ADDIS ABABA UNIVERSITY
COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES
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Survival Analysis of Time to Uptake of Modern Contraceptive among women in Ethiopia

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This is to certify that the thesis prepared by Shibabaw Addisu Bekere, entitled: "Survival analysis of time to uptake of modern contraceptive methods among women in Ethiopia" and submitted in partial fulfillment of the requirements for the degree of Master of Science in Statistics (Biostatistics) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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Declaration

I, the undersigned, declare that the thesis is my original work, has not been presented for degrees in any other university and all sources of materials used for the thesis have been duly acknowledged.

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This thesis has been submitted for examination with my approval as a university advisor.

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Abstract

Survival analysis of time to uptake of modern contraceptive methods among women in Ethiopia

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Contraceptive methods are one of the most important health interventions of the 21st century is crucial in reducing rapid population growth and improving women and family health. Contraceptive methods have now become a worldwide issue in general and developing countries in particular. The study was used to identify the factors associated with time to use of modern contraceptive methods among women in Ethiopia. The data used for the study were based on EDHS (2016) obtained from CSA. The Kaplan-Meier survival function and Log-Rank test were used to describe and compare the survival experience of different category of participants. In order to identify the associated risk factors of time to use modern contraceptive methods parametric survival model with frailty was employed and compared by using AIC and log-likelihood ratio test. The result of the study shows that from a total of 7,890 women, about 1,061(13.45%) used modern contraceptive methods while 6829 (86.55%) didn't use modern contraceptive methods. Among the fitted frailty models, Weibull regression survival model with Gamma frailty model was an appropriate fit of time to use modern contraceptive methods. Compared to the none frailty survival models the estimated frailty model which accounts for unobservable regional heterogeneity were more appropriate to fit time to use modern contraceptive method among the regions of Ethiopia. Furthermore, using the selected frailty model results, the independent variables age, place of residence, wealth index, educational status and awareness information from TV were identified as risk factors associated with time to use modern contraceptive method at 5% level of significance.

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List of abbreviations

AAU: Addis Ababa University
AIC: Akaike information criterion

AIDS: Acquired Immune Deficiency Syndrome

BIC: Bayesian information criterion

CI: Confidence Interval

CSA: Central Statistical Agency

DF: Degrees of Freedom

EDHS: Ethiopia Demographic and Health Survey

HIV: Human Immune Virus

HR: Hazard Ratio

HSTP: Health Sector Transformation Plan

KM: Kaplan- Meier

LE: Likelihood Estimation

LL: Log Likelihood

PH: Proportional hazard

SE: Standard Error

SNNPR: South Nation Nationality People Representative

STATA: statistical software package

STI: Sexually Transmitted Infection

TV: Television

WHO: World Health Organization

Chapter1: Introduction

1.1 Background of the Study

Contraceptives are one of the most important health interventions of the 21st century which crucial in reducing rapid population growth and improving women and family health. The Sustainable Development Goals targeted to expand access to family planning. Family planning saves lives and improves quality of life of women, children, and family at large. It also prevents pregnancy-related health risks in women, sexually transmitted infection (STI) and HIV/AIDS, and adolescent pregnancies and slows population growth (WHO, 2018).

The Ethiopian health sector gives emphasis to achieve the goal of the Health Sector Transformation Plan (HSTP) which is universal health coverage by strengthening primary health care. Street women living in informal settlements are likely excluded from formal public services, including contraceptive services. Despite Ethiopia's contraceptive prevalence rate increasing from 29% in 2011 to 35% in 2016, the target, 65% by 2015 was not achieved (Wondimnew et al., 2020).

The use of modern contraceptive methods translates into the prevention of unwanted pregnancy and subsequent abortions. If contraceptive use in the population increases among Ethiopia men and women who are sexually active, there will be a significant reduction in unwanted pregnancies and abortions leading to reduced maternal mortality. Research in Ethiopia indicates that more than 60% of women with an unplanned pregnancy are not using any form of contraception (WHO, 2019).

The national survey reports have shown that the age of first sexually intercourse is <18 years. This is an age at which adolescents are most susceptible to sexually transmitted infection, including HIV/AIDS and other health complication. Unfortunately, in Ethiopia cultural belief prevent discussion among young people about reproduction including the use of modern contraceptives. Young women who ask for contraceptives are regarded as promiscuous and as a result they choose either or not to use them or to rely on their female sexual partner, who are likely to be older or their peers.

