BMJ Open

Association between adolescent motherhood and maternal and child health indices in Maiduguri, Nigeria: a community-based cross-sectional study

Adewale L Oyeyemi,[ORCID] [1] Salamatu U Aliyu,[1] Fatima Sa'ad,[2] Adamu Ahmad Rufa'i,[1,3] Abdul Rahman M Jajere,[4] Adetoyeje Y Oyeyemi[1]

[1]Department of Physiotherapy, University of Maiduguri Medical College, Maiduguri, Nigeria
[2]Department of Physiotherapy, Neuropsychiatric Hospital Maiduguri, Maiduguri, Nigeria
[3]Department of Health Promotion, School of Health Sciences, Universiti Sains Malaysia, Kota Bharu, Malaysia
[4]Department of Physiotherapy, University of Maiduguri Teaching Hospital, Maiduguri, Nigeria

Correspondence to
Professor Adetoyeje Y Oyeyemi;
adeoyeyemi@aol.com

ABSTRACT

Introduction Adolescent motherhood (childbearing below 18 years of age) is a major global health and social problem. Understanding the impact of early motherhood on maternal and child health indices is important to community and population health promotion in developing countries. This study examined the association between adolescent motherhood and maternal and child health indices in Maiduguri, Nigeria.

Methods A cross-sectional design method was used to recruit 220 mothers (age=14–25 years) from four communities in the city of Maiduguri, Northeastern Nigeria. Participants were surveyed using a self-developed interviewer-administered questionnaire that assesses maternal and child health indices and sociodemographic characteristics. Logistic regression analysis was used to compute adjusted OR and 95% CI of the associations between motherhood in adolescence (mothers below 18 years old) and maternal and child health indices.

Results Compared to adult mothers, adolescent mothers were more likely to experience fistula (OR=5.01, 95% CI=3.01 to 14.27), to have postpartum haemorrhage (OR=6.83, 95% CI=2.93 to 15.92), to have sexually transmitted infections (OR=6.29, 95% CI=2.26 to 17.51) and to lose a child within 5 years of birth (OR=3.52, 95% CI=1.07 to 11.60). Children born to adolescent mothers were less likely to have normal weight at birth (OR=0.34, CI=0.15 to 0.73) than those born to adult mothers.

Conclusion Adolescent motherhood was associated with negative maternal and child health indices. The findings can be used by public health professionals including physiotherapists in this role to inform effective primary healthcare practice and community health advocacy to improve maternal and child health indices among adolescent mothers in Maiduguri. Future studies are needed to confirm the evidence at the regional or national level including the rural population in Nigeria.

Strengths and limitations of this study

► This is one of the few community-based studies to assess the impact of early marriage and adolescent motherhood on maternal and child health indices in Nigeria.

► The study utilised equal sample of adolescent and non-adolescent mothers to make the result more robust.

► Evidence from the data can be used to inform effective primary healthcare practice and public health advocacy to improve maternal and child health indices among adolescent mothers in the medically underserved and economically disadvantaged Northeast region of Nigeria.

► The study involved a convenience sample of urban community-dwelling mothers, so findings may not generalise to other samples with different characteristics in Nigeria.

► Causality between adolescent motherhood and maternal and child health indices cannot be inferred due to the cross-sectional design nature of the study.

INTRODUCTION

Adolescent motherhood is an important social and public health problem.[1] It is a common consequence of early marriage that has been defined as a formal marriage or informal union entered into by an individual before reaching the age of 18 years.[2 3] Worldwide, approximately 750 million girls and women were married before the age of 18.[4] In the developing countries, about 16 million adolescent mothers aged 15– 19 years and 2.5 million girls below 16 years give birth each year.[1] Across Africa, 125 million girls and women alive today were married, with attendant pregnancies, before their 18th birthday.[5] This practice is most common in West and Central Africa where more than 4 in 10 girls were married before age 18, and about one in seven were married or in union before age 15.[4] Underage brides are often likely to be forced into sexual activities and commence childbearing early and are therefore at higher risks of death from complications of pregnancy and child birth.[1 2 6] They are also at risk for developing health complications arising from early pregnancy that includes

heavy bleeding, sexually transmitted infections (STIs), eclampsia, obstructed labour and obstetric fistula, all due to physical and sexual immaturity.[6–8] Moreover, due to adolescents' physiological and social immaturity and their lack of adequate prenatal care, health risks associated with pregnancies and childbearing are more pronounced among them than among older women.[1 9]

