Adolescence as a Predictor of Adverse Pregnancy Outcomes: A comparative longitudinal study conducted in a national referral hospital in Western Kenya.

Veran Kemuma Mokua

veranmokua@gmail.com

Moi University https://orcid.org/0009-0003-2458-7571

Godfrey Shichenje Mutakha

Masinde Muliro University of Science and Technology https://orcid.org/0000-0002-7053-875X

Wycliffe Kosgei

Moi Teaching and Referral Hospital https://orcid.org/0000-0001-6010-4870

Pallavi Mishra

Moi University

Research Article

Keywords: Adolescent pregnancy, High-Risk Pregnancy, Maternal Outcomes, Fetal Outcomes, Western Kenya, Eldoret

Posted Date: May 27th, 2024

DOI: https://doi.org/10.21203/rs.3.rs-4470417/v1

Additional Declarations: The authors declare no competing interests.

Abstract

Adolescents present with unusual reproductive health, anatomical, psychological, and social characteristics, a situation that predisposes them high-risk pregnancies, necessitating prioritized obstetric services. Therefore, this study compared maternal and fetal outcome between adolescent (15–19 years) and adult (20-30years) pregnant mothers who delivered at Moi Teaching and Referral Hospital (MTRH) in Western Kenya. It adopted a six-month (1st July to 31st December 2021) prospective case-control study (ratio 1:3) among 836 (209 adolescents and 627 adult mothers) expectant mothers admitted at MTRH labour ward for delivery services. Maternal sociodemographic and reproductive characteristics data were collected using an interviewer administered questionnaire. Additionally, pregnancy outcomes data were collected after delivery and documented in the same questionnaire. Statistically, mean and frequencies, tests of association (Fisher's exact tests), risk ratios and multivariate logistic regression were conducted. Out of 836 participants, 547 (65.4%) were married (54 adolescents and 493 adults) and 289 (34.6%) were single. Level of education was distributed as primary (17.9%; n = 150), secondary (42.5%; n = 355) and Tertiary (39.5%; n = 330) with majority (56.3%: n = 112) of the adolescents being students. The mean antenatal visits were 3.960 ± 1.721 with more than two-thirds (68.1%) attending at least 4 visits. Adolescent mothers were significantly ($p < 0.001$) more likely (OR = 4.952; 95% CI: 3.313, 7.402) not to have used contraception prior to the current pregnancy, at risk of anaemia at labour ($p = 0.008$), hypertension in pregnancy ($p = 0.011$), preterm labour ($p = 0.011$), perineal trauma ($p = 0.004$) and having newborns with a low 5-minute Apgar score (RR = 1.601; 95% CI: 1.179, 2.174). In conclusion, expectant adolescent mothers have a significantly increased risk of adverse maternal and fetal outcomes compared to adults, warranting targeted obstetric care.

What is already known on this topic

Previous local studies conducted on adolescent pregnancy are descriptive in nature and have focused the trends.

What this study adds

This study used an analytical comparative approach in a public national referral hospital to provide baseline information on the role of age in pregnancy outcomes. It objectively demonstrates the risks associated with adverse maternal and fetal outcomes among adolescent mothers.

Introduction

Adolescent pregnancy is a topic of global complexity involving health, economic and social problems, as it is associated with high incidences of fetal outcomes and maternal mortality [1, 2]. An adolescent is defined by the World Health Organization (WHO) as those from 10 to 19 years of age and it's divided into early adolescence(10-14years) and late adolescence which is 15–19 years [3, 4] while adolescent pregnancy is defined as the occurrence of pregnancy in this age group [5, 6]. Almost one-tenth of all births occur in women below 20 years old, and more than 90% of such births occur in developing countries where the leading cause of death among girls of this age is a result of complications from pregnancy and childbirth [7].The declining age at menarche, better nutrition and healthier lifestyles of younger generations are the main factors for high rate of adolescent pregnancy globally [4, 8, 9]. The adolescent pregnancy epidemic in Kenya has been acknowledged as one of the worst in East Africa, with a recent prevalence of 15% in the country [10]. The prevalence of adolescent childbearing varies by region ranging from 50% ,23%,12.5% and 5% in Samburu, Homabay, Kilifi and Nyandarua counties respectively [10].

The pregnancy rates vary across countries because of differences in general sex education provided, socioeconomic status and access to affordable contraceptive options [11]. There is a rising concern about the various consequences of adolescent childbearing, particularly in sub-Saharan Africa, where rates are the highest worldwide [6, 12, 13].

In low and middle-income countries, the rise in adolescent pregnancy rates has been attributed to the early age of marriage, cultural practices, poverty, poor sex education, low level of education, peer influence, lack of knowledge, and/or ineffective

use of contraceptives, whereas the low adolescent birth rates in most continental western European countries is due to good sex education, traditional values and high levels of contraceptives use [14, 15].

Following the COVID-19 pandemic in Kenya, in mid-March 2020, there was an increased concern about potential increase in rates of adolescent pregnancies [16, 17]. This was because school closure separated girls from their teachers who could inform on suspected cases of abuse at home and students especially adolescents, who were not engaged (idle) and often unattended by busy parents [17]. Movement limitation also made it difficult for girls to gain access to contraceptives and essential family planning services, and compulsory curfews made girls stuck in homes with predatory family members and neighbours [16, 17].

Maternal age is an important factor in obstetric outcomes of pregnancy. Whether intended or unintended as pregnancy in adolescents increases the risk of maternal and fetal morbidities and mortalities [18].

