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Socioeconomic factors associated with the number of children ever born by married Ghanaian females: a cross-sectional analysis

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ABSTRACT

Objective Most studies in Ghana on determinants of children ever born (CEB) are often conducted among all females of reproductive age and do not adequately report patterns among married females. Considering the importance of marriage to fertility in the Ghanaian context, this study seeks to explore the association of socioeconomic characteristics of married Ghanaian women with CEB.

Design Data from the 2017 Ghana Maternal Health Survey were used. Three separate models were considered: linear regression model using CEB and two logistic regression models. Bivariate and multivariate analyses were considered for all models.

Setting The study was conducted in all 10 administrative regions of Ghana.

Participants Married females aged between 15 and 49 years.

Primary and secondary outcome measures Socioeconomic factors associated with married females' CEB.

Results In all three models, place of residence, zone, wealth index, age, age at marriage, media exposure, level of education, number of abortions and age at first sex were all significantly ($p<0.05$) associated with CEB. Married females with higher education had lower odds of one or more births and lower odds of giving birth to three or more children. Also, married females from households with the highest wealth index had fewer CEB, lower odds of one or more births and lower odds of giving birth to three or more children.

Conclusion Socioeconomic characteristics of married females in Ghana, including education and wealth status had a significant influence on the number of CEBs. We recommend governments' intervention to help bridge the gaps in access to education and income-generating opportunities. The mass media must be used to propagate and counsel married females on the potential of high fertility and its consequences.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This study is the foremost to explore factors associated with children ever born to married females in Ghana using nationally representative data.
⇒ The data used are representative of all married females aged 15–49 years and the findings can be generalised.
⇒ Given the focus of the paper, the analysis was limited to only married women and not all women of reproductive age.
⇒ Recall and self-report of total number of children ever born may be biased by under-reporting of parities, especially by older women.

INTRODUCTION

The number of children ever born (CEB) is a measure of fertility,[1] which has a direct consequence on population structure. Population growth can be quantified by the average number of CEB by a female, throughout a lifetime.[2] Its dynamics can be linked to females that are married, particularly in certain geographical context where marriage has a primary purpose of procreation. In Africa, marriage as an institution legitimises children born to both couples and extended families. The United Nations have projected an ascendancy in population growth that must be carefully planned by all countries considering limited resources in infrastructure. Population growth has been estimated to increase from 7.8 billion in the year 2020 to 10.9 billion by the year 2100.[3] This is pivotal and has several implications for the world at large, more importantly among developing countries where CEB among married females is high.

The discussions about female fertility vary greatly across cultures and geographical regions and remain an issue of contention. In Ghana, marriage is referred to as a proximate determinant of fertility because it is considered the social institution in which childbearing is mainly approved.[4] In pretransitional countries in Africa, fertility and birth control techniques among married couples are believed to be limited considering the

number of births.[5–7] Few studies have made full use of available data to explore factors associated with CEB among married females. The use of nationally representative data may allow for the identification of additional contributing factors for childbearing among married females. Several studies on female fertility point to a substantial relationship between education, age at first marriage and place of residence and the number of CEB.[8 9] Fertility is also influenced by cultural and economic factors,[10] which have both direct and indirect effects on the population structure. There are several other determinants of CEB among females of childbearing age in different regions.[11] However, the extent of these factors among married females could be an exclusive issue for targeted action for policy makers in programme planning. The dynamics of such determinants are constantly evolving even though several studies have concluded that literacy and age are major indicators[12 13] among females. Knowledge of the factors associated with CEB among married females could help explain the complexities of decreasing fertility rates and total fertility rate (TFR) trends. In the report of the 2017, Ghana Maternal Health Survey (GMHS),[14] a decline in TFR to females were observed from 4.4 in the year 2003 to 3.9 in the year 2017.

When marriage is constituted in Ghana, an expectation of childbirth and surviving children are in demand by parents, extended families and clans. When the initial stage of childlessness is overcome by couples, the size of the family becomes the next logical question posed by families involved in marriage. This is because children provide emotional fulfilment and social status[15] and can contribute to the household economy by helping with domestic and subsistence activities. As parents age, children become an important source of old-age support.

In Ghana, there has been a slow decline in the fertility rate, from 6.4 children per woman in 1988 to 4.2 children per woman in 2014.[16] The major factors attributed to the decline include an increase in women's education and contraception usage. In addition, many social institutions in Ghana including marriage and culture have undergone several significant changes, which has affected the number of CEB. Most studies in Ghana on fertility and its determinants are often conducted among all females of reproductive age and do not adequately report patterns among married females.[12 13] Considering the seeming importance of marriage to fertility in the Ghanaian context, this study, seeks to explore the association of socioeconomic characteristics of married Ghanaian women with CEB, using nationally representative data.