High death rates among adolescent mothers are usually due to eclampsia, postpartum haemorrhage, sepsis, HIV infection, malaria and obstructed labour.[9] In developing countries, these problems may occur as a result of lack of preconception care that include education, health promotion, screening and other interventions among women of reproductive age.[10] Another factor is lack of access to postnatal care, which include intervention to facilitate speedy recovery after birth, and to address concerns about newborn care, nutrition, breastfeeding and family planning.[11 12] In most African countries, many of the problems associated with childbearing are also partly attributed to lack of timely and appropriate healthcare attention during pregnancy.[7] Adolescent mothers are more susceptible to anaemia than adults and this greatly increases the risk and complications linked to pregnancy,[7] especially with the added pressure to prove their fertility in the first year of marriage as is the cultural practice in many developing countries.[3 6 9]

Childbearing during adolescence is not only a risk factor for adverse maternal health outcomes but also has negative impacts on child health indices and the future well-being of the infants.[1] Previous studies have documented associations between adolescent births and increased incidence of negative perinatal and child health outcomes, such as preterm delivery, low birth weight and perinatal death.[13–16] Recent evidence from a study involving 45 low- and middle-income countries found the risk of neonatal mortality in all regions, including Africa, to be markedly greater for infants with adolescent mothers and suggested reducing adolescent births as an important strategy for addressing the problem of neonatal mortality in the developing countries.[17] In addition, a large multi-country study that included data from African countries reported higher risks of low birth weight, preterm delivery and severe neonatal conditions, and an increased risk of intrahospital early neonatal mortality among infants born to adolescent mothers compared with adult mothers.[18]

In Nigeria, adolescent motherhood is believed to be rampant because an estimated 28.7% of girls (absolute number=2 470 183) were married before the age of 18 years as of 2010.[19] This prevalence is expected to double by 2050 and Nigeria is expected to have the largest absolute number of child bride in the coming decades.[5] Although Nigeria contributes to one in five and one in four of the global and regional maternal deaths,[20] respectively, yet there is paucity of evidence on the impact of adolescent motherhood on maternal and child health indices in Nigeria. Therefore, to enhance effective maternal and child health interventions in the vulnerable population subgroups, it is important to understand the impact of child marriage on maternal and child health in Nigeria. A recent study in Northeast Nigeria reported high maternal morbidity through various pregnancy complications among residents of Gombi, a town in Adamawa State.[21] However, until now, there is no report on the impact of adolescent motherhood on maternal and child health indices in Maiduguri, Borno State of Nigeria.

Maiduguri city is the origin of a religious uprising which started in 2009 and became escalated to an armed insurgency in the northeastern Nigeria which continues until 2016 when the insurgency activities within the city became degraded. This city however houses Internally Displaced Persons including adolescent mothers, in several camps untill now. The present study aimed to examine the associations between motherhood in adolescence (mothers below 18 years old) and maternal and child health indices in Maiduguri, Nigeria. This is a preliminary attempt to provide insights into the impact of early marriage on population health in the most economically disadvantaged and medically underserved region of Nigeria. In the present study, the terms adolescent mothers, teenage brides and minor mothers are used interchangeably to describe adolescent girls who were married before the age of 18 years.

METHODS
Setting, design and participants
The study was conducted in Maiduguri which is the capital city of Borno State and the commercial centre of the northeastern geopolitical zone of Nigeria. This zone, comprising six states, including Yobe, Adamawa, Taraba, Bauchi, Gombe and the Borno States, is considered to be economically disadvantaged with least manpower resources and is also the most medically underserved zone in Nigeria.[22] The city of Maiduguri has an estimated population of 1.2 million people.[23]

The study adopted a cross-sectional survey design to recruit 247 young mothers from their various households at *Gwange, Bulunkutu, Lamisula* and *Kofa biyu* communities (wards) in Maiduguri city. The age range (12–25 years) of the young mothers was based on definitions from previous studies on the same topic.[18 21] Sample size was calculated using the Cohen's formula: $n=2\ (Z_1+Z_2)^2/d^2$. With a modest effect size statistic of d=0.40,[24] we determined that 192 participants (96 each per group for adolescent and adult mothers) were needed to detect a moderate to large effect size with more than 80% power at 95% CI. A three-stage approach was used to determine household and participants selection into the study. In stage one, four wards (communities) were randomly selected (ballot method) from the available 15 communities in Maiduguri.[25] In the second stage, for convenient purpose, three streets each were randomly selected (ballot method) in each of the four communities. In stage three, houses and participants were selected using convenient sampling technique.

From each of the selected houses, all mothers that met the inclusion criteria and were willing to participate were recruited into the study.

The eligibility criteria for the study were as follows: (1) being a mother between the ages of 12 and 25 years, (2) having at least one child, (3) living within the identified community in the last 12 months and (4) willing to be interviewed for a survey in English or Hausa language. Mothers that got married at the age of 26 years and above, those that were experiencing their first pregnancy and yet to deliver a baby and mothers that married for more than 10 years were excluded from the study. Based on the preference of each participant, the survey interview was conducted by one of the researchers (FS) using either the English or Hausa language. The researcher who administered the survey was a native speaker of Hausa and also proficient in English language. Data collection was conducted between April and August 2014 and all measurements were completed at the participants' home. All participants provided signed informed consent.

