Risky Fertility Behavior, Breastfeeding Practices and Neonatal Mortality Risk: Evidence from Repeated Cross-Sectional Nationally Representative Data

Matthew A. Alabi, Grace E. Ihimekpen, and Taofeek A. Hassan

ABSTRACT

Background: Notwithstanding government efforts in improving maternal and child health, childhood mortality still remains a serious burden in the country, with neonatal mortality rate of 39 deaths and under-five mortality rate of 132 per 1,000 live births. This has implication on Sustainable Development Goals (SDGs) targeted towards reducing under-five mortality rate to 25 deaths per 1,000 live births by the year 2030. This study examined risky fertility behavior, breastfeeding practices, and neonatal mortality risk in Nigeria.

Materials and methods: This study involved the analysis of secondary data, Nigeria Demographic and Health Survey (pooled dataset of the three most recent surveys, NDHS, 2008, 2013 and 2018). The sample size was a weighted sample of 94,062 women aged 15-49 years with 172, 252 live births for the ten years period. Descriptive statistics and cox-proportional hazard model were performed using Stata 14.1 software.

Results: Nearly two thirds (64.0%) of births were high risk. The practice of breastfeeding among the women was quite poor, just (39.5%) initiated breastfeeding within one hour of childbirth, though (74.0%) reported breastfeeding their child for a minimum of 12 months. The independent effect of risky fertility behavior (RFB) was associated with elevated hazards of neonatal mortality, with the highest risk observed among births belonging to the multiple high-risk group (HR=2.1, $p<0.01$). Adjusting for breastfeeding practices, maternal/child characteristics and maternal health seeking behavior was associated with elevated hazard of neonatal mortality with the highest hazard observed among births belonging to the multiple high-risk group (HR=1.76, $p<0.05$). Other factors associated with elevated hazard for neonatal mortality are sex of the child, maternal level of education and breastfeeding duration.

Conclusion: RFB was associated with elevated hazard for neonatal mortality, even after adjusting for breastfeeding practices, maternal and child characteristics and maternal health-seeking behavior thereby lending credence to Mosley and Chen theory.

Keywords: high risk, fertility behaviour, breastfeeding practices, neonatal mortality.

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I. INTRODUCTION

Significant improvement has been made with regards to reduction in childhood mortality across the world and this has led to increased likelihood of millions of children under age five surviving. In addition, fast-tracking progress in the survival of children is urgently calling for more attention aimed at putting end to preventable deaths in southern and sub-Saharan Africa. In addition, recent statistics revealed at least one in every twelve children in sub-Sahara Africa will not live to celebrate his/her fifth birthday, when compared to an average of 1 death per 147 live births observed in developed countries of the world, making sub-Sahara Africa

the region with the highest burden bearer of under-five mortality globally [1].

Although, few African countries like Ethiopia and Egypt appears to be making appreciable progress with regards to childhood mortality reduction, the same cannot be said about Nigeria. For instance, Egypt and Ethiopia have achieved 26.7% and 18.6% reduction in infant mortality between the period 2009-2014 and 2011-2016 respectively based on statistics from the most recent Demographic and Health Surveys in these countries [2], [3]. On the contrary, under-5 mortality in Nigeria increased from 128 to 132, while neonatal mortality increased from 37 to 39 deaths per 1,000 live births between 2013 and 2018. The above statistics suggest childhood mortality in Nigeria still

remains a burden despite various interventions (including programmes designed to increase proportion of births attended to by skilled health personnel, promotion of increased immunizations against vaccine-preventable diseases amongst others) put in place by the government [4].

Currently in Nigeria, Total Fertility Rate (TFR) is 5.3 and two thirds of births are classified as high-risk [4]. With the high childhood mortality still ravaging the country, more research attention is no doubt needed into causes of death during the childhood period, especially if the country is going to make any meaningful progress in the just adopted Sustainable Development Goals (SDGs) which is targeted towards reducing under-five mortality rate to 25 deaths per 1,000 live births by the year 2030.

Besides, several social, cultural and religious factors shapes fertility behaviour in Nigeria and these factors continues to drive the high fertility level in the country. Nigeria is a heterogeneous country with about 374 different ethnic groups, although the Hausa/Fulani, Yoruba and the Igbo ethnic group are regarded as the major ethnic group [4]. More so, most of these ethnic groups emphasize the benefits of children and therefore support large number of children resulting in high fertility. Yet, it has been shown that countries with high fertility find it difficult to sustain programmes and policies needed for achieving sustainable growth and development.

