Determinants of age at first Marriage among Married women in Rural Ethiopia using 2016 Ethiopian Demographic Health Survey Data

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Abstract

Background: Age at first marriage is of interest because it determines the duration of such an exposure; hence, it affects fertility levels and population growth especially in countries where the use of contraceptives is low. This study aimed to investigate demographic and socioeconomic factors affecting age at first marriage in Ethiopian women.

Methods: The data source used for the analysis was the 2016 Ethiopian Demographic and Health Survey. The study considered 10,335 women aged 15-49 years from nine regions and one city administration. Accelerated failure time model was used for identifying factors associated with age at first marriage.

Results: The median time for age at first marriage was 17 years (95% CI: (16.904, 17.096). Based on Akaike's information criterion (AIC) the Log-logistic accelerated failure time model was found to be the best model in describing the age at first marriage among other candidate models. The result based on this model showed that region, women's educational level and women work status were significantly affect timing of first marriage. Women who had secondary and higher education prolonged time-to-first marriage by the factor of ϕ =1.285 and ϕ =1.363, respectively. Women from Oromia, Somali, BenishangulG and SNNP have prolonged time to age at first marriage by ϕ=1.047, ϕ=1.103, ϕ=1.028, and ϕ=1.086 respectively. However, women from Amhara region (ϕ =0.976) and Gambella region (ϕ =0.9982) had a significantly higher risk of early first marriage compared to their counterparts in the Tigray region.

Conclusions: Improving girls and young women access to education is important for rising the women's age at first marriage, which is vital for empowering them and enhancing their participation in any sector.

Keywords: Survival Data Analysis, Time to First Marriage, Accelerated Failure Time Model, Early Marriage

1. Background

Birth, marriage and death are key events in most people's lives. But only marriage is the matter of choice. The National Research Council and Institute of Medicine of the National Academies [13], states that the right to exercise the choice of marriage has been established in international human rights instruments. According to human rights advocates, marriage before 18 years contravenes the United Nations Convention on the rights of the child, which defines age18 as the end of childhood. Therefore, marriage before 18 years can be considered as child marriage [15]. Moreover, very early marriage is said to undermine other rights guaranteed by the convention, including the right to be protected from physical abuse and sexual exploitation and the right not to be separated from parents against one's will [15]. Yet many girls, and a smaller number of boys, enter marriage without any chance of exercising their right to choose. Some are forced into marriage at a very early age; others are simply too young to make an informed decision about their marriage partner or about the implications of marriage itself.

Age at first marriage is of interest because it determines the duration of such an exposure; hence, it affects fertility levels and population growth especially in countries where the use of contraceptives is low. Age at first marriage is an important indirect determinant of fertility because women who marry early will on the average have a longer period of exposure to the risk of pregnancy, often leading to higher completed fertility. Age at first marriage determines the age at first birth and at the long run influences the total number of children a woman bears throughout her reproductive period, in the absence of any active fertility control. Variation in age of entry into marriage explains the differences in fertility across populations [3].

Sub-Saharan Africa had the highest rates of early child marriage in the world. From 20 countries that had the highest rate of girl child marriage worldwide, 18 were found in the Sub-Saharan region. Evidence also reported that more than half of the girls in the region marry before 18 years in many countries in the sub-Saharan region [8, 10].

Worldwide, more than 700 million women alive were married before their 18th birthday. More than one in three (about 250 million) entered into union before age 15. If there is no reduction in the practice of child marriage, up to 280 million girls alive are at risk of becoming brides by the time they turn 18. Child marriage among girls is most common in South Asia and sub-Saharan Africa [17].

Early child marriage practices were a significant social concern globally in recent years due to dangerous health consequences such as increased risk of acquiring sexually transmitted diseases, child malnutrition, teenage pregnancy, miss the opportunity of formal education, dropping out of school and maternal and child morbidity and mortality on young women who marry at early ages [9, 12].

