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

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ABSTRACT

Introduction: Understanding the impact of early marriage and motherhood on maternal and child health indices is important to community and population health promotion. This study examined the associations between adolescent motherhood and maternal and child health indices in Maiduguri, Nigeria.

Methods: A cross-sectional design method was used to recruit 220 mothers from four communities in the city of Maiduguri, Northeastern Nigeria. Participants were surveyed using a self-developed interviewer administered questionnaire consisting of two parts. Part I elicited socio-demographic characteristics while part II consisted of items assessing maternal and child health indices. Logistic regression analysis was used to compute adjusted odd ratios (OR) and 95% confidence interval (95%CI) of the associations between motherhood in adolescence (mothers between 12-17 years) and maternal and child health indices.

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

Conclusion: Adolescent motherhood was associated with negative maternal and child health indices. The findings suggest that community health promotion and public health interventions should focus on improving maternal and child health indices among adolescent mothers in Maiduguri, Nigeria. Future studies are needed to confirm this evidence at the regional or national level including the rural population in Nigeria.

Keywords: Early marriage, teenage mothers, maternal health indices, child health indices

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 utilized equal sample of early married and non-early married mothers to make the result more robust
- Evidence from the data can be used to inform effective primary care practice and public health campaign to improve maternal and child health among early married 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 generalize 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 of the study

INTRODUCTION

Early or child marriage is defined as a formal marriage or informal union entered into by an individual before reaching the age of 18 years.[1,2] Worldwide, approximately 750 million girls and women were married before the age of 18.[3] Across Africa, 125 million girls and women alive today were married before their 18th birthday.[4] This practice is most common in West and Central Africa where more than 4 in 10 girls were married before age 18, and about 1 in 7 were married or in union before age 15.[3] Early marriage has been observed for both boys and girls, but the overwhelming majority of those affected by the practice are girls in poor socio-economic conditions.[1,2,5] Underage-brides are often likely to be forced into sexual activities and commence child bearing early and are therefore at higher risks of death from complications of pregnancy and child birth.[2,6] They are also at risk for developing health complications arising from early marriage that includes; heavy bleeding, sexually transmitted infections, eclampsia, obstructed labour and obstetric fistula, all due to physical and sexual immaturity.[1,5,7,8] 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.[6,9]

High death rates among adolescent mothers are usually due to eclampsia, postpartum hemorrhage, sepsis, HIV infection, malaria, and obstructed labor.[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 health care attention during pregnancy.[7] Adolescent mothers are more susceptible to anemia 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.[2,5,9]

In Nigeria, the practice of early marriage is believed to be rampant because an estimated 28.7% of girls (absolute number=2,470,183) were married before the age of 18 as of 2010.[13] 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 contributed 1 in 5 and 1 in 4 of the global and regional maternal deaths,[14] respectively, yet there is paucity of evidence on the impact of early marriage and 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 North east Nigeria reported high maternal morbidity through various pregnancy complications among residents of Gombi, a town in Adamawa State.[15] 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 up till now. The present study aimed to examine the associations between motherhood in adolescence (mothers between 12-17 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.

METHODS

Setting, design and participants

The study was conducted in Maiduguri which is the capital city of Borno State and the commercial center of the north eastern geopolitical zone of Nigeria. This zone comprising of 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 the Nigeria.[16] The city of Maiduguri has an estimated population of 1.2 million people.[17]

The study adopted a cross-sectional survey design. The participants were 220 mothers (aged = 12 - 25 years) recruited from their various households in *Gwange*, *Bulunkutu*, *Lamisula*

and *Kofa biyu* communities (wards) of Maiduguri city. The multistage (3 stages) sampling technique was used to select participants into the study. In stage one, four wards were randomly selected from the available 15 communities in Maiduguri, and from these communities, three streets were randomly selected in the second stage. In stage three, houses and participants were selected using convenient sampling technique. From each of the selected houses, mothers that met the inclusion criteria and were willing to participate were recruited into the study. Mothers that got married at the age of 26 years and above, those that were experiencing their first pregnancy and has not yet put to bed and mothers that married for more than 10 years, were excluded from the study. Data collection and all measurements were completed at the participants' home. All participants provided signed informed consent and the study was approved by the Ethics Committee of the University of Maiduguri Teaching Hospital.

Instruments

For this cross sectional survey study, socio-demographic 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 socio-economic status. A structured questionnaire was developed from insights provided through two previous studies.[15,18] The self-developed questionnaire was interviewer administered and contains 17 items that assess maternal and child health concerns. 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 sexually transmitted infections (STI)', 'was your child's weight at birth low', did the child suffer any infectious illness two weeks after birth', and 'was any child lost in the last five 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 was evaluated by two experts who are specialists in obstetrics and gynecology 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 standardized procedure, using a bathroom weighing scale (HANA, China) and a locally fabricated wooden height meter that was calibrated, respectively.

Data analyses

Analyses were conducted using the Statistical Package for the Social Science (SPSS) versions 18. Descriptive statistics of mean, standard deviation and percentages were used to summarize the participants' socio-demographic characteristics, socio-economic status and marriage and pregnancy history. Chi-square statistic was used to compare the prevalence of maternal (obstetric fistula, sexually transmitted disease, postpartum hemorrhage 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). 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. Alpha-value of 0.05 was used as the level of significance.

