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# Determinants of Age at First Sexual Intercourse Among Women in Rural Ethiopia

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**Abstract:** Age at first sex has important implications for gender relations and the organization of family life for in societies. This study aimed to investigate the determinant factors of age at first sexual intercourse among women in Rural Ethiopia. The 2011 Ethiopian Demographic and Health Survey was used to explore the determinant factors of age at first sexual intercourse. The study considered 10,417 women aged 15-49 years from nine regions and one city administration. The accelerated failure time models were employed with the help of R statistical package and STATA soft wares. The median time of age at first sexual intercourse was 17 year with 95% CI; (16.90, 17.11). Log-logistic accelerated failure time model was better than weibull and log-normal models based on Akaike's information criterion and graphical evidence. The result showed that, region, women's educational level, wealth index and religion were significantly affect timing of first sexual intercourse. Women who had secondary and higher education prolonged time-to-first sexual intercourse by the factor of  $\phi = 1.38$  and  $\phi = 1.34$ . Improving girls and young women access to education is important for rising the women age at first sexual intercourse, which is vital for empowering them and enhancing their participation in any sector.

**Keywords:** Survival Data Analysis, Acceleration Factor, Time to First Sexual Intercourse

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## 1. Introduction

Age at first sexual intercourse has important implications for gender relations and the organization of family life in societies [12]. Early sexual intercourse is commonly defined as having had first sexual intercourse before age 15 [9]. Studies in developed countries have found that the widespread availability of contraception is associated with a gradual decoupling of sexual debut among women [15]. When contraceptives are widely available, sexual intercourse tends to occur early, whereas marriage is delayed, leaving prolonged periods for sexual experimentation and mate selection [7].

Age at first marriage is often used as a proxy for first exposure to sexual intercourse and risk of pregnancy. But the two events may not occur at the same time because some women may engage in sexual activity before marriage. Early sexual debut increases the risk of unprotected sexual intercourse, multiple partnership, and sexually transmitted infections (STIs), including HIV/AIDS [2]. Indeed, recent studies have examined early sexual activity largely as a

potential risk factor for adverse social and health outcomes [18].

Age at first sex has been associated with increased risk of unplanned pregnancy [6]. Early sexual debut also leads to early childbearing, which increases risks for poor health outcomes including obstructed labor and its attendant risks of maternal mortality and morbidity (10). Evidence from sub-Saharan Africa indicates that 35% of pregnancies among 15-19 year olds were unplanned, unwanted or untimed and that the teenagers' relationships were unstable [12]. Only about two thirds of these unintended pregnancies end in childbirth, while a third results in unsafe abortions [1].

As in most developing countries early sexual intercourse is prevalent in Ethiopia. In 2000 EDHS 30% of women aged 25-49 years have had sexual intercourse before age 15, 69% of women in the same age group has had sexual intercourse before age 18. The median age at first intercourse for women age 25-49 was 16 years and it is identical to the median age at first marriage in the year [3]. In 2005 EDHS 32% of women had sexual intercourse before age 15, 65% of women has had sexual intercourse before age 18. The median age at

first sexual intercourse for women age 25-49 years was 16.1 years [4], which is identical to the median age at first marriage in the years. This suggests that Ethiopian women generally begin sexual intercourse at the time of their first marriage.

There are relatively few empirical generalizations about the social and economic determinants of age at sexual intercourse. Having these, this study examined factors associated age at first sexual intercourse using survival models.

## 2. Methodology

### 2.1. Source of Data

The data for this study has been the published reports of Ethiopian Demographic and Health Survey (EDHS, 2011). It is the third survey conducted in Ethiopia as part of the worldwide DHS project. The principal objective of the 2011 EDHS was to provide current and reliable data on marriage, fertility and family planning behavior, child mortality, adult and maternal mortality, children's nutritional status, use of maternal and child health services, knowledge of HIV/AIDS, and prevalence of HIV/AIDS and anemia.

### 2.2. Sampling Design

The sample for the 2011 EDHS was designed to provide population and health indicators at the national (urban and rural) and regional levels. The 2007 Population and Housing Census, conducted by the CSA, provided the sampling frame from which the 2011 EDHS sample was drawn. Administratively, regions in Ethiopia are divided into zones, and zones into administrative units called weredas. Each wereda is further subdivided into the lowest administrative unit, called kebele. During the 2007 census each kebele was subdivided into census enumeration areas (EAs), which were

convenient for the implementation of the census.