As in most developing countries, early marriage is prevalent in Ethiopia. The 2000 Ethiopian DHS further reveals that 31% of women aged 25-49 years were married before age 15 and 70% of women in the same age group were married before age 18. The median age at first marriage in the same year was 16 years [4]. The 2005 EDHS also maintains similar trends. The report shows that, nationwide, close to 34% women aged 25-49 were married before age 15 and 66% were married before age 18. In 2005, the median age at first marriage was 16.1years [5]. The 2011 EDHS report shows that among women age 25-49, 63 percent married by age 18, and 77 percent married by age 20. The median age at first marriage among women age 25-49 was 16.5 years [6]. According to 2016 EDHS the median age at first marriage among women age 25-49 was 17.1 years [7]. A slight increase from the 16.5 years reported in the 2011 EDHS.

2 Methods

2.1 Source of data

The data for this study was extracted from the published reports of Ethiopian Demographic and Health Survey (EDHS, 2016). It is the fourth survey conducted in Ethiopia as part of the worldwide DHS project. The principal objective of the 2016 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 sampling frame used for the 2016 EDHS is the Ethiopia Population and Housing Census (PHC), which was conducted in 2007 by the Ethiopia Central Statistical Agency (CSA). The census frame is a complete list of 84,915 *enumeration areas* (EAs) created for the 2007 PHC. Administratively, Ethiopia is divided into nine geographical regions and two administrative

cities. The sample for the 2016 EDHS was designed to provide estimates of key indicators for the country as a whole, for urban and rural areas separately, and for each of the nine regions and the two administrative cities.

The 2016 EDHS sample was stratified and selected in two stages. Each region was stratified into urban and rural areas, yielding 21 sampling strata. Samples of EAs were selected independently in each stratum in two stages. Implicit stratification and proportional allocation were achieved at each of the lower administrative levels by sorting the sampling frame within each sampling stratum before sample selection, according to administrative units in different levels, and by using a probability proportional to size selection at the first stage of sampling.

In the first stage, a total of 645 EAs (202 EAs in urban areas and 443 EAs in rural areas) were selected with probability proportional to the EA size (based on the 2007 PHC) and with independent selection in each sampling stratum. A household listing operation was carried out in all the selected EAs from September to December 2015. The resulting lists of households served as a sampling frame for the selection of households in the second stage. All women age 15-49 who were either permanent residents of the selected households or visitors who stayed in the household the night before the survey, were eligible to be interviewed. In the interviewed households, 16,583 eligible women were identified for individual interviews; interviews were completed with 15,683 women, yielding a response rate of 95 percent. Out of all 15,683 urban and rural respondents 10,335 rural women from nine regions and Dire Dewa city administration were included in the study. The data was analyzed using R and STATA statistical soft wares.

2.3. Variables in the Study

The Response Variable

The response variable is time to first marriage. It is measured as the length of time from birth until the age at first marriage which is measured in years. During the survey all women were asked a series of questions regarding to their marital status and whether they had ever lived with a man. The response to this question constitutes the women age at first marriage 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 time to first marriage. These are women education level, region, religion, and women work status and wealth index. All of these covariates were 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= South, 8 =Gambela, 9 = Harari,10=Dire Dewa
Religion	Women's religion	1= Orthodox,2=Catholic 3= Protestant,4= Muslim,5=Traditional, 6=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

2.4 Method of Data Analysis

This study was used accelerated failure time model to identify factors associated with age at first marriage.

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 $a'= (a_1, a_2, \ldots, a_p)$ is a vector of regression coefficients. In other words, the accelerated failure-time model is defined by the relationship.

$S(tlX) = S_o\{t * \exp(a'X)\}$, for all X

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 = −2LogL+2(k+c+1)

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 Result

A total of 10,335 rural women from nine regions and DireDewa city administration were included in the study. Out ofthe total women interviewed, 2,113(20.4%) did not get married at the time of the survey and none of the respondents had a marriage experience but unable to recall the age at first marriage (Left censored).Majority of the respondents,8,222(79.6%) were married at the time of the survey or had an experience before. About 12.2% of the respondents were fromTigray, 9.0% from Affar, 14.2% from Amhara, 15.9% from Oromiya, 10.2% from Somali, 9.5% from Benishangul-Gumuz, 15.7% from South, 6.6% from Gambela, 3.8% from Harari region and the rest 2.8% from Dire Dawa.

