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High-risk fertility behavior and infant mortality in Kenya

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Abstract

Study purpose: To establish the contribution of high-risk fertility behavior on infant mortality in Kenya.

Methodology: The study used cross-sectional survey data obtained from the 2022 Kenya demographic and health survey. Descriptive analysis involved frequencies and cross-tabulation. Inferential analysis involved multinomial logistic regression.

Results: Young age at first birth of under-20 years was significantly related to neonatal (OR = 1.001; $\rho<0.01$; CI = 0.347-0.850), post-neonatal (OR = 1.542; $\rho<0.01$; CI = 0.364-0.809), and infant (OR = 1.043; $\rho<0.01$; CI = 0.372-0.791) mortalities. Mothers who gave birth under-20 years of age had higher odds of experiencing neonatal mortality (OR = 1.183; $\rho<0.05$; CI = 0.374-1.733). Births of orders 2 to 3 had lower odds of neonatal (OR = 0.710; $\rho<0.05$; CI = 0.436-1.157) and infant (OR = 0.802; $\rho<0.05$; CI = 0.494-1.304) mortalities. Nulliparous women were 0.31 times less likely and 0.45 times more likely, to report neonatal and post-neonatal mortalities, respectively.

Conclusion: Analytical findings revealed under-20 years' age at first birth, under-20 years' age at motherhood, first order births, and births to nulliparous women to be high-risk fertility behaviors related to infant mortality. Old age at first birth and preceding birth interval were unrelated to infant mortality. Advocacy on the need to delay entry into marriage and sexual debut should be done so as to address the issues of child brides and young age at first birth.

Keywords: Age at first birth; Age at motherhood; Birth order; Parity; Preceding birth interval; Infant mortality

1. Introduction

High-risk fertility behavior is documented to have detrimental effects on the mother and child's health (Hammarberg, 2017; Khan & Ali Khan, 2010). Such high-risk fertility behaviors are expressed in terms of women's age at birth being too early or too late, shorter birth intervals, and high number of live births (Rahman et al., 2018; Rahman et al., 2017). Data indicates a high mortality risk for children born to mothers who are either too young (below 18) or too old (above 34), children born within a short birth interval (less than 24 months after the previous birth), and children born to mothers with a high parity (more than three children) (Habimana-Kabano et al., 2016; Santhya et al., 2010; Uddin et al., 2009). It is quite evidential that high-risk fertility behavior is widespread and a significant cause of early childhood mortalities in economically low and middle income countries (Finlay & Norton, 2017; Gurmu & Tariku, 2017), regions characterized by severe socioeconomic and demographic challenges, child marriage, high fertility, and high population growth (Amir-Ud-Din, 2021).

Seifu et al. (2023) conducted a study on the determinants of high-risk fertility behavior among women of reproductive age in Kenya. The study found the overall prevalence of high-risk fertility behavior among Kenyan women as 70.86 percent. Women with some education, those of Protestant and Muslim religions, those whose partners had some

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secondary education, those from a high household wealth index, those who ever had a terminated pregnancy, and those of rural residence were strongly associated with high-risk fertility behavior. The study however did not consider the association between high-risk fertility behavior and early childhood mortality.

A study by Dimbuene et al. (2023) assessed the geographical variations of, and identified risk factors associated with high-risk fertility behaviors among married women in the Democratic Republic of the Congo. The study found education to be negatively and significantly associated with the odds of high-risk fertility behaviors (aOR = 0.927; $\rho<0.01$; CI = 0.903 – 0.952). Further, women's age significantly increased the odds of high-risk fertility behaviors (aOR = 1.295; $\rho<0.01$; CI = 1.278 - 1.312). Regionally, high-risk fertility behaviors were highly clustered in the North-Eastern Provinces of the country. Yet still, the study did not consider the contribution of high-risk fertility behavior on infant mortality.

Amir-Ud-Din et al. (2021) did a study on the impact of high-risk fertility behaviors on under-five mortality in Asia and Africa. The study findings indicated that a less than 18 years' mother's age at birth of index child and a less than 24 months' preceding birth interval were significant risk factors of under-five mortality, while a child's birth order of above 3 was a protective factor. In the United States of America, maternal age of between 15 to 24 years was associated with a significant higher risk of infant death than maternal age of above 30 years (Ferres et al., 2020).