The 2011 EDHS sample was selected using two stage cluster design and EAs were the sampling units for the first stage. The sample included 624 EAs, 187 in urban areas and 437 in rural areas. Households comprised the second stage of sampling. A complete listing of households was carried out in each of the 624 selected EAs from September 2010 through January 2011. A representative sample of 17,817 households was selected for the 2011 EDHS, of these, 16,702 were successfully interviewed. In the interviewed households 17,385 eligible women were identified for individual interview; complete interviews were conducted for 16,515. Women whose current ages are 15-49 years are included in the survey. Out of all 16,515 urban and rural respondents 10,417 rural women from nine regions and Dire Dawa city administration were included in the study. The data was analyzed using R and STATA statistical softwares.

### 2.3. Variables in the Study

#### The Response Variables

The response variable is age at first sexual intercourse, which is measured in year as the length of time from birth until the age at first sexual intercourse. During the survey all women were asked a series of questions regarding to their sexual activity, whether they had sexual intercourse. The response to this question constitutes the women age at first sexual intercourse and women who had not yet experienced the events resulting in right censoring of the data.

#### Explanatory Variables

Several predictors were considered in this study to investigate the determinant factors of age at first sexual intercourse. These are women education level, region, religion, women work status, wealth index, and mass media. These covariates are described together with their coding scheme in table 1. All of these covariates are categorical.

*Table 1. Coding and explanation of explanatory variables.*

Variable	Description	Categories
Women education level	Women's level of education	0 = No education; 1 = Primary; 2 = Secondary, 3 = Higher
Region	Women's region	1 = Tigray, 2 = Affar, 3 = Amhara, 4 = Oromiya, 5 = Somali, 6 = Benishangul-G, 7 = SNNP, 8 = Gambela, 9 = Harari, 10 = Dire Dawa
Religion	Women's religion	1 = Orthodox, 2 = Muslim, 3 = Protestant, 4 = Others
Women work status	Women's Working status	0 = Not had work, 1 = Had work
Wealth index	Household wealth index	1 = Poor, 2 = Middle, 3 = Rich
Mass media	Access to mass media	0 = No, 1 = Yes

### 2.4. Method of Data Analysis

In this study we used accelerated failure time model to identify factors associated with age at first sexual intercourse.

#### Accelerated Failure Time Model

Although parametric models are very applicable to analyze survival data, there are relatively few probability distributions for the survival time that can be used with these

models. In these situations, the accelerated failure time model (AFT) is an alternative to the PH model for the analysis of survival time data. Under AFT models we measured the direct effect of the explanatory variables on the survival time instead of hazard. This characteristic allows for an easier interpretation of the results because the parameters measure the effect of the correspondent covariate on the mean survival time.

The AFT model states that the survival function of an individual with covariate X at time t is the same as the survival function of an individual with a baseline survival function at a time  $t * \exp(a'X)$ , where  $a' = (a_1, a_2, \dots, a_p)$  is a vector of regression coefficients. In other words, the accelerated failure-time model is defined by the relationship.

$$S(t|X) = S_o\{t * \exp(a'X)\}, \text{ for all } X \quad (1)$$

In this study the Weibull AFT, log- logistic AFT, and log-normal AFT Models were considered.

Model Selection: For comparing models that are not nested, the Akaike's information criterion (AIC) is used which is defined as:

$$AIC = -2\text{Log}L + 2(k + c + 1) \quad (2)$$

Where k is the number of covariates and c the number of model specific distributional parameters. Lower values of the AIC suggest a better model.

### 3. Results

Of 10,417 rural women from nine regions and Dire Dawa city administration who were included in the study. 2,069 (19.9%) did not had sexual intercourse at the time of the survey and none of the respondents had this experience but unable to recall the age at first sexual intercourse also (Left censored). Majority of the respondents 8,348 (80.1%) have had sexual intercourse at the time of the survey or had an experience before. From women who had sexual intercourse at the time of the survey 61.4% of them had sexual intercourse at their first union. This suggested that the majority of Rural Ethiopian women begin sexual intercourse at the time of their first marriage. The rest (18.7%) of the women enter into sexual intercourse at the age of 8-35 years. The overall median survival time of age at first sexual intercourse for Rural Ethiopian women is 17 years (with 95% CI; 16.90, 17.11), these is similar to the median age of first marriage.

About 12.2% of the respondents were from Tigray, 9.8% from Affar, 16.2% from Amhara, 16.1% from Oromia, 5.5% from Somali, 9.9% from Benishangul-Gumuz, 15.1% from

SNNP, 7.7% from Gambela, 4.1% from Harari region and the rest 3.4% from Dire Dawa. With regard to educational attainment, about 64.3% of the respondents had no education, while 32.9% had primary education, and 2% had attended secondary education. About 64.6% of the women respondent had no any access of mass media. About 53.7% of the households were classified as poor while 19.8% had middle income and 26.6% were rich. More than half (70%) of the women respondents had no work. Of the total women, 35.1% were Orthodox, 42.3% Muslim, 19.6% Protestant, and 3% of them were from other religion followers at the time of the survey.