Adolescents are a high-risk obstetric group as they are still growing physically and biologically, thus, they have been shown to have adverse maternal and fetal outcomes [2]. In Kenya, the government has played a major role in promoting adolescent sexual, reproductive health and rights by formulating and having clear policies and legal frameworks [18]. These include: National Guidelines for Provision of Adolescent Youth Friendly Services (YFS), National Adolescent Sexual and Reproductive Health Policy and the Children Act. Despite the ongoing strategies to improve adolescent and sexual reproductive health, the negative outcomes in this group still persist. Additionally, although there are various studies addressing adolescent/ teenage pregnancies in Kenya, very few clearly illustrate how age is an important factor during pregnancy by comparing the adolescents to the adult counterpart. This study will aid in providing data for developing context-based protocols and policies that will improve the prevention and management of complications in adolescent mothers in hospital settings. Therefore, this study determined the sociodemographic and reproductive characteristics of adolescent (15–19 years) and adult (20–30 years) pregnant mothers as well as compared maternal and fetal outcomes of all participants.

Materials and methods

The study was conducted at Moi Teaching and Referral Hospital (MTRH) located in Western Kenya's Eldoret town. The hospital is the second largest National Teaching and Referral hospital after Kenyatta National Hospital and has obstetric unit serves about 40 cases of deliveries in 24 hours, which translates to an average of 1200 to 1300 deliveries per month. We adopted a prospective comparative cohort design of expectant mothers seeking delivery services at Moi Teaching and Referral Hospital. Adolescent pregnant mothers between 15–19 years and adult mothers (20 to 30 years) who presented in labour ward were followed up through labour, and their immediate outcomes were documented. The comparative group were selected because anecdotal data indicate that women aged 20–30 years are more likely to have safe childbirth [19]. The sample size was estimated using the Fleiss formula for comparison of proportions [20]. This has also been confirmed by recent studies [21].

$$n \geq \frac{(1+r)}{r} \frac{\bar{p}\,(1-\bar{p})(Z_{\beta}+Z_{\frac{\alpha}{2}})^2}{(p_1-p_2)^2}$$

Where:

n = minimum sample size for one group

r = ratio taken as 1:3

$\bar{p}$ = pooled prevalence

Z_{β} = critical value corresponding to 80% power

$Z_{\frac{\alpha}{2}}$ = critical value corresponding to 0.05 type I error

p_1 = Caesarian section rate among adolescents

p_2 = Caesarian section rate among adults

Using this formula, the estimated minimum sample size was 836 (209 adolescent and 627 adults).

Caesarean section rate was used in calculating proportion of adverse maternal outcomes as this is the most objective variable reported by many studies under comparison [7, 13, 14, 22, 23]. A large ratio (1:3) for cases and controls was used to increase the likelihood of justifying that the adverse effects were isolated to one group (cases) and not a factor of chance [21]. For the adolescents and adult women who met the eligibility criteria, systematic sampling was applied. From previous records a total of 600 adolescents and 4206 adults aged between 20 and 30 years delivered in MTRH between January 2019 and June 2019. Thus every 3rd (N/n = 600/209 ~ 3) and 7th (4206/627 ~ 7) adolescent and adult women aged 20–30 years were recruited, respectively. They were identified upon admission at the labour ward and then followed through labour till delivery in order to document the outcomes. Prior to commencing the study, one-day training was offered to the research assistant and two midwives to help them know the objective and the significance of the study and the rights of the respondents either to participate or decline. The nurse in charge of the labour ward was informed of the study to be conducted and requested to help identify the target study participants that are pregnant mothers within the specified age limits upon admission. Potential participants who met the eligibility criteria were approached for potential enrolment. A private room was used when talking to each client, the purpose, objectives and procedures of the study were explained to potential subjects. Consent and assent were taken from adults and adolescents less than 18 years respectively, who freely agreed to participate in the study. In addition, the parents or guardian to the adolescents under 18 years of age were also required to give consent. Following consent, an interviewer administered questionnaire was used by the research assistants during the face-to-face collection of data variables. Clarification of any question was done, and translation to Kiswahili was done in cases where the participant did not understand English. The investigator worked with two midwives in recording the social and maternal characteristics of the participants. After the completion of all the questions in the questionnaire form and documentation of maternal and fetal outcome, the participant was thanked for her participation and allowed to exit. Descriptive statistics of mean (with corresponding standard deviation) and frequencies (with corresponding proportions) were conducted. Inferentially, a test of association was conducted using both Pearson chi-square and Fisher's exact tests. Risk ratios computed at 95% confidence interval and confounders were controlled using a multivariate logistic regression model. Ethical approvals were obtained from the Moi Teaching and Referral Hospital/Moi University School of Medicine Institutional Research and Ethics Committee (IREC) – Approval number: IREC/2020/247. Additionally, written informed consent was sought before patients were enrolled into the study.

Results

We enrolled 836 expectant mothers in labour, one-quarter (209) of whom were aged below 20 years of age with the rest (627) being aged between 20–30 years. About three quarters (74.2%) of adolescent mothers were single (not married) while 78.6% of their adult counterparts were married. This implies that adult expectant women were significantly ($p < 0.001$) more likely to be married compared to their younger counterparts who were single. About half (42.5%; n = 355) of all the women enrolled had attained at least a secondary level of education while 407 (48.6%) were unemployed (Table 1).

