Sociodemographic Determinants of Adolescent Childbirths in Ghana: Results from a nationwide survey

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Research Article

Abstract

Objective: To investigate the sociodemographic determinants of adolescent childbearing in Ghana.

Methods: This research studied reproductive-aged women who were systematically sampled in Ghana. Kaplan Meier and Cox proportional hazard regression with shared frailty were fitted on a nationwide population-based data from the 2014 Ghana Demographic and Health Survey (GDHS) to predict adolescent childbirth.

Results: The analysis revealed that approximately 49% initiated childbirth during adolescence. This study found higher adolescent childbirth rates among women who were not working (adjusted hazard ratio (AHR) =1.17; 95% confidence interval (CI) = 1.07 to 1.29) and resided in rural areas (AHR =1.22; 95% CI = 1.09 to 1.37). In addition, poor women (AHR= 1.71; 95% CI = 1.49 to 1.95) and middle-class women (AHR=1.67; 95% CI = 1.48 to 1.88) had a higher likelihood of having adolescent birth compared to the rich. Lastly, secondary and higher educated women were 0.74 (95% CI= 0.67 to 0.82) and 0.10 (95% CI= 0.06 to 0.16) times less likely to have adolescent birth, respectively.

Conclusions: This research revealed that adolescent childbearing was greatly influenced by socioeconomically disadvantaged background within the contexts of the women and the community in which they reside. This finding suggests the need to initiate and improve interventions that seek to reduce poverty among women and to promote and encourage adolescent girls to pursue secondary and higher education to help reduce unintended adolescent childbirths. Finally, adolescent girls should be empowered through counseling and education on reproductive and sexual health options and rights to ensure more informed decision-making about contraception.

Introduction

Birthing is the most memorable event in society but the timing of first childbirth has both countless positive and negative effects on women, babies, families, communities and the countries. Many adolescent women aged 10-19 years [1] contribute an increasing percentage of births and are at greater risk of experiencing social and medical consequences, and therefore inspire effective strategies to tackle the problem. Publicly available data revealed that approximately 16 million females aged 15-19 years give birth annually constituting approximately 11percent of worldwide births. [2] Unlike high-income countries, over 90 percent of adolescent childbirths in the world are recorded in developing countries[3]. A study [4] posited that approximately 60% of adolescent pregnancies and childbirths in developing countries are unplanned. The more devastating situation has typified sub-Saharan African countries including Ghana with an average adolescent pregnancy rate of 19.3%. [5]

In Ghana, almost half (49%) of the girls are sexually active by their eighteenth birthday but contraceptive prevalence rate among females aged 15-19 years is just 9.8%. [6] The early initiation of sexual intercourse

at the critical developmental stage coupled with low family planning uptake exposes adolescent girls to unplanned pregnancies. Research has found that approximately 14% of all childbirths in Ghana are from adolescent mothers. [7] Unintended adolescent pregnancies and subsequent childbirths pose serious social and medical problems. To avoid health threats as well as the social cost of stigma, poverty, parental neglect and discontinuation of education; some pregnant adolescent girls choose to terminate their pregnancy. [6] Recent figures show that approximately 19% of adolescent pregnancies are aborted and regrettably non-medical methods were utilized for almost 30% of the induced abortions. [6]

Most adolescent pregnant girls who proceed to give birth suffer numerous challenges in their journey to motherhood. [8, 9] These problems alongside the fear of stigmatization and inadequate knowledge on sexual and reproductive health rights have resulted in the avoidance of essential maternal and neonatal healthcare services among adolescent girls. [10, 11] The lack of care among adolescent mothers has contributed to the increased risk of poor maternal and neonatal health outcomes. A study in Ghana opined that adolescent mothers have a greater likelihood of stillbirths. [12] Past studies have also reported that pregnancies from adolescent girls are more likely to experience premature birth [13] and miscarriage [14] than older women. Other authors found adolescent mothers to be of greater risk for cephalo-pelvic disproportion [15], cardiovascular diseases [16], maternal mortality [17], eclampsia and puerperal endometritis. [1] Furthermore, newborns by adolescent girls have a higher chance of presenting a lower birth weight [18] and other serious neonatal disabilities [1] and eventually have an elevated risk of perinatal death [19], and infant and child mortality. [20]

In addition to medical issues, adolescent childbirths have detrimental demographic and social consequences on the future aspirations of the mother, baby and country at large. These adolescent mothers experience social isolation from parents and the community [21] and often drop out of school [22] to engage in low-income jobs [23], and even prostitution for a living. [21, 24] Apart from economic hardship, adolescent mothers suffer emotional and psychological trauma as well as increased rates of domestic violence [11, 23] which result in child neglect, distress and sometimes suicide. According to the Ghana Statistical Service; violence, accidents, homicide, and suicide accounted for 16% of all deaths among girls aged 15-19 years. [25] Moreover, the nation's scarce resources are unduly strained to deal with the negative consequences.

Considering these challenges, it is important to investigate the risk factors of adolescent childbearing to inform effective preventive programs and interventions to assist disadvantaged adolescent women. In addition, the correlates of adolescent childbirths are complex and interactive. Previous studies found many predictors of adolescent childbearing predominantly in higher-income countries, [1, 9, 26-28] however, the authors presented opposing views that could be blamed on the different study contexts, sample sizes, and methods. Although some studies in Ghana have predicted adolescent childbirths, [12, 22] yet none of the studies in Ghana have fully evaluated both the individual-level determinants and community effect on adolescent childbirth. In addition, a review of the literature has proven that no study in Ghana used large

nationwide population-based data and a robust model to predict adolescent childbirth. This research intends to address the research gap by using a robust model and nationally representative population data from the 2014 Ghana Demographic and Health Survey (GDHS). The study aims to investigate the sociodemographic determinants and community effect on adolescent childbirth in Ghana using Cox proportional hazard regression with shared frailty.

Methods

1 Study site

This current study was carried out in a West African coastal nation, Ghana. In 2010, the country's projected population was 27 million with a population density of 103 persons per square meter.[29] Females constitute approximately 55% of the population.[29] Ghana's overall fertility rate is 4.2 births,[7] while the total contraceptive prevalence rate among women of childbearing age is 24.7%. [6] Moreover, maternal and child health care is administered through public and private hospitals, clinics, health centers and maternity homes.