RESULTS

The participants comprised 220 young mothers with a mean age of 22.4 ± 2.5 years. Half of the participants were married before the age of 18 years (50.0%, n=110) and had been married for less than five years (50.5%, n=111). Many of the participants were muslim (92.3%), married (81.8%) and full time housewife (60.0%). About 13% were underweight and 20% were overweight or obese. 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. Details of the sociodemographic characteristics and socio-economic status of the participants are shown in Table 1

Table 1: Sociodemographic characteristics and socioeconomic status of the participants

Variables	n	(%)
Sociodemographic characteristics		
Age Group at marriage		
12-17	110	50
18-25	110	50
Age (22.36 ±2.5 years)		
BMI Group (kg/m^2)		

Underweight	29	13.2
Normal	147	66.8
Overweight	32	14.5
Obese	12	5.5
BMI (22.37 ±4.0 Kg/m^2)		
Level of Education		
None	33	15.0
Quranic	102	46.4
Primary	30	13.6
Secondary	36	16.4
Tertiary	19	8.6
Occupation		
Farming	11	5.0
Trading	67	30.5
Civil Servant	10	4.5
House wife	132	60.0
Religious Affiliation		
Muslim	203	92.3
Christian	17	7.7
Number of children born		
One	79	35.9
Two	68	30.9
Three	45	20.5
≥ Four	28	12.7
Marital Status		
Married	180	81.8
Not Married	5	2.3
Divorced	27	12.3
Widowed	8	3.6
Duration of Marriage (years)*		
Less than Five	111	50.5
Five to Nine	108	49.1
Socioeconomic Status		
Source of Drinking Water		
Borehole into Dwelling	24	10.9
Public Tap	172	78.2
Open Well	22	10.0
Surface Water	1	0.5
Type of Toilet Facilities		
Flush Toilet	21	9.5
Pit Toilet	191	86.8
No Facility	7	3.2
Cooking Facilities		
Gas	7	3.2
Kerosene	20	9.1

Charcoal	146	66.4
Firewood	47	21.4
Do you have a car/bus?		
Yes	14	6.4
No	205	93.2

* values do not add up to 220 due to missing data

Table 2 shows the marriage and pregnancy history of the participants. While majority of the participants (68.6%) reported 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 ante natal 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. Those who were attended to by doctors were 9.1%, those by midwives were 20.5% and those who were delivered at home by traditional birth attendant were 25.0%.

Table 2: Participants' marriage and pregnancy history

Variables	n	(%)
Decision to marry		
Both partners	151	68.6
Parents	58	26.4
Others	11	5.0
Domestic violence		
Yes	45	20.5
No	175	79.5
Discussion on family planning		
Yes	39	17.7
No	181	82.3
Ante-natal		
Yes	171	77.7
No	49	22.3
Prolonged labour		
Yes	99	45.0
No	121	55.0
Miscarriage		
Yes	47	21.4

No	173	78.6
Stillbirth		
Yes	42	19.1
No	178	80.9
Birth Attendance		
Doctor	20	9.1
Nurse	100	45.5
Midwife	45	20.5
Traditional birth attendant	55	25.0

n = frequency, % =percentage

Table 3 shows the difference in prevalence of maternal and child health indices between adolescent and adult mothers. Respondents who commenced childbearing between 12-17years 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 child bearing early reported having fistula (22% vs 0.0%) and had higher prevalence of sexually transmitted infection (38% vs 5%) when compared to adult mothers ($P < 0.001$). Postpartum hemorrhage (59% vs 13%, $P < 0.001$) and eclampsia (20% vs 8%, $P = 0.02$) 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%, $P = 0.04$), child loss within 5 years (21% vs 7%, $P = 0.006$) and low child birth weight (55% vs 29%, $P < 0.001$) were more frequently reported for children of adolescent mothers when compared to children of the adult mothers.

Table 3: Chi-square statistics for difference in the prevalence of maternal and child health indices between adolescent mothers and non-adolescent mothers

Variables	Motherhood Description				$\chi 2$	P-value
	Adolescent mothers		Adult mothers			
	Yes n (%)	No n (%)	Yes n (%)	No n (%)		
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**
Post-partum hemorrhage	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	0.02*
Child infectious illness	23 (21.0)	86 (78.0)	11 (10.0)	98 (89.0)	5.018	0.04*
Child lost in 5years	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 at 0.05

Table 4 shows the association of motherhood in adolescence with maternal and child health indices. Adolescent mothers were about 5 times more likely to experience fistula (OR=5.01, 95%CI=3.01-14.27), more than 6 times likely to have postpartum hemorrhage (OR=6.83, 95%CI=2.93-15.92) and sexually transmitted infections (OR=6.29, 95%CI=2.26-17.51), and more than 3 times likely to lose a child within 5 years of birth (OR=3.52, 95%CI=1.07-11.60), than adult mothers. Children born to adolescent mothers were 66% less likely to have a normal weight at birth (OR=0.34, 95%CI=0.15-0.73) than those born to adult mothers.