METHODS

Data source and data description

This study is a secondary analysis of data from the Ghana Demographic and Health Surveys (GDHS) and GMHS conducted through the years 2003,[17] 2008,[18] 2014[19] and 2017.[14] These studies were conducted by the Ghana Statistical Service and other collaborators including Ghana Health Service. The data accumulated from these surveys act as a repository and mirrors national estimates of maternal mortality and maternal health. The inherent complex survey design allows data to be collected at individual and household levels. These surveys contain the full birth history of females in their reproductive ages (15–49) years. From the 2003 GDHS, we extracted 4075 married females from 6251 households across 412 clusters, while the 2008 GDHS comprised 3323 married females from 6141 households with a coverage of 412 clusters. The 2014 GDHS contained 6302 married females from 11 835 households covering 427 clusters while the 2017 GHMS contained 16 665 married females from 27 000 households with a coverage of 900 clusters (see online supplemental figure S1). Data from the 2017 GMHS was the main pillar on which all model specifications and baseline characteristics were derived. The sampling frame for the 2017 GMHS was established from the 2010 Population and Housing Census in Ghana.[14] The sampling techniques used for all the different surveys consisted of a two-stage stratification procedure. In the first stage, rural and urban clusters are selected from each of the 10 regions of Ghana, to generate a total of 20 sampling strata. In the second stage, a systematic sampling of households is performed. A proportional probability sampling technique was used to select from the total number of enumeration areas consisting of all regions. Consequently, households were randomly sampled from each of the total clusters to produce a total sample size of households. The data for this secondary analysis were obtained from the DHS programme.

Study variables

The study variables and their definitions are provided in table 1.

Patient and public involvement

Patient were not involved in this study. Key stakeholder meetings will be organised to share the findings of this study with appropriate stakeholders.

Statistical analysis

Data analysis was performed using Stata statistical software (Release 14, StataCorp). Sampling weights were used to obtain a national representation of the survey results. Data for married females were extracted from all four surveys to build a graphical trend of evolution for CEB. Weights were calculated separately for each sampling stage and each cluster, using probability sampling. R statistical software (R V.3.4.1 and R Studio V.1.3.959) was used to plot the time series trend for the mean number of CEB as presented in figure 1. The unit of analysis was married females between the ages of 15–49 years and the number of CEB. For the primary analysis, that is, assessing the association of socio-economic factors with the number of CEB, data from the 2017 GMHS was used. The demographic characteristics of the study respondents including place/region/zone of residence,

Table 1 Study variables and definition

Variable	Definition
Child ever born (CEB)	Number of children ever born to a female
No birth	No child born to a female
Mid-size births	1 or 2 children born to a female
Large size births	More than 2 children born to a female
Place of residence	Location of household (urban; rural)
Region of residence	Location of household in the 10 administrative regions of Ghana (Western; Central; Greater Accra; Volta; Eastern; Ashanti; Brong Ahafo; Northern; Upper East; Upper West)
Zone	The location from the three major geographic regions in Ghana, that is, Coastal: Western, Central, Greater Accra and Volta regions. Middle: Eastern, Ashanti and Brong Ahafo regions Northern: Northern, Upper East and Upper West regions.
Wealth index	The wealth status of households which is grouped as Lowest, Second, Middle, Fourth and Highest.
Age	The Ages of females are grouped into 15–19 years, 20–24 years, 25–29 years, 30–34 years, 35–39 years, 40–44 years and 45–49 years.
Age at marriage	The age of a female at first marriage is grouped as under 20 years and above 20 years.
Media exposure	Females' access to media including the internet, print, television and radio at least once a week are grouped as yes; no.
Level of education	Female's highest level of education (no education; primary education; middle/junior secondary/high school; secondary/higher education)
No of abortions	No of abortions by a female is grouped as none, single and more than one
Age at first sex	Age at first sexual intercourse is grouped as ≤14 years, 15–19 years and ≥20 years.

wealth index, age, media exposure, level of education, age at marriage, number of abortions and age at first sex were presented as weighted frequencies and percentages. The mean and SD of CEB were also reported by the demographic variables and differences tested using the χ^2 test. Three separate models were used to assess the association of socioeconomic characteristics with CEB. First, a linear regression model was considered using CEB as a continuous response (model 1). Subsequently, two response variables were computed from the continuous response variable by grouping the number of CEB as, model 2: no births (ie, 0 CEB) vs at least one birth (ie, CEB≥1), model 3: among respondents with at least one birth, we compared those with 1 or 2 CEB (mid-size) vs ≥3 CEB (large size). In model 2, logistic regression was used to assess the association of maternal socioeconomic characteristics with having at least one birth versus no birth. Among respondents with at least one birth (model 3), logistic regression was used to assess the association of maternal socioeconomic characteristics with having 3 or more births versus having less than 3 births.

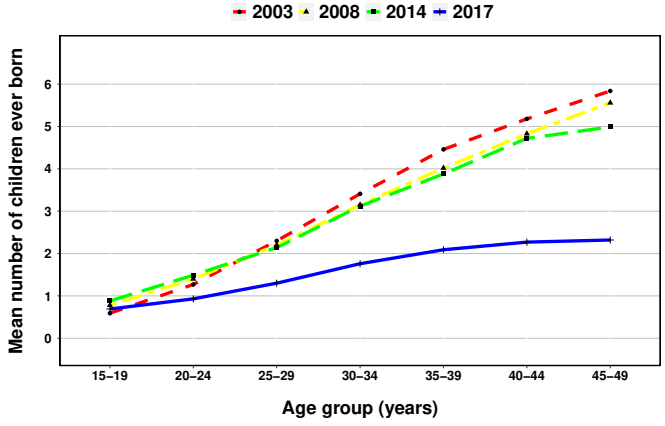

Figure 1 (Main): mean CEB for different time points by age groups. CEB, children ever born.