2. Study sampling and instruments

In 2014, a well-established Demographic and Health Survey (DHS) was operationalized to sample respondents across the 216 districts representing the ten regions of Ghana. The upgraded 2010 Ghana Population and Housing Census frame were adopted for the two-stage survey sampling design of the 2014 Ghana Demographic and Health Survey (GDHS). Initially, approximately 427 clusters (hereinafter communities) were selected from both urban and rural areas of the ten administrative regions in Ghana. Second, the survey systematically sampled 12,831 households for data collection, which was the sum of 30 households from each of the 427 communities. Out of the 12,831 households, study participants were successfully drawn from 11,835 households. Trained fieldworkers used a pretested structured questionnaire to collect population and health information from men and women aged 15-49 years who consented to be part of the survey. For women who were surveyed, 9,656 were deemed eligible to be interviewed from the households. Of the 9,656 potential participants, 9,396 women completed the survey process with a 97.3% response rate. The data was processed with CSPro software, and weighting factors were added to ensure proportionality at the national level. [7] This current study used data on women's background and reproductive health characteristics from the 2014 GDHS dataset;

3. Study Variables

This study described the outcome variable, adolescent childbirth, as first birth occurring between the ages of 10 and 19 years. All women whose first birth occurred before their 20th birthday by the end of the survey in mid-December 2014 were coded as "1" or else coded as "0". The survival time was measured in years.

Based on an extensive literature review and scope of the dataset, the following explanatory variables were selected and used in this study: first sexual debut, abortion status, religion, marital status, employment status, place of residence, parity, financial status and education. [1, 9, 12, 22, 27] Study variables characterizing adolescent childbirths were coded as described in Table 1.

Table 1 Summary of study variables used in the study

Variable name	Coding structure
Maternal age	Categorical, 1=15-24 years, 2=25-34 years, 3=35-49 years
First Sexual debut	Categorical, 0 = Outside union, 1 = union
Abortion experience	Categorical, 0 = No abortion, 1 = Had abortion
Religion	Categorized, 1 = Traditional/other, 2= Muslim, 3 = Christians
Marital status	Categorized, 0 = Unmarried, 1 = Married
Employment status	Categorized, 1= Not Working, 2 = Working
Place of residence	Categorized, 0 = Rural 1 = Urban
Parity	Categorized, 1 = One birth, 2 = Two births, 3 = Three or more births
Financial status	Categorized, 1 = Poor, 2 = Middle, 3 = Rich
Education	Categorized, 0 = No Education, 1= Primary, 2 = Secondary, 3 = Higher

Data Analysis

Descriptive Statistics: The chi-square test was deployed to compute the proportions of the distribution across the categorical study variables, and to assess the difference between adolescent childbirth and non-adolescent childbirths. The frequencies and percentages from the Chi-square test were tabulated based on the study predictors.

Hazard model: Cox proportional hazards regression with shared frailty to account for clustering at the community level was specified to estimate risk factors of adolescent childbirth and their 95% confidence interval. [30, 31] First, the study used a histogram to display the distribution of age at first childbirth, to check for features of survival data. Kaplan-Meier survivor function was plotted to visually display the cumulative survival probabilities of adolescent childbirth in the study period. Moreover, the log-rank test for equality of survivor functions was used to detect the difference between the observed and expected adolescent childbirths in categorical variables.

The proportional hazard assumption was assessed by Schoenfeld residuals which estimated the residuals from the observed survival times of adolescent childbirths to detect departures from non-proportionality. [32] To evaluate the assumption that censoring is independent of the outcome of interest, adolescent childbirth. A complete positive and negative correlation was used to check that censored women have the same future expectation as non-censored women. A complete positive correlation assumes that all censored women would have experienced adolescent childbirth immediately if they were not censored, while a negative correlation considers that all censored women would not experience adolescent childbirth for a long time if they were not censored. [33]

Crude Cox proportional hazard associations with random effects were fitted for each of the risk factors. Unadjusted hazard ratios, 95% confidence intervals, and p-values were computed. Moreover, study predictors with p-values ≤0.25 were selected for the multivariable analysis. A lenient p-value was used in this study because it would prevent missing important variables that may be suppressed by confounders. [34, 35] Multicollinearity was tested among select variables for the multivariable survival model; predictors with variance inflation factor (VIF) of > 4 and tolerance < 0.2 were considered collinear. A manual backward elimination selection strategy was followed, excluding predictors with high p-values one at a time until the final multivariable model contained only variables with significant parameter estimates at p-value less than or equal to 0.05. Furthermore, confounding factors were checked and predictors that changed the regression coefficient of other factors by more than 20% were considered confounders. Additionally, all two-way interactions were tested among significant predictors in the multivariable model, and interaction terms with p-values ≤0.05 were deemed significant. A complete case analysis was used in the model.

Model diagnostics were evaluated through Harrell's C concordance statistic and assessment of Cox-Snell residuals. Akaike's information criterion (AIC) was used for model selection. The data analyses were conducted in Stata software version 14™ (StataCorp LP, College Station, TX, USA).

5. **Research Ethics**

The 2014 GDHS sought ethical approval from the review boards of Ghana Health Service and ICF international. This study used de-identified secondary data, and the findings from the study do not reveal the identity of the participants.

Results

The study data captured women between 11 and 41 years of age at first childbirth. The mean age at first birth was 20 years (SD=4). As shown in Table 2, of the 6,511 women who gave birth during the survey, 3,178 of the women experienced adolescent childbirth, accounting for 48.8% of all births.

Age: Almost half (47.1%) of the women who gave birth were aged 35-49 years. Of the mothers aged 35-49 years, approximately 40% had adolescent childbirth. The adolescent childbirth rate was highest (71%) among women aged 15-24 years.

First sexual debut: Approximately two-thirds (66.3%) of women had first sexual encounters outside unions, while 64% of women who had first sexual debut outside unions experienced adolescent childbearing. The adolescent birth rate was greater (52.6%) among women who had their first sexual experience within union than among those with encounters outside the union.

Abortion experience: Women who had never had abortion accounted for approximately three-quarters (74%) of all births, and most (76%) adolescent childbirths were found among women with no abortion experience. Women who had never terminated a pregnancy had markedly greater (50.3%) adolescent birth rates than women who had ever had an abortion.

Religion: Approximately 7 out of 10 (73.7%) women were Christians, while less than 10% of the women belonged to the traditional and other minority religious groups. Out of the small proportion of women who were traditional or other believers, 56.7% gave birth between the ages of 11-19 years, which was higher than Christian and Muslim women.

Marital status: Of the total women who were studied, 62% were married. Among unmarried women, more than half gave birth during adolescence which was higher than that of married women ((54.7% vs 45.2%).

Employment status: Women who were not working constituted a smaller proportion (16.5%) than those who were working. An elevated adolescent birth rate was observed among women who were not working compared with the working class (51.8% vs 48.2%).

