Fertility Behaviour of Adolescent Mothers in Northern Nigeria and Neonatal Mortality Risk: Mediating Effect of Quality Maternal Health Services

Matthew A. Alabi, Motunrayo I. Fasasi and Mary O. Akanbi

ABSTRACT

Background: Despite rising prevalence of high-risk birth and adverse birth outcome among adolescent mothers in Nigeria, there is paucity of studies relating childhood mortality risk with fertility behaviour of adolescent mothers. This study examines fertility behaviour of adolescent mothers in northern Nigeria and neonatal mortality risk.

Methods: Data were derived by pooling together the three most recent Nigeria Demographic and Health Surveys (NDHS, 2008, 2013 and 2018). The sample size comprises of weighted sample of 3,739 adolescent mothers 15-19 years with 5, 274 live births for the period under consideration. Survival analysis (cox proportional hazard model) was used to estimate the hazard of neonatal mortality risk as a result of risky fertility behaviour.

Results: Quality of maternal health service utilization was poor among (73.0%) of the adolescent mothers. The independent effect of adolescent fertility behaviour revealed a rise in hazard for neonatal mortality, with increasing high risk fertility behaviour, single high-risk (HR=2.69, $p<0.001$) and multiple high risk (HR=6.04, $p<0.001$). Adjusting for quality of maternal health service utilization, resulted in reduced hazard for neonatal mortality, though the result did not reach statistical significance ($p>0.05$). Adjusting for maternal, child characteristics and quality of maternal health service utilization, resulted in reduced hazard for neonatal mortality, though, the effect of risky fertility behaviour remained insignificant. Multiple birth babies were however, associated with elevated hazard for neonatal mortality (HR=11.4, $p<0.05$) relative to single birth babies.

Conclusion: Adolescent fertility behaviour was associated with elevated hazard for neonatal mortality.

Keywords: Adolescent, fertility behaviour, adolescent mother, health service utilization, neonatal mortality, Nigeria.

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I. INTRODUCTION

Globally, the population of young people is apparently rising, especially in developing countries. Young people aged 15-24 years accounts for 16.0% of the total world population [1]. More so, the demographics of most developing countries indicate adolescents and young people constitute significant proportion of their population. According to UNFPA, in seventeen developing countries, individuals under age 18 years accounts for at least half of its entire population. However, despite constituting substantial proportion of the population, majority of these young people are faced with barriers to development, making it difficult for them to fulfill their potentials, thereby undermining the prospects to achieving demographic

dividend (the growth in an economy driven by changes in the age and education structure of a country's population) for the host countries, couple with the worrisome reproductive health indices of these young people [2].

Available statistics indicates nothing less than 16 million young adolescent mothers give birth for the first time under 19 years of age. Also, there are other millions of adolescent girls who become mothers before reaching age 15 and most of them resides in low or middle income countries [3], [4]. In Nigeria, the trend in reproductive behaviour indicates high prevalence of adolescent's child bearing in the North east and North western part of the country relative to the southern region of the country [15]. However, of great concern is the fact that substantial amount of literature has

associated these adolescent births with adverse birth outcomes for the mother and risk of neonatal and infant death for the newborn [5]-[8].

Studies have offered possible explanations for these adverse birth outcomes and neonatal mortality risk among adolescent mothers. The higher likelihood of adolescent mothers having low birth weight babies is one of the explanations cited in literature [9]. Some other studies [10], [11] have reported adolescent mothers to be at increased risk of hypertension during pregnancy period. Another study [12] suggests poor birth outcomes among adolescent mothers to be linked with physiological immaturity among other factors.

Besides, recent childhood mortality indices showed Africa continues to account for greater burden of childhood mortality. Although few African countries such as Ethiopia and Egypt seem to be making appreciable progress in reducing childhood mortality, same cannot be said about Nigeria. Ethiopia and Egypt achieved 18.6% and 26.7% decline in Infant Mortality (IM) between 2011-2016 and 2009-2014 respectively during the five-year period preceding the most recent Demographic and Health Surveys [12], [13]. In contrast, Nigeria only achieved a 2.9% decline in IM for the five year period preceding the most recent 2018 Demographic and Health Survey. Also, while Egypt and Ethiopia achieved a decline in their childhood mortality, under-5 mortality in Nigeria increased from 128 to 132 deaths per 1,000 live births within the same period [14]. The above statistics indicate childhood mortality in Nigeria still remains a burden despite various interventions including implementation of programmed geared towards promoting higher proportion of childbirth receiving the attention of skilled health professional, increased immunization coverage among others [15].