In all models, bivariate and multivariate techniques were used to assess the association of demographic variables with CEB. Based on literature review, all the selected sociodemographic variables were included in the multivariate model whether significant in bivariate analysis or not. For ease and clarity of interpretation, zone was used in all bivariate and multivariate models and not region of residence. The collinearity of the socioeconomic variables was checked using the variance inflation factor (VIF), where values >10 indicate a high correlation.[20] Parameter estimates were reported with their 95% CIs and variables with $p<0.05$ in the bivariate/multivariate analyses were considered statistically significant. In the linear regression model, a histogram of the residuals and a quantile-quantile (q-q) plot were used to assess the distributional assumption.

RESULTS

Characteristics of study participants

Out of the 25 062 females aged between 15 and 49 years included in the 2017 GMHS, 16 665 (66.0%) were

married and 8397 (34.0%) were unmarried. More details on the data description and model schema are presented in online supplemental figure S1. Data from the 16665 married females were included in this analyses. The mean age of the study respondents was 33.8 (95% CI 33.6 to 34.0) years, and was 27.4 (95% CI 26.9 to 28.0) years among the 1161 (7%) with no birth and 34.3 (95% CI 34.1 to 34.5) years among the 15504 (93%) who had at least one birth.

As shown in figure 1, from all four surveys, there was an increase in the mean number of CEB for to married females by age group. However, in each age group, the mean CEB decreased from 2003 to 2017, especially for the year 2017 with less than 2 CEB for ages 30–34 compared with the other years where CEB was more than 3. CEB to married females aged 45–49 years decreased more than double from a mean of 5.8 in the year 2003 to 2.3 in 2017.

Baseline characteristics of married females

The demographic characteristics of the 16665 respondents included in this analysis are presented in table 2. The majority (38.9%) of the study participants had middle/JSS/JHS education, and most of the study participants were from the Ashanti region (18.8%). About half (50.3%) of the study respondents got married before they turned 20 years. Most of the respondents had never had an abortion (75.6%), whereas 15.5% had a single abortion and 8.9% had multiple abortions. Majority (65.9%) of the married females had their first sexual experience between 15 and 19 years.

Mean number of CEB by demographic characteristics of the study respondents

Out of the 16665 married females, the mean number of CEB was 3.2 (SD=2.2, ranging from 3.2 to 3.3). There were significant differences in the mean number of CEB for all the demographic variables included in this study. The mean number of CEB was higher in rural areas, in the Northern region, among those in the lowest wealth quintile, among older respondents, among those with no formal education and higher among those who had their first sexual intercourse under the age of 14 years (see table 2).

Association of socioeconomic factors with the number of CEB (model 1: linear regression)

As shown in online supplemental figure S2, the normality assumption was satisfied. In the bivariate regression analysis, place of residence (p<0.001), zone (p<0.001), wealth index (p<0.001), age (p<0.001), age at marriage (p<0.001), media exposure (p<0.001), level of education (p<0.001), number of abortions (p<0.001) and age at first sex (p<0.001) were significantly associated with CEB. In the multivariate regression analysis, place of residence (p<0.001), zone (p<0.001), wealth index (p<0.001), age (p<0.001), age at marriage (p<0.001), media exposure (p=0.020), level of education (p<0.001), number of abortions (p<0.001) and age at first sex (p<0.001) were significantly associated with CEB. The VIF for the variables shows that there is no collinearity between the variables. The proportion of variability explained by the socioeconomic variables was 50.9%.

In the adjusted analysis, the number of CEB was significantly lower (−1.72, 95% CI −0.26 to −0.09) for married females living in urban areas compared with those living in rural areas. Married females from households with the highest wealth index have a significantly lower number of CEB compared with those from households with the lowest wealth index (−1.20, 95% CI −1.34 to −1.05). The number of CEB was higher among older married females: 1.07, 2.21, 3.21, 3.93,4.53 and 4.80 for those aged 20–24 years, 25–29 years, 30–34 years, 35–39, 40–44, 45–49 years, respectively, compared with those aged 15–19 years. CEB was significantly lower (−0.65, 95% CI −0.72 to −0.58) for married females who got married when they were over 20 years compared with those that got married below the age of 20 years. Married females with secondary/higher education had a significantly lower number of CEB compared with those with no formal education (−0.69, 95% CI −0.80 to −0.59) (see table 3).

