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Determinants of Adolescent Fertility among Rural Women of Ethiopia

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Abstract

The main objective of this study is to identify the factors that contribute to adolescent childbearing and to examine to what extent these factors influence adolescent fertility of women in rural Ethiopia. This study was based on 2510 adolescent fertility data of rural women aged 15 - 19 years that was extracted from the original women data of the 2011 Ethiopia Demographic and Health Survey (EDHS). Descriptive analysis, chi-square test and binary logistic analysis were employed. Hence, based on the result, religion, current contraceptive method use, woman educational level, wealth index were the most contributing risk factors for adolescent childbearing of women in rural Ethiopia. The risk of having children in adolescent years was greater for not educated women than those who had secondary or higher education. In addition, the chance of having a child in adolescent years for poor households' women was higher than that of their counterparts. Hence strengthening poor households by designing different strategies can have better life and good decision maker about their adolescent childbearing.

Keywords

Adolescent Fertility, Binary Logistic Model, DHS, Odds Ratio

Subject Areas: **Mathematical Analysis**

1. Introduction

About 15 million babies are born to adolescent mothers each year. These are high-risk births from the perspective of the health of both mother and child. They are also high-cost births when the associated negative effects on the quality of life and role of women in society are considered. About 8 in every 10 of these babies are born in the developing countries of Asia, Africa, and Latin America. And about 13 percent of all children born in developing countries are born to teenage mothers [1].

The incidence of adolescent pregnancy remains high around the world. According to the United Nations 2001

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adolescent females give birth to 15 million infants every year. Several international studies have indicated that health and mortality risks are dramatically higher among women who give birth at a young age. Thus, teenage motherhood is a concern from both a human right and a public health perspective. The adolescent marriage in developing countries is costly for women in several dimensions. As a result of high rates of marriage at very young ages, girls in rural Bangladesh attain significantly less schooling, experience more frequent reproductive health complications, have higher fertility and experience lower levels of gender equality in marriage [2].

Teenage childbearing has been shown to have negative and long-term effects on women's socioeconomic outcomes. The study using the logit model suggests that teenage childbearing is related to lower educational achievements, which may in turn lead to longer-term effects on labour force participation and rates of living in low income. However, teenage mothers and adult mothers with similar levels of education also had similar labour market participations and rates of living in low income suggesting that education is more important in determining labour force participation and income in the long run [3].

The study done by [4] in Ethiopia, using multilevel logistic model, found that early marriage and early sexuality of women had a direct and significant association with adolescent motherhood, *i.e*., early married women and women with an early sexual experience were more likely to have had an early birth than women in their counterpart. This is so because early marriage may result in increased periods of exposure to the risk of sexual intercourse during adolescence. In the absence of contraceptive use this could cause a teenage pregnancy/motherhood. On the other hand, having a secondary and above education, urban place of residence, type of occupation (women working in non agricultural sectors) had an inverse but a noteworthy association with early birth. Moreover, these characteristics have an indirect influence on adolescent motherhood as they had an inverse and noteworthy association with early sexuality and early marriage of women.

About one out of six female adolescents aged between 15 and 19 years in Ethiopia were either already had child or pregnant using [5] data. 12 percent of women aged 15 - 19 have already started childbearing; 10 percent have had a live birth, and 2 percent are pregnant with their first child [6]. The study suggested that teenagers whose age was between 18 and 19 years were about eight times more likely to be fertile than the younger ones [7]. As the age increases, the risk of exposure to pregnancy and childbearing also increases, because of higher probability of getting sexual relation and marriage. A study done by [8] suggests that higher and lower risks of adolescent childbearing in the regions are partly due to lower and higher age at first marriage of women in those regions. The cultural tradition across the regions and prevailing socioeconomic status may be also partly attributed to the adolescent motherhood of the women.

Statistically the rate of teenage motherhood in Ethiopia is still high compared with other countries. This study is expected to contribute its part by filling the information gap concerning adolescent fertility of women in the rural Ethiopia. The main objective of this study will focus on the investigation of the relationship between demographic and socioeconomic factors with adolescent fertility, it is especially to identify the factors that contribute to adolescent childbearing and to examine to what extent these factors influence adolescent fertility of women in rural Ethiopia.

2. Methodology

2.1. Data

This study based on data of the 2011 Ethiopia Demographic and Health Survey (EDHS) were used. The 2011 EDHS is a periodic cross-sectional survey administered at the household level and it is a representative sample of 17,817 households was selected for the 2011 EDHS survey. Therefore, the analysis presented in this study is based on adolescent fertility data of rural women aged 15 - 19 years. After delete missing values and inconsistencies a total of 2510 women were selected for this study from the original women data. In this paper, the terms adolescent and teenagers are used to represent women age from 15 to 19 years.