Place of residence: Rural dwellers constitute a larger proportion (54.1%) of the study population and contribute approximately 61.9% of adolescent births. Notably, a heightened adolescent birth rate was identified among women from rural areas relative to urban dwellers (55.9% vs 40.5%).

Parity: The majority (60.7%) of the women had at least three births. A smaller proportion of mothers with one birth accounted for approximately 15% of adolescent childbirth; this represents an adolescent birth rate of 37.1% lower than women with two births (40.4%) and at least three births (55.3%).

Financial status: Among the study population, approximately 47% were poor, 21% were middle class and 33% were rich. In this research, the adolescent childbearing rate had an inverse relationship with the financial status of women. A higher childbirth rate was observed among poor women (56.4%) than among middle (53.9%) and rich women (34.8%).

Education: Secondary educated women had the largest proportion (43.9%). Moreover, women with postsecondary education had lower (8.5%) adolescent birth rates compared with other groups.

Table 2 Distribution of study characteristics across all women, adolescent birth and rates of adolescent birth

Variable	Category	All births N=6511 (%)	Adolescent births N=3178 (%)	Birth rate (Per 100)
Maternal age	15-24 years	979(15.0)	702 (22.1)	71.7
	25-34 years	2,466 (37.9)	1,081(34.0)	43.8
	≥ 35 years	3,066 (47.1)	1,395 (43.9)	45.5
First sexual debut	Outside union	4,314 (66.3)	2,023 (63.6)	46.9
	Union	2,196 (33.7)	1,155 (36.4)	52.6
Abortion experience	No abortion	4,817 (74.0)	2,421 (76.2)	50.3
	Had abortion	1,694 (26.0)	757 (23.8)	44.7
Religion	Traditional/other	448 (6.9)	254 (8.0)	56.7
	Muslim	1,262 (19.4)	625 (19.7)	49.5
	Christian	4,801 (73.7)	2,299 (72.3)	47.9
Marital status	Unmarried	2,471 (38.0)	1,351 (42.5)	54.7
	Married	4,040 (62.0)	1,827 (57.5)	45.2
Employment status	Not working	1,075 (16.5)	557 (17.5)	51.8
	Working	5,431 (83.5)	2,618 (82.5)	48.2
Place residence	Rural	3,522 (54.1)	1,968 (61.9)	55.9
	Urban	2,989 (45.9)	1,210 (38.1)	40.5
Parity	One birth	1,303 (20.0)	483 (15.2)	37.1
	2 births	1,254 (19.3)	507 (16.0)	40.4
	At least 3 births	3,954 (60.7)	2,188 (68.8)	55.3
Financial status	Poor	3,029 (46.5)	1,707 (53.7)	56.4
	Middle	1,365 (21.0)	735 (23.1)	53.9
	Rich	2,117 (32.5)	736 (23.2)	34.8
Education	No education	2,125 (32.6)	1,167 (36.7)	54.9
	Primary	1,282 (19.7)	777 (24.4)	60.6
	Secondary	2,857 (43.9)	1,213 (38.2)	42.5
	Higher	247 (3.8)	21 (0.7)	8.5

N, frequency; %, percentage

Kaplan-Meier survivor function curves

Figure 1 displays a plot that compares the survival experience of women who reported working and those who were not working. Based on the follow-up time in each of the two groups, it appears that women who were not working had shorter survival times. Furthermore, the log-rank test for equality of survivor functions found a p-value of 0.05, indicating a statistically significant difference between the two groups. This implies that women who are not working are associated with higher adolescent childbirths than those working.

Figure 2 displays the survival function for a place of residence. The graph suggests that women in rural areas have shorter survival times when compared with urban dwellers, indicating that rural women are at a higher risk of adolescent childbirth before their twentieth birthday than urban women. To confirm this, the log-rank test was conducted, and a statistically significant difference between urban and rural survival functions was detected (p-value <0.001).

Figure 3 shows the Kaplan-Meier survivor functions for financial status. The graph depicts a lower cumulative survival probability among poor women when compared with middle and rich women. This indicates that rich women had a lower risk of adolescent childbearing than middle and poor women. This assertion was supported by a log-rank test for equality of survivor functions that observed a statistically significant difference (p-value < 0.001).

Figure 4 displays a graph that compares the survival experience of women based on the education level. From the follow-up time in each of the four groups, it appears that women who have secondary and higher have longer survival times relative to those with primary and no education. This implies that women with at least secondary education were at lower risk of having a child before attaining 20 years when compared with their counterparts who had primary or no formal education. Furthermore, the log-rank test for equality of survivor functions found a p-value of <0.001, indicating a statistically significant difference between the four groups.

Hazard model results

Some risk factors violated the proportional hazard assumption that their hazard functions would remain proportional and constant over time. The study variables first sexual debut (p-value=0.018), maternal age (p-value= 0.014), marital status (p-value=0.001), and parity (p-value< 0.001) violated the proportional hazard assumption with a significant association in the Schoenfeld residuals test and hence were not considered in the univariate model. Furthermore, the coefficients from the positive and negative correlations were compared. The sensitivity analyses observed no significant difference in the parameter estimates, indicating that the independent censoring assumption was not violated.

As shown in Table 3, all the study predictors that were considered in the unadjusted model to explore the hazard of having adolescent childbirth had a p-value less than 0.2, and no multicollinearity was detected among the variables evidenced by VIF less than 4 and tolerance of more than 0.2. Moreover, all the selected risk factors were included in the multivariable model. No confounding and significant interaction

terms were detected in the multivariable model. The final model had a smaller AIC of 7,226.5 than the null model (without predictors) with AIC of 7,871.0 and hence was considered a better model fit.

The adjusted hazard ratios reported in Table 3 demonstrate that the significant effects of first sexual debut, religion and abortion experience on the adolescent childbirth in the unadjusted model were attenuated after controlling for all other risk factors.

Employment status: The hazard of adolescent childbearing among women who were not working was 17% (95% CI= 1.07 to 1.29) higher than those who were working.

Place residence: The analysis revealed that women in rural areas were 22% (95% CI= 1.09 to 1.37) more likely to experience adolescent childbirth when compared with urban dwellers.

Financial status: The likelihood of having adolescent childbirth among poor and middle-class women was 71% (95% CI= 1.49 to 1.95) and 67% (95% CI= 1.48 to 1.88) respectively, greater than that among rich women.

Education: Secondary and higher educated women were 74% (95% CI= 0.67 to 0.82) and 10% (95% CI= 0.06 to 0.16) respectively, less likely to give birth during adolescence than women with no education. However, women with primary education were 25% (95% CI= 1.14 to 1.38) more likely to have adolescent childbirth than uneducated women.