Association of socioeconomic factors with any childbirth (model 2: ≥ 1 birth vs no birth)

In this analysis, logistic regression was used to assess the association of socioeconomic factors with any childbirth, defined as having one or more births. In the bivariate analysis, place of residence (p<0.001), wealth index (p<0.001), age (p<0.001), age at marriage (p<0.001), media exposure (p<0.001), level of education (p<0.001), number of abortions (p=0.040) and age at first sex (p<0.001) were significantly associated with having one or more births. In the multivariate logistic analysis, wealth index (p<0.001), age (p<0.001), age at marriage (p<0.001), level of education (p<0.001), ever had an abortion (p=0.007) and age at first sex (p<0.001) were significantly associated with one or more births to married females. With regard to the wealth index, the odds of one or more births were significantly lower in households with middle (adjusted OR, AOR 0.66, 95% CI 0.49 to 0.89), fourth (AOR 0.58, 95% CI 0.42 to 0.81) and highest wealth index (AOR 0.32, 95% CI 0.22 to 0.46) compared with those from households with the lowest wealth index. The odds of one or more births were higher among older respondents: AOR=5.45, 19.66, 51.33, 67.22, 96.28 and 73.10 for ages 20–24 years, 25–29 years, 30–34 years, 35–39, 40–44, 45–49 years, respectively, compared with those aged 15–19 years. There was a significantly lower odds (AOR=0.60, 95% CI 0.44 to 0.82) of one or more births among married females who had secondary/higher education compared with those with no formal education (see table 4 for the other details).

Association of socioeconomic factors with having three or more births (model 3: ≥ 3 birth vs 1 or 2 births)

In this analysis, among respondents who have had at least one birth, logistic regression was used to assess the association of socioeconomic factors with having three or more

Table 2 Characteristics for married females aged 15–49 years using survey design

Variable	Weighted frequency N=16 665	Weighted percentage (%)	Mean CEB	SD	P value
Overall			3.2	2.2	–
Place of residence					<0.001
Urban	8560	51.4	2.8	1.8	
Rural	8105	48.6	3.7	2.5	
Region of residence					<0.001
Western	2076	12.5	3.3	1.8	
Central	1529	9.2	3.4	1.9	
Greater Accra	2814	16.9	2.5	1.2	
Volta	1369	8.2	3.5	1.8	
Eastern	1690	10.1	3.3	2.0	
Ashanti	3129	18.8	3.1	1.7	
Brong Ahafo	1601	9.6	3.4	2.1	
Northern	1370	8.2	3.9	3.8	
Upper east	637	3.8	3.3	3.8	
Upper west	449	2.7	3.7	5.0	
Zone					<0.001
Northern	2456	14.7	3.7	4.1	
Middle	6421	38.5	3.2	1.9	
Coastal	7788	46.7	3.1	1.6	
Wealth Index					<0.001
Lowest	3065	18.4	4.2	3.2	
Second	3294	19.8	3.7	2.3	
Middle	3338	20.0	3.3	2.0	
Fourth	3484	20.9	2.8	1.6	
Highest	3485	20.9	2.3	1.4	
Age					<0.001
15–19 years	435	2.6	0.8	0.7	
20–24 years	2011	12.1	1.3	1.0	
25–29 years	3168	19.0	2.1	1.3	
30–34 years	3309	19.9	3.1	1.7	
35–39 years	3106	18.6	3.9	1.9	
40–44 years	2379	14.3	4.5	2.2	
45–49 years	2258	13.5	4.9	2.5	
Age at Marriage					<0.001
Under 20 years	8380	50.3	3.7	2.3	
Above 20 years	8285	49.7	3.0	2.0	
Media exposure (Internet/print/television/radio)					<0.001
Yes	15 031	90.2	3.1	2.1	
No	1634	9.8	4.2	3.0	
Level of education					<0.001
No education	4243	25.5	4.4	2.8	
Primary	2928	17.6	3.6	2.1	
Middle/JSS/JHS	6475	38.9	2.9	1.7	
Secondary/Higher	3018	18.1	1.8	1.4	

Continued

Table 2 Continued

Variable	Weighted frequency N=16 665	Weighted percentage (%)	Mean CEB	SD	P value
No of abortions					<0.001
None	12 593	75.6	3.3	2.3	
Single abortion	2584	15.5	2.9	1.7	
More than one	1488	8.9	3.1	1.6	
Age at first sex					<0.001
≤14 years	2189	13.1	4.0	2.3	
15–19 years	10 978	65.9	3.3	2.2	
≥20 years	3489	21.0	2.4	1.7	
Refuse answer	9	0.0			

CEB, children ever born; JSS/JHS, junior secondary school/junior high school.

births (high births) compared with having one or two births (low births). In the bivariate analysis, place of residence (p<0.001), wealth index (p<0.001), age (p<0.001), age at marriage (p<0.001), media exposure (p<0.001), level of education (p<0.001), number of abortions (p<0.001) and age at first sex (p<0.001) were significantly associated with high births. In the multivariate analysis, place of residence (p=0.033), zone (p=0.003), wealth index (p<0.001), age (p=0.001), age at marriage (p<0.001), media exposure (p=0.049), level of education (p<0.001), number of abortions (p<0.001) and age at first sex (p<0.001) were significantly associated with high births. In the adjusted analysis, the odds of high births were significantly lower among married females living in urban areas compared with those living in rural areas (AOR 0.85, 95% CI 0.73 to 0.99). The odds of high births for married females in the middle zone were higher (AOR 1.29, 95% CI 1.11 to 1.50) compared with the northern zone. With regard to the wealth index, the odds of high births were significantly lower among married females from households with the second, middle and highest wealth index compared with those from households with the lowest wealth index. The odds of high births were higher among older respondents: AOR 8.12, 65.50, 261.00, 641.74, 723.80 and 725.83 for married females aged 20–24 years, 25–29 years, 30–34 years, 35–39, 40–44, 45–49 years, respectively, compared with those aged 15–19 years. Married females who had secondary/higher education had significantly lower odds of high births compared with those with no formal education (AOR 0.34, 95% CI 0.28 to 0.41) (see table 5).