#### Accelerated Failure Time Model Results

We fitted the datasets using Weibull, log-logistic and log-normal AFT model. For age at first sexual intercourse data, multivariable AFT models of weibull, log-logistic, and log-normal distributions were fitted by including all the covariates those are significant in the univariable analysis at 20% level. To compare the efficiency of different models, the AIC was used. A model having the minimum AIC value was preferred. Accordingly, Log-logistic AFT model (AIC = 46,031.71) found to be the best for age at first sexual intercourse data sets from the given alternatives when we include all the covariate those are significant in the univariable analysis. AFT models and the corresponding AIC values are displayed in table 2. Therefore the final conclusion of this study result based on the results of Log-logistic AFT model.

Table 2. Comparison of AFT Models Using AIC.

Baseline Distribution	AIC
Weibull	49, 235.79
Log- logistic	46, 031.71
Log- normal	46, 405.15

AIC = Akaike's information criteria.

From the log-logistic accelerated failure time model, Women's educational level and religion prolong time-to-age at first sexual inter course, while wealth index and some categories of region statistically significantly shorten time-to-age at first sexual inter course in Rural Ethiopia.

Table 3. Log logistic multivariable model for Determinants of woman age at first sexual intercourse in Ethiopia, 2011.

Covariates	Coef	$\phi$	95% CI $\phi$	p-value
Region				
Tigray	Ref			
Afar	0.06	1.06	(1.041, 1.086)	0.000
Amhara	-0.05	0.95	(0.937, 0.966)	0.000
Oromiya	0.06	1.06	(1.046, 1.084)	0.000
Somali	0.09	1.09	(1.070, 1.121)	0.000
Benishangul-G	-0.006	0.99	(0.975, 1.013)	0.524
SNNP	0.11	1.12	(1.096, 1.139)	0.000
Gambela	-0.03	0.96	(0.946, 0.987)	0.002
Harari	0.05	1.05	(1.023, 1.077)	0.000
Dire Dawa	0.13	1.14	(1.113, 1.177)	0.000
/Women education level				
No education	Ref			
Primary	0.12	1.13	(1.119, 1.140)	0.000
Secondary	0.32	1.38	(1.335, 1.429)	0.000

Covariates	Coef	$\phi$	95% CI $\phi$	p-value
Higher Wealth index	0.29	1.34	(1.284, 1.407)	0.000
Poor	Ref			
Middle	-0.003	0.99	(0.986, 1.008)	0.552
Rich	-0.023	0.98	(0.967, 0.987)	0.000
Religion				
Orthodox	Ref			
Muslim	0.0098	1.01	(0.997, 1.023)	0.148
Protestant	0.0265	1.03	(1.011, 1.043)	0.001
Others	0.0209	1.02	(0.995, 1.048)	0.119

Coef = coefficient,  $\phi$  = acceleration factor, 95%CI = 95% confidence interval for acceleration factor, Ref = Reference.

From table 3 the acceleration factor for women from Affar, Amhara, Oromia, Somali, SNNP, Gambela, Harari and Dire Dawa is estimated to be 1.06, 0.95, 1.06, 1.09, 1.12, 0.96, 1.05, 1.14 with 95% CI; (1.041, 1.086), (0.937, 0.966), (1.046, 1.084), (1.07, 1.121), (1.096, 1.139), (0.946, 0.987), (1.023, 1.077), (1.113, 1.177) respectively by using Tigray region as reference category. This indicates women from Affar, Oromiya, Somali, SNNP, Harari, and Dire Dawa have prolonged time to age at first sexual intercourse and the time-to-age at first sexual intercourse decreased in Amhara and Gambela than Tigray women.

The acceleration factors for women attending primary education, secondary education, and higher are 1.13, 1.38 and 1.34 with 95% CI; (1.119, 1.140), (1.335, 1.429), (1.284, 1.407) respectively. These confidence intervals does not include one in all category ; indicating primary, secondary and higher educations were significantly important factors for the timing of age at first sexual intercourse by using uneducated women as a reference category. This indicates that women with primary, secondary and higher education prolonged the age at first sexual intercourse.

The acceleration factors for middle wealth index and rich are 0.99 and 0.98 with 95% CI; (0.986, 1.008), and (0.967, 0.987) respectively. This implied that poor house hold women have longer time-to-age at first sexual intercourse, however the difference is not significant for middle and poor house hold wealth index ( $P = 0.552$ ). The acceleration factor for protestant religion was 1.03 with 95% CI: (1.011, 1.043) as compared to Orthodox religion. This result suggested that women from Protestant religion had longer time-to-age at first intercourse than women from Orthodox religion.