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

	Adolescent mothers (12-17 years old)	
Variables	Unadj O.R (95% CI)	Adj† O.R (95% CI)
Presence of fistula		
No	1.00	1.00
Yes	9.18 (0.00)	5.01 (3.01-14.27)*
Sexual transmitted infection		
No	1.00	1.00
Yes	7.24 (2.41-21.70)*	6.29(2.26-17.51)*
Presence of eclampsia		
No	1.00	1.00
Yes	2.20 (0.68-7.03)	2.17 (0.70-6.68)
Postpartum hemorrhage		
No	1.00	1.00
Yes	8.19 (3.73-17.97)*	6.83 (2.93-15.92)*
Child infectious illness		
No	1.00	1.00
Yes	0.96 (0.33-2.78)	1.20 (0.44- 3.29)
Child lost in 5 years		

No	1.00	1.00
Yes	3.52 (1.07-11.60)*	2.30 (0.74-7.15)
Normal child weight at birth		
No	1.00	1.00
Yes	0.39 (0.17-0.89)*	0.34 (0.15-0.73)*

Adj= Adjusted, Unadj= Unadjusted, OR= Odd Ratio, CI =Confidence Interval

†= Odd Ratio adjusted for participants' sociodemographic characteristics, socioeconomic status and marriage and pregnancy characteristic. *-Significant at 0.05

DISCUSSION

Early marriage practices 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. In this study, adolescent mothers aged 12-17 years in this study reported higher maternal morbidity and child morbidity and mortality indices than adult mothers. Our finding of higher likelihood (more than 5 times) of experiencing fistula among adolescent mothers compared to their adult counterparts is similar to the findings of Melo *et al*., in Brazil which reported that adolescent mothers are about 8 times more likely to experience fistula than adult mothers.[19] 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.[15,20]

In the present study, adolescent mothers tended to report sexually transmitted infection 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 sexually transmitted infection.[21] Moreover, our finding that adolescent mothers were more than 6 times likely to have sexually transmitted infection than their adult counterparts is consistent with a previous Nigerian study which found that teenage mothers were 6.7 times likely to experience sexually transmitted infection than their adult counterparts.[15]

In contrast to previous studies from Ethiopia and Nigeria that found lower postpartum hemorrhage rate (17.2% and 19%, respectively) among adolescent mothers,[15,20] postpartum hemorrhage was more frequently (59.0%) reported by adolescent mothers in the present study. However, our finding that adolescent mothers were 6 times more likely to experience post-

partum hemorrhage compared to adult mothers is consistent with the finding in Ethiopia that adolescent mothers were about 4 times more likely to report postpartum hemorrhage.[20] Although the prevalence of eclampsia was higher among adolescent mothers and they were about twice more likely to have eclampsia than their adult mothers counterparts in the present study, we did not find association between motherhood in adolescence and eclampsia. This finding was somewhat contrary to that of an hospital based study in Nigeria that reported significant association between patients' relative perception of early marriage and eclampsia.[22]

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 no proportional difference in the occurrence of child respiratory infection and diarrhea between minor mothers and non-minor ones.[18] However, our finding that adolescents 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.[18] 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,[18] we found the 2 times higher likelihood of child loss within 5 years among adolescent mothers compared to 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 to their adult mother counterparts.[18,19]

Generally, the findings of the present study have practical implications for population health in Maiduguri and Nigeria. Public health professionals, including physiotherapists in health promotion, can use the evidence to develop educational programmes and campaign to improve awareness on the health consequences of early motherhood. For instance, parents and community and religious leaders could be sensitized that early marriage and motherhood during adolescence is a risk factor for multiple negative maternal and child health indices such as eclampsia, fisula, sexually transmitted infection, postpartum hemorrhage and infant morbidity and mortality. With this evidence, traditional and religious leaders, long recognized as key partners to ending the harmful practice of child marriage in Africa,[23] can be appropriately mobilized and their support enlisted towards delaying girls marriage till 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. Scarce evidence-based information such as this is needed to enhance effective and targeted interventions to improve maternal and child health in a most economically disadvantaged and medically underserved region of Nigeria. Until now, only one study provided empirical data on the impact of early marriage practices in a small town in northeastern Nigeria.[15] Therefore, more community based epidemiological studies are needed to fully understand the impact of early marriage on child and maternal health is this disadvantaged 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 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 marriage have not been analysed in pecuniary terms, neither has this cost been compared with cost of care for adult mothers. Third, the study involved a convenience sample of urban living mothers in a metropolitan city. Thus, the findings may not generalize to other samples with different demographics in the Nigerian society. The small sample size of the present study is also a limitation regarding its generalizability to the entire Maiduguri population itself. However, the findings of this preliminary study 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 the need for an expanded survey at a regional or national scale to include the rural population in Nigeria.

Conclusion

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, Nigeria. 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.

Contributors: ALO, SUA, FS, AAU, AMJ and AYO were involved in the design of the study. SUA, FS, AMJ and AYO led the data collection. SUA, FS and AYO led data cleaning and data analysis. ALO contributed to data analysis and interpretation. ALO and AYO wrote the manuscript. SUA and AAU revised the drafted manuscript. All authors provided input in the revision and gave approval of the final manuscript.

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

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ABSTRACT

Introduction: Adolescent motherhood (child bearing 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 associations 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= 12 – 25 years) from four communities in the city of Maiduguri, Northeastern Nigeria. Participants were surveyed using a self-developed interviewer administered questionnaire consisting of two parts. Part I elicited socio-demographic characteristics while part II consisted of items assessing maternal and child health indices. Logistic regression analysis was used to compute adjusted odd ratios (OR) and 95% confidence interval (95%CI) of the associations between motherhood in adolescence (mothers below 18 years old) and maternal and child health indices.

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

Conclusion: Adolescent motherhood was associated with negative maternal and child health indices. The findings suggest that community health promotion and public health interventions should focus on improving maternal and child health indices among adolescent mothers in Maiduguri, Nigeria. The findings can be used to inform effective primary health care practice and public health campaign to improve maternal and child health indices in Maiduguri, Nigeria. However, future studies are needed to confirm this evidence at the regional or national level including the rural population in Nigeria.