With regard to educational attainment, about 59.1% of the respondents had no education, while32.2% had primary education, and 7.3% had attended secondary education. About 55.8% of the households were classified a spoor while 18.8% had middle income and 25.4% were rich. More than half (71.3%) of the women respondents had no work. Of the total women, 32.9% were Orthodox, 0.6% catholic, 44.5% Muslim, 20.6% Protestant, 0.8% traditional and 3% of them were from other religion followers at the time of the survey. The overall median time of age at first marriage for Rural Ethiopian women was 17 years with 95% CI; (16.904, 17.096).

Table 2: Descriptive Summary of Demographic and Socio-economic Variables

Variable	Categories	Frequency	Percent
Region	Tigray	1265	12.2
	Affar	931	9.0
	Amahara	1471	14.2
	Oromiya	1640	15.9
	Somali	1057	10.2
	Benshangul-G	977	9.5
	South	1623	15.7
	Gambella	687	6.6
	Harari	391	3.8
	Dire Dewa	293	2.8
Women education level	No education	6113	59.2
	Primary	3225	32.2
	Secondary	750	7.3
	Higher	147	1.4
Wealth index	Poor	5769	55.8
	Middle	1941	18.8
	Rich	2625	25.4
Women work status	Not had work	7374	71.3
	Had work	2961	28.7
Religion	Orthodox	3404	32.9
	Catholic	62	0.6
	Protestant	2127	20.6
	Muslim	4602	44.5
	Traditional	82	0.8
	Others	58	0.6

Accelerated Failure Time Model Results

The datasets was fitted using Weibull, log-logistic and lognormalAFT model. For age at first marriage data, multivariable AFT models of weibull, log-logistic, and lognormal distributions were fitted by including all thecovariates 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 =46585.08) found to be the best for age at first marriage datasets from the given alternatives when including all the covariate those are significant in the uni-variable analysis. AFT models and the corresponding AIC values were displayed in table 3.

Table 3: Comparison of AFT Models Using AIC criteria for AFM data

Baseline Distribution	AIC
Weibull50450.59	
Log-logistic	46585.08
Log-normal	46915.71

From the log-logistic accelerated failure time model, Women educational level when using no education as reference and region when using Tigray as reference prolong time to-age at first marriage, while work and some categories of region (Amhara, Gambella) when Tigray was reference statistically significantly shorten time-to-age at first marriage in Rural Ethiopia.

Under the log-logistic AFT model, from region category Affar region (p-value =0.478, ϕ=1.008, 95% CI: (-0.014, 0.031)), Harari(p-value =0.086, ϕ=1.025, 95% CI: (-0.004, 0.053)) and Dire Dewa (p-value=0.153, ϕ=1.022, 95% CI :(-0.008, 0.052)) are not significant when compare toTigray region. Wealth index and religion were not significant.

Table 4. Log-logistic Multi-variable AFT Model for Age at First Marriage data.

Covariates	Coef	Se(Coef)	ϕ	95% CI for ϕ	P-value
Tigray	Ref				
Afar	0.008	0.011	1.008	(-0.014,0.031)	0.477
Amhara	-0.024	0.008	0.976	(-0.041,-0.007)	0.004
Oromiya	0.046	0.009	1.047	(0.027,0.065)	2.33e-06
Somali	0.098	0.012	1.103	(0.075,0.121)	3.332e-17
BenishangulG	0.028	0.010	1.028	(0.008,0.049)	0.006
South	0.082	0.010	1.086	(0.062,0.103)	3.78e-15
Gambella	-0.018	0.012	0.982	(-0.042,0.006)	0.136e-01
Harari	0.025	0.014	1.025	(-0.004,0.053)	0.086
Dieredawa	0.022	0.015	1.022	(-0.008,0.052)	0.153
Women education level					
No education	Ref				
Primary	0.088	0.005	1.092	(0.078,0.098)	< 2e-16
Secondary	0.251	0.009	1.285	(0.231,0.270)	< 2e-16
Higher	0.310	0.020	1.363	(0.270,0.350)	< 2e-16
Wealth index					
Poor	Ref				
Middle	0.001	0.006	1.001	(-0.010,0.013)	0.8120
Rich	-0.003	0.005	0.997	(-0.014,0.008)	0.6497
Women work status					
Not had work	Ref				
Had work	-0.010	0.005	0.989	(-0.019,-0.001)	0.038
Religion					
Orthodox	Ref				