Many factors contribute to unwanted pregnancy in Ethiopia, and a very important factor is the low level of contraceptive use. In addition, a desire to limit family size to enable the family to provide a better education for the children, the increased participation of women in the labor force, and urbanization are other factors leading to the desire of Ethiopian women to have a predetermined number of children. Contraceptive prevalence rates are correlated with maternal mortality and it has been shown that countries with low contraceptive prevalence rates are also countries with very high maternal mortality ratios. Ethiopia has one of the highest maternal mortality ratios in sub-Saharan Africa, and Ethiopia is one of the six countries which have contributed to more than 50% of all maternal deaths across the world. (Yifru, Asres (2014); Merh and WHO (2018)).

The literature review of contraception uses in Ethiopia identifies reasons for low levels of contraceptive use, the factors responsible for this low utilization, and recommends interventions, programs, and policies to increase contraceptive utilization (Betelhem et al., 2017; Merhawi et al., 2018). In addition, the review provides recommendations and direction for future political policy changes and is intended to serve ultimately as a guide for population and demographic planning. Ideally, family planning programs should offer a wide range of methods and appropriate counseling, so that users can make an informed choice and easy access to quality follow-up services since these factors are associated with method satisfaction, continuation and switching. Studies of contraceptive use dynamics typically address the mentioned three aspects in order to provide guidance for improving services. Evidence from these studies has a number of implications, including better monitoring and evaluation of program activities, improved effectiveness in meeting the needs of users, and more generally, improved ability of governments to achieve goals set for total fertility, and for maternal and child health services.

1.2. Statement of the problem

Unplanned pregnancy and abortions lead to increased maternal mortality in Ethiopia indicates that more than 65% of women are not using any contraceptive methods. It is critical for family planning workers to continue to meet the needs of existing contraceptive users, and also to address barriers for contraceptive users in the society among various socio-economic and demographical factors such as age, education level of the women, wealth index, residence, religion, region, current marital status, family planning from radio, TV, newspaper, and so on. That is why their efforts and approaches do not seem to be equally effective, evenly served or acknowledged in some areas.

1.3 Objective of the study

1.3.1 General objective of the study

The main objective of the study was to identify the significant factors associated with the time to use modern contraceptive methods among women in Ethiopia.

1.3.2. Specific objectives of study

- To describe the socio-economic and demographic factors with respect to the time to use modern contraceptive methods among women in Ethiopia.
- To fit a survival model that best-fits the dataset.

1.4 Significance of the study

The findings of the study could provide information about use modern contraceptive method after they started sexual intercourse in order to avoid unwanted pregnancy. In addition, the study helps to understand risk factors that are related to unwanted pregnancy and subsequent abortions at any time in follow-up period and their families also helps in awareness development about the use of modern contraceptive.

Chapter 2: Literature Review

Several studies have led many to conclude that it is better to initiate contraception immediately after delivery in order to avoid the potential consequences (Ross et al., 1989). Several benefits have been attributed to the early initiation of family planning in the postpartum period. First of all, it is an effective means of preventing unintended pregnancies. It is estimated that unintended pregnancies will drop by greater than two-thirds, from 75 million in 2008 to 22 million per year if the need for both family planning and maternal and newborn services are met (Singh et al., 2009). Women will therefore not have to worry about getting pregnant when they are not ready to do so. Unsafe abortions will also decline as women will not get desperate and resort to all sorts of unsafe means to terminate unwanted pregnancies (Singh et al., 2009). Maternal deaths are expected to reduce drastically with a concomitant decline in the number of stillbirths, neonatal and infant mortalities (Singh et al., 2009). Overall, public sector spending will reduce and the productive life years lost as a result of death and disability will be greatly minimized.

A study conducted by Zerihun Kura (2020) using multinomial logistic regression women's decision on contraceptive use was influenced by many factors such as age of women, place of residence, women and husbands education, occupation of both woman and her husband, and number of children were significantly associated with women's decision for contraceptive use. Residing in urban or in rural areas the decision-making of women who live in urban were more likely to decide by themselves than jointly as compared to women living in a rural area. The possible reason might be women who reside in urban were more educated, have information and awareness about the contraceptive compared to those women resided in rural areas. Women whose husbands had no formal education or secondary education were more likely to decide by themselves as compared to women whose husbands had higher education. The education statuses of women or husbands were the factors that affect the decision-making of women. The result also indicated that women who have a lower number of children have more deciding power than those who have more than 5 children.