Moreover, quality and use of maternal health services can help reduce the risk of maternal and childhood morbidity and mortality. Studies [16], [17] have shown the use of maternal health services to significantly help in moderating the adverse effect that might arise from pregnancy and child birth complications for the child and the mother. Yet, there exist dearth of research on risky fertility behaviour and neonatal mortality hazard especially among adolescent mothers in the northern part of the country. This is despite the fact that most of these girls are faced with poor socioeconomic status ranging from low level of school enrolment, residence in the poorest household wealth status with poor access and use of maternal health services.

Notwithstanding the fact that Nigeria has a relatively young population, with implication on sexual and reproductive health, available data indicates sexual and reproductive health indicators of the young people remains worrisome. With nearly half (42.5%) of its population in the age group 10-14 years [18], they remained neglected in terms strategic, youth-oriented national sexual and reproductive policies and programmes which could have adverse effect on the country's prospect for sustainable development goal of achieving good wellbeing among its population. It is on this premise that this study, seeks to examine the fertility behaviour of adolescent mothers in northern Nigeria and neonatal mortality risk.

A. Theoretical Framework

1. Mosley and Chen (1984)

The theoretical framework underpinning this study is the Mosley and Chen childhood mortality framework [19]. This framework is applicable to this study, in addition to the fact that it has been widely applied in the study of childhood mortality in developing countries as a whole and Nigeria in particular. A study on contextual determinants of infant mortality in Nigeria, applied this theory [20]. The main thrust of this theory is that some sets of proximate factors were found to have a direct effect on childhood morbidity and mortality. However, this study will be adapting 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. Consequently, risky fertility behaviour which is the principal explanatory variable (consisting of the Mosely and Chen maternal factors) was generated.

II. MATERIAL AND METHODS

A. Data Source, Study Design and Study Population

The study data were derived from the three most recent Nigeria Demographic and Health Surveys (NDHS, 2008, 2013 and 2018), pooled together to generate a single dataset. The NDHS is a nationally representative survey which collected data from a total sample size of (2008=33, 385), (2013=38, 948) and (2018=41,821) women age 15-49 for the 2008, 2013 and 2018 survey respectively. ICF International through the USAID-funded MEASURE DHS program provided technical and financial assistance for the survey designed to collect data on fertility, family planning and maternal and child health. The survey used cross-sectional research design.

The study population comprised women in the child bearing years who had at least one live birth, five years period preceding the survey. Since the unit of analysis is neonatal mortality, the kids recode dataset was analyzed. The sample size comprises of a weighted sample of 3,739 adolescent mothers 15-19 years (pooled from the three datasets) with 5, 274 live births for the period under consideration. Owing 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 was nationally representative. Analysis was performed using the cox proportional hazard model (survival analysis). The choice of survival analysis was necessitated by the fact that the analytical interest is to study the time until an event occurs. The outcome variable was neonatal mortality, defined as occurring within the first 28 days of life. Deaths occurring after 28 days were excluded in the analysis.

B. Sampling Technique

A nationally representative sample was used for the 2008, 2013 and 2018 NDHS, 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 design 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. Administratively, Nigeria as a country is divided into states. Each state is further divided into Local Government Areas (LGAs), while each LGA is divided into localities. In addition to these administrative units, during the 2006 population census, each locality was subdivided into census enumeration areas.

The primary sampling unit (PSU), referred to as a cluster in the NDHS, is defined on the basis of EAs from the 2006 EA census frame. 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. Statistical Analysis

The study employed both univariate, bivariate, and multivariate analysis. Descriptive such as frequency count and percentages were performed at the univariate level. At the bivariate level, chi square test was performed to test for association between categorical variables. Only explanatory variables that were significantly associated with outcome variable were included into the multivariate model. The multivariate analysis involves performing survival analysis (cox proportional hazard model). The use of survival analysis was considered more appropriate since the outcome variable is a time to event variable i.e. age at birth and involves following the newborn from birth until time of death. The 0.05% alpha threshold was the acceptable level of significance for the study. Stata 14.0 was used in performing the analysis.

D. Measurement of Variables

The outcome variable is neonatal mortality, defined as death occurring within the first 28 days of life. The variable measuring age at death in the Nigeria Demographic and Health Survey dataset was used for the outcome variable (risk of neonatal mortality). 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. The principal explanatory variable was adolescent fertility behaviour. Adolescent fertility behaviour (proxy by 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, 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.

