497	0.9(0.4-2.1)	0.911
After 3 days	102	46	0.8(0.6-1.0)	0.064	0.5(0.2-1.2)	0.129
Child sleeps under net						
No	99	46	Ref *	1.000	Ref*	1.000
Yes	93	48	0.9(0.7-1.2)	0.424	1.4(0.7-2.7)	0.355
Drinking water source						
Pipe/Tap/Borehole	97	57	Ref	1.000	Ref	1.000
Well	107	41	1.0(0.8-1.3)	0.683	1.8(1.1-2.9)	0.021
Surface/flowing	124	81	1.1(0.8-1.4)	0.616	2.1(1.3-3.4)	0.002
Rain	120	63	xxx		0.8(0.2-3.2)	0.711
Others/Water tanker	75	57	1.1(0.7-1.7)	0.746	1.1(0.5-2.5)	0.760
Had postnatal care	No	65	Ref	1.000	Ref	1.000
Yes	42	7	0.9(0.6-1.5)	0.977	0.1(0.0-1.1)	0.057
Place of child's delivery						
DeliveryHomes	104	71	Ref	1.000	Ref	1.000
Public Hospitals	87	59	0.6(0.5-0.9)	0.009	1.1(0.7-1.8)	0.634
Private hospital	97	47	0.5(0.1-1.5)	0.200	0.5(0.3-0.9)	0.033
Others	191	80	3.1(1.8-5.3)	0.000	1.4(0.7-2.9)	0.345

378 HR Hazard Ratio, xxx No convergence due to insufficient sample size

379

380 Table 5: Factors affecting Infant Mortality in North East and South West Nigeria

Variable	Categories	North East		South West	
		AOR(95% CI)	p-value	AOR(95% CI)	p-value
Location	Urban	Ref	1.000	Ref	1.000
	Rural	1.0(0.6-1.7)	0.882	1.4(0.3-7.6)	0.689
Highest level of Education	No Education	Ref	1.000	Ref	1.000
	Primary	0.9(0.5-1.4)	0.531	0.8(0.1-5.2)	0.859
	Secondary	0.9(0.4-2.1)	0.859	0.9(0.1-6.6)	0.943
	Higher	2.7(0.3-24.9)	0.386	xxx	
Father's Highest Education	No Education	Ref	1.000	Ref	1.000
	Primary	1.2(0.7-1.9)	0.524	1.7(0.2-13.5)	0.602
	Secondary	1.3(0.7-2.3)	0.374	1.8(0.2-15.5)	0.607
	Higher	0.3(0.1-1.1)	0.064	1.9(0-100.1)	0.740
Wealth Index	Poorest	Ref	1.000	Ref	1.000
	Poorer	0.7(0.5-1.1)	0.151	0.3(0.0-5.5)	0.427
	Middle	0.8(0.5-1.4)	0.475	4.6(0.3-81.3)	0.294
	Richer	0.4(0.1-1.1)	0.078	1.4(0.1-23.6)	0.833
	Richest	0.7(0.1-6.1)	0.765	1.9(0.1-36.7)	0.670
Marital Status	Never Married	Ref	1.000	Ref	1.000
	Currently Married	1.5(0.6-3.4)	0.378	xxx	
	Formerly Married	1.5(0.6-3.4)	0.378	xxx	
Currently Working	No	Ref	1.000	Ref	1.000
	Yes	1.2(0.5-1.0)	0.434	0.1(0.0-0.3)	0.000
Age of Mother at first Birth	<13 years	Ref	1.000	Ref	1.000
	13-19 years	0.7(0.5-0.9)	0.046	xxx	
	20-29 years	0.8(0.4-1.5)	0.497	xxx	
	30 years & Above	1.3(0.6-2.8)	0.532	xxx	
Total Children Ever Born	1 or 2 Children	Ref	1.000	Ref	1.000
	3 or 4 Children	0.7(0.4-1.1)	0.109	2.3(0.5-11.3)	0.299
	Over 4 Children	0.9(0.6-1.4)	0.704	6.8(1.6-29.6)	0.011
Size of Child at Birth	Very Large	Ref	1.000	Ref	1.000
	Above Average	0.9(0.5-1.6)	0.774	1.6(0.2-14.2)	0.663
	Average	1.0(0.6-1.7)	0.934	4.7(0.4-60.2)	0.239
	Below Average	1.7(0.9-3.2)	0.090	5.9(0.4-78.9)	0.179
	Very Small	0.9(0.4-1.7)	0.667	2.1(0.1-36.3)	0.609
Drinking water source	Pipe/Tap/Borehole	Ref	1.000	Ref	1.000
	Well	1.5(1.4-1.8)	0.003	3.6(0.4-34.1)	0.264
	Surface/flowing	0.6(0.4-1.0)	0.078	6.1(1.1-42.2)	0.046
	Rain	xxx	.	xxx	
	Others/Water	0.8(0.3-2.5)	0.725	2(0.1-27.6)	0.606
Had postnatal care	No	Ref	1.000	Ref	1.000
	Yes	1(0.6-1.7)	0.942	0.2(0-1.5)	0.109

381 Hr Hazard Ratio, xxx No convergence due to insufficient sample size

382