Table 1
Participants' Sociodemographic Characteristics

Sociodemographic Characteristics		Age Categories		Total	p-value
		< 20 years	20–30 years		
Marital status	Married	54 (25.8)	493 (**78.6**)	**547 (65.4)**	< 0.001
	Single	155 (**74.2**)	133 (21.2)	**288 (34.4)**	
	Widowed	0	1 (0.2)	**1 (0.2)**	
Education level	None	0	1 (0.2)	**1 (0.1)**	< 0.001
	Primary	70 (33.5)	80 (12.8)	**150 (17.9)**	
	Secondary	114 (**54.5**)	241 (38.4)	**355 (42.5)**	
	Tertiary	25 (12.0)	305 (**48.6**)	**330 (39.5)**	
Occupation	Employed	2 (1.0)	52 (8.3)	**54 (6.5)**	< 0.001
	Self-employed	12 (5.7)	164 (26.2)	**176 (21.1)**	
	Student	112 (**56.3**)	87 (13.8)	**199 (23.8)**	
	Unemployed	83 (20.4)	322 (**51.4**)	**407 (48.6)**	

The average antenatal visits were about four (3.960; SD ± 1.721) visits over the course of pregnancy. When the visits were stratified by frequency, 55 (6.6%) did not attend any antenatal clinic while 569 (68.1%) had at least four visits. 185 (88.5%) of the adolescent mothers did not report using any form of contraception (Table 2).

Table 4.2
Reproductive Characteristics of the Study Participants

Reproductive Characteristics		Age Categories		Total	COR (95% CI:)
		< 20 years	20–30 years		
ANC Visits	None	14 (6.7)	41 (6.5)	55 (6.6)	
	1–3 visits	77 (36.8)	135 (21.5)	212 (25.3)	
	≥ 4 visits	118 (**56.5**)	453 (**72.0**)	569 (68.1)	
Contraceptives use	No	185 (**88.5**)	324 (**51.7**)	509 (60.9)	4.952 (3.313, 7.402)
	Yes	24 (11.5)	303 (48.3)	327 (39.1)	**p < 0.001**

The main maternal outcomes of interest in this study were anaemia at the time of labour, hypertension, preterm labour, caesarean section and perineal trauma. This study noted that adolescent mothers below 20 years of age were significantly more at risk to present with anaemia at labour (p = 0.008), hypertension (p = 0.011), preterm labour (p = 0.011) and perineal trauma (p = 0.004) compared to their older counterparts (Table 3).

Table 4.3
Adverse Maternal outcomes among adolescent and adult pregnant mothers aged 20–30 years.

Adverse Maternal Outcomes		Age Categories		Total	p-value	RR (95% CI:)
		< 20 years	20–30 years			
Anaemia at Labour	Yes	34 (16.3)	59 (9.4)	93 (11.1)	**0.008**	**1.552 (1.153, 2.090)**
	No	175 (83.7)	568 (90.6)	743 (88.9)		
Hypertension	Yes	31 (14.8)	53 (8.5)	84 (10.0)	**0.011**	**1.559 (1.146, 2.121)**
	No	178 (85.2)	574 (91.5)	752 (90.0)		
Preterm Labour	Yes	63 (30.1)	134 (21.4)	197 (23.6)	**0.011**	**1.400 (1.092, 1.795)**
	No	146 (69.1)	493 (78.6)	639 (76.4)		
Caesarean Section	Yes	51 (24.4)	146 (23.3)	197 (23.6)	0.778	1.047 (0.797, 1.375)
	No	158 (75.6)	482 (76.7)	639 (76.4)		
Perineal Trauma	Yes	79 (37.8)	169 (27.0)	248(29.7)	**0.004**	**1.143 (1.039, 1.257)**
	No	130 (62.2)	458 (73.0)	588 (70.3)		

When the study conducted a logistic regression controlling for hypertension and anaemia in pregnancy as risk factors for preterm labour, the study noted that only age (being below 20 years) was a significant risk factor. Adolescents were nearly three times more likely to have preterm labour compared to their adult counterparts (Table 4).

Table 4

Relationship between Preterm labour with Anaemia and Hypertension in Pregnancy

Maternal Outcome		**p-value**	**RR (95% CI)**
Preterm labour	**<20 years**	**0.002**	**2.627 (1.417, 4.870)**
	Hypertension in Pregnancy	0.061	0.473 (0.216, 1.036)
	Anaemia in Pregnancy	0.762	0.869 (0.351, 2.152)

The three main fetal outcomes of interest in this study were Low birthweight, low 5-minute Apgar score and still birth. One quarter (25.4%) of adolescent mothers gave birth to newborns with a low birthweight compared to 19.1% of their older compatriots, a difference that was not statistically significant (p=0.061). 14.8% of adolescent mothers had newborns with low 5-minute Apgar score compared to their adult counterparts at 8.1%. From these findings, adolescent mothers had a significantly (p=0.007) greater risk (RR=1.601; 95% CI: 1.179, 2.174) of having newborns with low 5-minute Apgar score compared to the adult mothers. Adolescent mothers (1.9%) were less likely to have stillbirths compared to adult mothers at 3.2% (Table 5)

Table 5
Adverse fetal outcomes of newborns born of adolescent and adult mothers seeking care at MTRH.