Community effect: The estimated variance of the gamma frailty distribution of 0.08 was significant (LRT χ^2 = 54.60, p<0.001) suggesting that some communities had greater hazards of adolescent childbirth than other communities. Furthermore, the computed variance describes the unexplained heterogeneity at the community level.

Table 3 Unadjusted and adjusted hazard ratio (HR), and 95% confidence interval (CI) of Cox proportional hazards models predicting adolescent births

Variable	Category	Unadjusted		Adjusted
		HR (95% CI)	P-value	HR (95% CI)
Abortion experience	No abortion	Reference	< 0.001	-
	Had abortion	0.83 (0.76, 0.89)		-
Religion	Traditional/other	Reference	< 0.001	-
	Muslim	0.80 (0.69, 0.93)		-
	Christian	0.71(0.62, 0.81)		-
Employment status	Working	Reference	0.003	Reference
	Not working	1.15 (1.05, 1.26)		1.17 (1.07, 1.29)
Place residence	Urban	Reference	< 0.001	Reference
	Rural	1.91 (1.78, 2.05)		1.22 (1.09,1.37)
Financial status	Rich	Reference	< 0.001	Reference
	Middle	2.28 (2.06, 2.53)		1.67 (1.48,1.88)
	Poor	2.66 (2.43, 2.90)		1.71 (1.49,1.95)
Education	Higher	Reference	< 0.001	Reference
	Secondary	0.06 (0.07, 0.17)		0.10 (0.06, 0.16)
	Primary	0 .58 (0.54. 0.63)		0.74 (0.67, 0.82)
	No education	1.18 (1.08, 1.29)		1.25 (1.14, 1.38)
Community Frailty	Variance (SE)	-	-	0.081 (0.015)

CI, confidence interval; HR, **hazard ratio**; %, percentage; SE, standard error

Discussion

This research identified and studied 6,511 women across Ghana from the age of 10 years and observed women who had first childbirth as an adolescent. The findings from this study revealed that approximately 49% of women initiate childbearing during the adolescent period, which was higher than the 18.3% reported in the USA [36] and the 30.8% observed in Bangladesh. [37]

The study analysis proved that statistically significant association was identified between the risk of adolescent childbearing and abortion experience and religion in the conditional model, which is consistent with earlier studies. [20, 38] However, the significant effect was attenuated after adjustment for other study predictors. This result agrees with a study in Bangladesh that opined that religion does not have a significant influence on the risk of adolescent childbearing among teenage girls. [37]

Furthermore, disparities in adolescent childbirths are widely driven by disproportionate rates of socioeconomic disadvantage. [22, 37, 38] Considering this association, this study found that employment status, place of residence, financial status and education were more predictive of adolescent childbirth. This result would help initiate and shape policies and programs that have the potential to minimize adolescent unintended pregnancies and childbirths and increase adolescent contraceptive uptake.

Moreover, earlier studies have shown varied findings concerning the effect of employment status on adolescent childbearing. Whereas a study found no significant link between women's employment and childbearing in adolescence, [37] other studies observed a protective effect on adolescent childbirths for employed women. [39, 40] This study identified that unemployed women were at higher risk of adolescent childbirth when compared with their employed counterparts. This finding is consistent with a study that stated that women who were employed are at a lower risk of childbirth in adolescence. [39] Our results may be explained by the fact that economically active women tend to play a significant role in reproductive health decision making in households. Perhaps may choose to delay childbearing to achieve career aspirations, and thereby help mitigate the risk of unintended pregnancies and childbirths.

Additionally, previous studies found a link between place of residence and adolescent childbirth, [37] this study observed that women who live in rural areas have higher vulnerability with regard to initiating childbearing as an adolescent. This study finding suggests a strong relationship between place of residence and the likelihood of beginning childbirth during adolescence which is consistent with a study in Bangladesh. [38] In view of this result, it appears that adolescent girls in rural areas are more likely to engage in high-risk sexual encounters, which predisposes them to a greater risk of unintended pregnancy leading to adolescent childbirth because family planning services are skewed in favor of urban residents [6] and differential cultural practices. [11] Further research is required to assess the pressure that areas' traditional beliefs and cultural norms exert on adolescent childbearing. Additionally, given that mass media has a higher penetrating rate in urban areas than rural areas, urban dwellers may be more exposed to family planning and reproductive health information through mass media than rural women. The use of this information dissemination channel can reduce unplanned adolescent pregnancy and eventually childbirth.

In addition, financial status is a well-established predictor of the risk of adolescent childbirths. [38, 39] In this study, women who were middle class and rich were linked with lower rates of adolescent childbirth relative to poor women. This suggests that poor women were more likely to give adolescent birth, a finding congruous with prior research. [37] The result suggests that women who are poor and rely on partners may have lower participation in household decision making such as family planning uptake, the timing of childbirth and many others. Moreover, women with poorer backgrounds have increased vulnerability to trade sexual activity for financial support from men, [41, 42] which can result in unplanned pregnancies and unwanted adolescent childbirths. Lastly, contraceptives are not covered under the free maternal care policy in Ghana, which makes poor women especially adolescent girls, perceive childbirths to be cheaper than purchasing family planning methods. The inability to afford contraceptives and consequent low uptake of family planning methods among poor women may explain the increased adolescent childbirth among that cohort.

Furthermore, the association of adolescent childbirth and education has been studied extensively. [22, 30] This research found a curvy-linear association between adolescent childbirth and education. The study findings demonstrated that women with just primary education had heightened

vulnerability for adolescent childbirth than women with no education. This result does not support similar research that observed no significant relationship between adolescent childbearing and primary education. [38] Notwithstanding, the study further revealed that secondary or higher educated women were less likely to begin birthing as an adolescent than those without education, and this finding is consistent with previous studies. [37, 43, 44] This may be attributed to inadequate knowledge of sexual health and contraceptive methods as well as the damaging effect of adolescent childbearing among lower educated women. [45] Furthermore, women with no education and lower education may not be empowered leading to a lower contribution to the family's sexual and reproductive health decision making including the timing of childbirths.

Finally, this study found significant heterogeneity in adolescent childbirth across communities. This finding suggests that the community in which adolescent women live has a substantial influence on the timing of childbirth, which is consistent with previous studies. [39, 40] Most likely, disparities in socioeconomic status and cultural traditions may explain the variation in adolescent childbearing at the community-level. Further investigations into community-level factors are proposed to identify unobserved covariates to support the development of strategies and policies to reduce adolescent childbirths.