Quality of maternal health service utilization was measured using antenatal attendance, number of antenatal visits, place of delivery, postnatal check for baby and mother. Postnatal check for baby after two months was excluded since the unit of analysis was neonatal mortality (death within 28 days). Mothers who utilize at least three of the maternal health services were classified as having good maternal health service utilization, otherwise categorized as poor. For instance, a woman who attended antenatal, had minimum of four visit, and deliver in a health facility was categorized as having good maternal health service utilization. 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 1, Yes, otherwise no, coded 0) and place of delivery (whether delivery occurs in a health facility or outside health facility).

E. Ethical Consideration

Strict standards are usually maintained for protecting respondents of all DHS surveys. As a registered DHS dataset user, approval for the use of data set used for this study was sought and granted by the Demography and Health Survey (DHSP program). The Demography and Health Survey (DHS) program and ICF international: 530 Gaither Road, Suite 500, Rockville, MD 20850, USA.

III. RESULTS

A. Univariate Analysis

The socio-demographic characteristics of the women (table 1) indicates larger percentage (40.4%) of the adolescent mothers were age 18 years, followed by age 19 years (32.7%), while age 15 years accounted for the least proportion (2.4%). Likewise, nearly three quarter (73.7%) had no formal education; only (12.0%) had secondary/higher education. Significant proportion (86.6%) resides in rural area. The distribution of the adolescent mothers according to geopolitical zone indicates, higher proportions (56.2%) were residing in the North-west region, followed by North-east (29.0%) region. Majority (88.1%) of the adolescent mothers were affiliated to Islam religion, while (10.6%) practice Christianity. Women from the poorest household accounted for more than two thirds (71.2%). Similarly, higher percentage (45.7%) of the women had birth interval of 24–35 month, (49.5%) attended antenatal care during pregnancy, while significant proportion (81.7) of the births occurred outside health facility. There was no postnatal check for (85.2%) of the

adolescent mothers after child delivery. Overall, the quality of maternal health service utilization of majority (73.0%) of the adolescent mothers was poor. Considerable proportions (98.9%) of the births were single birth, with sex of the child almost evenly distributed, male (50.3%) and female (49.7%). The trend in risky fertility behaviour suggest gradual decline (36.5%) in 2008, (32.7%) in 2013 and (30.3%) in 2018 (Table 1).

TABLE 1: SOCIO-DEMOGRAPHIC CHARACTERISTICS

Maternal Characteristics	[N=3739]	%
Age Group		
15 years	89	2.4
16 years	242	6.6
17 years	661	17.9
18 years	1490	40.4
19 years	1208	32.7
Level of Education		
No formal education	2754	73.7
Primary	534	14.3
Secondary/higher	451	12.0
Wealth Index		
Poor	2662	71.2
Middle	683	18.3
Rich	394	10.5
Region of Residence		
North-Central	553	14.8
North-East	1084	29.0
North-West	2102	56.2
Place of Residence		
Urban	501	13.4
Rural	3237	86.6
Religion		
Islam	3,285	88.1
Christianity	396	10.6
Others	47	1.3
Exposure to mass media		
Yes	1593	42.6
No	2146	57.4
CHILD'S CHARACTERISTICS		
Child's Sex		
Male	1879	50.3
Female	1860	49.7
Birth Type		
Single birth	3700	98.9
Multiple birth	39	1.1

B. Bivariate Analysis

The result of the bivariate analysis revealed maternal characteristics were significantly associated with risky fertility behaviour (RSB). Poor socioeconomic characteristics were significantly associated with risky fertility behavior (table 3). For instance, RFB was more prevalent ($\chi^2=67.0$, $p<0.05$) among adolescent mothers with no education (80.0%) when compared to those with at least secondary education (6.0%). Also, risky fertility behaviour was observed among nearly three quarter of the adolescent mothers (72.0%) from the poorest household wealth index relative to (10.0%) adolescent mothers from rich household wealth status ($\chi^2=34.2$, $p<0.05$). Similarly, the prevalence of risky fertility behaviour was highest among adolescent mothers from Northwest (47.6%), followed by Northeast (35.1%) and North central (17.3%). Regional variation was statistically significant ($\chi^2=20.8$, $p<0.05$). Place of residence was significantly associated with risky fertility behaviour ($\chi^2=25.0$, $p<0.05$) among adolescent mothers. Higher prevalence was found among adolescent mothers from the

rural area (86.8%) when compared to the urban area (13.2%). Exposure to mass media also influenced risky fertility behaviour among the adolescent women ($\chi^2=12.3$, $p<0.05$). Higher prevalence was found among adolescent mothers not exposed to social media (59.8%). Other maternal characteristics that were significantly associated with risky fertility behaviour are ethnicity ($\chi^2=28.7$, $p<0.05$) and religion ($\chi^2=39.1$, $p<0.05$) (Table 2 and 3).