Instruments

Sociodemographic form was used to collect information about the participant's characteristics. These include age, marital status, age at time of marriage, years of marriage, number of children ever born, level of formal education, occupation, religion, area of residence and socioeconomic status. A structured questionnaire was developed from insights provided through previous studies.[21 26 27] The self-developed questionnaire was interviewer administered and contains 17 items that assess maternal and child health concerns (see online appendix). The questionnaire has two sections. Section A addresses maternal health indices while section B addresses child health indices. The respondents were asked series of questions such as 'have you ever experience domestic violence', 'have you ever experienced pregnancy-related complications', 'have you ever had STIs', 'was your child's weight at birth low', did the child suffer any infectious illness 2 weeks after birth' and 'was any child lost in the last 5 years'. The response to the questions was anchored on a dichotomous scale, (1) Yes or (2) No. The face and content validity of the questionnaire were evaluated by two experts who are specialists in obstetrics and gynaecology and maternal and child health. These specialists have a combined experience of over 23 years and they attested to the face and content validity of the developed questionnaire. The participants' weight and height were measured following standardised procedure, using a bathroom weighing scale (HANA, China) and a locally fabricated wooden height metre that was calibrated, respectively. Body mass index was calculated as body weight divided by the square of height (kg/m^2), and participants were categorised as underweight ($<18.5\,kg/m^2$), normal weight ($18.5–24.9\,kg/m^2$), overweight ($25.0–29.9\,kg/m^2$) and obese ($\geq30.0\,kg/m^2$) according to the WHO guidelines.[28]

Patient and public involvement

Patients were not directly involved in the recruitment to and conduct of the study. However, authors are practicing physiotherapists two of whom (AJ) and (AYO) carry caseloads that includes paediatric patients and mothers requiring obstetric and gynaecological physiotherapy care for more than 10 years each on a consistent basis. Thus, the authors had long histories of interaction with adolescent and adult mothers. Since all authors reviewed the questionnaire, approved its use and attested to its content and face validity, it can be assumed that the development of the research questionnaire and the design of the study were informed by the priorities, preferences and experience of the adolescent and adult mothers and the public.

Data analyses

Analyses were conducted using the Statistical Package for the Social Science V.18. Descriptive statistics of mean, SD and percentages were used to summarise the participants' sociodemographic characteristics, socioeconomic status and marriage and pregnancy history. χ^2 statistic was used to compare the prevalence of maternal (obstetric fistula, sexually transmitted disease, postpartum haemorrhage and eclampsia) and child (low birth weight, child infectious illness and child mortality) health indices between adolescent mothers (age=12–17 years) and non-adolescent mothers (age=18–25 years). Multivariate logistic regression analysis adjusted for participants' sociodemographic characteristics, socioeconomic status and marriage and pregnancy history was used to examine the associations between motherhood in adolescence and maternal and child health indices. All maternal and child health variables that were significant in the bivariate analysis (χ^2 statistics) were included in the regression models. Alpha value of 0.05 was used as the level of significance.

RESULTS

A total of 247 young mothers (age=12–25 years) were contacted for the study, but only 220 consented and completed the questionnaire, yielding a response rate of 89.1% (220/247). The mean age of the final sample was 22.4±2.5 years (age range=14–25 years). Half of the participants were married before the age of 18 years (50.0%, n=110) and had been married for less than 5 years (50.5%, n=111). Many of the participants were Muslims (92.3%), married (81.8%) and full-time housewives (60.0%). Compared with adult mothers (p<0.05), most adolescent mothers were underweight (75.9% vs 24.1%), had no education (75.8% vs 24.2%), had at least four or more children (96.4% vs 3.6%) and had been married for between 5 and 9 years (68.5% vs 31.5%). Majority of the participants (78.2%) used public tap water while 10.9% used borehole and 10% used open well water as source of their drinking water. Most of the participants (86.8%) used pit toilet, 9.5% used flush toilet and 3.2% has no toilet facility in their household. Compared with adult mothers (p<0.05), few proportions of adolescent mothers

Table 1 Sociodemographic characteristics and socioeconomic status of the participants