Fetal Outcome		< 20 years	20–30 years	Total	p-value	RR (95% CI:)
Low birthweight	Yes	53 (25.4)	120 (19.1)	173 (20.6)	0.061	1.302 (1.001, 1.694)
	No	156 (74.6)	507 (80.9)	663 (79.4)		
Low 5-minute Apgar score	Yes	31 (14.8)	51 (8.1)	82 (9.8)	**0.007**	**1.601 (1.179, 2.174)**
	No	178 (85.2)	576 (91.9)	754 (90.2)		
Stillbirth	Yes	4 (1.9)	23 (3.7)	27 (3.2)	0.264	0.586 (0.235, 1.459)
	No	205 (98.1)	604 (96.3)	809 (96.8)		

The study further controlled the effect of adverse maternal outcomes on Low 5-minute Apgar score (as a fetal outcome), and preterm labour significantly increased the risk of Low Apgar score at the 5th minute by more than five folds (RR = 5.714; 95% CI: 1.569, 20.816).

Discussion

This study enrolled 836 expectant women of whom 209 were below 20 years of age while 627 were aged between 20–30 years in a ratio of 1:3. This ratio was higher than three studies under comparison where the authors opted for a 1:2 [5, 24] and 1:1[23] adolescent to adult ratio respectively. The high number of controls in comparative studies help clearly determine whether the effect of risk factors seen among the cases is isolated or universal irrespective of the risk status, because this study design is used to determine causality. This was also witnessed in a nested case-control study in a cohort of 4,591 expectant women from Northern England where the authors [25] adopted a higher case to control ratio of 1:6 compared to the current study. This study hypothesized that being aged below 20 years is a risk factor for undesirable pregnancy outcome. Furthermore, it is easier to identify women within safe age of pregnancy (> 20 years) compared to adolescent mothers in many public healthcare facilities in Kenya.

This study reports that about two thirds (65.4%, n = 547) of the expectant mothers enrolled were married while 288 (34.4%) were single and 0.2% were widowed. A high proportion of married women was also reported in a study conducted at the Cape Coast Metropolis in Ghana[26] where the proportion of those married (51.2%) was higher than single women (46.3%), while the rest were either divorced or opted not to respond to the marital status question. Similarly, in Northern England, 55.2% of those enrolled were married while 23.1% were single. The authors (Marvin-Dowle et al., 2018) further noted that 21.5% were not married but living with a partner. This high proportion of unmarried women compared to the current study could be attributed to two factors. First, methodologically, the authors focused on adolescent pregnancies reported in national surveys while the current study was a hospital-based study. Very low proportions of marriages are reported among adolescents as adolescent marriages are both forbidden by law and most of adolescent pregnancies are either undesired or unplanned for.

When the level of education of the participants was assessed, majority (42.5%) of this study's participants attained a secondary level of education followed by those with a tertiary (39.5%) level of education and primary (17.9%) level of education. Only one participant was reported as not having any formal education. This finding is similar to that conducted in major towns in Kenya where nearly half (44.5%) of the study's participants had attained a secondary level of education[27]. The authors[27] merged those with primary level of education or less and got a higher proportion (34.9%) compared to that of the current study. Furthermore, their proportion of tertiary level of education stood at 20.6% [27]. This high proportion of secondary and tertiary level of education reported in both studies could be attributed to the fact that Kenya has high literacy levels courtesy of state sanctioned universal primary education and transition to secondary level of education. However, the proportionate distribution of level of education reported in this study varies from that reported across studies conducted in Africa. In Ethiopia, the authors [5] reported a higher (8.28%) proportion of those with no formal education compared to the

current study. This study collected level of education data because previous studies have correlated highest level of education and reproductive health awareness. Higher level of education leads to lower rates of adolescent pregnancy due to its positive effect on contraceptive acceptance and use. Education also increases autonomy and decision-making power of an individual. Furthermore, it increases economic independence leading to postponement of marriage and reduction of fertility. The lower the level of education, the earlier the age of consent to first sexual encounter which increases the risk of adolescent pregnancy.

About half (48.6%) of this study's participants were unemployed followed by students (23.8%), those who were self-employed (21.1%) and the formally employed (6.5%) being the least represented. This high prevalence of students and unemployed could be attributed to the fact that this study enrolled one-third of its participants who were adolescent mothers. Furthermore, majority of the adult mothers were young and yet to be engaged in meaningful employment as most of them did not attain tertiary level of education. The proportionate findings of this study match that reported in a local study conducted in Kenya's major towns and cities (Nairobi, Mombasa, Kisumu, Machakos, and Kakamega) where 44.3% were unemployed, 32.6% were students and 44.3% were employed [27].

The mean number of antenatal visits during the pregnancy of this study's participants (irrespective of their age grouping) was 3.960 ± 1.721 visits. This finding is close to that reported in Ethiopia[5] where the average visits for adolescent pregnancies 3.26 ± 1.24 (cases) and 3.54 ± 1.5 for adult pregnancies (controls). When the antenatal visits were stratified by frequency, 55 (6.6%) of all this study's participants did not attend any antenatal clinic, 212 (25.3%) made 1–3 visits while majority of them (n = 569; 68.1%) had at least 4 visits. In South Africa's KwaZulu-Natal, the authors[28] determined that most of the study participants had two antenatal visits during their pregnancy under study. The difference in the average number of antenatal visits could be attributed to the fact that maternity services are free in Kenya thus an increased access by the pregnant mothers.

When we compared the rates of contraceptives use, the least uptake was adolescent expectant mothers (11.5%) compared to their adult counterparts (48.3%). This study's average is higher than that reported in East and Southern African Countries at 23.08%[29] and a local study conducted in Kenya[27] at 18.07%. Higher overall contraception rate than that found in this study was reported in a Wogedi town in Northeast Ethiopia[30] at 46.3%.