The relationship between fertility and mortality has been well established in literature. A study in Uganda on the effects of high-risk fertility behaviour on the survivorship status of the child using the country's Demographic and Health Survey (DHS) data revealed mother's age at birth, birth intervals and parity were significant predictors of child survival [5]. Another study in Malawi on infant and child mortality revealed length of preceding birth interval was a significant predictor of infant and child mortality [6]. Studies have also shown differentials in breastfeeding practices and demonstrate significant association between breastfeeding practices and childhood mortality [7]-[10]. These studies found significant association between early initiation of breastfeeding and risk of infection-related mortality during childhood. Adapting the maternal factors of Mosley and Chen framework of childhood mortality, this study investigates risky fertility behavior, breastfeeding practices and neonatal mortality risk in Nigeria using evidence from repeated cross-sectional surveys. Most high-risk fertility studies [11-16] especially in Nigeria, have been measured using birth interval, age at first birth and birth order independently, thereby leaving a gap in studies relating composite risky fertility behaviour (combination of birth interval, age at first birth and birth order) with childhood mortality which necessitated this study.

A. Theoretical Framework

1. Mosley and Chen (1984)

The theoretical foundation for this study is the 1984 childhood mortality framework developed by Mosley and Chen [17]. This framework is very relevant to this study and has enjoyed wide applications in the study of childhood mortality in developing countries including Nigeria [18],

[19]. According to this framework, some sets of proximate factors were found to have a direct effect on childhood morbidity and mortality. This study however, adapts the maternal factors (one of the proximate determinants of childhood mortality) identified by the framework. These maternal factors are: age at first birth, parity and birth interval. Therefore, risky fertility behaviour (comprising of the Mosely and Chen maternal factors) was used to generate the principal explanatory variable.

II. MATERIALS AND METHODS

A. Study Design and Population

The study analyzed a nationally representative data – pooled data of the three most recent Nigeria Demographic and Health Surveys (NDHS, 2008, 2013 and 2018). The survey used a cross-sectional research design. The population of the study comprises of women in the child bearing years that had at least one live birth five years period preceding the survey. Since DHS uses standardized methodologies and procedures across the different surveys, important questions relating to variables used in this study were framed in this manner.

B. Sampling Technique

A nationally representative sample was used for all the DHS surveys, covering the whole population residing in non-institutional residence in the country. The sample frame used for the survey was the list of Enumeration Areas (EAs) originally prepared the National Population Commission for the 2006 Population Census of Nigeria. The sample designed made provision for population and health indicators to be estimated at the national, regional and state levels. In addition, there was provision for computing indicators specific for the six regions of the country, 36 states and the Federal Capital Territory, Abuja. The sample was selected using a stratified three-stage cluster design in both rural and urban areas. Complete household listing was carried out including mapping exercise for each cluster, with the list of households serving as the sampling frame used for selecting the households. Households that were regular were all selected. Training was conducted for the NPC listing enumerators on the use of Global Positioning System (GPS) receivers for calculating coordinates of the sample clusters. The eligibility criteria for interview were all women of reproductive age 15-49 years who were either permanent residents of the households or visitors present in the households on the night before the survey.

C. Data collection and Sample Size

The survey used a model questionnaire designed by MEASURE DHS programme. The questionnaire elicits information from women in their reproductive years 15-49 years through a face-to-face interview. Technical and financial assistance for the survey was provided by ICF International through the USAID-funded MEASURE DHS program. Precisely, the kid recode dataset was analyzed. The sample size comprise of a weighted sample of 94,063 women aged 15-49 years (pooled from the three datasets

2008, 2013 and 2018) with 172, 252 live births for the ten years period.

D. Outcome Variable

The outcome variable is neonatal mortality, defined as death within the first 28 days of life. The variable b7 (age at death) in the Nigeria Demographic and Health Survey dataset was used. This was however recoded by keeping for only deaths occurring within the first 28 days of life, while deaths after 28 days were right-censored.

E. Explanatory Variables

The main explanatory variables are risky fertility behaviour and breastfeeding practices. Risky fertility behaviour was generated from the NDHS dataset as a single variable categorized into four, namely: no risk, unavoidable risk, single high-risk and multiple high-risk. According to DHS classification, the first category (no risk) comprises of women who are not at risk at all; the second category (unavoidable risk) is defined as women whose age at first birth is in the age range 18-34 years; the third category (single high-risk) is defined as women exposed to just one risk i.e. those whose age at first birth is either below 18 years, above 34 years, birth interval less than 24 months or birth order above 3; fourth category (multiple high-risk) is defined as women exposed to more than one risk i.e. combination of at least two single high risk. For instance, the combination of age at first birth below 18 years and birth interval less than 24 months etc. Breastfeeding practices was measured using time of initiating breastfeeding after birth (immediately, within an hour, 1-23 hours and after 24 hours) and breastfeeding duration (less than six months, 6-11 months, 12-23 months and 24 months and above). Other explanatory variables used are: maternal education, defined as (no education, primary, secondary and higher), household wealth index derived using principal component analysis and categorized as poor, middle and rich. Place of residence (rural and urban), child's sex (male and female), birth type (single and multiple births), antenatal attendance (measured as attended antenatal, coded as Yes i.e. 1, otherwise no, coded 0) and place of delivery (whether delivery occurs in a health facility or outside health facility).