Variables	Total sample n=220	Adolescent mothers n=110 (50%)	Adult mothers n=110 (50%)	P value†
Sociodemographic characteristics				
Age (years)	22.36±2.5	21.45±2.9	23.37±1.6	<0.001*
BMI (kg/m²)	22.37±4.0	21.84±4.1	22.89±3.8	0.052
Weight status (n, %)				
Underweight	29 (13.2)	22 (75.9)	7 (24.1)	0.029*
Normal	147 (66.8)	68 (46.3)	79 (53.7)	
Overweight	32 (14.5)	15 (46.9)	17 (53.1)	
Obese	12 (5.5)	5 (41.7)	7 (58.3)	
Level of education (n, %)				
None	33 (15.0)	25 (75.8)	8 (24.3)	<0.001*
Quranic	102 (46.4)	57 (55.9)	45 (44.1)	
Primary	30 (13.6)	15 (50)	15 (50)	
Secondary	36 (16.4)	11 (30.6)	25 (69.4)	
Tertiary	19 (8.6))	2 (10.5)	17 (89.5)	
Occupation (n, %)				
Farming	11 (5.0)	6 (54.5)	5 (45.5)	0.281
Trading	67 (30.5)	34 (50.7)	33 (49.3)	
Civil servant	10 (4.5)	2 (20)	8 (80)	
House wife	132 (60.0)	68 (51.5)	64 (48.5)	
Religious affiliation (n, %)				
Muslim	203 (92.3)	103 (50.7)	100 (49.3)	0.449
Christian	17 (7.7)	7 (41.2)	10 (58.8)	
Number of children born (n, %)				
One	79 (35.9)	26 (32.9)	53 (67.1)	<0.001*
Two	68 (30.9)	29 (42.6)	39 (57.4)	
Three	45 (20.5)	28 (62.2)	17 (37.8)	
≥Four	28 (12.7)	27 (96.4)	1 (3.6)	
Marital status (n, %)				
Married	180 (81.8)	92 (51.1)	88 (48.9)	0.508
Not married	5 (2.3)	2 (40)	3 (60)	
Divorced	27 (12.3)	14 (51.9)	3 (48.1)	
Widowed	8 (3.6)	2 (25)	6 (75)	
Years of marriage (n, %)‡				
Less than 5	111 (50.5)	36 (32.4)	75 (67.6)	<0.001*
5–9	108 (49.1)	74 (68.5)	34 (31.5)	
Socioeconomic status				
Source of drinking water (n, %)‡				
Borehole into dwelling	24 (10.9)	10 (41.7)	14 (58.3)	0.367
Public tap	172 (78.2%)	86 (50.0)	86 (50.0)	
Open well	22 (10.0)	14 (63.6)	8 (36.4)	
Surface water	1 (0.5)	0 (0.0)	1 (100.0)	
Type of toilet facilities (n, %)‡				
Flush toilet	21 (9.5)	2 (9.5)	19 (90.5)	<0.001*
Pit toilet	191 (86.8)	105 (55.0)	86 45.0)	

Table 1 Continued

Variables	Total sample n=220	Adolescent mothers n=110 (50%)	Adult mothers n=110 (50%)	P value†
No facility	7 (3.2)	3 (42.9)	4 (57.1)	
Cooking facilities (n, %)‡				
Gas	7 (3.2)	0 (0.0)	7 (100.0)	0.004*
Kerosene	20 (9.1)	5 (25.0)	15 (75.0)	
Charcoal	146 (66.4)	79 (54.1)	67 (45.9)	
Firewood	47 (21.4%)	26 (55.3)	21 (44.7)	
Household car/bus (n, %)‡				
Yes	14 (6.4)	0 (0.0)	14 (100.0)	<0.001*
No	205 (93.2)	109 (53.2)	96 (46.8)	

*Significant difference between group (p<0.05).
†Values based on independent t-tests statistics for continuous variables and χ^2 statistics for categorical variables.
‡Values do not add up to 220 due to missing data.
BMI, Body mass index.

had flush toilets in their homes (9.5% vs 90.5%) and none used gas in their homes for cooking (0.0% vs 100.0%) or had a car in their households (0.0% vs 100.0%). Details of the sociodemographic characteristics and socioeconomic status of the participants are shown in table 1.

Table 2 shows the marriage and pregnancy history of the participants. While majority of the participants (68.6%) reported that they took decision to get married with their partners, 26.4% responded their marriage were decided by their parents and a few (5%) reported their decision to get married was made by others. Majority of the participants (82.3%) had never discussed family planning with their spouses and a substantial number of the mothers (22.3%) had never attended antenatal care. About 45% of the participants had experienced prolonged labour and 21.4% had history of miscarriage and few (19.1%) had a history of stillbirth. Almost half (45.5%) delivered their babies in the hospital and were attended to by nurses. About 9% were attended to by doctors and 25.0% delivered their babies at home by traditional birth attendant. Compared to the adult mothers (p<0.05), most of the adolescent mothers had their marriage decided by their parents (62.1% vs 37.9%) or others (81.8% vs 18.25%), had experienced prolonged labour (73.7% vs 26.3%), had a history of miscarriage (68.1% vs 31.9%) and stillbirth (81.0% vs 19.0%) and had their babies delivered at home by traditional birth attendants (69.1% vs 30.9%). Significantly fewer number of adolescent mothers (20.5%) had ever discussed family planning with their spouses compared with adult mothers (79.5%).