DISCUSSION

This secondary data analysis aimed to assess the socioeconomic determinants of CEB to married females of childbearing age in Ghana. Out of 16 665 respondents included in this study, the mean CEB for married females (15–49) years was 3.2 which was higher in comparison to the mean CEB of 2.2 among all females aged 15–49 years included in the 2017 GMHS. This is an indication of how marriage contributes to fertility as established by findings obtained in Ethiopia[21] and Nigeria.[22] The concepts of fertility cannot be easily disentangled since marriage is deeply rooted in the perceptions of sexual legitimacy and resulting children.[23] Even though CEB is higher among older married females, there is a substantial decrease among those aged 45–49 years: from 5.8 births in the year 2003 to 2.3 births in 2017. These results are consistent with reported data from the United Nations[24] suggesting a similar decline in -sub-Saharan Africa. In Ghana, it is less common for couples to voluntarily decide not to have children,[25] since children are associated with happiness and are viewed as a form of intergenerational social security.[26] This reinforces how infertility or childlessness is a major problem and can cause marital instability.[27] In contrast, other developed countries have modernised and liberalised the concepts of marriage, including same-sex marriage with implications on fertility.[28]

In the adjusted analyses, all three models confirmed that place of residence, zone, wealth index, age, age at marriage, media exposure, level of education, number of abortions and age at first sex were significantly associated with fertility. CEB to married females in Ghana was significantly lower among those living in urban areas compared with those living in rural areas. The lower number could be attributed to the higher use of modern contraception methods[29] in urban areas compared with rural areas where patronage is low. It has been estimated that a decline of one child was associated with a 15% increase in the use of contraception.[30] Our findings are consistent with studies that concluded that social life in urban cities is associated with economic activities that limit sexual activities[31 32] coupled with stress and strain prevalence.

Married females from the middle and coastal zones had fewer CEB from the bivariate regression model compared with the northern zone. Studies carried out on the historic transition of fertility among females, in general, reveal similar trends of high births in the northern zones of Ghana compared with the middle and coastal zones.[33 34] An attributable reason could be that married females from the middle zones practice longer

Table 3 Regression model for married females

Socioeconomic variable	VIF	Bivariate weighted analysis			Multivariate weighted analysis		
		Estimate	95% CI	P value	Estimate	95% CI	P value
Place of residence	1.53			<0.001			<0.001
Rural		Ref			Ref		
Urban		−0.89	(−0.99 to −0.78)		−1.72	(−0.26 to −0.09)	
Zone	1.22			<0.001			<0.001
Northern		Ref			Ref		
Middle		−0.47	(0.59, to 0.35)		0.17	(0.06 to 0.27)	
Coastal		−0.63	(−0.76 to −0.51)		0.04	(−0.07 to 0.14)	
Wealth Index	2.21			<0.001			<0.001
Lowest		Ref			Ref		
Second		−0.50	(−0.63 to −0.36)		−0.29	(−0.40 to −0.19)	
Middle		−0.90	(−1.04 to −0.75)		−0.55	(−0.67 to −0.43)	
Fourth		−1.38	(−1.52 to −1.24)		−0.87	(−1.00 to −0.74)	
Highest		−1.90	(−2.03 to −1.76)		−1.20	(−1.34 to −1.05)	
Age	1.11			<0.001			<0.001
15–19 years		Ref			Ref		
20–24 years		0.52	(0.41 to 0.63)		1.07	(0.95 to 1.19)	
25–29 years		1.31	(1.19 to 1.43)		2.21	(2.08 to 2.34)	
30–34 years		2.26	(2.12 to 2.39)		3.21	(3.07 to 3.35)	
35–39 years		3.04	(2.91 to 3.18)		3.93	(3.79 to 4.08)	
40–44 years		3.73	(3.57 to 3.90)		4.53	(4.36 to 4.70)	
45–49 years		4.07	(3.90 to 4.23)		4.80	(4.62 to 4.97)	
Age at marriage	1.35			<0.001			<0.001
Under 20 years		Ref			Ref		
Above 20 years		−0.88	(−0.96 to −0.79)		−0.65	(−0.72 to −0.58)	
Media exposure (internet/print/television/radio)	1.22			<0.001			0.020
Yes		Ref			Ref		
No		1.12	(0.99 to 1.25)		0.12	(0.02 to 0.22)	
Level of education	1.57			<0.001			<0.001
No education		Ref			Ref		
Primary		−0.80	(−0.94 to −0.66)		−0.21	(−0.42 to −0.10)	
Middle/JSS/JHS		−1.43	(−1.54 to −1.32)		−0.45	(−0.54 to −0.35)	
Secondary/higher		−2.53	(−2.65 to −2.41)		−0.69	(−0.80 to −0.59)	
No of abortions	1.12			<0.001			<0.001
No		Ref			Ref		
Single abortion		−0.41	(−0.53 to −2.84)		−0.20	(−0.30 to −0.11)	
More than 1		−0.15	(−0.30 to −0.01)		−0.18	(−0.29 to −0.07)	
Age at first sex	1.312			<0.001			<0.001
≤14 years		Ref			Ref		
15–19 years		−0.67	(−0.80 to −0.54)		−0.50	(−0.60 to −0.41)	
≥20 years		−1.54	(−1.69 to −1.41)		−1.01	(−1.13 to −0.90)	