Keywords: Adolescent pregnancy, early marriage, teenage mothers, maternal health, adverse child health outcomes

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 utilized equal sample of early married and non-early married mothers to make the result more robust
- Evidence from the data can be used to inform effective primary health care practice and public health campaign to improve maternal and child health indices among early married 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 generalize 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 to 19 years and 2.5 million girls under 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 1 in 7 were married or in union before age 15.[4] Underage-brides are often likely to be forced into sexual activities and commence child bearing 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, eclampsia, obstructed labour and obstetric fistula, all due to physical and sexual immaturity.[6,7,8] 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 hemorrhage, sepsis, HIV infection, malaria, and obstructed labor.[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 health care attention during pregnancy.[7] Adolescent mothers are more susceptible to anemia 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]

Child bearing 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 birthweight, preterm delivery and severe neonatal conditions, and an increased risk of intra-hospital 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 1 in 5 and 1 in 4 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 North east 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 up till 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 center of the north eastern geopolitical zone of Nigeria. This zone comprising of 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. The participants were 220 young mothers (aged = 12 - 25 years) recruited from their various households in *Gwange*, *Bulunkutu*, *Lamisula* and *Kofa biyu* communities (wards) of Maiduguri city. The age range of the mothers was based on definitions from previous studies on the same topic.[18,21] Sample size was calculated with the Cohen's formula: $n = \underline{2\ (Z_1 + Z_2)^2}\ /\ d^2$, using a modest effect size statistic [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% confidence interval. 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 (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 March and August, 2014 and all measurements were completed at the participants' home. All participants provided signed informed consent and the study was approved by the Ethics Committee of the University of Maiduguri Teaching Hospital.

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 pediatric patients and mothers requiring obstetric and gyneacological physiotherapy 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.

Instruments

For this cross-sectional survey study, socio-demographic 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 socio-economic 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 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 sexually transmitted infections (STI)', 'was your child's weight at birth low', did the child suffer any infectious illness two weeks after birth', and 'was any child lost in the last five 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 was evaluated by two experts who are specialists in

obstetrics and gynecology 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 standardized procedure, using a bathroom weighing scale (HANA, China) and a locally fabricated wooden height meter that was calibrated, respectively. Body mass index (BMI) was calculated as body weight divided by the square of height (kg/m^2), and participants were categorized 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 (≥ 30.0 kg/m^2) according to the WHO guidelines.[28]

Data analyses

Analyses were conducted using the Statistical Package for the Social Science (SPSS) versions 18. Descriptive statistics of mean, standard deviation and percentages were used to summarize the participants' socio-demographic characteristics, socio-economic status and marriage and pregnancy history. Chi-square statistic was used to compare the prevalence of maternal (obstetric fistula, sexually transmitted disease, postpartum hemorrhage 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 (chi-square statistics) were included in the regression models. Alpha-value of 0.05 was used as the level of significance.

RESULTS

The participants comprised 220 young mothers with a mean age of 22.4 ± 2.5 years. Half of the participants were married before the age of 18 years (50.0%, n=110) and had been married for less than five years (50.5%, n=111). Many of the participants were muslim (92.3%), married (81.8%) and full-time housewife (60.0%). Compared to adult mothers ($P < 0.05$), most adolescents 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 five to nine 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 to adult mothers ($P < 0.05$), few proportions of adolescent mothers 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 socio-economic status of the participants are shown in Table 1.

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/m^2)	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)	13 (48.1)	
Widowed	8 (3.6)	2 (25)	6 (75)	
Years of Marriage (n, %)^				
Less than Five	111 (50.5)	36 (32.4)	75 (67.6)	<0.001*
Five to Nine	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)	
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)	

†- Values based on independent t-tests statistics for continuous variables and chi-Square Statistics for categorical variables; *- Significant difference between group ($P < 0.05$); ^- values do not add up to 220 due to missing data ; BMI- Body Mass Index

Table 2 shows the marriage and pregnancy history of the participants. While majority of the participants (68.6%) reported 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 ante natal 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. Those who were attended to by doctors

were 9.1%, those by midwives were 20.5% and those who were delivered at home by traditional birth attendant were 25.0%. Compared to 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 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)	2.263	0.133
No	175 (79.5)	83 (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)		
Ante-natal					
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)		

n = frequency, % =percentage, BA = Birth Attendant, *- Significant difference between group ($P < 0.05$)

Table 3 shows the difference in prevalence of maternal and child health indices between adolescent and adult mothers. Respondents who commenced childbearing between 12-17years 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 child bearing early reported having fistula (22% vs 0.0%) and had higher prevalence of sexually transmitted infection (38% vs 5%) when compared to adult mothers ($P < 0.001$). Postpartum hemorrhage (59% vs 13%, $P < 0.001$) and eclampsia (20% vs 8%, $P = 0.02$) 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%, $P = 0.04$), child loss within 5 years (21% vs 7%, $P = 0.006$) and low child birth weight (55% vs 29%, $P < 0.001$) were more frequently reported for children of adolescent mothers when compared to children of the adult mothers.