2.2. Variables of the Study

Based on the objectives of the study, dependent variables and some independent variables have been selected from different literatures of adolescent fertility.

Dependent variables: the dependent variable is childbearing status of the adolescent women. If the adolescent women aged 15 - 19 years had given birth; the value is 1, if the adolescent woman had not given birth, the

value is zero, this dependent variable was measured based on women age (in years) from birth to the date of the interview.

Independent variables: the following demographic and socio economic variables have been selected as explanatory variables which are expected to have an impact on adolescent fertility.

The predictor variables included in this study are current contraceptive method use, sex of household head, women's educational level, woman's religion, region, wealth index, working status, current marital status and frequent media exposure.

2.3. Methods of Data Analysis

The statistical methods used in this study are descriptive analysis, chi-square test and binary logistic analysis. In this study logistic regression model is used to investigate the effect of predictors on the adolescent childbearing of women in rural Ethiopia. The response variable is dichotomous and denoted by $Y_i, i=1,\cdots,n$ which is Bernoulli random variable with two possible values, $Y_i=1$ with probability of having child $P_i=P\left(Y_i=1/X_i\right)$ and $Y_i=0$ with probability of not having child $1-P_i=1-P\left(Y_i=1/X_i\right)$. Then, the conditional probability that women having a child given X is denoted by $P_i=P\left(Y_i=1/X_i\right)$. The expression P_i in logistic regression model can be expressed in the form of:

$$P_i=P\left(Y_i=1/X_i\right)=\frac{e^{X_i\beta}}{1+e^{X_i\beta}}, i=1,\cdots,n \tag{2.1}$$

where $P\left(Y_i=1/X_i\right)$ is the probability of i^{th} adolescent woman having child given her individual characteristics X_i, and $\beta=\left(\beta_0,\beta_1,\cdots,\beta_K\right)^{\mathrm{T}}$ are the model parameters to be estimated with dimension of $(K+1)\times 1$.

However, the relationship between the probability of i^{th} adolescent woman having child given her individual characteristics are non linear. In order to make meaningful interpretation, logit transformation of the probability of i^{th} adolescent woman having child should be written as linear combinations of predictors which is given by:

$$\log\left(\frac{P_i}{1-P_i}\right)=\operatorname{logit}\left(P_i\right)=\sum_{j=0}^{K}\beta_j X_{ij}, i=1,2,\cdots,n;\ j=0,1,\cdots,K \tag{2.2}$$

where $X_{i0}=(1,1,\cdots,1)^{\mathrm{T}}$.

For this study the parameters in binary logistic regression model estimated by using maximum likelihood estimation method. This method is designed to maximize the likelihood of obtaining the data given its parameter estimates. The maximum likelihood estimation method is appropriate for estimating the logistic model parameters due to this less restrictive nature of the underlying assumptions [9].

In a cohort study, the odds ratio is expressed as the ratio of the number of cases to the number of non-cases in the exposed and unexposed groups [10]. In binary logistic regression, odds ratio is the exponential of the estimated coefficient, $\exp\left(\hat{\beta}\right)$ an odds ratio of one corresponds to an explanatory variable that does not affect the outcome variable. In case of categorical predictor variable, $\exp\left(\hat{\beta}\right)$ is the predicted change in odds of having child for adolescent women for a given category of the predictor variable with respect to the reference category.

As preliminary step to variable selection, the Pearson's chi-square and the likelihood ratio chi-square tests were used for categorical predictor variables. Furthermore collinearity among the candidate predictors is checked for the binary logistic regression analysis. *i.e.*, Values of variance inflation factor (VIF) exceeding 10 are often regarded as indicating multicollinearity, but in weaker models, which is often the case in logistic regression; values above 2.5 may be a cause for concern [11].

The model is validated by checking the goodness of fit and discrimination on a different set of data from that which will be used to develop the model [12]. The Pearson's Chi-square, the likelihood ratio tests (LRT), Hosmer and Lemeshow Goodness of fit Test and the Wald tests are the most commonly used measures of goodness of fit for categorical data [9].

3. Results

Out of the total 2510 adolescent women included in this study, it is observed that 85.6 percent of adolescent women had not given birth and another 14.4 percent had given birth, at the time of the survey. **Table 1** presents

Table 1. Region wise frequency and percentage distribution of adolescent fertility of women in rural Ethiopia based on EDHS, 2011.