A study conducted by Paul (2018) using multiple logistic regression model was employed to assess level of significance between the dependent and independent variables. The results obtained indicate that a number of factors including partners' approval, marital status, and employment status were associated with use of modern contraceptives while only religious beliefs and attitude significantly associated with use of modern contraceptives. The results found no significant association between level of formal education and current use of modern contraceptive.

A study conducted by Tilahun (2013) using logistic regression showed that socio-demographic factors like age of the women, educational level, family size, economic status and history of abortion a statistically significant difference. Ethnic group, marital status, religion and duration lived at the place of survey had no statistically significant effect. Women in the age group 25-34 were 1.5 times more likely to use modern contraceptives as compared to 15-24 years. And those above the age of 34 were 2 times more likely to use modern contraceptives than those 15-24 years of age. The results indicate that there was a significant effect for those women educated up to high school and above. Those with to high school level of education and above were 2 times more likely to use modern contraceptives as compared with the illiterate ones. Analysis of the family size of the study population showed that respondents who had more than 10 family members were 9 times more likely to use modern contraceptives than those who had 1- 5 family members. Those women in the category of medium to rich socioeconomic status were to use contraceptives less likely than the poor ones. In the study, women who ever had history of abortion were less likely to use contraceptives as compared to those who did not have history of abortion.

A study conducted by Bogale et al. (2011) using logistic regression showed the overall decision-making power in urban areas tends to be joint 225 (67.06%) but in rural areas it is the husband without involving his wife 153 (45.83%). Among the respondents with joint decision makers, in conditions where their wish did not coincide or their decision were in conflict, the husband's decision override 331 (98.7%) in rural and 305 (91.2%) in urban. Forty three women 43 (6.45%) replied they can independently decide in children related issues in both settings. Economic decisions taken by wife only showed relatively higher percentage in rural than urban. On the other hand decisions related to socio-cultural and family relations, the reverse holds true. The majority of the focus group participants agreed that mutual discussion is relevant but practically domestic decisions are male dominated especially in the rural part. Current practice of modern contraceptive method was higher than the national and regional figures and the urban rural difference was lower in comparison to the regional and national data. In urban setting, gender equitable attitude had significant statistical association with decision making on modern contraceptive use but not in rural settings. Modern contraceptive decision-making power found to be higher in urban than rural areas. Increasing knowledge of women on contraceptive will increase contraceptive use decision making power both in the urban and rural areas.

A study conducted by Tilahun (2013) using the multilevel logistic regression indicates that place of residence, working status, exposure to mass media, educational status, and women religion had shown a significantly association with use of modern contraceptive methods. Women who reside in rural areas had lower rate of modern contraceptive use (23.9 percent) than those who lives in urban area (20.7 percent). This study also shows that religious belief of a woman has an important effect on modern contraceptive use. Women who are orthodox believers are using modern contraceptives higher than those with others religions.

A study conducted by Melash (2020) using multivariable logistic regression was done to identify factors associated with modern contraceptive use. Modern contraceptive use among married reproductive-age women was being from households with rich wealth index (AOR = 1.6; 95% CI: 1.1–2.5), a secondary or higher level of education (AOR = 3.0; 95% CI: 1.4–6.2), and desire to space (AOR = 2.6; 95% CI: 1.9–3.7) or want no more child (AOR = 2.4; 95% CI: 1.6–3.5) were found positively associated with modern contraceptive use. On the other hand, modern contraceptive use was negatively associated with women aged 35–49 years (AOR = 0.7; 95% CI: 0.5–0.9). Modern contraceptive use was relatively high in the Amhara region. The odds of modern contraceptive use were higher among women with secondary or more educational levels. Women from households with rich wealth index and those who want to delay or avoid pregnancy had also more odds of using modern contraceptives.

A study conducted by Teshale (2020) using logistic regression used to analyze the association between the knowledge of husband approval towards modern family planning methods, couple's discussion, male involvement in decisions about family planning desire for additional child and previous use of contraception were significantly associated with modern contraceptive utilization. Even though knowledge of modern family planning methods was very high, the overall modern family planning method use in the study area was low.

A study conducted by Oluwafemi (2020) using a multilevel logistic regression shows a significant association of educational level, marital status, parity, socio-economic status, fertility intention, and awareness of family planning methods on the use of modern contraceptives. Women who had support from someone in the community on family planning were more likely to use modern contraceptive unlike those without such support. Those who believed that contraceptive methods are used by almost all and some of their friends or relatives were more likely to use modern contraceptive compared to those who think otherwise.