Table 3: Chi-square statistics for difference in the prevalence of maternal and child health indices between adolescent mothers and non-adolescent mothers

Variables	Motherhood Description				χ^2	*P*-value
	Adolescent mothers		Adult mothers			
	Yes n (%)	No n (%)	Yes n (%)	No n (%)		
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**
Post-partum hemorrhage	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 5years	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 ($P < 0.05$)

Table 4 shows the association of motherhood in adolescence with maternal and child health indices. Adolescent mothers were about 5 times more likely to experience fistula (OR=5.01, 95%CI=3.01-14.27), more than 6 times likely to have postpartum hemorrhage (OR=6.83, 95%CI=2.93-15.92) and sexually transmitted infections (OR=6.29, 95%CI=2.26-17.51), and more than 3 times likely to lose a child within 5 years of birth (OR=3.52, 95%CI=1.07-11.60), than adult mothers. Children born to adolescent mothers were 66% less likely to have a normal weight at birth (OR=0.34, 95%CI=0.15-0.73) than those born to adult mothers.

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

	Adolescent mothers (12-17 years old)	
Variables	Unadj O.R (95% CI)	Adj† O.R (95% CI)
Presence of fistula		
No	1.00	1.00
Yes	9.18 (0.00)	5.01 (3.01-14.27)*
Sexual transmitted infection		
No	1.00	1.00
Yes	7.24 (2.41-21.70)*	6.29(2.26-17.51)*
Presence of eclampsia		
No	1.00	1.00
Yes	2.20 (0.68-7.03)	2.17 (0.70-6.68)
Postpartum hemorrhage		
No	1.00	1.00
Yes	8.19 (3.73-17.97)*	6.83 (2.93-15.92)*
Child infectious illness		
No	1.00	1.00
Yes	0.96 (0.33-2.78)	1.20 (0.44- 3.29)
Child lost in 5 years		

No	1.00	1.00
Yes	3.52 (1.07-11.60)*	2.30 (0.74-7.15)
Normal child weight at birth		
No	1.00	1.00
Yes	0.39 (0.17-0.89)*	0.34 (0.15-0.73)*

Adj= Adjusted, Unadj= Unadjusted, OR= Odd Ratio, CI =Confidence Interval

†= Odd Ratio adjusted for participants' sociodemographic characteristics, socioeconomic status and marriage and pregnancy characteristic. *-Significant at $P < 0.05$, Model fit: (Chi-Square = 113.182; df =7; -2 Log Likelihood = 184.867; R^2= 0.564; $P < 0.001$).

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 12-17 years reported higher maternal morbidity and child morbidity and mortality indices compared to adult mothers aged 18 years and above. Broadly, this finding from Nigeria supports the conclusions from multiple international literature that child bearing during adolescence is associated with adverse maternal, perinatal and child health indices.[13–18]

Our finding of higher likelihood (more than 5 times) of experiencing fistula among adolescent mothers compared to their adult counterparts is similar to the findings of Melo *et al*., in Brazil which reported that adolescent mothers are about 8 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 sexually transmitted infection 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 sexually transmitted infection.[30] Moreover, our finding that adolescent mothers were more than 6 times likely to have sexually transmitted infection than their adult counterparts is consistent with a

previous Nigerian study which found that teenage mothers were 6.7 times likely to experience sexually transmitted infection than their adult counterparts.[21]

In contrast to previous studies from Ethiopia and Nigeria that found lower postpartum hemorrhage rate (17.2% and 19%, respectively) among adolescent mothers,[21,29] postpartum hemorrhage was more frequently (59.0%) reported by adolescent mothers in the present study. However, our finding that adolescent mothers were 6 times more likely to experience post-partum hemorrhage compared to adult mothers is consistent with the finding in Ethiopia that adolescent mothers were about 4 times more likely to report postpartum hemorrhage.[29] Although the prevalence of eclampsia was higher among adolescent mothers and they were about twice more likely to have eclampsia than their adult mothers counterparts in the present study, we did not find association between motherhood in adolescence and eclampsia. This finding was somewhat contrary to that of an 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 no proportional difference in the occurrence of child respiratory infection and diarrhea between minor mothers and non-minor ones.[27] However, our finding that adolescents 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 2 times higher likelihood of child loss within 5 years among adolescent mothers compared to 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 to their adult mother counterparts.[26,27]

Generally, the findings of the present study have practical implications for population health in Maiduguri and Nigeria. Public health professionals, including physiotherapists in health promotion and primary health care, can use the evidence to develop educational programmes and campaign to improve awareness on the health consequences of early motherhood. For instance, parents and community and religious leaders could be sensitized that early marriage and

motherhood during adolescence is a risk factor for multiple negative maternal and child health indices such as eclampsia, fistula, sexually transmitted infection, postpartum hemorrhage and infant morbidity and mortality. With this evidence, traditional and religious leaders, long recognized as key partners to ending the harmful practice of child marriage in Africa,[32] can be appropriately mobilized and their support enlisted towards delaying girls marriage till 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 a 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 utilized 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 the 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 generalize to other samples with different demographics in the Nigerian society. Also, the small sample size and the inherent selection bias in the sampling strategy constitute some limitations to the present study regarding its generalizability to the entire Maiduguri population. However, the findings of this preliminary study 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 the need for an expanded survey at a regional or national scale to include the rural population in Nigeria.

Conclusion

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, Nigeria. Data from the study can be used to inform effective community and primary health care practice and public health campaign to improve maternal and child health indices in Maiduguri, Nigeria. 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.

Contributors: ALO, SUA, FS, AAU, AMJ and AYO were involved in the design of the study. SUA, FS, AMJ and AYO led the data collection. SUA, FS and AYO led data cleaning and data analysis. ALO contributed to data analysis and interpretation of results. ALO and AYO wrote the manuscript. SUA and AAU revised the drafted manuscript. ALO drafted the revisions. All authors gave approval of the final manuscript.