The main maternal outcomes of interest in this study were anaemia at the time of labour, hypertension in pregnancy, preterm labour, caesarean section and perineal trauma. Anaemia at the time of labour was more prevalent in adolescent pregnancies at 16.3% compared to adult pregnancies at 9.4%. This relationship was statistically significant ($p = 0.008$), with adolescent mothers being more at risk of anaemia at the time compared to adult expectant mothers (RR = 1.556; 95% CI: 1.156, 2.096). The proportion of expectant mothers with anaemia at the time of labour, who were enrolled in this study was close to that reported in Raymond Mhlaba sub-District of South Africa [23] where 13% of adolescent mothers were diagnosed with anaemia at labour compared to 10% of adult mothers. Higher prevalence of anaemia at labour for adolescent mothers of 46% compared to 32% among adult mothers was reported in Lahore-Pakistan [31] in a study conducted among 300 participants. The authors [31] used a haemoglobin (Hb) cut-off of < 11 g/dL noted a statistically significant relationship ($p = 0.010$). The high prevalence of anaemia in adolescents than in older women might be because of their nutritional deficiencies related to social and environmental factors, growth spurt and onset of menstruation which increase iron requirements [23].

Hypertension in pregnancy was seen in 14.8% of the adolescent mothers compared to 8.5% of the adult expectant women enrolled in this study, a relationship that was statistically significant ($p = 0.012$; RR = 1.543; 95% CI: 1.133, 2.100). This finding was higher than that reported in South Africa at 2.1% among adolescent mothers and 2.0% among adult mothers. In a large prospective study conducted in Northern England[25] that enrolled 640 adolescent and 3951 adult mothers, the overall prevalence hypertension in pregnancy was 3.6%. The proportionate difference could be attributed to spatial and sample size differences in both studies. Prevalence rates tend to be lower in large sample sizes compared to studies with fewer participants. Secondly, because of the difference in health promotion and primary care services offered in Northern England -

through the National Health Service- compared to Kenya, mitigating interventions could be instituted earlier hence the lower prevalence. In Nigeria, there were nearly equal proportions of hypertension in pregnancy for both adolescent and adult mothers at 4.1% and 3.8% respectively, a relationship that was not statistically significant (p = 0.934). This current study findings contrast those reported in Egypt where the authors[19] reported lower proportion (6.9%) of hypertension in adolescents compared to the adult mothers (8.3%), a relationship that was found to be statistically significant (p = 0.001). These differences could be attributed to both study methodology and settings. Whereas this study adopted a 1:3 ratio, the study from Egypt used a 1:5 ratio. Larger case-control ratios directly affect the proportions of variable of interest. Additionally, the socioeconomic differences in Egypt and Kenya, where Egypt is a developed economy compared to Kenya could also attribute to a more sedentary lifestyle further increasing the risk of hypertension among adolescents [10, 19]. A similar finding was also reported in South Africa [32], the rate of hypertension was noted to be higher in adolescents (39.8%) while it was at 26.4% in adult mothers, a difference that was noted to be statistically significant (p = 0.003). However, in Turkey [33], lower proportion (13.7%) of hypertension among adolescent mothers compared to their adult compatriots at 14.3% was reported, a relationship that was not statistically significant (p = 0.622).

Preterm labour was witnessed more in adolescents (30.1%) compared to adult (21.4%) mothers enrolled in this study, a relationship that was found to be statistically significant (p = 0.011; RR = 1.395; 95% CI: 1.092, 1.795). This finding compares to that reported in Lahore-Pakistan at 11.3% among adolescent mothers and 4.6% of adult mothers delivering below 37 weeks' gestation, a relationship that was statistically significant [31]. Additionally, caesarean Section was noted more among adolescent mothers (24.4%) compared to adult mothers (23.3%); however, the difference was not statistically significant (p = 0.778; RR = 1.050; 95% CI: 0.800, 1.379). A similar trend was noted in Raymond Mhlaba sub-District of South Africa at 27.4% among adolescent mothers and 13.7% among adult mothers [23]. Contrasting findings of 16.6% among adolescent mothers who underwent caesarean section was reported in Lahore-Pakistan [31] compared to 21.33% among adult mothers with no statistically significant association noted (p = 0.290). In Turkey [33] where 66.8% of the adolescent mothers underwent a caesarean section a proportion that was lower than the 87.4% of adult mothers who underwent the same procedure. The variance could be attributed to methodological differences in the studies under review compared to the current study. In Pakistan [31], the adolescent to adult ratio was 1:1 compared to the 1:3 adopted in this study. In Turkey, the authors opted for a larger sample size (n = 1861) compared to the 836 enrolled in the current study. Furthermore, in Turkey [33] adopted a retrospective design compared to the prospective nature of the current study. Because of the large sample size and study design differences, the findings of these two studies on caesarean section rates for adolescent and adult mothers were likely to contrast.

This study reports that more than one-third (37.8%) of adolescent mothers had perineal trauma (perineal tears and episiotomy) compared to adult mothers at 27.0%, a relationship that was found to be statistically significant (p = 0.004; RR = 1.144; 95% CI: 1.040, 1.259). A similar trend was reported in a study conducted in the Northwest region of Ethiopia [22] where 30.9% of adolescent mothers had perineal tears compared to 10.9% of adult mothers. The findings in the current study are higher than that reported from a retrospective study conducted in Tigray region of Ethiopia where perineal tears were witnessed in 7.4% of adolescent mothers compared to 5.2% of adult mothers. This proportionate difference could be attributed to difference in study designs. Retrospective studies are often fraught with incomplete data, a phenomenon that could explain the marked proportionate difference.