			Childbearing status	
Region	Frequency	Percent	Had not given birth	Had given birth
Tigray	348	13.9	86.8	13.2
Affar	205	8.2	87.3	12.7
Amhara	446	17.8	87.2	12.8
Oromiya	435	17.3	86	14
Somali	114	4.5	80.7	19.3
Benishangul-g	245	9.8	80	20
SNNP	364	14.5	94	6
Gambela	190	7.6	75.3	24.7
Harari	101	4	77.2	22.8
Dire Dawa	62	2.5	87.1	12.9

the frequency and percentage of adolescent women aged 15 - 19 years in region wise distribution in rural Ethiopia. The proportion of teenage childbearing was found to be highest among women living in Gambela region (24.7%) than those living other regions of rural Ethiopia, while the lowest proportion (6%) of childbearing were obtained in southern nations and nationalities peoples of Ethiopia.

Table 2 showed that from sampled adolescent girls most of (63.4%) them current age were 15 to 17 years while the remaining 36.6 percent women's current age were 18 to 19 years. Among adolescent women living in rural Ethiopia 69 percent of them had primary education. In addition, 26.8 percent of females with no educational level gave birth in adolescent years than those females who had secondary and higher educational level (8.2%). From sampled adolescents 23.2% of females who had other religion (catholic, traditional & other) had given birth in adolescent years followed by females who had Muslim religion (16.3%). Furthermore, 77 percent of females had male headed household in adolescent years.

Table 2 also shows that only 17.8 percent of adolescent females had frequent media exposure (listening to radio at least once in a week) in rural parts of Ethiopia. In addition, early childbearing almost did not vary across frequent media exposure. Almost half (50.8%) of rural adolescent females wealth index of a household was poor (poorer/poorest) and 17 percent of adolescent females had given birth for those who had middle wealth index household. The descriptive analysis presented in **Table 2** also shows that 15.8 percent of adolescent girls that was not working had given birth more than those adolescent girls who were working (able to work). According to selected background characteristics, 94.1 percent of adolescent women were not using current contraceptive method while the remaining 5.9 percent were using current contraceptive method (pill, injection, condom, periodic abstinence and implants/Norplant). The adolescent women had gave birth was found more among women using current contraceptive method (42.3%) than those women not using current contraceptive method (12.6%). Moreover, 68.3 percent of teenagers whose current marital status was never in union and 25.1 percent were married.

As preliminary analysis to check whether there is an association between risk factors and adolescent childbearing of women, use Pearson chi-square test. Hence based on the results the risk factors (highest educational level, religion, sex of household head, wealth index, woman work status, current contraceptive method use) were associated with childbearing of adolescent women are significant at the 5% level. But, frequent media exposure is not associated with childbearing of adolescent woman at 5% level of significance (**Table 2**).

The log transformation of the likelihood functions yields a chi-squared statistic G^2 with degree of freedom equal to the difference between the numbers of parameters estimated in the two models [13]. The results presented in **Table 3** shows that the Likelihood ratio chi-squared statistic is used in the test of overall statistical significance. In this analysis, the model chi-square is 210.199, which is statistically significant at $p < 0.01$. This

Table 2. Frequency, percentage and Chi-square distribution of variables with childbearing status of women in rural Ethiopia based on EDHS, 2011.

Variables	Label	Frequency	Percent	Childbearing status		d.f	Pearson chi-square
				Had not given birth	Had given birth		
Highest educational level	No education	680	27.1	73.2	26.8	2	116.347**
	Primary	1732	69.0	90.1	9.9		
	Secondary & higher	98	3.9	91.8	8.2		
Religion	Orthodox	989	39.4	87.3	12.7	3	9.267**
	Protestant	493	19.6	87	13		
	Muslim	972	38.7	83.7	16.3		
	Other	56	2.2	76.8	23.2		
Sex of household head	Male	1933	77	84.8	15.2	1	4.1**
	Female	577	23	88.2	11.8		
Frequent media exposure	No	2064	82.2	85.2	14.8	1	1.852
	yes	446	17.8	87.7	12.3		
Wealth index	Poor	1276	50.8	84.3	15.7	2	14.37**
	middle	506	20.2	83	17		
	rich	728	29.0	89.7	10.3		
Woman's work status	Not working	1364	54.3	84.2	15.8	1	5.124**
	working	1146	45.7	87.3	12.7		
Woman current age group	15 - 17	1592	63.4				
	18 - 19	918	36.6				
Current contraceptive method use	Not using	2361	94.1	87.4	12.6	1	100.13**
	use	149	5.9	57.7	42.3		
Current marital status	Never in union	1715	68.3	99.5	0.5		
	Married	630	25.1	50.8	49.2		
	Living with partner	31	1.2	58.1	41.9		
	Widowed	5	0.2	40	60		
	Divorced	103	4.1	80.6	19.4		
	separated	26	1	73.1	26.9		

**significant at 5%.

implies that one or more of the effects (explanatory variables) in the model is important for predicting the probability of having child in adolescent years of women in rural Ethiopia.