Full model fit: F (22,859) =434.42, R^2=50.89.
JSS/JHS, junior secondary school/junior high school; VIF, variance inflation factor.

postpartum behaviours including breastfeeding.[8] Also, strong customs that encouraged prolific childbearing among the middle and coastal zones celebrated with a public ceremony of congratulations[35] for married couples with more than 10 children are gradually been eroded in contrast with the northern zone. However, in our adjusted models, the trend was reversed with an increase in CEB and odds for the middle zone compared with the northern zone which describes the heterogeneity of fertility patterns in different regions of Ghana.[36]

Table 4 Logistic model for fertile married females

Variable	VIF	No births N (%)	At least one birth N(%)	Bivariate analysis			Multivariate analysis		
				OR	95% CI	P value	AOR	95% CI	P value
Overall		1161 (7.0)	15504 (93.0)						
Place of residence	1.67					<0.001			0.331
Rural		454 (39.0)	7851 (49.0)	1			1		
Urban		706 (61.0)	7854 (51.0)	0.66	(0.56 to 0.77)		1.11	(0.90 to 1.37)	
Zone	1.34					0.130			0.341
Northern		154 (13.0)	2302 (15.0)	1			1		
Middle		435 (37.0)	5986 (39.0)	0.92	(0.78 to 1.09)		1.15	(0.93 to 1.42)	
Coastal		572 (49.0)	7216 (47.0)	0.85	(0.72 to 1.00)		1.02	(0.82 to 1.27)	
Wealth Index	2.53					<0.001			<0.001
Lowest		132 (11.0)	2934 (19.0)	1			1		
Second		148 (13.0)	3146 (20.0)	0.95	(0.76 to 1.20)		0.98	(0.74 to 1.28)	
Middle		207 (18.0)	3131 (20.0)	0.68	(0.53 to 0.86)		0.66	(0.49 to 0.89)	
Fourth		240 (21.0)	3244 (21.0)	0.61	(0.48 to 0.77)		0.58	(0.42 to 0.81)	
Highest		434 (37.0)	3051 (20.0)	0.32	(0.26 to 0.39)		0.32	(0.22 to 0.46)	
Age	1.13					<0.001			<0.001
15–19 years		141 (12.0)	294 (1.9)	1			1		
20–24 years		351 (30.0)	1660 (11.0)	2.28	(1.72 to 3.02)		5.45	(4.06 to 7.32)	
25–29 years		307 (26.0)	2860 (18.0)	4.48	(3.29 to 6.12)		19.66	(14.00 to 27.62)	
30–34 years		153 (13.0)	3156 (20.0)	9.94	(7.21 to 13.70)		51.33	(35.88 to 73.44)	
35–39 years		104 (9.0)	3002 (19.0)	13.86	(9.86 to 19.51)		67.22	(45.50 to 99.33)	
40–44 years		49 (4.2)	2330 (15.0)	22.98	(15.14 to 34.87)		96.28	(61.69 to150.27)	
45–49 years		55 (4.7)	2203 (14.0)	19.38	(13.19 to 28.45)		73.10	(47.67 to 112.10)	
Age at Marriage	1.29					<0.001			<0.001
Under 20 years		388 (33.0)	7993 (52.0)	1			1		
Above 20 years		773 (67.0)	7512 (48.0)	0.47	(0.40 to 0.55)		0.33	(0.26 to 0.41)	
Media exposure (internet/print/television/radio)	1.21					<0.001			0.845
Yes		1098 (95.0)	13933 (90.0)	1			1		
No		63 (5.4)	1571 (10.0)	1.97	(1.53 to 2.55)		1.03	(0.76 to 1.40)	
Level of education	1.67					<0.001			<0.001
No education		138 (12.0)	4106 (26.0)	1		<0.001	1		
Primary		133 (11.0)	2795 (18.0)	0.70	(0.53 to 0.94)		1.12	(0.82 to 1.53)	
Middle/JSS/JHS		405 (35.0)	6070 (39.0)	0.50	(0.40 to 0.64)		1.04	(0.79 to 1.38)	
Secondary/higher		485 (42.0)	2533 (16.0)	0.18	(0.14 to 0.23)		0.60	(0.44 to 0.82)	

Continued

Table 4 Continued

Variable	VIF	No births N (%)	At least one birth N(%)	Bivariate analysis			Multivariate analysis		
				OR	95% CI	P value	AOR	95% CI	P value
No of abortions	1.14					0.040			0.833
No		907 (78.0)	11 686 (75.0)	1			1		
Single abortion		180 (16.0)	2404 (16.0)	1.04	(0.83 to 1.29)		0.99	(0.77 to 1.26)	
More than 1		74 (6.4)	1415 (9.1)	1.49	(1.10 to 2.02)		1.09	(0.80 to 1.49)	
Age at first sex	1.28					<0.001			<0.001
≤14 years		77 (6.7)	2112 (14.0)	1					
15–19 years		695 (60.0)	10 283 (66.0)	0.54	(0.40 to 0.72)		0.55	(0.39 to 0.77)	
≥20 years		383 (33.0)	3106 (20.0)	0.30	(0.22 to 0.41)		0.38	(0.26 to 0.56)	

Multivariate model fit: F(9,872) = 0.88, p =0.5382.
AOR, adjusted OR; JSS/JHS, junior secondary school/junior high school; VIF, variance inflation factor.