From the existing literature, high-risk fertility behavior is depicted in such pathways as age at first birth, age at motherhood, birth order, birth interval, and parity. This is more evident in the economically less-developed countries with majority of women being rural dwellers, religious ardent, out of school and in the non-working category. Such women, in the struggle to meet their day-to-day needs, participate in coitus-for-cash with some ending up bearing children as a result. This study sought to establish the contribution of high-risk fertility behavior on infant mortality in Kenya, a less-economically developed country in sub-Saharan Africa. The study findings point to the need to do advocacy on the need to delay entry into marriage and sexual debut beyond the teen ages so as to address the issues of child brides and young age at first birth, and hence infant mortality.

2. Review of Related Literature

Studies have indicated a relationship between age of a mother at the birth of an index child and early childhood mortality (Raj et al., 2014; Kravdal, 2018; Amir-Ud-Din et al., 2021; Omedi, 2023). A study conducted in economically low and middle income countries by Amir-Ud-Din et al. (2021) found mothers aged less than 18 years to report higher odds of under-five mortality (aOR = 1.61; 95% CI = 1.56–1.67) with reference to their counterparts aged at least 18 years. A different study by Omedi (2023) found maternal age of below 20 years to be significantly associated with neonatal mortality (cOR = 2.408; $\rho<0.05$; CI = 0.943 – 6.148) with reference to motherhood in the age range $20\leq x\leq 34$ years in urban areas. Young mothers have higher chances of experiencing adverse birth outcomes, are not fully matured physically, are deprived of nutritional and biological advantages, and are less experienced in childcare (Alio et al., 2011; Ganchimeg et al. 2014; Omedi, 2023).

Pregnancy at an older age is associated with higher risks of complications for both the mother and the baby: stillbirth, a smaller-sized baby for gestational age, pre-eclampsia, and maternal death (Loaiza & Wong, 2012). In case of a live birth, then the rest of these complications can yield into an early childhood death. An Indonesian-based study by Wardani et al. (2022) found older maternal ages to be risk factors of infant mortality (aOR = 3.61; CI = 1.42 – 9.23). In Kakamega Central sub-County, Kenya, mothers aged 35 to 49 years were 2.929 and 1.891 times more likely to experience post-neonatal and infant mortality in rural and urban areas, respectively, relative to mothers aged 20 to 34 years (Omedi, 2023). However, a study by Amir-Ud-Din et al. (2021) found contrary results in that mothers who were aged above 34 years at the birth of their index child were less likely to lose their children to death (aOR = 0.98; 95% CI = 0.96–1.01) compared to those mothers aged at most 34 years. Another study by Omedi (2023) found rural mothers aged 35 to 49 years to be 0.714 times less likely to experience neonatal mortality relative to mothers aged 20 to 34 years. This observation is because few women give birth at above 34 years of age (Morris et al., 2018; Amir-Ud-Din et al., 2021).

Existing literature does not agree on the relationship between birth order and infant mortality. Some studies have documented high order birth to be a high-risk fertility behavior associated with infant mortality (Omedi, 2023; Brown et al., 2015; Akinyemi et al., 2013; Fotso et al., 2013; Kabir et al., 2011). In rural areas of Kakamega Central sub-County, Kenya, above 3 birth orders had higher likelihood of neonatal mortality (aOR = 1.881; $\rho<0.01$; CI = 0.584 – 6.063) whereas first births had higher likelihood of infant mortality (aOR = 3.492; $\rho<0.05$; CI = 0.992 – 2.291) (Omedi, 2023). On their side, Kabir et al. (2011) found a U-shaped relationship between birth order and infant mortality rates: 79, 51, 66 and 97 for 1, 2-3, 4-6, and 7+ birth orders, respectively. Counter-intuitively, a study by Amir-Ud-Din et al. (2021) found that, compared with children with birth order ≤3, children with birth order > 3 had lower odds of under-five mortality (aOR = 0.91; 95% CI = 0.89 - 0.93). In support of this finding, a study by Uddin et al. (2009) found an inverse-U shaped relationship between birth order and under-five mortality with the highest mortality risks being recorded amongst the second and third-born children (χ^2 - 6.58; $\rho<0.05$). Amir-Ud-Din et al. (2021) explained that the relatively younger maternal age, even with high parity, was the reason for the protective effect of higher-order births against under-five mortality in the low and middle income countries characterized by child brides.