This research used a large nationally representative population-based dataset to identify sociodemographic risk factors of adolescent childbearing using a robust model. This study fills a research gap and makes an impactful contribution to the body of knowledge. Notwithstanding, some limitations were identified. Information bias could arise in the survey because participants must recollect past events which can lead to recall bias. Additionally, adolescent childbearing is a culturally sensitive matter and can cause social desirability bias. Finally, considering the cross-sectional nature of the survey causality cannot be assumed.

Conclusion

This research revealed that the hazard of having adolescent childbirth was significantly affected by socio-economically disadvantaged background within the contexts of the women and the community in which they reside. This study found higher adolescent childbirth among poorer, unemployed, lower educated women who reside in rural areas. Additionally, heterogeneity in adolescent childbearing at the community level could be explained by community variability. The identified predictors of adolescent childbirth and the community-level heterogeneity suggest targeted initiatives and policies to prevent unwanted pregnancies and childbirths as well as improve the health of adolescent mothers and babies. This study finding suggests the need to provide reproductive and sexual health education for high-risk adolescents, and to improve family planning uptake among this vulnerable group to prevent unintended pregnancies and unplanned childbirth. Furthermore, the results of this study support economic initiatives and the strengthening of welfare interventions that seek to empower women to help reduce poverty such as the Livelihood Empowerment against Poverty (LEAP) program in Ghana. Additionally, this research seems to suggest that there is the need to promote and encourage adolescents especially girls to pursue secondary and higher education, alongside ensuring affordability of schooling such as the Ghana free

secondary education policy initiated in 2017. Finally, the study proposes that adolescent-friendly health care services including counseling are crucial to improve access and to help mitigate the negative maternal and neonatal health outcomes during adolescence.

Declarations

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COMPETING INTERESTS

The author declare no competing interest.

ETHICAL APPROVAL

Ethical review was not required because secondary de-identified data was used in the study.

References

1. Ganchimeg T, Ota E, Morisaki N, et al. Pregnancy and childbirth outcomes among adolescent mothers: a W orld H ealth O rganization multicountry study. *BJOG: An International Journal of Obstetrics & Gynaecology*. 2014; 121: 40-8.
2. WHO. Media Centre: adolescent pregnancy. World Health Organization 2014.
3. WHO. WHO guidelines on preventing early pregnancy and poor reproductive health outcomes among adolescents in developing countries. *World Health Organization*. 2011.
4. Weiss E, Whelan D and Gupta GR. Gender, sexuality and HIV: making a difference in the lives of young women in developing countries. *Sexual and Relationship Therapy*. 2000; 15: 233-45.
5. Kassa GM, Arowojolu A, Odukogbe A and Yalew AW. Prevalence and determinants of adolescent pregnancy in Africa: a systematic review and Meta-analysis. *Reproductive health*. 2018; 15: 195.
6. GSS. Ghana Maternal Health Survey 2017: Key Indicators Report. Accra, Ghana: Ghana Statistical Service (GSS), Ghana Health Service (GHS), and ICF, 2018.
7. GSS. Ghana Demographic and Health Survey 2014. Ghana Statistical Service (GSS), Ghana Health Service (GHS), and ICF International, 2015.
8. WHO. Adolescent pregnancy: unmet needs and undone deeds: a review of the literature and programmes. *World Health Organization*. 2007.

9. Olausson PO, Haglund B, Weitoft GR and Cnattingius S. Teenage childbearing and long-term socioeconomic consequences: a case study in Sweden. *Family planning perspectives*. 2001: 70-4.

10. Atuyambe LM, Kibira SP, Bukenya J, Muhumuza C, Apolot RR and Mulogo E. Understanding sexual and reproductive health needs of adolescents: evidence from a formative evaluation in Wakiso district, Uganda. *Reproductive health*. 2015; 12: 35.

11. Edirne T, Can M, Kolusari A, Yildizhan R, Adali E and Akdag B. Trends, characteristics, and outcomes of adolescent pregnancy in eastern Turkey. *International Journal of Gynecology & Obstetrics*. 2010; 110: 105-8.

12. Yussif A-S, Lassey A, Ganyaglo GY-k, Kantelhardt EJ and Kielstein H. The long-term effects of adolescent pregnancies in a community in Northern Ghana on subsequent pregnancies and births of the young mothers. *Reproductive health*. 2017; 14: 178.

13. de Vienne CM, Creveuil C and Dreyfus M. Does young maternal age increase the risk of adverse obstetric, fetal and neonatal outcomes: a cohort study. *European Journal of Obstetrics & Gynecology and Reproductive Biology*. 2009; 147: 151-6.

14. Chantrapanichkul P and Chawanpaiboon S. Adverse pregnancy outcomes in cases involving extremely young maternal age. *International Journal of Gynecology & Obstetrics*. 2013; 120: 160-4.

15. Ganchimeg T, Mori R, Ota E, et al. Maternal and perinatal outcomes among nulliparous adolescents in low-and middle-income countries: a multi-country study. *BJOG: An International Journal of Obstetrics & Gynaecology*. 2013; 120: 1622-30.

16. Rosendaal NT, Alvarado B, Wu YY, Velez MP, da Câmara SMA and Pirkle CM. Adolescent childbirth is associated with greater Framingham risk scores for cardiovascular disease among participants of the IMIAS (international mobility in aging study). *Journal of the American Heart Association*. 2017; 6: e007058.

17. Conde-Agudelo A, Belizán JM and Lammers C. Maternal-perinatal morbidity and mortality associated with adolescent pregnancy in Latin America: Cross-sectional study. *American journal of obstetrics and gynecology*. 2005; 192: 342-9.

18. Chen CW, Tsai CY, Sung FC, et al. Adverse birth outcomes among pregnancies of teen mothers: age-specific analysis of national data in Taiwan. *Child: care, health and development*. 2010; 36: 232-40.

19. Mukhopadhyay P, Chaudhuri R and Paul B. Hospital-based perinatal outcomes and complications in teenage pregnancy in India. *Journal of health, population, and nutrition*. 2010; 28: 494.

20. Awusabo-Asare K, Abane AM and Kumi-Kyereme A. *Adolescent sexual and reproductive health in Ghana: A synthesis of research evidence*. Alan Guttmacher Institute New York, NY, 2004.

21. Aujoulat I, Libion F, Berrewaerts J, Noirhomme-Renard F and Deccache A. Adolescent mothers' perspectives regarding their own psychosocial and health needs: a qualitative exploratory study in Belgium. *Patient education and counseling*. 2010; 81: 448-53.

22. Biney AA and Nyarko P. Is a woman's first pregnancy outcome related to her years of schooling? An assessment of women's adolescent pregnancy outcomes and subsequent educational attainment in Ghana. *Reproductive health*. 2017; 14: 123.