F. Statistical Analysis

Both descriptive (frequency count and percentages) were performed. Inferential analyses performed include chi square test and cox proportional hazard model (survival analysis). Survival analysis was considered more appropriate since the analytical interest is to study the time until an event occurs. Chi square test was used to test for association between categorical variables. Only explanatory variables that were highly significantly associated with outcome variable ($p < 0.002$) were included into the multivariate model. Due to the complex nature of DHS design, the "svy" command was employed during analysis to adjust for clustering (enumeration areas) and sampling weight so as to ensure the data is nationally representative. Data analysis was performed using Stata 14.0 software.

G. Ethics Approval and Consent to Participate

Strict standards are usually maintained for protecting respondents of all DHS surveys. The survey was approved by Institutional Review Board (IRB) of ICF Macro International in the United States and the National Ethics Committee in the Federal Ministry of Health of Nigeria. National Population Commission obtained both oral and written consent from the survey participants.

III. RESULTS

A. Socio-demographic Characteristics

The socio-demographic characteristics of the women (Table 1) indicates greater percentage 28.1% were in the age group 25-29 years, followed by age group 30-34 years 22.1%, while age group 45-49 accounted for the least proportion 2.9%. Also, (47.4%) had no formal education, only (6.5%) had higher education. Majority (65.3%) reside in rural area, with higher proportion (35.1%) residing in the North-west and North-east (17.4%) region. 60.5% of the women were affiliated to Islam religion, 38.2% practice Christianity, while women from the poorest household accounted for higher proportion (45.8%).

TABLE I: SOCIO-DEMOGRAPHIC CHARACTERISTICS

Maternal characteristics	[N=94,062]	%
Age Group		
15-19 years	4535	4.8
20-24 years	18403	19.6
25-29 years	26414	28.1
30-34 years	20789	22.1
35-39 years	14568	15.5
40-44 years	6663	7.0
45-49 years	2688	2.9
Level of Education		
No formal education	44586	47.4
Primary	17700	18.8
Secondary	25614	27.2
Higher	6162	6.6
Wealth Index		
Poor	43117	45.8
Middle	18417	19.6
Rich	32528	34.6
Region of Residence		
North-Central	12781	13.6
North-East	16366	17.4
North-West	33066	35.1
South-East	8992	9.6
South-South	9570	10.2
South-West	13287	14.1
Place of Residence		
Urban	32649	34.7
Rural	61413	65.3
Child's characteristics		
Child's Sex		
Male	47,749	50.8
Female	46,313	49.2
Birth Type		
Single birth	90, 776	96.5
Multiple birth	3,286	3.5
Fertility behaviour		
Risky fertility behaviour		
No Risk	21,160	22.5
Unavoidable Risk	13,012	13.8
Single High-risk	35,988	38.3
Multiple High-risk	23,901	25.4
Birth Interval		
< 24 months	18,142	24.0
24-35 months	29,261	38.7
36+ months	28,281	37.3

B. Breastfeeding Practices and Maternal Health-seeking Behaviour

The breastfeeding practices of the women (Table II) revealed 73.9% breastfeed their child for at least 12 months, while higher proportion 38.1% also initiated breastfeeding between 1-23 hours after childbirth. Also, 37.4% of the women initiated breastfeeding immediately after birth. Likewise, higher percentage of the women (38.7%) had birth interval of 24-35 month, 67.4% attended antenatal during pregnancy, while most of the births (61.7%) were outside health facility. Substantial proportion 96.5% of the births were single birth, with sex of the child almost evenly distributed, male (50.8%) and female (49.1%). The trend in risky fertility behaviour suggest little or no decline, (64.5%) in 2008, (64.0%) in 2013 and (63.2%) in 2018. The prevalence of early breastfeeding initiation (immediately after childbirth) appears to be rising, from 36.9% in 2008 to 43.7% in 2018.