Table 3 shows the difference in prevalence of maternal and child health indices between adolescent and adult mothers. Respondents who commenced childbearing between 14 and 17 years of age experienced at least one pregnancy or birth-related health problem and their children had more health concerns than those who commenced childbearing above 17 years. A substantial number of those that commenced childbearing early reported having fistula (22% vs 0.0%) and had higher prevalence of STI (38% vs 5%) when compared with adult mothers (p<0.001). Postpartum haemorrhage (59% vs 13%, p<0.001) and eclampsia (20% vs 8%, p=0.020) were more prevalent among adolescent mothers than among adult mothers. Just as for maternal health indices, all child health indices such as child infections (21% vs 10%, p=0.040), child loss within 5 years (21% vs 7%, p=0.006) and low birthweight child (55% vs 29%, p<0.001) were more frequently reported for children of adolescent mothers when compared with children of the adult mothers.

Table 4 shows the association of motherhood in adolescence with maternal and child health indices. Adolescent mothers were about five times more likely to experience fistula (OR=5.01, 95% CI=3.01 to 14.27), more than six times likely to have postpartum haemorrhage (OR=6.83, 95% CI=2.93 to 15.92) and STIs (OR=6.29, 95% CI=2.26 to 17.51) and more than three times likely to lose a child within 5 years of birth (OR=3.52, 95% CI=1.07 to 11.60) than adult mothers. Children born to adolescent mothers were 66% less likely to have a normal weight at birth (OR=0.34, 95% CI=0.15 to 0.73) than those born to adult mothers.

DISCUSSION

Adolescent motherhood in the developing African countries is a global health problem, and periodic evaluation of its impacts on population health status is important to assessing progress in this context. The main finding of the present study was that adolescent mothers aged 14–17 years reported higher maternal morbidity and child morbidity and mortality indices compared with adult mothers aged 18 years and above. Broadly, this finding from Nigeria supports the conclusions from multiple

Table 2 Participants' marriage and pregnancy history

Variables	Total sample n (%)	Adolescent mothers n (%)	Adult mothers n (%)	χ^2	P values
Decision to marry					
Both partners	151 (68.6)	65 (43.0)	86 (57.0)	10.754	0.005*
Parents	58 (26.4)	36 (62.1)	22 (37.9)		
Others	11 (5.0)	9 (81.8)	2 (18.2)		
Domestic violence					
Yes	45 (20.5)	27 (60)	18 (40)	0.263	0.133
No	175 (79.5)	3 (47.4)	92 (52.6)		
Discussion on family planning					
Yes	39 (17.7)	8 (20.5)	31 (79.5)	16.487	<0.001*
No	181 (82.3)	102 (56.4)	79 (43.6)		
Antenatal					
Yes	171 (77.7)	81 (47.4)	90 (52.6)	2.127	0.145
No	49 (22.3)	29 (59.2)	20 (40.8)		
Prolonged labour					
Yes	99 (45.0)	73 (73.7)	26 (26.3)	40.569	<0.001*
No	121 (55.0)	37 (30.6)	84 (69.4)		
Miscarriage					
Yes	47 (21.4)	32 (68.1)	15 (31.9)	7.819	0.005*
No	173 (78.6)	78 (45.1)	95 (54.9)		
Stillbirth					
Yes	42 (19.1)	34 (81.0)	8 (19.0)	19.893	<0.001*
No	178 (80.9)	76 (42.7)	102 (57.3)		
Birth attendance					
Doctor	20 (9.1)	7 (35.0)	13 (65.0)	14.374	0.002*
Nurse	100 (45.5)	40 (40.0)	60 (60.0)		
Midwife	45 (20.5)	25 (55.6)	20 (44.4)		
Traditional BA	55 (25.0)	38 (69.1)	17 (30.9)		

*Significant difference between group (p<0.05).
%, percentage; BA, birth attendant; n, frequency.

Table 3 χ^2 statistics for difference in the prevalence of maternal and child health indices between adolescent mothers and non-adolescent mothers

| Variables | Motherhood description | | | | | |
| | Adolescent mothers | | Adult mothers | | | |
	Yes n (%)	No n (%)	Yes n (%)	No n (%)	χ^2	P value
Presence of fistula	24 (22.0)	86 (78.0)	0 (0.0)	110 (100.0)	26.939	<0.001**
Sexual transmitted infection	42 (38.0)	68 (62.0)	6 (5.0)	104 (95.0)	34.535	<0.001**
Postpartum haemorrhage	65 (59.0)	45 (41.0)	14 (13.0)	96 (87.0)	51.371	<0.001**
Eclampsia	22 (20.0)	88 (80.0)	9 (8.0)	101 (92.0)	6.346	0.020*
Child infectious illness	23 (21.0)	86 (78.0)	11 (10.0)	98 (89.0)	5.018	0.040*
Child lost in 5 years	23 (21.0)	86 (78.0)	8 (7.0)	100 (91.0)	8.307	0.006*
Normal child weight	49 (45.0)	61 (55.0)	78 (71.0)	32 (29.0)	15.67	<0.001*