A study conducted by Kirui (2021) using multiple logistic regression to identify the factors associated with the uptake of injectable contraceptives. education, marital status, wealth index, place of residence and number of births were significant predictors of the contraceptive uptake among women of reproductive age in Kenya. Women with post-primary/vocational levels of education were 54% less likely to use contraceptive as compared to those who had no education at all.

A study conducted by George (2021) using conditional logit model to examine associations between method-specific beliefs and choice of injectable, implants or pills among women who were not using any method or were pregnant at baseline (round 1) but adopted these methods at 12-month follow-up. Beliefs about pills, injectable and implants among non-users were generally negative. With the partial exception of the pill in Nairobi, the majority thought that each method was likely to cause serious health problems, unpleasant side effects, menstrual disruption, and would be unsafe for long-term use.

Chapter 3: Data and Methodology

3.1 Data Source

The data for this study were secondary data obtained from Central Statistics Agency (CSA) in 2016 Ethiopia Demographic and Health Survey (2016EDHS). All women aged 15-49 in the household were eligible for individual interview.

3.2 Study Variables

3.2.1. The Dependent variable

The dependent variable is the time (in years) to the uptake of modern contraceptives among women in Ethiopia. In this study, the "time to the uptake of modern contraceptives" was defined as the time-(in years) between when a woman first had sexual intercourse and when she first used modern contraceptives. The survival time is assumed to begin at the time a woman has her first sexual intercourse until the time she starts using modern contraceptives is an event. The survival time is censored for women who have never used a modern contraceptive at the time of the survey.

3.2.2. The Independent variables

The independent variables were selected based on a literature review which deemed to be the factors associated with modern contraceptive use and includes age, education level of the women, wealth index, residence, religion, region, current marital status, work status heard family planning information on radio, TV and newspaper. These categories of the independent variables were coded to make it appropriate for further analysis using different statistical models.

3.2.3. Coding and description of variables

No	Variable	Type	Coding
1	Age	Categorical	1=15-19 2= 20-24 3=25-29 4=30-34 5=35-39 6=40-44 7=45-49
2	Educational status	Categorical	0 = No education 1 = Primary 4 = Secondary and above
3	Place of residence	Categorical	1= Urban 2 = rural
4	Religion	Categorical	1=Orthodox 2= Catholic 3= Protestant 4=Muslim 5=others
5	Wealth index	Categorical	1=Poor 2=Middle 3= Rich
6	Region	Categorical	1=Tigray, 2 = Afar, 3 = Amhara, 4= Oromia, 5= Somalia, 6= Benishangul, 7= SNNPR, 8 =Gambela, 9 =Harari, 10 = Addis Ababa, 11=Dire Dawa
7	Marital status	Categorical	0 =Never married 1=married 2 =others
8	Work status	Categorical	0= no and 1= yes
9	Heard information on Radio	Categorical	0= no and 1= yes
10	Heard information on TV	Categorical	0= no and 1= yes
11	Heard information on Newspaper	Categorical	0= no and 1= yes

3.3 Methodology

3.3.1 Introduction

Survival analysis is a collection of statistical procedures for data analysis for which the outcome variable of interest is time until an event occurs. By time, we mean years, months, weeks, or days from the beginning of follow-up of an individual until an event occurs. The use of survival analysis, as opposed to the use of other statistical methods, is most important when some subjects are lost to follow up or when the period of observation is finite and certain participant may not experience the event of interest over the study period. These incomplete observations are referred to as being censored. Most survival analyses consider a key analytical problem of censoring. In essence, censoring occurs when we have some information about individual survival time, but we do not know the survival time exactly.

An initial step in the analysis of a set of survival data is to present numerical or graphical summaries of the survival times in a particular group. In summarizing survival data, the two common functions applied are the survivor function and the hazard function (Hosmer and Lemeshow, 1999). Moreover, the distribution of survival time is characterized by the survival and hazard functions:

(a) Survival function: The basic quantity employed to describe time-to-event phenomena is the survival function, the probability of an individual surviving or being event-free beyond time t (experiencing the event after time t). The survivor or survival function, $S(t)$, is defined as

$$S(t) = P(T > t) = 1 - F(t)$$

where, $S(t)$ is used to represent the probability that a randomly selected individual survives from the time origin to sometime t or beyond time t.