TABLE II: MATERNAL HEALTH-SEEKING BEHAVIOUR AND BREASTFEEDING PRACTICES

Maternal Health Seeking Behaviour	Freq	%
Antenatal Visit**		
Yes	38742	67.4
No	18728	32.6
Place of Delivery**		
Non-health facility	57669	61.7
Health facility	34646	37.1
Others	1131	1.2
Breastfeeding Practices		
Time of initiating breastfeeding**		
Immediately	33985	37.5
Within one hour	1827	2.0
1-23 hours	34604	38.1
After 24 hours	20322	22.4
Duration of breastfeeding**		
Less than six months	991	5.8
6-11 MONTHS	1534	8.9
12-23 months	12687	73.9
24+ months	1949	11.4

**Missing and non-response excluded in analysis.

C. Predictors of Neonatal Mortality

Multivariate analysis involves performing cox proportional hazard model. Five models were presented. The first model (unadjusted) examined the influence of risky fertility behaviour (RFB) on hazard of neonatal mortality. The result showed increasing high-risk fertility was associated with elevated hazard for neonatal mortality, single high-risk (HR=1.46, $p<0.001$) and multiple high risk (HR=2.08, $p<0.001$). Adjusting for breastfeeding practices (model two), results in elevated hazard for neonatal mortality, single high-risk (HR=1.59, $p<0.001$) and multiple high risk (HR=1.77, $p<0.001$). While time of initiating breastfeeding did not influence risk of neonatal death, breastfeeding duration was significantly associated with risk of neonatal mortality. Model three adjusted for maternal and child characteristics. The result also showed elevated hazard for neonatal mortality, single high-risk (HR=1.37, $p<0.001$) and multiple high risk (HR=1.88, $p<0.001$). However, increasing level of education was associated with reduced hazard of neonatal mortality, secondary (HR=0.78, $p<0.05$) and higher (HR=0.64, $p<0.05$) education. Elevated hazard was found among births from women residing in

rural area (HR=1.33, $p<0.05$) and belonging to multiple birth (HR=4.32, $p<0.05$), while reduced hazard of neonatal mortality was associated with the female sex (HR=0.81, $p<0.05$). Furthermore, adjusting for maternal health-seeking behaviour (model four), elevated hazard for neonatal mortality was found, single high-risk (HR=1.60, $p<0.001$) and multiple high risk (HR=2.16, $p<0.001$). Risk of neonatal mortality was lower among women who attended antenatal care (HR=0.63, $p<0.05$). The full model (model five) adjusted for breastfeeding practices, maternal and child characteristics and maternal health-seeking behaviour. The result showed multiple high-risk fertility was associated with elevated hazards (HR=1.76, $p<0.05$) for neonatal mortality. Other factors that were significantly associated with risk of neonatal deaths are: breastfeeding duration and level of education.

IV. DISCUSSION

The prevalence of risky fertility behaviour (RFB) was relatively high, comprising of (38.3%) single high-risk birth and (25.4%) multiple high-risk births. The study found risky fertility behaviour was significantly associated with hazard of neonatal mortality even after adjusting for breastfeeding practices, maternal and child characteristics and maternal health-seeking behaviour. Also, the study revealed breastfeeding practices among the women was rather poor. Less than half of the women initiated breastfeeding within one hour of child birth. Similarly, in the study by Waiswa, Peterson, Tomson and Pariyo [8] in Uganda to assess newborn care practices among women, it was found that all the babies were breastfed, though only about half were initiated within the first hour of birth, with a little above one third initiating breastfeeding within 1 - 6 hours. Also, previous study conducted in Nepal by Devkota and Bhatta [20] among women in a rural community revealed less than ten percent breast fed their babies within one hour, though all babies were breast fed. Also, about one third of the women threw away the first milk (colostrum), while most of the women did not give pre lacteals to their newborns. Nonetheless, most of the women breastfed their child for at least 12 months. In this study, the effect of place of delivery on neonatal mortality risk was not significant. This, however, may not be unconnected with the fact that nearly two thirds of the births were outside health facility.

V. CONCLUSION

This study has demonstrated significant effect of risky fertility behaviour on neonatal mortality risk in Nigeria. While time of initiating breastfeeding was not significantly associated with neonatal mortality, duration of breastfeeding significantly predicted neonatal mortality risk. Other important predictors of neonatal mortality risk in this study include sex of the child and maternal level of education.

VI. POLICY IMPLICATION

If the country is going to make any significant achievement with respect to the SDGs 2030 targets, it must prioritize programmes and interventions that will address factors accounting for high childhood mortality, including addressing the high prevalence of high risk fertility behaviour especially through improved maternal education and empowerment. This is in addition to strengthening the health system, so as to guarantee quality maternal health services that are capable of managing complications that could aggravate risk of neonatal and infant deaths as a result of high-risk birth.

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