This study reports that sub-optimal antenatal care attendance is not a significant predictor of adverse maternal outcomes such as anaemia in labour, hypertension and preterm labour. These findings match that reported in Kilifi County [34] where the authors stated that although there were higher proportions (31%) of preterm labour among adolescent mothers, the possible biological explanation could be prematurity as both the physiological and anatomical systems were still developing. Although the authors also attributed this preterm labour to inadequate and lack of proper antenatal care offered to adolescent mothers to address their medical and nutrition needs, the relationship was not statistically significant.

In this study, more adverse maternal complications were noted among adolescent pregnant mothers compared to their adult counterparts. Perineal trauma was the outcome with the highest incidence of 29.7% while hypertension in pregnancy had the

least incidence of 10.0% These findings compared to those of a study conducted in Nigeria [15] where more adverse maternal complications were also noted among adolescent pregnant mothers compared to their adult counterparts however the most common adverse outcome was anaemia at labour and it was attributed to inadequate nutrition during the antenatal period which could also be linked to adverse fetal outcomes such as low birth weight.

The three main fetal outcomes of interest in this study were low birth weight, low 5-minute Apgar score and stillbirth. One quarter (25.4%) of adolescent mothers gave birth to newborns with a low birthweight compared to 19.1% of their older compatriots, a difference that was not statistically significant ($p = 0.061$). A higher proportion of low birthweight among adolescent mothers was also reported in a number of studies under comparison. In Turkey [33], 44.5% of adolescent mothers had low birthweight newborns compared to 21.8% of adult mothers, a difference that was found to be statistically significant ($p < 0.001$). Similarly, in a study conducted in Tigray-Ethiopia [14] where 17.5% of adolescent mothers gave birth to low birthweight newborns compared to 6.8% of adult mothers. These findings contrast that of a retrospective comparative study done by Hoque et al in a tertiary hospital in South Africa [35] where the rate of low birth weight was almost similar between the adolescents and adult mothers with no statistical difference, $p = 0.174$. The difference could be attributed to the study designs and sample size differences in both studies. The current study was a prospective study whereas the study in South Africa was retrospective thus possibly prone to missing information compared to the current prospective study.

The study further assessed stillbirths as a fetal outcome among the study's participants who were stratified by age. Younger (adolescents) mothers (1.9%) were less likely to have still births compared to adult mothers at 3.7%. These finding contrasts that reported in a retrospective study conducted in Nigeria where the rate of still births was higher among adolescent mothers at 16.2% compared to older women above 20 years, which was 12.4% [15]. The difference could be attributed to methodological difference in the study in Nigeria compared to current study. In Nigeria, the study was a retrospective review and over a period of 6 years while this study, was prospective and over 6 months. Additionally, the findings of this study contrasts that reported in retrospective study conducted in Ethiopia where the rate of stillbirths was more in adolescents at 6.1% than (Abebe et al., 2018). This is similar to the findings of a study done in Cameroon [36] where there was also no statistical significance, $p = 0.080$. A phenomenon that could be explained by the fact that our study was not designed to detect risk factors such as smoking or alcohol abuse among the adolescent population.

Lastly, when the study controlled for the effect adverse maternal outcomes on fetal complications in the regression model and noted that preterm labour significantly ($p = 0.005$) increased the risk of low 5-minute Apgar score by five folds (RR = 5.714; 95% CI: 1.569, 20.816). Similar to this study's findings, a study conducted in Kilifi County[34] also noted a high prevalence of low birthweight newborns among adolescent mothers. The authors[34] argued that this phenomenon could be since a high proportion of preterm labour increases the risk of low birth weight as these newborns had not attained their full intrauterine growth weight. A situation more common among adolescent mothers who were malnourished and had a low number of antenatal visits. Additionally, in a prospective case-control study conducted in Northeast India among 495 expectant mothers [37], adolescent mothers were more at risk (RR = 1.655; 95% CI: 1.039, 2.636) of preterm labour after controlling for adverse maternal outcomes compared to their adult counterparts, a finding that is similar to the current study. The authors[37] argued that the although the mechanism of preterm labour among adolescent mothers is still unclear; one of the explanations could be immaturity of the uterine and cervical blood supply in young mothers which leads to increase in prostaglandin production leading to preterm labour. Secondly, lack of proper menstrual preconditioning among young adolescent interferes with the process of decidualization and trophoblastic invasion that increases the risk of defective deep placentation. This could increase the likelihood of preterm deliveries in adolescent primigravidae [37]. In Pakistan, the authors[31] noted that maternal youth is a risk factor for preterm labour and adverse fetal outcomes. This creates the need to screen for biological risks among expectant adolescent mothers such as cervical shortness, infections and inadequate nutrition. Education about these risks should be given and frequent antenatal visits advised.

Conclusions and Recommendations

This study reports that more than half of the adolescent mothers were secondary school students with no history of contraception and attended at least four antenatal visits. In comparison to adult expectant women, adolescent mothers had a significantly increased risk of anaemia at labour, hypertension in pregnancy, preterm labour, perineal trauma and having neonates with a low 5-minute Apgar score whose risk was elevated by preterm labour. Therefore, there is need for targeted interventions such as contraception use among secondary school students to reduce the risk of adolescent pregnancies. Additionally, healthcare workers in the antenatal care and delivery cascade should monitor for anaemia and hypertension in pregnancy while recommending interventions such as optimal nutrition and regular antenatal visits to avert the likelihood of adverse pregnancy outcomes. Lastly, risk factors for preterm delivery and low 5-minute Apgar score such as prolonged labour should be addressed by ensuring adequate antenatal follow-up and strict labour progress monitoring.