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QUESTIONNAIRE ASSESSING MATERNAL AND CHILD HEALTH INDICES

Socio-demographic Form

1. Age……years
2. Age at the time of marriage…….....years
3. Height…….meters
4. Weight……....kg
5. Child Age……..……..years
6. Child Sex Male…….……1
   Female…….……..2
7. Highest level of formal Education
   NIL…….....1
   Primary…….....2
   Secondary……. ……3
   Tertiary…….….4
8. Occupation
   Farming ……1
   Trading…….……...…..2
   Civil Servant…… …….3
   House wife…….……4
9. Religious affiliation
   Muslim…….....1
   Christian ……..2
10. Number of children ever born
    One……..1
    Two…….2
    Three…….....3
    Four and above...…….....4
11. Marital status
    Married……1
    Not married…….2
    Divorced…….....3
    Widowed……..4
12. Duration of marriage (years)
    Less Than 5……...1
    5 to 9…….....2

Household Items

13. Main source of drinking water?
    Piped water/bore hole into dwelling……..1
    Public tap/bore hole……2
    Open well into dwelling…….3
    Surface Water…….4
    Others ……5
14. Type of Toilet Facilities in your House hold?
    Flush toilet……..1
    Pit toilet/latrine……2

No Facility……..…….3

15. What does your household mainly use for cooking?

Gas…….……1
Kerosene……..2
Charcoal……...3
Fire wood…….4

16. Do you have a car or bus in your household?

Yes…….....1
No……..2

Questions on Maternal and Child Health Indices

Section A: Maternal issues

1. The decision to marry taken by?

Both partners……..1
Parents……2
Others…….3

2. Ever experience Domestic violence?

Yes……1
No……2

3. Ever had discussion on family planning with spouse?

Yes……1
No…….2

4. Ever experienced pregnancy related complications?

Yes……1
No…….2

5. Ever experienced postpartum hemorrhage?

Yes……1
No……..……2

6. Ever had Eclampsia?

Yes……1
No…….2

7. Ever experienced Obstructed and/or prolonged Labor?

Yes……..1
No……2

8. Ever had prolonged sickness after child birth?

Yes……1
No…….2

9. Ever Experienced Fistula?

Yes……1
No……..2

10. Ever had sexually transmitted infections (STI)?

Yes…….……...1
No…….……2

11. Type of Health personnel for delivery of last child

Doctor……1

Nurse……..2
Midwife……3
Traditional birth attendant…4

12. Do you attend ante natal care during pregnancy?

Yes……..……..1
No……..2

13. Ever had history of miscarriage?

Yes…….……1
No…….…….2

Section B: Child items

14. Child weight at birth……kg
15. Does your child weight at birth low?

Yes……...……1
No……..…….……2

16. Does the child suffer any infectious illness two weeks after birth?

Yes……..…….……1
No…….……2

If yes please specify……..

17. Any child lost in the last five years?

Yes……..……..1
No…….2

18. Ever had stillbirth?

Yes….. ……..1
No……..2

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract [pg1]
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found [pg2]
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported [pg4-5]
Objectives	3	State specific objectives, including any prespecified hypotheses [pg5]
Methods		
Study design	4	Present key elements of study design early in the paper [pg6]
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection [pg6-7]
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants [pg6]
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable [pg7]
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group [pg7]
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at [pg6]
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding [pg8]
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders [pg8]
		(b) Indicate number of participants with missing data for each variable of interest
Outcome data	15*	Report numbers of outcome events or summary measures [pg10-11]
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included [pg12]
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a

		meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Summarise key results with reference to study objectives [pg14]
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias [pg16]
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence [pg14-16]
Generalisability	21	Discuss the generalisability (external validity) of the study results [pg16]
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based [pg17]

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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

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

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ABSTRACT

Introduction: Adolescent motherhood (child bearing 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 odd ratios (OR) and 95% confidence interval (95%CI) of the associations between motherhood in adolescence (mothers below 18 years old) and maternal and child health indices.

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

Keywords: Adolescent pregnancy, early marriage, teenage mothers, maternal health, adverse child health outcomes

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 utilized 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 health care 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 generalize 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 to 19 years and 2.5 million girls under 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 1 in 7 were married or in union before age 15.[4] Underage-brides are often likely to be forced into sexual activities and commence child bearing 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, eclampsia, obstructed labour and obstetric fistula, all due to physical and sexual immaturity.[6,7,8] 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 hemorrhage, 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 health care 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]

Child bearing 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 birthweight, preterm delivery and severe neonatal conditions, and an increased risk of intra-hospital 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 1 in 5 and 1 in 4 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 North east 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 up till 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 center of the north eastern geopolitical zone of Nigeria. This zone comprising of 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 with the Cohen's formula: $n = \underline{2}\ \underline{(Z_1 + Z_2)^2}\ / d^2$. Using a modest effect size statistic [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% confidence interval. 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 (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 and the study was approved by the Ethics Committee of the University of Maiduguri Teaching Hospital (ADM/TH/EC/75; 08/04/2014).