TABLE 2: MATERNAL HEALTH-SEEKING BEHAVIOUR

Maternal health seeking behaviour	Freq	%
Antenatal Visit**		
Yes	1454	49.5
No	1484	50.5
Number of antenatal visit**		
Less than 4 visits	539	37.1
At least four visits	915	62.9
Others		
Place of Delivery**		
Non-health facility	3040	81.7
Health facility	683	18.3
Postnatal check for mother after delivery		
Yes	435	14.8
No	2502	85.2
Postnatal check for baby		
Yes	347	12.3
No	2483	87.7
Quality of maternal health service utilization		
Good	328	27.0
Poor	889	73.0
FERTILITY BEHAVIOUR		
Risky fertility behaviour		
No Risk	262	7.0
Unavoidable Risk	456	12.2
Single High-risk	2803	75.0
Multiple High-risk	217	5.8
Birth Interval		
< 24 months	313	38.0
24-35 months	376	45.7
36+ months	134	16.3

**Missing and non-response excluded in analysis.

C. Multivariate Analysis

Multivariate analysis involves performing cox proportional hazard model. Five models were presented (Table 4). The first model (unadjusted) examined the independent effect of risky fertility behaviour (RFB) on hazard of neonatal mortality. The result showed a rise in hazard for neonatal mortality with increasing risky fertility behaviour, single high-risk (HR=2.69, $p<0.001$) and multiple high risk (HR=6.04, $p<0.001$). Adjusting for maternal characteristics (model two), resulted in elevated neonatal mortality, single high-risk (HR=2.90, $p<0.001$) and multiple high risk (HR=7.14, $p<0.001$). Model three adjusted for quality of maternal health service utilization. The result revealed the effect of risky fertility behaviour on hazard of neonatal mortality became statistically insignificant. Furthermore, the fourth model (full model) adjusted for maternal, child characteristics and adequacy of maternal health service utilization. The result revealed reduced hazard for neonatal mortality. Also, the effect of risky fertility behaviour remained insignificant. Multiple birth babies were however, associated with elevated hazard for neonatal mortality (HR=12.1, $p<0.05$) relative to single birth babies (Table 4).

TABLE 3: RISKY FERTILITY BEHAVIOUR AND SOCIO-DEMOGRAPHIC CHARACTERISTICS

Maternal Characteristics	No risk	Unavoidable risk	Single risk	Multiple risk	χ^2 statistics [N=3,739]
No formal education	184 (70.8)	280 (60.1)	2009 (73.2)	176 (80.0)	67.0 (p=0.001)
Primary	41 (15.8)	71 (15.2)	396 (14.4)	31 (14.1)	
Secondary/higher	35 (13.4)	115 (24.7)	339 (14.4)	13 (5.9)	
Wealth Index					
Poor	163 (62.2)	283 (62.1)	2051 (73.2)	165 (75.9)	34.23 (p=0.001)
Middle	71 (27.0)	96 (21.1)	482 (17.2)	33 (15.3)	
Rich	28 (10.8)	77 (16.8)	270 (9.6)	19 (8.8)	
Region of Residence					
North-Central	37 (14.0)	93 (20.4)	400 (14.3)	23 (10.6)	20.81 (p=0.002)
North-East	72 (27.5)	131 (28.8)	805 (28.7)	75 (34.4)	
North-West	153 (58.5)	231 (50.8)	1598 (57.0)	119 (55.0)	
Place of Residence					
Urban	38 (14.7)	91 (20.0)	345 (12.3)	27 (12.3)	24.97 (p=0.001)
Rural	224 (85.3)	364 (80.0)	2459 (87.7)	191 (87.7)	
Exposure to mass media					
Yes	136 (51.8)	222 (48.8)	1153 (41.1)	81 (37.3)	12.28 (p=0.001)
No	126 (48.1)	233 (51.2)	1650 (58.9)	136 (62.7)	