A study was done to examine the association of parity with birthweight and neonatal deaths in five sites of low and middle-income countries (Garces et al., 2020). The study found nulliparous women to have a significantly higher neonatal mortality rate (27.7 deaths per 1,000 live births) than parous women (17.2 deaths, and 20.7 deaths per 1,000 live births for 1-3 and ≥4 births, respectively). The researchers indicated that first pregnancy primes the female body for subsequent pregnancies. Other studies indicate that higher risks faced by infants of nulliparous women are associated with factors related to maternal immaturity, including incomplete growth, small uterus size, and fetal competition for nutrients (Kozuki et al., 2014; Chen et al., 2007). A study based in the United States by Hellerstedt et al. (1995) found infants of adolescent multiparous women to be almost twice as likely to die after the first month of life as infants of adolescent primiparous women (aOR = 1.9; 95% CI = 1.6 – 2.4). The study explained that post-neonatal deaths were associated with environmental risks (Kleinman & Kiely, 1990) and thus potentially preventable through primary care in the first year of life.

Preceding birth interval has been found to be associated with infant mortality (Omedi, 2023; Amir-Ud-Din et al., 2021; Adebowale et al., 2017; Conombo & Sawadogo, 2017; Kabir et al., 2011). Compared to the reference category of women with preceding birth interval of at least 24 months, those with a preceding birth interval of less than 24 months had higher odds of under-five mortality (aOR = 2.02; 95% CI = 1.97–2.07) (Amir-Ud-Din et al., 2021). This is explained by maternal depletion hypothesis that suggests that with short preceding birth intervals, women cannot recover their nutritional stores which may result in malnutrition in the next pregnancy (Molitoris, 2017). Faced with malnutrition, women's bodies prioritize their own needs over the nutritional needs of the foetus (Ellison, 2003). Sibling rivalry hypothesis suggests that closely spaced children compete for attention of the parents as well as for scarce resources in the household, resulting in a weakened immune system, increased risks of infectious diseases and mortality among children (Tariku, 2019). Further, short preceding birth intervals are associated with increased risks of premature rupture of membranes, antepartum haemorrhage, anaemia, placental abruption, which increases the risk of stillbirth and neonatal mortality (Conde-Agudelo et al., 2007).

3. Methodology

3.1. Data source

The study used cross-sectional data derived from the 2022 Kenya Demographic and Health Survey (KDHS). The 2022 KDHS was a nationally representative probability sample survey of 42,022 households of which 38,731 (92%) were occupied at the time of survey. Of the occupied households, 37,911 (98%) were successfully interviewed. Of the 33,879 eligible women, a total of 32,156 were successfully interviewed, giving an acceptable response rate of 95 percent (KNBS & ICF, 2023). As appreciated by Omedi (2018), this kind of survey provides data for a wide range of monitoring and impact evaluation in areas of population, health and nutrition.

3.2. Study variables

The outcome variable was infant mortality measured at neonatal, post-neonatal and infant levels. The exposure variables were: age at first birth - categorised as <20 years, 20 to 39 years, and ≥40 years; age at motherhood - categorised as <20 years, 20 to 39 years, and ≥40 years; birth order - categorised as 1st, 2nd to 3rd, and ≥4th; parity - categorised as 0, 1 to 3, and ≥4 live births; and preceding birth interval - categorised as either <24 months or ≥24 months.

3.3. Statistical analysis and results presentation

Analysis was done at two levels: descriptive analysis and inferential analysis. Descriptive analysis involved frequencies and cross-tabulation statistics in order to obtain the distribution of high-risk fertility behaviors in the study population, and the distribution of infant deaths based on the high-risk fertility behaviors under study. Inferential analysis involved multinomial logistic regression analysis in order to obtain the likelihood of infant mortality based on the high-risk fertility behaviors of age at first birth, age at motherhood, birth order, parity, and preceding birth interval. The analytical findings were presented in statistical tables, graph, and in text form, followed by their interpretation and discussion.

3.4. Eligibility criteria

The analysis included women of reproductive ages 15 to 49 years who gave birth in the five –year period that preceded the survey. All other respondents who did not meet this criterion were excluded from the study.

4. Results

4.1. Results of descriptive analysis

4.1.1. Distribution of high-risk fertility behaviors

Frequencies were done to bring out the distribution of high-risk fertility behaviors in the study population. The results were as presented in Table 1.