CEB was lower among women in high-wealth index households compared with those from households with a lower wealth index. This could be attributed to possible engagement in higher wage employment which tends to count the opportunity cost for child care in favour of greater investment in resource production.[37] In similar studies conducted in Burkina Faso and Congo Democratic Republic,[38] poor financial ability had implications on the provision of food and adequate nutrition. This could be an explanation for why family sizes are kept small by the highest wealth index households to provide the basic needs of the family including food, shelter and medical care.

Even though the overall reproductive potential is decreased as females grow, older married females had more CEB compared with younger females[39] since the cumulative births before the end of the lifetime fertility cycle are higher. The age of a female is a universal and single most influential factor that moderates fertility in the biological domain.[13] Our findings can be compared with research done on women using models chosen to predict fertility rates for various ages in African countries. Compared with younger females, older females had more births with greater variability considering the number of CEB.[40 41]

In comparison to women who married after turning 20 years old, those who married before 20 years were more likely to have higher CEBs. This result may be explained by the fact that women who enter into early marriages are more likely to originate from low-income families. A study that focused on sub-Saharan countries concluded that countries with the highest rates of early marriage also have the highest rates of poverty and population growth.[42] Early age of marriage is likely to expose females to early sexual intercourse which in turn may lead to a high number of CEB.[43] Early marriage has many implications and can be avoided by mapping out strategies that engage adolescent females with education to reduce the high number of CEB.[44]

Media exposure was significantly associated with a lower CEB and lower odds of high fertility compared with married females without any media exposure. The media has played a critical role in educating individuals on maternal health and mortality in a broader scope. The benefits of such interventions can be attributed to the decreased CEB among married females exposed to the mass media. A study among 15–24 years females in Ghana showed that mere exposure to the media may not be enough to change one's sexual and reproductive behaviour if the contents of the particular media source do not positively address sexual and reproductive health issues.[45] This confirms that a targeted approach using specialised messages is an effective tool with positive health outcomes in maternal health and maternal mortality campaigns.[46] Even though messages are targeted to all females of reproductive age, greater declines can be achieved when messages are formulated to target fertility in marriage. This calls for an expansion

Table 5 Logistic model for high fertility among married females

Variable	VIF	Low births N(%)	High births N(%)	Bivariate weighted analysis			Multivariate weighted analysis		
				OR	95% CI	P value	AOR	95% CI	P value
Overall		5992 (39.0)	9513 (61.0)						
Place of residence	1.66					<0.001			0.033
Rural		2481 (41.0)	5169 (54.0)	1			1		
Urban		3510 (59.0)	4344 (46.0)	0.59	(0.54 to 0.65)		0.85	(0.73 to 0.99)	
Zone	1.34					0.130			0.003
Northern		757 (13.0)	1545 (16.0)	1			1		
Middle		2275 (38.0)	3711 (39.0)	0.80	(0.73 to 0.88)		1.29	(1.11 to 1.50)	
Coastal		2960 (49.0)	4257 (45.0)	0.70	(0.64 to 0.78)		1.11	(0.96 to 1.28)	
Wealth Index	2.51					<0.001			<0.001
Lowest		775 (13.0)	2159 (23.0)	1			1		
Second		1014 (17.0)	2131 (22.0)	0.75	(0.66 to 0.86)		0.81	(0.68 to 0.97)	
Middle		1136 (19.0)	1995 (21.0)	0.63	(0.55 to 0.73)		0.67	(0.54 to 0.84)	
Fourth		1448 (24.0)	1796 (19.0)	0.44	(0.39 to 0.51)		0.46	(0.37 to 0.58)	
Highest		1619 (27.0)	1432 (15.0)	0.32	(0.28 to 0.36)		0.37	(0.28 to 0.47)	
Age	1.11					<0.001			<0.001
15–19 years		286 (4.8)	8 (0.0)	1			1		
20–24 years		1454 (24.0)	205 (2.2)	5.16	(2.10 to 12.65)		8.12	(3.28 to 20.10)	
25–29 years		1738 (29.0)	1122 (12.0)	23.57	(9.76 to 56.91)		65.50	(26.84 to 159.79)	
30–34 years		1154 (19.0)	2002 (21.0)	63.33	(26.36 to 152.15)		261.00	(107.40 to 634.22)	
35–39 years		615 (10.0)	2387 (25.0)	141.65	(58.72 to 341.72)		641.74	(262.89 to 1566.57)	
40–44 years		399 (6.7)	1931 (20.0)	176.85	(72.69 to 430.31)		723.80	(292.47 to 1791.23)	
45–49 years		346 (5.8)	1857 (20.0)	196.23	(81.22 to 474.08)		725.83	(295.39 to 1783.54)	
Age at marriage	1.28					<0.001			<0.001
Under 20 years		2570 (43.0)	5422 (57.0)	1			1		
Above 20 years		3421 (57.0)	4091 (43.0)	0.57	(0.52 to 0.62)		0.43	(0.39 to 0.49)	
Media exposure (internet/print/television/radio)	1.21					<0.001			0.049
Yes		5625 (94.0)	8308 (87.0)	1			1		
No		366 (6.1)	1205 (13.0)	2.22	(1.95 to 2.54)		1.21	(1.00 to 1.46)	
Level of education	1.66					<0.001			<0.001
No education		805 (13.0)	3301 (35.0)	1			1		
Primary		906 (15.0)	1889 (20.0)	0.51	(0.44 to 0.58)		0.74	(0.63 to 0.89)	
Middle/JSS/JHS		2606 (43.0)	3464 (36.0)	0.32	(0.29 to 0.36)		0.56	(0.48 to 0.66)	
Secondary/higher		1674 (28.0)	859 (9.0)	0.13	(0.11 to 0.14)		0.34	(0.28 to 0.41)	