*Significant difference between group (p<0.05); **Significant difference between group (p<0.001)

Table 4 Association of adolescent motherhood with maternal and child health indices

Variables	Adolescent mothers (<18 years old)	
	Unadj OR (95% CI)	Adj† OR (95% CI)
Presence of fistula		
No	1.00	1.00
Yes	9.18 (0.00)	5.01 (3.01 to 14.27)*
Sexual transmitted infection		
No	1.00	1.00
Yes	7.24 (2.41 to 21.70)*	6.29 (2.26 to 17.51)*
Presence of eclampsia		
No	1.00	1.00
Yes	2.20 (0.68 to 7.03)	2.17 (0.70 to 6.68)
Postpartum haemorrhage		
No	1.00	1.00
Yes	8.19 (3.73 to 17.97)*	6.83 (2.93 to 15.92)*
Child infectious illness		
No	1.00	1.00
Yes	0.96 (0.33 to 2.78)	1.20 (0.44 to 3.29)
Child lost in 5 years		
No	1.00	1.00
Yes	3.52 (1.07 to 11.60)*	2.30 (0.74 to 7.15)
Normal child weight at birth		
No	1.00	1.00
Yes	0.39 (0.17 to 0.89)*	0.34 (0.15 to 0.73)*

*Significant at $p<0.05$, Model fit: ($X^2=113.182$; df=7; −2 Log Likelihood=184.867; $R^2=0.564$; $p<0.001$).
†OR adjusted for participants' sociodemographic characteristics, socioeconomic status and marriage and pregnancy characteristic.
Adj, adjusted; Unadj, unadjusted.

international literature that childbearing during adolescence is associated with adverse maternal, perinatal and child health indices.[13–18]

Our finding of higher likelihood (more than five times) of experiencing fistula among adolescent mothers compared with their adult counterparts is similar to the findings of Melo et al, in Brazil which reported that adolescent mothers are about eight times more likely to experience fistula than adult mothers.[26] Also, the finding that a substantial proportion of adolescent mothers had obstetric fistula in the present study is comparable to previous studies that 26% and 20% of minor mothers had experienced vesico and recto vaginal fistula in Adamawa, Nigeria and Ethiopia, respectively.[21 29]

In the present study, adolescent mothers tended to report STI more frequently (38%) than mothers who married at the age of 18 and above. This finding is consistent with reports from Kenya and Zambia that teenage mothers have high rate (39%) of STI.[30] Moreover, our finding that adolescent mothers were more than six times likely to have STI than their adult counterparts is consistent with a previous Nigerian study which found that teenage mothers were 6.7 times likely to experience STI than their adult counterparts.[21]

In contrast to previous studies from Ethiopia and Nigeria that found lower postpartum haemorrhage rate (17.2% and 19%, respectively) among adolescent mothers,[21 29] postpartum haemorrhage was more frequently (59.0%) reported by adolescent mothers in the present study. However, our finding that adolescent mothers were six times more likely to experience postpartum haemorrhage compared with adult mothers is consistent with the finding in Ethiopia that adolescent mothers were about four times more likely to report postpartum haemorrhage.[29] Although the prevalence of eclampsia was higher among adolescent mothers and they were about twice more likely to have eclampsia than their adult mother counterparts in the present study, we did not find association between motherhood in adolescence and eclampsia. This finding was somewhat contrary to that of a hospital-based study in Nigeria that reported significant association between patients' relative perception of early marriage and eclampsia.[31]

Adolescent mothers tended to report child infectious illness more frequently than their adult counterparts in the present study. This finding is at variance with a previous Indian study that found no proportional difference in the occurrence of child respiratory infection and

diarrhoea between minor mothers and non-minor ones.[27] However, our finding that adolescent mothers were 1.2 times likely to have children with infectious illness than the adult mothers is consistent with the Indian study which found adolescent mothers were 1.3 times likely to have child infectious illness than the adult mothers.[27] Also, consistent with the findings of Raj *et al,* in which Indian adolescent mothers were 2.5 times more likely to experience the loss of an infant or child,[27] we found the two times higher likelihood of child loss within 5 years among adolescent mothers compared with their adult counterparts. Also, our finding that children born to adolescent mothers were less likely to have a normal weight baby at birth than those born to adult mothers is consistent with previous findings that children of adolescent mothers in India and Brazil were more likely to have low birth weight when compared with their adult mother counterparts.[26 27]