Table 1 Distribution of high-risk fertility behaviors, 2022 KDHS

Variable name	Count	Percent
Age at first birth		
<20 years	11875	50.87
20 to 39 years	11462	49.10
40 to 49 years	6	0.03
Age at motherhood		
<20 years	2780	11.91
20 to 39 years	19754	84.62
40 to 49 years	809	3.47
Birth order		
1 order	5119	21.93
2 to 3 order	9489	40.65
≥4 order	8735	37.42
Parity		
0	8813	27.41
1 to 3	14608	45.43
≥4	8735	27.16
Preceding birth interval		
<24 months	3114	17.18
≥24 months	15017	82.82

Results in Table 1 indicated that beyond half of women started childbearing at ages less than 20 years (50.87%) with a paltry 0.03 percent starting childbearing at ages above 39 years. Further, about 84.62 percent of mothers were aged 20 to 39 years in the five-year period that preceded the survey. Another 11.91 percent and 3.47 percent were aged under-20 years and at least 40 years, respectively. The scatterplot in Figure 1 shows age at motherhood in Kenya based on the 2022 Kenya demographic health survey.

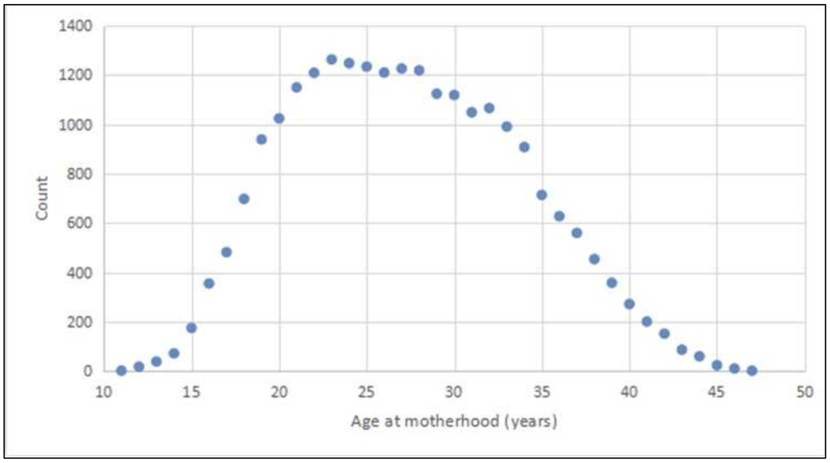

Figure 1 A scatter-plot showing age at motherhood in Kenya, 2022 KDHS

Data in Figure 1 shows that motherhood in Kenya began at an early age of 11 (two mothers) peaked at the age of 23 (1,263 mothers) and ended at the age of 47 (two mothers). Majority of infants (57.6%) were born to mothers beyond 25 years of age, with motherhood in the age range 11 to 25 years contributing 42.4 percent of the births.

As pertains to the order of the index birth, about 40.65 percent, 37.42 percent, and 21.93 percent of the respondents reported their births to be of orders 2 to 3, 4+ and 1, respectively. Majority of the births were to parous women (72.59%) with another 27.41 percent being to nulliparous women. Almost 83 in every 100 births occurred at a preceding interval of beyond 23 months.

4.1.2. Distribution of infant deaths based on high-risk fertility behaviors

Cross-tabulation analysis was done to ascertain the distribution of infant deaths according to each high-risk fertility behavior. The results were as presented in Table 2.

Table 2 Distribution of infant deaths based on high-risk fertility behaviors, 2022 KDHS

Variable name	Count	Percent
Age at first birth		
<20 years	262	53.47
20 to 39 years	228	46.53
40 to 49 years	-	-
Age at motherhood		
<20 years	72	14.69
20 to 39 years	384	78.37
40 to 49 years	34	6.94
Birth order		
1 order	108	22.04
2 to 3 order	174	35.51
4+ order	208	42.45
Preceding birth interval*		
<24 months	89	23.92
At least 24 months	283	76.08
TOTAL	**490**	**100**

First births have no preceding birth order, thus fewer cases compared to other variables

From Table 2, the study learnt that majority of infants who died were of mothers who started childbearing at ages less than 20 years. About 46.53 percent of infants died to women who started childbearing in the age range of 20 to 39 years. No women who started childbearing at ages beyond 39 years reported an infant death. About age at motherhood, 78.37 percent, 14.69 percent, and 6.94 percent of infants died to women aged 20 to 39 years, under-20 years, and 40 to 49 years, respectively. Majority (42.45%) of infant deaths were of order 4+, with another 35.51 percent and 22.04 percent of infant deaths being of orders 2 to 3 and 1, respectively. Furthermore, about 76 in every 100 infants who died were born at an at least 2 years' preceding interval.