Declarations

Acknowledgements

Moi Teaching and Referral Hospital management, healthcare workers working at the labour ward, the mothers who participated in this study and the faculty at Moi University's Department of Reproductive Health.

Competing Interests

The authors declare no financial conflict of interest or any other non-financial competing interests.

Author Contribution:

1. **VKM, GSM, PM and WK:** Substantial contributions to conception and design of the study.
2. **VKM, GSM, PM and WK:** Acquisition of data, analysis and interpretation of data designed and carried out data collection and participated in drafting the manuscript.
3. **VKM, GSM, PM and WK:** Drafting the article or revising it critically for important intellectual content.
4. **VKM, GSM, PM and WK:** Final approval of the version to be published intellectual content. They also gave the final approval of the version to be published and have agreed to be accountable for all aspects of this work.

References

1. Singh R, Kumari S, Sinha S. Adolescent Pregnancy: A Prospective Study in a Tertiary Care Centre. European Journal of Molecular and Clinical Medicine. 2022;9: 9818–9823. Available: https://www.embase.com/search/results?subaction=viewrecord&id=L2018717516&from=export
2. Akseer N, Keats EC, Thurairajah P, Cousens S, Bétran AP, Oaks BM, et al. Characteristics and birth outcomes of pregnant adolescents compared to older women: An analysis of individual level data from 140,000 mothers from 20 RCTs. EClinicalMedicine. 2022;45. doi:10.1016/J.ECLINM.2022.101309
3. Chandra-Mouli V, Camacho AV, Michaud PA. WHO guidelines on preventing early pregnancy and poor reproductive outcomes among adolescents in developing countries. Journal of Adolescent Health. 2013;52: 517–522. doi:10.1016/j.jadohealth.2013.03.002
4. De Freitas Galvão RB, Figueira CO, Borovac-Pinheiro A, De Morais Paulino DS, Faria-Schützer DB, Surita FG. Hazards of repeat pregnancy during adolescence: A case-control study. Revista Brasileira de Ginecologia e Obstetricia. 2018;40: 437–443. doi:10.1055/s-0038-1666811
5. Kassa GM, Arowojolu AO, Odukogbe AA, Yalew AW. Prevalence and determinants of adolescent pregnancy in Africa: A systematic review and Meta-analysis 11 Medical and Health Sciences 1117 Public Health and Health Services.

Reproductive Health. BioMed Central Ltd.; 2018. p. 195. doi:10.1186/s12978-018-0640-2

6. Kassa GM, Arowojolu AO, Odukogbe AA, Yalew AW. Adverse neonatal outcomes of adolescent pregnancy in Northwest Ethiopia. Saaka M, editor. PLoS One. 2019;14: e0218259. doi:10.1371/journal.pone.0218259
7. Althabe F, Moore JL, Gibbons L, Berrueta M, Goudar SS, Chomba E, et al. Adverse maternal and perinatal outcomes in adolescent pregnancies: The Global Network's Maternal Newborn Health Registry study. Reprod Health. 2015;12: S8. doi:10.1186/1742-4755-12-S2-S8
8. Therrien KJ. Repeat pregnancies during adolescence : factors that influence Repeat pregnancies during adolescence : factors that influence teens' decisions to have more than one child teens' decisions to have more than one child. 2009. Available: https://scholarworks.smith.edu/theses/1154
9. Kinaro J, Kimani M, Ikamari L, Ayiemba EHO. Perceptions and Barriers to Contraceptive Use among Adolescents Aged 15 - 19 Years in Kenya: A Case Study of Nairobi. Health N Hav. 2015;07: 85–97. doi:10.4236/health.2015.71010
10. KNBS. Kenya Demographic and Health Survey 2022 Key Indicators Report. 2023. Available: www.DHSprogram.com.
11. Dutta I, Joshi P. Maternal and perinatal outcome in teenage Vs. vicenarian primigravidae - A clinical study. Journal of Clinical and Diagnostic Research. 2013;7: 2881–2884. doi:10.7860/JCDR/2013/7265.3783
12. Shi H, Chen L, Wang Y, Sun M, Guo Y, Ma S, et al. Severity of Anemia during Pregnancy and Adverse Maternal and Fetal Outcomes. JAMA Netw Open. 2022;5: 1–13. doi:10.1001/jamanetworkopen.2021.47046
13. Ogawa K, Matsushima S, Urayama KY, Kikuchi N, Nakamura N, Tanigaki S, et al. Association between adolescent pregnancy and adverse birth outcomes, a multicenter cross sectional Japanese study. Sci Rep. 2019;9: 1–8. doi:10.1038/s41598-019-38999-5
14. Abebe AM, Fitie GW, Jember DA, Reda MM, Wake GE. Research Article Teenage Pregnancy and Its Adverse Obstetric and Perinatal Outcomes at Lemlem Karl Hospital. 2018. doi:10.1155/2020/3124847
15. Ezegwui HU, Ikeako LC, Ogbuefi F. Obstetric outcome of teenage pregnancies at a tertiary hospital in Enugu, Nigeria. Niger J Clin Pract. 2020;15: 147–150. doi:10.4103/1119-3077.97289
16. Briggs H, Haberland N, Desai S, Hoop T de, Ngo T. The impact of COVID-19 on opportunities for adolescent girls and the role of girls' groups. Poverty, Gender, and Youth. 2020 [cited 5 Dec 2023]. Available: https://knowledgecommons.popcouncil.org/departments_sbsr-pgy/1206
17. Zimmermanid LA, Karpid C, Thiongoid M, Gichangiid P, Guiella G, Gemmillid A, et al. Stability and change in fertility intentions in response to the COVID-19 pandemic in Kenya. PLOS Global Public Health. 2022;2: e0000147. doi:10.1371/JOURNAL.PGPH.0000147
18. Ministry of Health Kenya. National Adolescent Sexual and Reproductive Health Policy, 2015. National Adolescent Sexual and Reproductive Health Policy. 2015; 1–37. doi:10.1017/CBO9781107415324.004
19. Abbas AM, Ali SS, Ali MK, Fouly H. The maternal and neonatal outcomes of teenage pregnancy in a tertiary university hospital in Egypt. 2017;7: 1–10.
20. Fleiss JL. Statistical Methods for Rates and Proportions. Second Edition - J. L. Fleiss - Google Books. second edi. Newyork.wiley; 1981.
21. Hulley SB. Designing Clinical Research. LIPPINCOTT WILLIAMS & WILKINS. 2013. doi:10.1201/9781003039648-ch2
22. Mullu Kassa GI, Arowojolu AO, Tunde Odukogbe AA, Worku Yalew A. Adverse maternal outcomes of adolescent pregnancy in Northwest Ethiopia: A prospective cohort study. 2021. doi:10.1371/journal.pone.0257485
23. Tshakweni N, Goon D Ter, Okafor UB. A comparative analysis of teenagers and older pregnant women concerning maternal and neonatal adverse outcomes in raymond mhlaba sub-district, south africa. Afr J Reprod Health. 2020;24: 138–146. doi:10.29063/ajrh2020/v24i4.15
24. Ochen AM, Chi PC, Lawoko S. Predictors of teenage pregnancy among girls aged 13-19 years in Uganda: A community based case-control study. BMC Pregnancy Childbirth. 2019;19: 1–14. doi:10.1186/s12884-019-2347-y