23. Urdinola BP and Ospino C. Long-term consequences of adolescent fertility: The Colombian case. *Demographic Research*. 2015; 32: 1487-518.

24. Adzitey S, Adzitey F and Suuk L. Teenage pregnancy in the Builsa District: A focus study in Fumbisi. *Journal of Life Science Biomed*. 2013; 3: 185-8.

25. GSS. Ghana 2010 Population and Housing Census, Mortality Report. *Ghana Statistical Service* 2014.

26. Gibb SJ, Fergusson DM, Horwood LJ and Boden JM. Early motherhood and long-term economic outcomes: Findings from a 30-year longitudinal study. *Journal of Research on Adolescence*. 2015; 25: 163-72.

27. Gurmu E and Etana D. Age at first marriage and first birth interval in Ethiopia: analysis of the roles of social and demographic factors. *African Population Studies*. 2014; 28: 1332-44.

28. Logubayom IA and Luguterah A. Survival analysis of time to first birth after marriage. *Survival*. 2013; 3.

29. GSS. 2010 Population & Housing Census: National Analytical Report. Ghana Statistical Service (GSS), 2013.

30. Kunnuji MO, Eshiet I and Nnorom CC. A survival analysis of the timing of onset of childbearing among young females in Nigeria: are predictors the same across regions? *Reproductive health*. 2018; 15: 173.

31. Vaupel JW, Manton KG and Stallard E. The impact of heterogeneity in individual frailty on the dynamics of mortality. *Demography*. 1979; 16: 439-54.

32. Schoenfeld D. Partial residuals for the proportional hazards regression model. *Biometrika*. 1982; 69: 239-41.

33. Dohoo IR, Martin SW and Stryhn H. *Methods in epidemiologic research*. 2012.

34. Bursac Z, Gauss CH, Williams DK and Hosmer DW. Purposeful selection of variables in logistic regression. *Source code for biology and medicine*. 2008; 3: 17.

35. Hosmer DW LS. *Applied logistic regression* New York: Wiley, 2000.

36. King B and Van Wert M. Predictors of early childbirth among female adolescents in foster care. *Journal of Adolescent Health*. 2017; 61: 226-32.

37. Islam MM, Islam MK, Hasan MS and Hossain MB. Adolescent motherhood in Bangladesh: Trends and determinants. *PloS one*. 2017; 12: e0188294.

38. Kamal SM. Adolescent motherhood in Bangladesh: Evidence from 2007 BDHS data. *Canadian Studies in Population*. 2012; 39: 63-82.

39. Penman-Aguilar A, Carter M, Snead MC and Kourtis AP. Socioeconomic disadvantage as a social determinant of teen childbearing in the US. *Public Health Reports*. 2013; 128: 5-22.

40. Wright DM, Rosato M, Doherty R and O'Reilly D. Teenage motherhood: Where you live is also important. A prospective cohort study of 14,000 women. *Health & place*. 2016; 42: 79-86.

41. Mac Domhnaill B, Hutchinson G, Milev A and Milev Y. The social context of schoolgirl pregnancy in Ghana. *Vulnerable children and youth studies*. 2011; 6: 201-7.

42. Gyesaw NYK and Ankomah A. Experiences of pregnancy and motherhood among teenage mothers in a suburb of Accra, Ghana: a qualitative study. *International journal of women's health*. 2013; 5: 773.

43. Gupta N and Mahy M. Adolescent childbearing in sub-Saharan Africa: Can increased schooling alone raise ages at first birth? *Demographic research*. 2003; 8: 93-106.

44. Sullivan K, Clark J, Castrucci B, Samsel R, Fonseca V and Garcia I. Continuing education mitigates the negative consequences of adolescent childbearing. *Maternal and child health journal*. 2011; 15: 360-6.

45. Marchetta F and Sahn DE. The role of education and family background in marriage, childbearing, and labor market participation in senegal. *Economic Development and Cultural Change*. 2016; 64: 369-403.
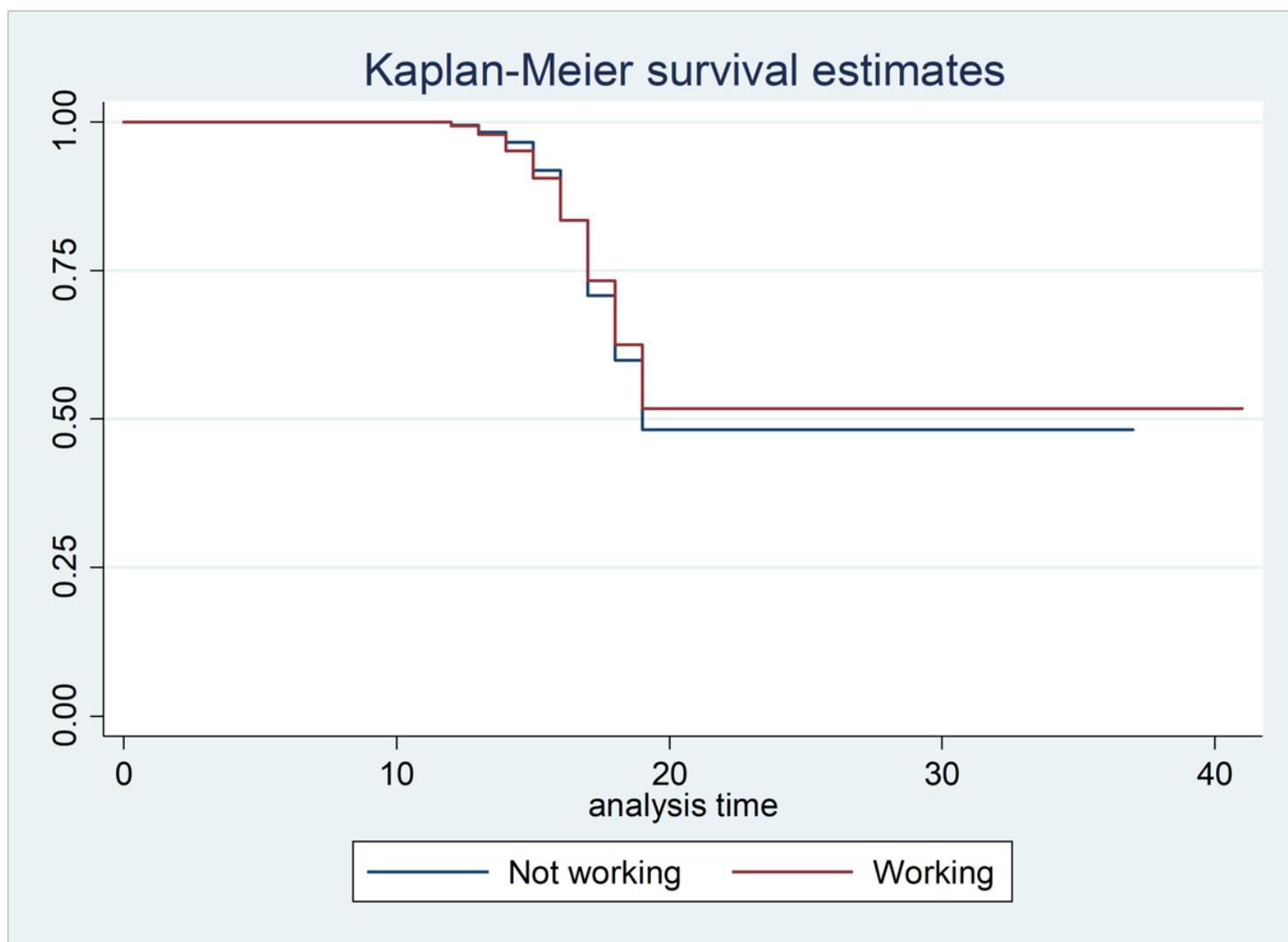
Figures