4.2. Results of inferential analysis

Inferential analysis involved multinomial logistic regression to bring out the likelihood of infant mortality based on each high-risk fertility behavior under study. The results were as presented in Table 3.

Table 3 Results of multinomial logistic regression analysis, 2022 KDHS

	Neonatal mortality		**Post-neonatal mortality**		**Infant mortality**	
Exposure variable	**Exp(β)**	**CI**	**Exp(β)**	**CI**	**Exp(β)**	**CI**
Age at first birth						
20-39 years	1.000		1.000		1.000	
<20 years	1.001*	0.347-0.850	1.542*	0.364-0.809	1.043*	0.372-0.791
≥40 years	0.543	0.690-1.452	0.999	0.689-1.449	0.865	0.407-0.974
Age at motherhood						
20-39 years	1.000		1.000		1.000	
<20 years	1.183**	0.374-1.733	1.243	0.577-2.677	1.372	0.619-3.043
≥40 years	1.089	0.230-1.319	1.815	0.758-4.344	1.594	0.656-3.874
Birth order						
First	1.000		1.000		1.000	
2 to 3	0.710**	0.436-1.157	1.476	0.864-2.295	0.802**	0.494-1.304
≥4	0.677	0.443-1.035	1.408	0.966-2.257	0.946	0.633-1.414
Parity						
1-3 births	1.000		1.000		1.000	
0 births	0.690**	0.471-1.009	1.450**	0.991-2.122	1.122	0.783-1.608
4+ births	0.698	0.450-1.085	1.013	0.691-1.484	1.204	0.797-1.819
Preceding birth interval						
≥24 months	1.000		1.000		1.000	
<24 months	1.345	0.801-2.256	0.744	0.443-1.248	1.093	0.689-1.734

*ρ<0.01; **ρ<0.05

Results in Table 3 indicated significantly higher odds of neonatal, post-neonatal and infant mortality among women who begun childbearing under the age of 20 years (ORs = 1.001; 1.542; 1.043, respectively). The likelihood of neonatal mortality was higher among mothers aged under-20 years (OR = 1.183; 95%CI = 0.374 - 1.733) as compared to those aged 20 to 39 years. Second to third order births were significantly less likely to experience neonatal (OR = 0.710; 95% CI = 0.436 - 1.157) and infant mortalities (OR = 0.802; 95%CI = 0.494 - 1.304) with reference to first order births. As pertains to parity, nulliparous women were 0.31 times less likely to report neonatal mortality and 0.45 times more likely to report post-neonatal mortality with reference to women of parities 1 to 3. Preceding birth interval insignificantly contributed to infant mortality.

5. Discussion

This study aimed at establishing the contribution of high-risk fertility behavior on infant mortality in Kenya. The analytical findings pointed out that under-20 years' age at first birth was a significant contributor to neonatal (OR = 1.001; ρ<0.01; CI = 0.347 - 0.850), post-neonatal (OR = 1.542; ρ<0.01; CI = 0.364 - 0.809) and infant mortality (OR = 1.043; ρ<0.01; CI = 0.372 - 0.791). A worth note was that majority of mothers (50.87%) started childbearing under the age of 20 years and that about 53.47 percent of infants died to mothers who started childbearing under-20 years of age. Clearly, early age at first birth was related to many infant deaths and higher likelihood of infant mortality. This finding is consistent with findings of other studies (Neal et al., 2018; Selemani et al., 2014; Finlay et al., 2011). A study by Neal et al. (2018) explained that adolescent motherhood was associated with a potential physiological risk of neonatal mortality, which was particularly concentrated among younger teens. Such physiological pathways include low birthweight and premature births (Chen et al., 2008), nutritional insufficiencies (Scholl et al., 1994), such infections as malaria and urinary tract infections (Wort et al., 2006; Leppalahti et al., 2013), and increased risk of hypertension (Okusanya et al., 2013), and reduced placental transportation (Hayward et al., 2012).

As much as it was insignificant, older age at first birth was related to low likelihood of infant mortality, with only 0.03 percent of women reporting to have started childbearing in the 40-49 age range. This is unlike a United States-based study that found an increasing age at first birth as more women delayed childbirth due to societal changes, cultural expectations, and financial situations (Martin et al., 2011). In the current study, none of the women who started childbearing beyond 39 years of age reported an experience of infant mortality. Generally, at ages 40+, women are better exposed in terms of awareness on childcare (considering it may be the only child they will have), they are likely to have better planned for childbirth and nurturing, could be better economically, likely to seek healthcare services during and after pregnancy, deliver in a health facility and seek good nutrition.