Generally, the findings of the present study have practical implications for population and community health in Maiduguri and Nigeria. Public health professionals, including physiotherapists in health promotion and primary healthcare, can use the evidence to develop educational programmes and campaign to improve awareness and advocacy on the health consequences of early motherhood. For instance, parents and community and religious leaders could be sensitised that early marriage and motherhood during adolescence is a risk factor for multiple negative maternal and child health indices such as eclampsia, fistula, STI, postpartum haemorrhage and infant morbidity and mortality. With results of the current study, traditional and religious leaders, long recognised as key partners to ending the harmful practice of child marriage in Africa,[32] can be appropriately mobilised and their support enlisted in Maiduguri towards delaying girls' marriage untill full maturity. Moreover, the findings could provide factual tools for policy-makers, responsible for health planning and funding, to improve maternal and child health indices in Maiduguri. There is evidence that reducing adolescent births among young girls, as well as ensuring that pregnant adolescents have access to quality maternal health services are effective strategies for addressing the problem of neonatal mortality and negative health outcomes among both adolescent mothers and their infants in the developing countries.[17] Until now, only one study has provided empirical data on the impact of early marriage practices in northeastern Nigeria.[21] Therefore, scarce evidence-based information such as in the present study is relevant for policy-makers to enhance effective and targeted interventions to improve maternal and child health in the northeast of Nigeria which is the most economically disadvantaged and medically underserved region of Nigeria.

Our study has some important limitations that should be considered when interpreting the findings. First, the study adopted a cross-sectional design, in which causality between motherhood in adolescence and maternal and child health indices cannot be inferred. Second, the questionnaire utilised for the study did not explore important pregnancy-related complications like heavy bleeding and anaemia, and its construct validity and reliability are unknown. However, the items in the questionnaire are similar to those used in previous studies.[21 26 27] Third, the maternal and child health consequences explored in the present study is presented in child mortality and morbidity counts and prevalence only. The cost of care and burden of diseases due to early motherhood have not been analysed in pecuniary terms, neither has this cost been compared with cost of care for adult mothers. Fourth, the study involved a convenience sample of urban living mothers in a metropolitan city. Thus, the findings may not generalise to other samples with different demographics in the Nigerian society. Also, the inherent selection bias (ie, presence of systematic differences between the groups of adolescent and adult mothers) arising from non-matching of participants in the sampling strategy constitutes a limitation to the present study. However, the study utilised equal sample of adolescent and adult mothers, and the data analysis accounted for differences in participants' sociodemographics to make the result more robust. Moreover, this is a preliminary study and the findings suggest that motherhood in adolescence is a potential risk factor to some adverse maternal and child health indices. In order to better estimate the impact of early marriage and motherhood on maternal and child morbidity for Nigeria or identify any pattern to the disease burden, there is a need for an expanded survey at a regional or national scale to include the rural population in Nigeria.

CONCLUSIONS

Adolescent motherhood was associated with negative maternal and child health indices among urban-dwelling mothers in Maiduguri city. The findings suggest the need for community health promotion and public health interventions to improve maternal and child health among early married mothers in Maiduguri. Data from the study can be used by public health professionals including physiotherapists in this role to inform effective primary healthcare practice and community health advocacy to improve maternal and child health indices in Maiduguri. However, for effective population-wide public health actions to improve maternal and child health in Nigeria, future studies are needed to confirm this evidence at the regional or national level including the rural population in Nigeria.