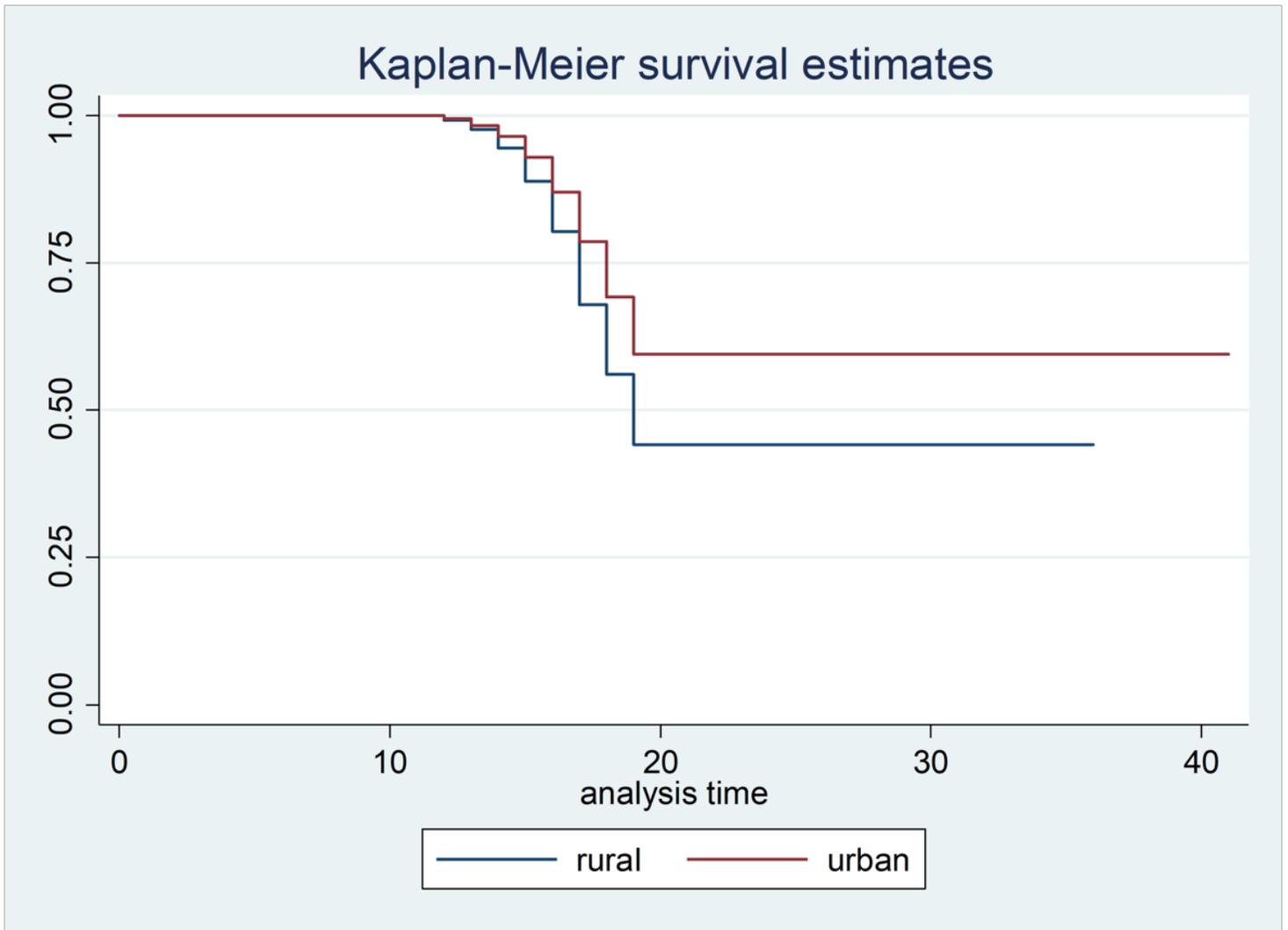
Figure 1

Kaplan-Meier survival curves by employment

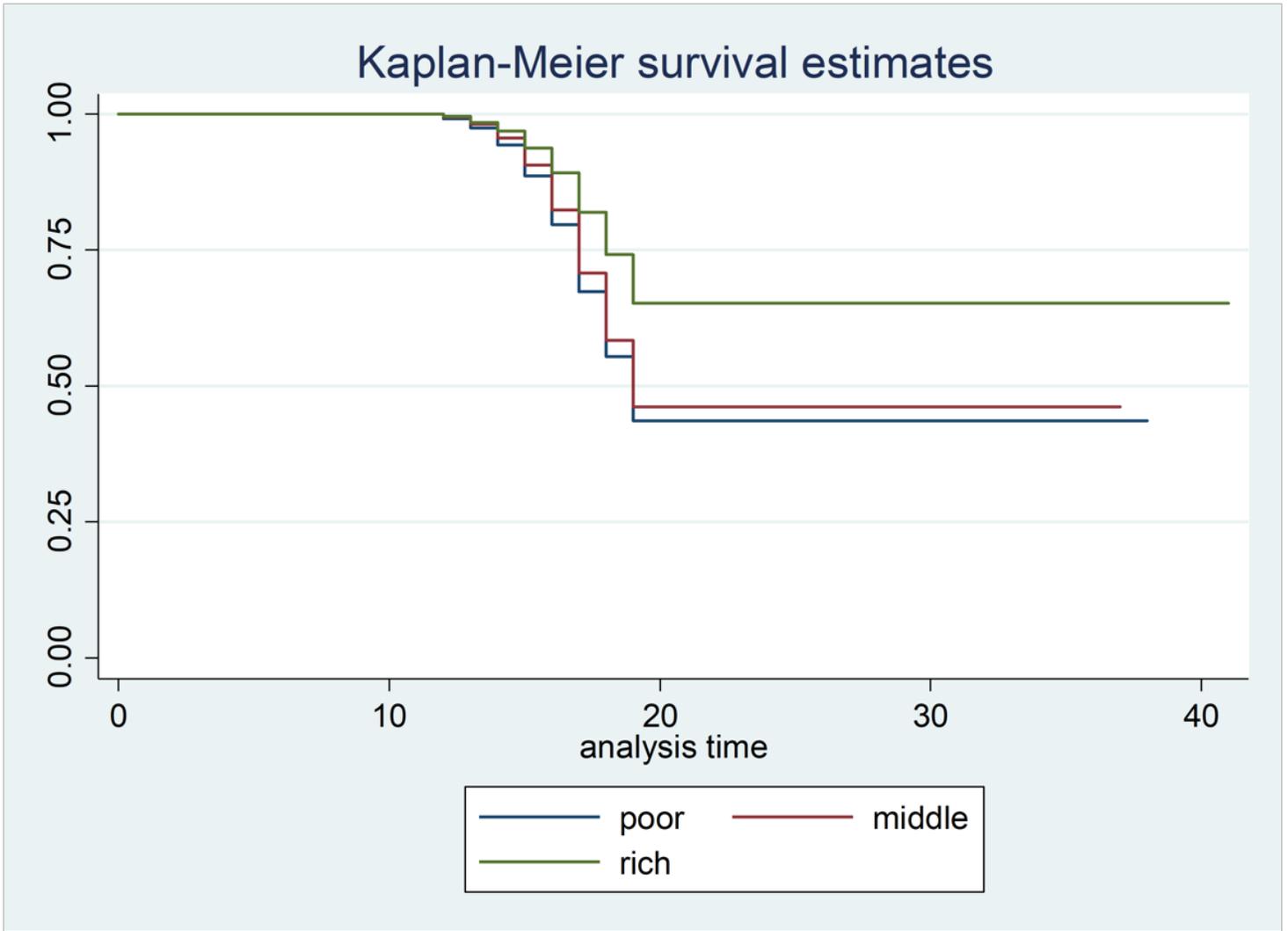**Figure 2**

Kaplan-Meier survival curves by place of residence