An under-20 years' age at motherhood of the index birth was 0.183 times more likely to be associated with neonatal mortality with reference to the 20 to 39 years' age at motherhood. Such mothers contributed to about 11.91 percent of the births and 14.69 percent of the infant deaths. This is consistent with findings of other studies (Omedi, 2023; Arunda et al., 2022; Amir-Ud-Din et al., 2021; Woodall & Driscoll, 2020). Pregnancies of women aged under-20 years face complications of preterm and underweight leading to higher risk of mortality and disability for girls and their products of conception. Other authors (Alio et al., 2011; Ganchimeg et al. 2014; Omedi, 2023) explained that young mothers had higher chances of experiencing adverse birth outcomes, were not fully matured physically, were deprived of nutritional and biological advantages, were less experienced in childcare, and were passive on partaking antenatal care services.

Births of orders 2 to 3 were significantly less likely to experience neonatal (OR = 0.710; ρ<0.05; CI = 0.436 - 1.157) and infant (OR = 0.802; ρ<0.05; CI = 0.494 - 1.304) mortalities as compared to first order births. As much as majority (40.65%) of mothers reported their births being of orders 2 to 3, a lesser proportion of infants died in this order (35.51%). This indicates that second to third order births are a safe category when it comes to infant mortality. These findings agreed with findings of other studies (Kibet, 2010; Kabir et al., 2011; Omedi, 2023). First order births are a result of first pregnancies that primes the female body for subsequent pregnancies. As such, they experience higher likelihoods of infant mortality than second and third order births.

Nulliparous women showed variant mortality patterns: they were 0.31 times less likely to report neonatal mortality but 0.45 times more likely to report post-neonatal mortality with respect to women of parities 1 to 3. The lower likelihood of neonatal mortality is against findings of a study by Garces et al. (2020) that found higher neonatal mortality rate among nulliparous than parous women. The higher likelihood of post-neonatal mortality could be due to the effect of environmental risks in which the post-neonate is being raised. A nulliparous woman might be inexperienced on such environmental risks.

The finding that majority (82.82%) of women observed an at least 2 years' preceding birth interval was an improvement from the 76.4 percent reported in 2008/09 KDHS (Omedi, 2011). Again, that 23.92 percent of infants who died were born at a less than two years' preceding interval was an improvement from the 31.8 percent reported in 2008/09 KDHS (Omedi, 2011), and the 28.32 percent (urban) and 29.92 percent (rural) reported in the 2014 KDHS (Omedi, 2018). This is appreciative and points to the general widening of birth intervals whose fruit is both reduced births and infant deaths in the narrow birth intervals. Wider birth intervals allow women to recover their nutritional stores so as to check on malnutrition in the next pregnancy, reduce sibling rivalry and risks of premature rupture of membranes, antepartum haemorrhage, anaemia, and placental abruption.

The study may have suffered the following limitations: there might have been a likelihood of recall bias on the respondents' side since exposure variables relied on interviews and self-reported accounts that occurred in the five-year period that preceded the survey. Having drawn data from a cross-sectional survey which only detects associations between exposure and outcome variables, the study could not assess the causality between high-risk fertility behaviors and infant mortality.

6. Conclusion

Findings of the study indicated the following to be high-risk fertility behaviors: under-20 years' age at first birth; under-20 years' age at motherhood; first order births; and births to nulliparous women. Women who started childbearing pre-20 years of age were more likely to experience neonatal, post-neonatal and infant mortalities than their counterparts who started childbearing in the age range of 20 – 39 years. Mothers aged under-20 years were more likely to experience neonatal mortality than their colleagues aged 20 to 39 years. Births of orders 2 – 3 were protective against infant mortality. Nulliparous women were less and more likely to experience neonatal and post-neonatal mortalities, respectively. Both old age at first birth and preceding birth interval were insignificantly associated with infant mortality. Addressing the issues of child brides, age at first sexual debut and protected sex are crucial concerns for they have direct linkages to age at first birth and age at motherhood, both of which are high-risk fertility behaviors related to infant mortality.

Compliance with ethical standards

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Disclosure of conflict of interest

The author declares no conflict of interest and that this work was not funded by any institution/organisation.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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