Catholic	0.008	0.029	1.008	(-0.049,0.066)	0.784
Protestant	0.006	0.008	1.006	(-0.011,0.022)	0.488
Muslim	-0.011	0.007	0.989	(-0.025,0.004)	0.156
Traditional	0.014	0.024	1.014	(-0.033,0.062)	0.552
Others	0.032	0.029	1.032	(-0.027,0.090)	0.289

Coef : coefficient, Se: Standard error, ϕ : acceleration factor, CI : Confidence interval, Ref : Reference

From table 4 the estimated acceleration factor for women from Amhara, Oromia, Somali, Benishangul-Gumuz, South and Gambela was estimated to be 0.976, 1.047, 1.103, 1.028, 1.086, 0.982 with 95% CI; (-0.041,-0.007) , (0.027,0.065) , (0.075,0.121), (0.008,0.049),(0.062,0.103), (-0.042,0.006) respectively by using Tigray region as reference category. This indicates women from Oromia**,** Somali and South region have prolonged time to age at first marriage and time-to-age at first marriage decreased in Amhara and Gambela region than Tigray region women. The acceleration factors for women attending primary education, secondary education, and higher were 1.092, 1.285, and 1.363 with 95% CI; (0.078,0.098), (0.231,0.270) , (0.270,0.350) respectively. These confidence intervals does not include one in all category; indicating primary, secondary and higher education's were significantly important factors for the timing of age at first marriage by using uneducated women as a reference category. This indicates that women with primary, secondary and higher education prolonged age at first marriage.

The acceleration factors for women who had work was 0.989 with 95% CI; (-0.019,-0.001) by using not had work as reference. This implied that women had work have shorter time-to age at first marriage.

4 .Discussion

The findings of this study revealed that Amhara and Gambela region have significantly shorter time-to-age at first marriage while women's educational level and from region category (Oromia, Benishangul Gumuz and South) prolonged time-to age at first marriage among women in Rural Ethiopia. About 63.9% of women were married before age of 18 years. This indicates that early

marriage is highest in Ethiopia. The median time of age at first marriage for Rural Ethiopian women is 17 years with 95% CI; (16.904, 17.096).

The findings of this study suggested that women's educational level had a significant effect on time to age at first marriage with 5% level of significance and it prolonged age at first marriage by the factor of ϕ = 1.14, ϕ =1.42 and ϕ= 1.46 for primary, secondary and higher education respectively when compared to illiterate women. The result of the study shows that woman who had higher education was more survived than those uneducated and primary education. A similar study conducted in Ethiopian by Tezera (2013) used data from 2011 EDHS to examine the effect demographic and socioeconomic variables to determine early marriage among women. The result of the study showed that educational level of women was found to be significant predictors for early marriage. Similar study in Malawi by Palamuleni (2011) also found that women education were statistically significant factor of age at first marriage. Also, Agaba et al (2011) indicates that educational attainment were strong socio-economic determinants of first marriage in Western Uganda.

The results of this study suggested that region was significant predictive factor for the timing of age at first marriage of women in Rural Ethiopia. Women in the Oromia region, Somali region,Benishangul Gumuz and South region prolong age at first marriage by a factor of ϕ =1.047, ϕ =1.103, ϕ =1.028, and ϕ =1.086 respectively compared to those in the Tigray region. However, women from Amhara region (ϕ =0.976) and Gambela region (ϕ =0.982) had a significantly higher risk of early first marriage compared to their counterparts in the Tigray region. A study conducted by Tezera (2013) to examine the effect demographic and socioeconomic variables to determine early marriage among women in Ethiopia. The result of the study revealed that region of women was significant predictor for early marriage. A similar study in Nigeria by Adebowale et al. (2012) also found that region was significantly associated with the timing of first marriage. Also another study in Vietnam by Lung Vu (2009) finds that region was significantly related to age at first marriage.

The result of this study revealed that Women work status were significantly shortened time to age at first marriage in Rural Ethiopian women. Compared to women had not, women had work relatively lower risk of first marriage.