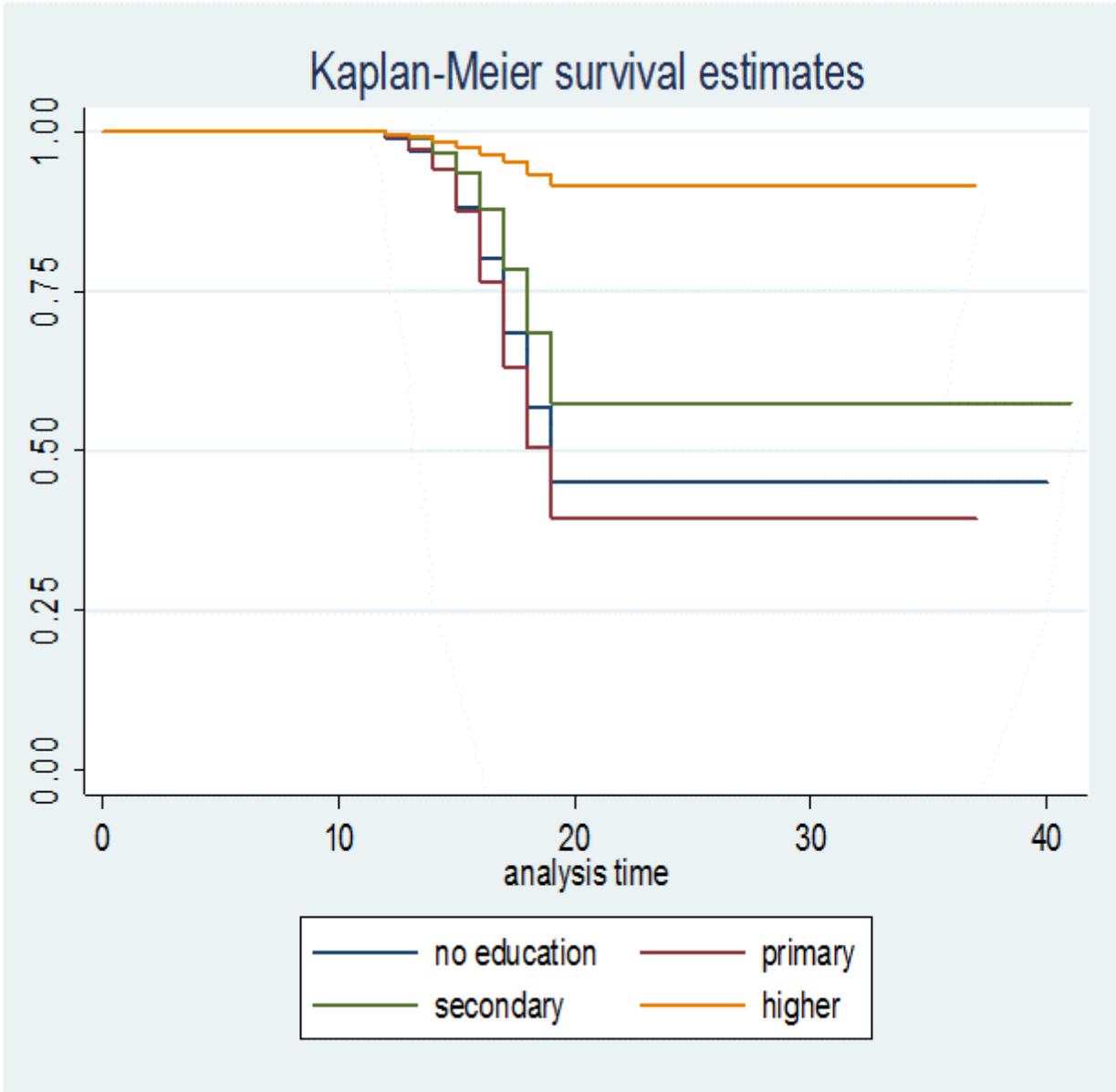
Figure 3

Kaplan-Meier survival curves by financial status

Figure 4

Kaplan-Meier survival curves by education