REFERENCES

1. World Health Organization. Adolescent pregnancy: WHO factsheet 2018. 2018 http://www.who.int/en/news-room/fact-sheets/detail/adolescent-pregnancy (Accessed 4 Nov 2018).
2. United Nations Children's Fund. *Early marriage: a harmful traditional practice. A statistical exploration*. New York: UNICEF, 2005.
3. Parsons J, Edmeades J, Kes A, *et al*. Economic impacts of child marriage: a review of the literature. *Rev Faith Int Aff* 2015;13:12–22.
4. United Nations Population Fund-United Nations Children's Fund. Global programme to accelerate action to end child marriage. Progress report 2016. UNFPA-UNICEF. 2017 https://www.unicef.org/protection/files/ChildMarriage-Global-DonorReport-v7.pdf (Accessed 12 Mar 2018).
5. United Nations Children's Fund. *Accelerating efforts to eliminate child marriage in Africa*. New York: UNICEF, 2017.
6. United Nations Children's Fund. *Ending child marriage: progress and prospects*. New York: UNICEF, 2014.
7. Nour NM. Health consequences of child marriage in Africa. *Emerg Infect Dis* 2006;12:1644–9.
8. World Health Organization. *Obstetric Fistula. Guiding principles for clinical management and programed development*. Geneva: World Health Press, 2006.
9. Nour NM. Child marriage: a silent health and human rights issue. *Rev Obstet Gynecol* 2009;2:51–6.
10. World Health Organization. *Meeting to develop a global consensus on preconception care to reduce maternal and childhood mortality and morbidity*. Geneva: WHO, 2013.
11. Say L, Raine R. A systematic review of inequalities in the use of maternal health care in developing countries: examining the scale of the problem and the importance of context. *Bull World Health Organ* 2007;85:812–9.
12. Langlois ÉV, Miszkurka M, Zunzunegui MV, *et al*. Inequities in postnatal care in low- and middle-income countries: a systematic review and meta-analysis. *Bull World Health Organ* 2015;93:259–70.
13. Chen XK, Wen SW, Fleming N, *et al*. Teenage pregnancy and adverse birth outcomes: a large population based retrospective cohort study. *Int J Epidemiol* 2007;36:368–73.
14. de Vienne CM, Creveuil C, Dreyfus M. Does young maternal age increase the risk of adverse obstetric, fetal and neonatal outcomes: a cohort study. *Eur J Obstet Gynecol Reprod Biol* 2009;147:151–6.
15. Chen CW, Tsai CY, Sung FC, *et al*. Adverse birth outcomes among pregnancies of teen mothers: age-specific analysis of national data in Taiwan. *Child Care Health Dev* 2010;36:232–40.
16. Marvin-Dowle K, Kilner K, Burley VJ, *et al*. Impact of adolescent age on maternal and neonatal outcomes in the Born in Bradford cohort. *BMJ Open* 2018;8:e016258.
17. Neal S, Channon AA, Chintsanya J. The impact of young maternal age at birth on neonatal mortality: Evidence from 45 low and middle income countries. *PLoS One* 2018;13:e0195731.
18. Ganchimeg T, Ota E, Morisaki N, *et al*. Pregnancy and childbirth outcomes among adolescent mothers: a World Health Organization multicountry study. *BJOG* 2014;121(s1):40–8.
19. Walker JA, Mukisa S, Hashim Y, *et al*. Mapping Early Marriage in West Africa: a scan of trends, interventions, what works, best practices, and the way forward. *Ford Foundation* 2013.
20. Alkema L, Chou D, Hogan D, *et al*. Global, regional, and national levels and trends in maternal mortality between 1990 and 2015, with scenario-based projections to 2030: a systematic analysis by the UN Maternal Mortality Estimation Inter-Agency Group. *Lancet* 2016;387:462–74.
21. Adedokun O, Adeyemi O, Dauda C. Child marriage and maternal health risks among young mothers in Gombi, Adamawa State, Nigeria: implications for mortality, entitlements and freedoms. *Afr Health Sci* 2016;16:986–99.
22. Federal Ministry of Health. *National Health Policy 2016: promoting the Health of Nigerians to Accelerate Socioeconomic Development*: FMOH, 2016.
23. Population City. Maiduguri population. 2018 http://population.city/nigeria/maiduguri/ (Accessed 03 Mar 2018).
24. Cohen JA. *Statistical power analysis for the behavioural sciences*. 2nd edn. Hillsdale, NJ: Lawrence Erlbaum Associates, 1988.
25. National Population Commission (NPC) [Nigeria] and ICF International. *2014 Nigeria Demographic and Health Survey*. Abuja, Nigeria and Rockville, MD: NPC and ICF International, 2013.
26. Melo EC, Ribeiro AB, de Oliveira RR, *et al*. Analysis of maternal and child health indicators in an area at paraná state, Brazil. *Nurs Res Pract* 2013;2013:1–9.
27. Raj A, Saggurti N, Winter M, *et al*. The effect of maternal child marriage on morbidity and mortality of children under 5 in India: cross sectional study of a nationally representative sample. *BMJ* 2010;340:b4258.
28. World Health Organization. *Obesity: Prevention and managing the global epidemic. Report of a WHO consultation on obesity*. Geneva, Switzerland: World Health Organization, 1988.
29. Pathfinder International Ethiopia. *Report on causes and consequences of early marriage in Amhara region*. Addis Ababa: Pathfinder International, 2006.
30. International Women's Health Program. Early Marriage. The Society of Obstetricians and Gynaecologists of Canada. 2010 http://iwhp.sogc.org/index.php?page=early-marriage (Accessed 01 Apr 2018).
31. Adamu AN, Tunau KA, Hassan M, *et al*. The perception of patients' relations on the cause of eclampsia. *Gynecol Obstet (Sunnyvale)*;4:205.
32. African Union. Campaign to end child marriage in Africa. The Effects of Traditional and Religious Practices of Child Marriage on Africa's Socio-Economic Development. A Review of Research, Reports and Toolkits from Africa. 2015 https://au.int/sites/default/files/documents/31018-doc-5465_ccmc_africa_report.pdf (Accessed 01 Apr 2018).