The Nagelkerke R Square shows that about 14.3% of the variation in the adolescent childbearing of women is explained by this logistic model (**Table 4**).

If the observed number of outcomes differs from what is expected by the model, the statistic χ^2_{HL} will be large and there will be evidence against the null hypothesis that the model is adequate to fit the data. This statistic has an approximate chi-square distribution on $(g-2)$ degrees of freedom when the fitted model is appropriate [14]. Hosmer-Lemeshow Goodness of Fit Test tells us how closely the observed and predicted probabilities

Table 3. Omnibus tests of model coefficients.

	Chi-square	df	Sig.
Step	210.199	10	0.00
Block	210.199	10	0.00
Model	210.199	10	0.00

Table 4. The amount of variation explained by the model.

−2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1857.269	0.08	0.143

match. The null hypothesis is the model fits and a p value greater than 0.05 is expected. Hence, **Table 5** shows that a non significant chi-square (p value > 0.05) indicates that the data fit the model well.

A binary logistic regression analysis was carried out to assess the contribution of selected socio economic and demographic variables that have influence on adolescent childbearing of women in rural Ethiopia. **Table 6** shows that the tests for parameters suggest that among the selected variables the following variables effect in the model is significant at the 0.005 level (p value < 0.005). Based on the fitted model; religion, current contraceptive use, woman educational level, wealth index were the most important predictor variables for adolescent childbearing of women in rural Ethiopia, with p-values of 0.016, 0.000, 0.000 and 0.005, respectively.

The result indicate that religion has an impact on adolescent childbearing, females who follow an orthodox compared to others religion is 61.1% [OR: 0.389, (95% CI: (0.198:0.764)] times less likely to have child in adolescent years. Moreover, the odds of having child in adolescent years for Muslim women are half as likely as the odds of having a child for women who follow other religions [OR: 0.499, (95% CI: (0.255:0.976)].

The null hypothesis that the coefficient for current contraceptive method use was equal to zero was rejected. Women who use current contraceptive method have an impact on adolescent childbearing. The value of Exp (B) was 0.144 which implies that the risks of having child is about 85.6% times less for women not use current contraceptive method than for women using current contraceptive method, adjusting for other explanatory variables. Binary logistic results also show that women educational level had a significant effect on adolescent childbearing in rural Ethiopia. The risk of having children in adolescent years are 3.689 times greater for women's who were not educated than those women who had secondary or higher education [OR: 3.689, (95% CI: (1.692: 8.042)].

The result also showed that wealth index of households was found to be a significant predictor for adolescent childbearing of rural women in Ethiopia. Particularly, the odds of having a child in adolescent years for poor households' women are 52.7% higher than the odds of having a child in adolescent years for rich households. [OR: 1.527, (95% CI: (1.122:2.08)]. In addition, the risks of having a child in adolescent years is 76.7% higher for women coming from middle wealth index of households than rich [OR: 1.767, (95% CI: (1.236:2.526)].

4. Discussion

This study assesses the demographic and socio economic determinants of adolescent childbearing of women in Rural Ethiopia based on 2011 Ethiopian Demographic and Health survey data. From the descriptive part of this study it is observed that 85.6 percent of adolescent rural women had not given birth and another 14.4 percent had given birth, at the time of the survey. [7] reported that the proportion of teenagers that had given birth at least once prior to the survey at the time of interview were 13.6%.

Using binary logistic analysis, it was found that woman educational level had an effect on adolescent childbearing of woman in rural Ethiopia. The risk of having children in adolescent years were greater for not educated woman than those who had secondary or higher education. This finding was consistent with the studies done in Ethiopia by [7], those who have primary or secondary level of education have lower probability of being fertile during their adolescence period than those who have no education. This study also associated with the previous studies by [15], adolescent fertility truncates the process of formal education among women in Osun State, Nigeria. Studies conducted in Bangladesh also showed that women's education had significant depressive

Table 5. Hosmer and Lemshow test.