Instruments

Socio-demographic 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 socio-economic 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 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 sexually transmitted infections (STI)', 'was your child's weight at birth low', did the child suffer any infectious illness two weeks after birth', and 'was any child lost in the last five 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 was evaluated by two experts who are specialists in obstetrics and gynecology 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 standardized procedure, using a bathroom weighing scale (HANA, China) and a locally fabricated wooden height meter that was calibrated, respectively. Body mass index (BMI) was calculated as body weight divided by the square of height (kg/m^2), and participants were categorized 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 (≥ 30.0 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 pediatric patients and mothers requiring obstetric and gyneacological 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 (SPSS) versions 18. Descriptive statistics of mean, standard deviation and percentages were used to summarize the participants' socio-demographic characteristics, socio-economic status and marriage and pregnancy history. Chi-square statistic was used to compare the prevalence of maternal (obstetric fistula, sexually transmitted disease, postpartum hemorrhage 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 (chi-square 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 five years (50.5%, n=111). Many of the participants were muslim (92.3%), married (81.8%) and full-time housewife (60.0%). Compared to adult mothers ($P < 0.05$), most adolescents 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 five to nine 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 to adult mothers ($P < 0.05$), few proportions of adolescent mothers 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 socio-economic status of the participants are shown in Table 1.

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/m^2)	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)	13 (48.1)	
Widowed	8 (3.6)	2 (25)	6 (75)	
Years of Marriage (n, %)^				
Less than Five	111 (50.5)	36 (32.4)	75 (67.6)	<0.001*
Five to Nine	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)	
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)	

†- Values based on independent t-tests statistics for continuous variables and chi-Square Statistics for categorical variables; *- Significant difference between group ($P < 0.05$); ^- values do not add up to 220 due to missing data ; BMI- Body Mass Index

Table 2 shows the marriage and pregnancy history of the participants. While majority of the participants (68.6%) reported 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 ante natal 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 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 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)	2.263	0.133
No	175 (79.5)	83 (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)		
Ante-natal					
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)

n = frequency, % =percentage, BA = Birth Attendant, *- Significant difference between group ($P < 0.05$)

Table 3 shows the difference in prevalence of maternal and child health indices between adolescent and adult mothers. Respondents who commenced childbearing between 14-17years 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 child bearing early reported having fistula (22% vs 0.0%) and had higher prevalence of sexually transmitted infection (38% vs 5%) when compared to adult mothers ($P < 0.001$). Postpartum hemorrhage (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 child birth weight (55% vs 29%, $P < 0.001$) were more frequently reported for children of adolescent mothers when compared to children of the adult mothers.

Table 3: Chi-square statistics for difference in the prevalence of maternal and child health indices between adolescent mothers and non-adolescent mothers

Variables	Motherhood Description				χ^2	*P*-value
	Adolescent mothers		Adult mothers			
	Yes n (%)	No n (%)	Yes n (%)	No n (%)		
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**
Post-partum hemorrhage	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 5years	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 ($P < 0.05$)

Table 4 shows the association of motherhood in adolescence with maternal and child health indices. Adolescent mothers were about 5 times more likely to experience fistula (OR=5.01, 95%CI=3.01-14.27), more than 6 times likely to have postpartum hemorrhage (OR=6.83, 95%CI=2.93-15.92) and sexually transmitted infections (OR=6.29, 95%CI=2.26-17.51), and more than 3 times likely to lose a child within 5 years of birth (OR=3.52, 95%CI=1.07-11.60), than adult mothers. Children born to adolescent mothers were 66% less likely to have a normal weight at birth (OR=0.34, 95%CI=0.15-0.73) than those born to adult mothers.

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

	Adolescent mothers (< 18 years old)	
Variables	Unadj O.R (95% CI)	Adj† O.R (95% CI)
Presence of fistula		
No	1.00	1.00
Yes	9.18 (0.00)	5.01 (3.01-14.27)*
Sexual transmitted infection		
No	1.00	1.00
Yes	7.24 (2.41-21.70)*	6.29(2.26-17.51)*
Presence of eclampsia		
No	1.00	1.00
Yes	2.20 (0.68-7.03)	2.17 (0.70-6.68)
Postpartum hemorrhage		
No	1.00	1.00
Yes	8.19 (3.73-17.97)*	6.83 (2.93-15.92)*
Child infectious illness		
No	1.00	1.00
Yes	0.96 (0.33-2.78)	1.20 (0.44- 3.29)

Child lost in 5 years		
No	1.00	1.00
Yes	3.52 (1.07-11.60)*	2.30 (0.74-7.15)
Normal child weight at birth		
No	1.00	1.00
Yes	0.39 (0.17-0.89)*	0.34 (0.15-0.73)*

Adj= Adjusted, Unadj= Unadjusted, OR= Odd Ratio, CI =Confidence Interval

†= Odd Ratio adjusted for participants' sociodemographic characteristics, socioeconomic status and marriage and pregnancy characteristic. *-Significant at $P < 0.05$, Model fit: (Chi-Square = 113.182; df =7; -2 Log Likelihood = 184.867; R^2= 0.564; $P < 0.001$).

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 to adult mothers aged 18 years and above. Broadly, this finding from Nigeria supports the conclusions from multiple international literature that child bearing during adolescence is associated with adverse maternal, perinatal and child health indices.[13–18]

Our finding of higher likelihood (more than 5 times) of experiencing fistula among adolescent mothers compared to their adult counterparts is similar to the findings of Melo *et al*., in Brazil which reported that adolescent mothers are about 8 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 sexually transmitted infection 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 sexually transmitted infection.[30] Moreover, our finding that adolescent mothers were more than 6 times

likely to have sexually transmitted infection than their adult counterparts is consistent with a previous Nigerian study which found that teenage mothers were 6.7 times likely to experience sexually transmitted infection than their adult counterparts.[21]