## 4. Discussion

The findings of this study revealed that wealth index and from the category of region Amhara and Gambela region were significantly shorten the time-to-age at first sexual intercourse while women educational level, religion, and Affar, Somali, Oromiya, SNNP, Harri and Dire Dawa from region category prolonged time-to-age at first sexual intercourse among women in Rural Ethiopia. About 68.6% of the women have had first sexual intercourse before age of 18 years. This indicates that early first sexual intercourse is highest in Ethiopia. 61.4% of the women have had first sexual intercourse at their first union. This suggests that the

majority of Rural Ethiopian women begin sexual intercourse at the time of their first marriage. The median time of age at first sexual intercourse for Rural Ethiopian women was 17 years with 95% CI; (16.90, 17.11).

The findings of this study suggested that the women educational level had a significant effect on the timing of age at first sexual intercourse at 5% level of significance and it prolonged age at first sexual intercourse by the factor of  $\phi = 1.13$ ,  $\phi = 1.38$  and  $\phi = 1.34$  for primary, secondary and higher education respectively when compared to illiterate women. The result of the study shows that woman who had secondary education was more survived than those uneducated and primary education. Recent analyses of DHS data have shown that increased educational attainment in sub-Saharan Africa has contributed to the decline in early marriage [12] and that girls who are enrolled in school are less likely than those who are not enrolled to engage in premarital sex [2].

The results of this study suggested that region was significant predictive factor for the timing of age at first sexual intercourse of women in Rural Ethiopia. Women in the Affar region, Oromiya region, Somali region, SNNP region, Harari region and Dire Dawa administration prolong time to age at first sexual intercourse by a factor of  $\phi = 1.06$ ,  $\phi = 1.06$ ,  $\phi = 1.09$ ,  $\phi = 1.12$ ,  $\phi = 1.05$ , and  $\phi = 1.14$  respectively compared to those in the Tigray region. However, women from the Amhara region ( $\phi = 0.95$ ) and Gambela region ( $\phi = 0.96$ ) had significantly higher risk of early first sexual intercourse compared to their counterparts in the Tigray region. Similar study conducted in Namibia revealed that age at first sex varied though not significantly, according to region, with women from the Zambezi and Kavango regions exhibiting higher risk of early sexual debut compared to all other regions.

The result of this study revealed that household wealth index were significantly shortened time to age at first sexual intercourse in Rural Ethiopian women. Compared to rich women, poor women had relatively lower risk of first sexual intercourse.

The result of this study also revealed that religion was an important factor for age at first sexual intercourse of women in Rural Ethiopia. Women from protestant religion had prolonged age at first marriage by a factor of  $\phi = 1.03$  as compared to Orthodox.

## 5. Conclusions

This study was used age at first sexual intercourse datasets among women in Rural Ethiopia which were obtained from central statistics agency with an aim of modeling the determinant of age at first sexual intercourse by using AFT models.

The result of Log-logistic AFT model showed that region, women's educational level, wealth index and religion were found significant predictors to age at first sexual intercourse among women in Rural Ethiopia. Among these significant predictors, women's educational level and religion of women prolong age at first sexual intercourse while wealth index of the family shortens timing of first sexual intercourse.

The study findings reveal that education is the most significant variable affecting age at first sexual intercourse in rural Ethiopia. Therefore, it is important that government policies promote the status of women in rural Ethiopia by helping them to have more access to education so that they can make their own decision regarding when to had sexual intercourse. It is crucial to continue improving girls and young women access to education for rising the women's age at first sexual intercourse, which is vital for empowering them and enhancing their participation in any sector. The education system should aim at providing life skills to enable girls avoid early sexual debut as well as providing reproductive health information so that they are aware of the advantages of delayed sexual intercourse.

## List of Abbreviations

AFT	Accelerated Failure Time
AIC	Akaike Information Criterion
CI	Confidence Interval
CSA	Central Statistics Agency
DHS	Demographic and Health Survey
EAs	Enumeration areas
EDHS	Ethiopian Demographic and Health Survey
HIV/AIDS	Human Immune deficiency Virus/Acquired Immune deficiency Syndrome
STDs	Sexual Transmitted Diseases

## Declarations

Ethics approval and consent to participate.

Human subject research approval for this study was received from Jimma University Research Ethics Committee.

## Availability of Data and Materials

The data sets analyzed in this study available from the corresponding author on reasonable request. The R code used to analyze the data provided as a supplement of the article.

## Competing Interests

The authors declare that they have no competing interests.

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