Chi-square	df	Sig.
10.622	8	0.224

Table 6. Estimates of the binary logistic regression model.

Variables	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Religion			10.281	3	0.016			
Orthodox	−0.945	0.345	7.503	1	0.006	0.389	0.198	0.764
Protestant	−0.572	0.357	2.576	1	0.109	0.564	0.281	1.135
Muslim	−0.696	0.342	4.130	1	0.042	0.499	0.255	0.976
Others (ref.)								
Sex of household head								
Male	0.212	0.151	1.974	1	0.160	1.237	0.920	1.663
Female (ref.)								
Current contraceptive								
Not use	−1.935	0.195	98.831	1	0.000	0.144	0.099	0.211
Use (ref.)								
Woman working status								
Not working	0.223	0.128	3.015	1	0.083	1.249	0.972	1.607
Working (ref.)								
Woman educational level			86.190	2	0.000			
No education	1.305	0.398	10.778	1	0.001	3.689	1.692	8.042
Primary	0.127	0.392	0.105	1	0.746	1.136	0.526	2.450
Secondary and higher (ref.)								
Wealth index			10.705	2	0.005			
Poor	0.424	0.157	7.235	1	0.007	1.527	1.122	2.080
Middle	0.569	0.182	9.749	1	0.002	1.767	1.236	2.526
Rich (ref.)								
Constant	−0.479	0.554	0.747	1	0.387	0.619		

ref. = reference category.

influence on the probability of adolescent childbearing. Overall, women's secondary or higher education acted as catalyst toward delayed childbearing. The findings may be explained by the way that the women who had at least secondary level of education have postponed substantial times during their schooling and married at later ages compared to their lesser educated counterparts [8].

The result also showed that wealth index of households was found an important predictor for adolescent childbearing. Particularly, the chance of having a child in adolescent years for poor households' woman was higher than for those rich households. In addition, the risk of having a child in adolescent years was higher for woman coming from middle wealth index of households than rich. This is in agreement with the result of previous studies that have examined the adolescent mothers are more likely to be seen in the informal sector of the

economy with poor income. Consequently, majority of adolescent mothers in the State cannot afford good schools for their children, good accommodation to live in and basic necessities of life [15]. This study also consistent with [8] reported that the richest compared to the poorest were less likely to be adolescent mother. This is partly attributed to the fact that the women from richest family are more educated, more conscious about the timing of childbearing and are also better informed regarding adverse effect of early motherhood compared to women of other wealth quintiles.

It was also found that religion has been an important predictor on adolescent childbearing, females who follow an orthodox compared to others religion was less likely to have child in adolescent years. Moreover, the risk of having child in adolescent years for Muslim women is half as likely as for woman who follow other religions. This finding is not consistent with studies done by [16] from Nigeria remarked that religious affiliation is not significantly associated with adolescent fertility. Also [8] reported that the Muslim women were also more likely to have childbirth earlier than the non-Muslim women. It is plausible that, the normative pressure, traditional belief and cultural practice of lead Muslim women to have early birth compared to their non-Muslim counterparts which also reflected from the findings of the study.

In addition, women who use current contraceptive method have an impact on adolescent childbearing. The risks of having a child was less for woman not use current contraceptive method than for those using current contraceptive method. Studies done by [16] from Nigeria showed that those who use contraceptives are more likely to have one or more children relative to the reference category. But this finding is not expected in reality. Although, this could be as a result of inconsistency in the usage of contraceptive methods and also that adolescents who are using contraceptives might have only started after having one or more births. The reason for this could be ineffective use of contraceptive method in rural areas. In addition, the findings revealed that the adolescents and adult women who had ever used any contraceptive method were more likely to initiate childbearing at adolescence period. This may be explained by the way that many of the women initiated contraceptive use after they had completed fertility as their desired size and some wanted to make significant space to delay the next birth [8].

5. Conclusion and Recommendations

Using binary logistic result concluded that religion, current contraceptive use, woman educational level, wealth index were the most contributing risk factors for adolescent childbearing of women in rural Ethiopia. The risk of having children in adolescent years were greater for not educated women than those who had secondary or higher education. Therefore, special attention should be given for rural Ethiopian females to have primary education and also give initiation for those who have primary education to have secondary or above education. In addition, the chance of having a child in adolescent years for poor households' women was higher than that of their counterparts. Hence strengthening poor households by designing different strategies can have better life and good decision maker about their adolescent childbearing. Further research should be suggested to investigate the impact of variables to different dimensions on adolescent childbearing.

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