TABLE 4: COX PROPORTIONAL HAZARD SHOWING THE INFLUENCE OF RISKY FERTILITY BEHAVIOUR ON NEONATAL MORTALITY RISK

Explanatory variables	Model One: Risky fertility behaviour		Model Two: Maternal characteristics		Model Three: adjusted for health seeking behaviour		Model Four: Full model	
	UHR	95% CI	AHR	95% CI	HR	95% CI	OR	95% CI
Risky Fertility								
No risk	1.000		1.000		1.000		1.000	
Unavoidable risk	1.88	0.9-4.0	2.31*	1.1-4.8	1.49	0.5-4.0	1.91	0.6-5.4
Single High-Risk	2.69**	1.4-5.3	2.90**	1.5-5.6	1.22	0.5-3.2	1.16	0.4-3.1
Multiple High-Risk	6.04**	2.6-13.8	7.14**	3.2-16.0	1.64	0.3-9.0	2.21	0.4-12.8
Education Level								
No formal education			1.000				1.000	
Primary			1.34	0.9-1.9			1.81	0.9-4.0
Secondary			0.61	0.3-1.0			0.40	0.1-1.4
Wealth Index								
Poor			1.000				1.000	
Middle			1.36	0.9-2.0			1.41	0.7-2.7
Rich			1.07	0.6-1.9			0.85	0.2-3.0
Region of Residence								
North-Central			1.000				1.000	
North-East			1.11	0.7-1.8			1.67	0.6-5.0
North-West			1.17	0.6-1.8			2.47	0.9-6.7
Media exposure								
No			1.000					
Yes			0.90	0.4-1.8				
Place of Residence								
Urban			1.000				1.000	
Rural			0.91	0.6-1.4			1.11	0.5-2.4
Child's sex								
Male			1.000				1.000	
Female			0.82	0.6-1.1			0.84	0.4-1.7
Birth Type								
Single birth			1.000				1.000	
Multiple birth			8.15**	4.5-14.7			11.37*	3.8-34.3
Adequacy of maternal health service utilization								
Inadequate					1.000		1.000	
Adequate					1.03	0.4-1.5	1.26	0.6-2.7

UHR=Unadjusted Hazard Ratio, AHR=Adjusted Hazard Ratio, CI=Confidence Interval.

IV. DISCUSSION AND CONCLUSION

The study lends credence to Mosley and Chen framework of childhood mortality, with regards to the effect of maternal characteristics namely age at first birth, parity, and birth interval on childhood mortality. Since adolescent births are largely regarded as high risk, the poor socioeconomic status of these adolescent mothers, in addition to the poor maternal health service utilization that could have helped in mitigating the negative effect of this risky fertility behaviour on neonatal mortality risk calls for serious attention. The quality of maternal health service

utilization was poor among the adolescent mothers. This study found risky fertility behaviour was independently associated with elevated risk for neonatal mortality. A recent study on high risk pregnancies and factors associated with neonatal mortality found newborn baby of women with high-risk pregnancies were at risk of neonatal mortality [21]. Also, a review of young maternal age at birth and risk of neonatal death, using data from Demographic and Health Surveys of 45 middle and low income countries found that regardless of the region, risk of death was reportedly higher among younger mothers below age 16 years [22]. Previous

studies [23], [24] have also reported young maternal age to be independently associated with adverse birth outcome. However, the effect became insignificant after adjusting for maternal, child characteristics and quality of maternal healthcare utilization.

These studies reported poor socioeconomic status namely poverty, low educational status, inadequate prenatal care and being unmarried were reported to be prevalent among adolescent mothers and can therefore enhanced the adverse birth outcomes. This study also found the socioeconomic status of the adolescent mothers to be poor. For instance, nearly three quarter of the adolescent mothers had no formal education, belonged to the poorest household wealth status and resides in rural area. Moreover, some researchers have argued that with adequate prenatal care, pregnancy among adolescent mothers will not necessarily pose any risk [25], [26].

In our study, even after adjusting for maternal socioeconomic, demographic attributes and health service utilization, the direction of risk of neonatal death among the adolescent mothers did not vary. Lowest risk was however, reported among adolescent mothers with first birth. In this study the effect of adolescent fertility behaviour on neonatal mortality risk was similar with previous models focusing on adverse birth outcomes after adjusting for maternal socioeconomic characteristics and other health and behavioural factors. Therefore, appropriate interventions can target improving the poor maternal socioeconomic status of adolescent mothers in addition to removing socio-cultural barriers impeding access to quality maternal health service utilization especially among adolescent mothers in low income countries such as Nigeria.

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