5 Conclusions

The main objective of this study was modeling the determinant of age at first marriage by using AFT models. The result of Log-logistic AFT model showed that region, women's educational level and women work status were found significant predictors to age at first marriage among women in Rural Ethiopia. Among these significant predictors, Region and women's educational level prolong age at first marriage while from region category Amhara and Gambella and women work status shortens timing of first marriage.

The study findings reveal that education is the most significant variable affecting age at first marriage 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 get married. It is crucial to continue improving girls and young women access to education is important for rising the women's age at first marriage, 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 marriage as well as providing reproductive health information so that they are aware of the advantages of delayed marriage.

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/Accuired

Immune deficiency Syndrome

PHC=Population and Housing Census

STDs= Sexual Transmitted Diseases

Declarations

Ethics approval and consent to participate

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

Consent for publication

Not applicable

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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Author's contributions

YM contributed to the study concept and design, performed the analysis on the data set as well as wrote the first draft of the paper. MG contributed to the analysis and interpretation of the data, in addition to drafting and critical revision of the manuscript. All authors read and approved the final manuscript.

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Reference

1. Adebowel A., Fagbamigbe A., Okareh O. and Lawal O. (2012). Survival Analysis of Timing of First Marriage among Women of Reproductive age in Nigeria: African Journal ofReproductive Health.
2. Agaba. P, Atuhaire. L. K, Rutaremwa. G (2011), Determinants of Age at First Marriage among women in Western Uganda. SSAE, Makerere University, Uganda.
3. Anu N, Praveen S (2013) "Impact of Education and Age at Marriage on Fertility among Uttar Pradesh Migrants of Ludhiana, Punjab, India". Anthropologist 15: 225-30.
4. Central Statistical Authority and ORC Macro. (2001). Ethiopia demographic and health survey 2000. Addis Ababa, Ethiopiaand Calverton, Maryland, USA: Central Statistical Authority and ORC Macro.
5. Central Statistical Agency and ORC Macro. (2006). Ethiopia demographic and health survey 2005. Addis Ababa, Ethiopia and Calverton, Maryland, USA: Central Statistical Agency and ORC Macro.
6. Central Statistical Agency, (2011).Ethiopian Demographic and Health Survey, Addis Ababa, Ethiopia.
7. Central Statistical Agency, (2016). Ethiopian Demographic and Health Survey, Addis Ababa, Ethiopia
8. Efevbera Y, Bhabha J, Farmer P, Fink G. Girl child marriage, socioeconomicstatus, and undernutrition: evidence from 35 countries in sub-SaharanAfrica. BMC Med. 2019;17(1):55.
9. Hotchkiss DR, Godha D, Gage AJ, Cappa C. Risk factors associated with thepractice of child marriage among Roma girls in Serbia. BMC Int Health HumRights. 2016;16(1):6.
10. Koski A, Clark S, Nandi A. Has child marriage declined in sub-Saharan Africa?An analysis of trends in 31 countries.PopulDev Rev. 2017;43(1):7–29.
11. Lung Vu (2009). Age at first marriage in Vietnam: Trends and determinants. Paper presented at Population Association of America (PAA), April 30- May 2.

12. Montazeri S, Gharacheh M, Mohammadi N, Alaghband Rad J, Eftekhar AH.Determinants of early marriage from married girls' perspectives in Iraniansetting: a qualitative study. J Environ Public Health. 2016;2016:1.
13. National Research Council and Institute of Medicine of theNational Academies (NRC-IOM).2005.Growing Up Global: The Changing Transitions to Adulthood in Developing Countries.Ed. Cynthia B. Lloyd. Washington, DC: The National Academies Press. New York.
14. Palamuleni. E. Martin, (2011). Socioeconomic determinants of age at first marriage in Malawi. International Journal of Sociology and Anthropology vol. 3(7), pp224-235.
15. Population Council, (2002). Background document prepared for working group on Girls, United Nations Special Session on Children, 10 may, New York.
16. Tezera A. (2013). Determinants of Early Marriage among Women in Ethiopia.
17. United Nations Children's Fund (2014) "Ending Child Marriage: Progress and prospects". New York.