25. Marvin-Dowle K, Kilner K, Burley VJ, Soltani H. Impact of adolescent age on maternal and neonatal outcomes in the Born in Bradford cohort. BMJ Open. 2018;8: 16258. doi:10.1136/bmjopen-2017-016258
26. Siakwa M, Nyarko-Sampson M, Bruce SD. Obstetric outcomes: A comparison of teenagers and adults in the Cape Coast metropolis, Ghana. Heliyon. 2020;6: e05466. doi:10.1016/j.heliyon.2020.e05466
27. Okigbo CC, Speizer IS. Determinants of sexual activity and pregnancy among unmarried young women in urban Kenya: A cross-sectional study. PLoS One. 2015;10: 1–17. doi:10.1371/journal.pone.0129286
28. Govender T, Reddy P, Ghuman S. Obstetric outcomes and antenatal access among adolescent pregnancies in KwaZulu-Natal, South Africa. South African Family Practice. 2018;60: 1–7. doi:10.1080/20786190.2017.1333783
29. Worku MG, Tessema ZT, Teshale AB, Tesema GA, Yeshaw Y. Prevalence and associated factors of adolescent pregnancy (15–19 years) in East Africa: a multilevel analysis. BMC Pregnancy Childbirth. 2021;21: 1–8. doi:10.1186/s12884-021-03713-9
30. Habitu YA, Yalew A, Bisetegn TA. Prevalence and factors associated with teenage pregnancy, northeast Ethiopia, 2017: A cross-sectional study. J Pregnancy. 2018;2018. doi:10.1155/2018/1714527
31. Naz U. Comparison of obstetric outcome in terms of the risk of low birth weight, preterm delivery, cesarean section rate and anemia in primigravid adolescents and older primigravida. Journal of the College of Physicians and Surgeons Pakistan. 2014;24: 131–134. doi:02.2014/JCPSP.131134
32. Ogunwale OI, Rangiah S. Profile and obstetric outcome of teenage pregnancies compared with pregnant adults at a district hospital in kwazulu-natal. South African Family Practice. 2021;63: 1–5. doi:10.4102/safp.v63i1.5290
33. Bildircin FD, Kurtoglu E, Kokcu A, Işik Y, Ozkarci M, Kuruoglu S. Comparison of perinatal outcome between adolescent and adult pregnancies. Journal of Maternal-Fetal and Neonatal Medicine. 2014;27: 829–832. doi:10.3109/14767058.2013.829816
34. KOMBE DR. Prevalence and Perinatal Outcomes of Teenage Pregnancy in Kilifi County, Kenya. 2019. Available: https://elibrary.pu.ac.ke/handle/123456789/834%0Ahttps://elibrary.pu.ac.ke/bitstream/handle/123456789/834/KOMBE DISMUS RAMADHAN.pdf?sequence=1
35. Hoque ME, Towobola OA, Mashamba TJ, Monokoane T. Comparison of adverse pregnancy outcome between teenage and adult women at a tertiary hospital in South Africa. Biomedical Research. 2014. Available: http://www.biomedres.info
36. Region SW, Egbe TO, Omeichu A, Halle-ekane GE, Tchente CN, Egbe E, et al. Prevalence and outcome of teenage hospital births at the buea health district ,. Reprod Health. 2015; 1–10. doi:10.1186/s12978-015-0109-5
37. Das B, Medhi R, Das A, Ahmed M, Bawri S, Rai S. Adverse obstetrical and perinatal outcome in adolescent mothers associated with first birth: a hospital-based case-control study in a tertiary care hospital in North-East India. Adolesc Health Med Ther. 2016; 37. doi:10.2147/ahmt.s91853

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Dr.VeranMokuaSupportinginformation.docx