In contrast to previous studies from Ethiopia and Nigeria that found lower postpartum hemorrhage rate (17.2% and 19%, respectively) among adolescent mothers,[21,29] postpartum hemorrhage was more frequently (59.0%) reported by adolescent mothers in the present study. However, our finding that adolescent mothers were 6 times more likely to experience post-partum hemorrhage compared to adult mothers is consistent with the finding in Ethiopia that adolescent mothers were about 4 times more likely to report postpartum hemorrhage.[29] Although the prevalence of eclampsia was higher among adolescent mothers and they were about twice more likely to have eclampsia than their adult mothers 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 diarrhea between minor mothers and non-minor ones.[27] However, our finding that adolescents 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 2 times higher likelihood of child loss within 5 years among adolescent mothers compared to 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 to 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 health care, 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 sensitized that early marriage and motherhood during adolescence is a risk factor for multiple negative maternal and child health indices such as eclampsia, fistula, sexually transmitted infection, postpartum hemorrhage and infant morbidity and mortality. With results of the current study, traditional and religious leaders, long recognized as key partners to ending the harmful practice of child marriage in Africa,[32] can be appropriately mobilized and their suppourt enlisted in Maiduguri towards delaying girls' marriage till 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 utilized 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 generalize to other samples with different demographics in the Nigerian society. Also, the inherent selection bias (i.e., presence of systematic differences between the groups of adolescent and adult mothers) arising from non-matching of participants in the sampling strategy constitute a limitation to the present study. However, the study utilized 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 the 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 health care 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.

Contributors: ALO, SUA, FS, AAU, AMJ and AYO were involved in the design of the study. SUA, FS, AMJ and AYO led the data collection. SUA, FS and AYO led data cleaning and data analysis. ALO contributed to data analysis and interpretation of results. ALO and AYO wrote the manuscript. SUA, FS and AAU revised the drafted manuscript. ALO drafted the revisions. All authors gave approval of the final manuscript.

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QUESTIONNAIRE ASSESSING MATERNAL AND CHILD HEALTH INDICES

Socio-demographic Form

1. Age……years
2. Age at the time of marriage…….....years
3. Height…….meters
4. Weight……....kg
5. Child Age……..……..years
6. Child Sex Male…….……1
   Female…….……..2
7. Highest level of formal Education
   NIL…….....1
   Primary…….....2
   Secondary……. ……3
   Tertiary…….….4
8. Occupation
   Farming ……1
   Trading…….……...…..2
   Civil Servant…… …….3
   House wife…….……4
9. Religious affiliation
   Muslim…….....1
   Christian ……..2
10. Number of children ever born
    One……..1
    Two…….2
    Three…….....3
    Four and above...…….....4
11. Marital status
    Married……1
    Not married…….2
    Divorced…….....3
    Widowed……..4
12. Duration of marriage (years)
    Less Than 5……...1
    5 to 9…….....2

Household Items

13. Main source of drinking water?
    Piped water/bore hole into dwelling……..1
    Public tap/bore hole……2
    Open well into dwelling…….3
    Surface Water…….4
    Others ……5
14. Type of Toilet Facilities in your House hold?
    Flush toilet……..1
    Pit toilet/latrine……2

No Facility……..…….3

15. What does your household mainly use for cooking?

Gas…….……1
Kerosene……..2
Charcoal……...3
Fire wood…….4

16. Do you have a car or bus in your household?

Yes…….....1
No……..2

Questions on Maternal and Child Health Indices

Section A: Maternal issues

1. The decision to marry taken by?

Both partners……..1
Parents……2
Others…….3

2. Ever experience Domestic violence?

Yes……1
No……2

3. Ever had discussion on family planning with spouse?

Yes……1
No…….2

4. Ever experienced pregnancy related complications?

Yes……1
No…….2

5. Ever experienced postpartum hemorrhage?

Yes……1
No……..……2

6. Ever had Eclampsia?

Yes……1
No…….2

7. Ever experienced Obstructed and/or prolonged Labor?

Yes……..1
No……2

8. Ever had prolonged sickness after child birth?

Yes……1
No…….2

9. Ever Experienced Fistula?

Yes……1
No……..2

10. Ever had sexually transmitted infections (STI)?

Yes…….……...1
No…….……2

11. Type of Health personnel for delivery of last child

Doctor……1

Nurse……..2
Midwife……3
Traditional birth attendant…4

12. Do you attend ante natal care during pregnancy?

Yes……..……..1
No……..2

13. Ever had history of miscarriage?

Yes…….……1
No…….…….2

Section B: Child items

14. Child weight at birth……kg
15. Does your child weight at birth low?

Yes……...……1
No……..…….……2

16. Does the child suffer any infectious illness two weeks after birth?

Yes……..…….……1
No…….……2

If yes please specify……..

17. Any child lost in the last five years?

Yes……..……..1
No…….2

18. Ever had stillbirth?

Yes….. ……..1
No……..2

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract [pg1]
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found [pg2]
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported [pg4-5]
Objectives	3	State specific objectives, including any prespecified hypotheses [pg5]
Methods		
Study design	4	Present key elements of study design early in the paper [pg6]
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection [pg6-7]
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants [pg6]
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable [pg7]
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group [pg7]
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at [pg6]
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding [pg8]
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders [pg8]
		(b) Indicate number of participants with missing data for each variable of interest
Outcome data	15*	Report numbers of outcome events or summary measures [pg10-11]
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included [pg12]
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a

		meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Summarise key results with reference to study objectives [pg14]
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias [pg16]
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence [pg14-16]
Generalisability	21	Discuss the generalisability (external validity) of the study results [pg16]
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based [pg17]

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.