Continued

Table 5 Continued

Variable	VIF	Low births N(%)	High births N(%)	Bivariate weighted analysis			Multivariate weighted analysis		
				OR	95% CI	P value	AOR	95% CI	P value
No of abortions	1.14					<0.001			0.007
No		4406 (74.0)	7281 (77.0)	1			1		
Single abortion		1063 (18.0)	1340 (14.0)	0.76	(0.67 to 0.86)		0.78	(0.66 to 0.92)	
More than 1		523 (8.7)	892 (9.4)	1.03	(0.89 to 1.20)		0.88	(0.72 to 1.05)	
Age at first sex	1.27					<0.001			<0.001
≤14 years		593 (9.9)	1519 (16.0)	1					
15–19 years		3780 (63.0)	6502 (68.0)	0.67	(0.59 to 0.76)		0.53	(0.44 to 0.64)	
≥20 years		1618 (27.0)	1488 (16.0)	0.36	(0.31 to 0.41)		0.31	(0.25 to 0.38)	

Model Fit: F (9,872) = 1.1 p= 0.3418.
AOR, adjusted OR; JSS/JHS, junior secondary school/junior high school; VIF, variance inflation factor.

in the use of mass media in new formats to propagate and counsel married females on the potential of high fertility and its consequences.

The level of education was also significantly associated with CEB, and those who had obtained higher education had lower CEB, lower odds of one or more births and lower odds of high births. This could be attributed to the fact that those with higher education spend more time in training or knowledge acquisition.[44 47] Their investment in education indirectly allocates the early years of their life development to set other priorities and postpone childbearing after securing an established profession. Policies that enable females to access education could be the motivational factor to decrease fertility. Access to education creates an awareness of purpose by orienting individuals to set high standards in their career development process.[44]

The number of abortions was significantly associated with the number of CEBs. The pattern of abortion differentials could be attributed to unintended pregnancies among married females. In comparison to a study in Uganda,[48] unintended pregnancy among married females requires access to adequate family planning messages and services to reduce the high fertility. Abortions can be performed lawfully by trained medical professionals based on a medical condition and approval. However, when abortions are unsafe,[49] it could predispose a female to have lower odds of high fertility. We do not advocate for a decrease in the number of CEBs by abortion methods, but present proactive methods with less risk and complications as substitutes. In this regard, a variety of options for birth control measures should be made available for married females that require urgent need in the provision of healthcare services and interventions.

Age at first sex was significantly associated with a higher CEB and higher odds of high births. This could be related to the fact that females that had an early sexual engagement before the age of 15 years may have little or no knowledge of their sexual ovulation cycle leading to unintended pregnancies. Unprotected sex during intercourse may lead to unintended pregnancies as well. This fact was supported by a study in Uganda that linked several children to the risk of unintended births.[48] A focused publication that used data from the capital of Ghana[50] found that the prolongation of initial sex by a female is attributed to fertility decline. Our findings were also supported by other studies in India[51] and Zimbabwe[52] that found an association between fertility and age at first sex.

CONCLUSION

Socioeconomic factors among married females have a significant influence on the number of CEBs. Despite a consistent drop between 2003 and 2017, estimates of the mean CEB among married females are still high.

Based on our findings, we recommend specific government programmes be expanded to close the inequalities in rural areas access to education and income-generating

possibilities and consciously lower the high fertility rate among married women.

The mass media must be used to propagate and counsel married females on the potential of high fertility and its consequences.

Limitation

Variables on risk factors, lifestyle and biological indicators for married females were not available to be included in our models such as weight and alcohol intake, which could have been interesting to examine. Given the focus of this paper, the analysis was limited to only married women and not all women of reproductive age. Sophisticated models such as proportional odds and their assumptions could not be satisfied, hence for ease of interpretation, a modest approach was used for the model specification. Considering that CEB measures the lifetime fertility of a female, the data are limited to births recorded during the interview and exclude future births. Recall and the self-reported of total number of CEB may be biased by under-reporting of parities, especially by older women.

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