(b) The hazard functions: The hazard function is used to express the risk or hazard of experiencing the event at some time t, and is obtained from the probability that an individual experiencing the event at time t, given that an individual has survived (censored) at time t. Consider the probability that the random variable T lies between t

and $t + \Delta t$, conditional on T being greater than or equal to t, written $P(t \leq T \leq t + \Delta t / T \geq t)$. The hazard function, $h(t)$, is then the limiting value of this quantity as $\Delta t \to 0$, so that

$$h(t) = \lim_{\Delta t \to 0} \left\{ \frac{P(t \leq T < t + \Delta t / T \geq t)}{\Delta t} \right\}$$

where

$$P(t \leq T < t + \Delta t / T \geq t) = \frac{P(t \leq T < t + \Delta t)}{P(T \geq t)} = \frac{F(t + \Delta t) - F(t)}{S(t)}.$$

3.3.2 Estimation of survival function

In survival analysis, it is always a good idea to present numerical or graphical summaries of the survival times for the individuals. In general, survival data are conveniently summarized through estimates of the survival function and hazard function. This method is non-parametric or distribution-free, since they require no specific assumptions to be made about the underlying distribution of the survival times (Hosmer and Lemeshow, 1999). Among the other estimators of the survivor function the Kaplan-Meier estimator is the most common one [Kaplan and Meier (1958)]. This estimator incorporates information from all of the observations available, both uncensored and censored, by considering survival to any point in time as a series of steps defined by the observed survival and censored times.

Kaplan-Meier Product Method

Kaplan-Meier estimator used to display the graph of the survival time of the time to uptake of modern contraceptives among women in the reproductive age. The Kaplan-Meier estimate of the survival function at time *t* is given by:

$$\hat{S}(t) = \prod_{i=1}^{k} \left(\frac{R(t_{(j)}) - d_{(j)}}{R(t_{(j)})} \right), \text{ for } t_{(j)} < t < t_{(j+1)}, k = 1, 2, \dots, r$$

where, $\hat{S}(t)$ is the survival function at time t

$R(t_{(j)})$ is the risk set at time t

$d_{(j)}$ is number death at time t.

Log-rank test

The log rank test, developed by Mantel and Haenszel, is a non-parametric test for comparing two or more independent survival functions. Since it is a non-parametric test, no assumption about the distributional form of the data is required. The log rank test statistic (Kleinbaum and Klein, 2005 and Hosmer and Lemeshow, 1999) for comparing two groups is given by:

$$Q = \frac{[\sum_{i=1}^{m} w_i(d_i - \hat{e}_{1i})]^2}{\sum_{i=1}^{m} w_i{}^2 \hat{v}_{1i}}$$

where,

- m is the number of rank ordered event times,
- d_{1i} is the observed number of events (use in group 1at event time,
- $e_{1i} = n_{1i} - d_{1i}/n_i$ is the expected no of events corresponding to d_{1i},
- n_{1i} is the number of individuals at risk in group1 just prior to event (usee) time t_j.
- $v_{1i} = \frac{n_{1i}\, n_{2i} d_{i(n_i - d_i)}}{n_{i2}\,(n_i - \quad 1)}$ is the variance of the number of events d1i at time t_j.
- n_{2i} is the number of individuals at risk in group1 just prior to event (use) time t_j.
- n_i and di are the number of individuals at risk and number of event in both groups (i.e., group 1 and group 2) just prior to event time t_i respectively.

Under the null hypothesis that two survival functions are equal, the log rank test statistic Q has an approximation of chi-square distribution with one degree of freedom for $\chi^2(1)$ large samples. The null hypothesis of equality of survival functions will be rejected for large values of Q. The most frequently used test is based on weights equal to one $w_i = 1$ .Note that the log-rank test can be extended for comparing three or more groups of survival experience.

3.4 Parametric Frailty models

The frailty models are survival models which accounts unobservable random effects for the existence of unmeasured attributes. In frailty models, the variability of survival times can be divided into two parts. One part is the observed risk factors, known as covariates and the other part is unobserved risk factors, known as frailty. Including the frailty term in the model allows to correctly measuring the covariate effects avoiding underestimation or overestimation of the parameters (Li et al., 2007). The advantage of frailty models over other conditional models is that they use a single parameter to index the degree of dependence; in contrast to the fixed effects model, where the numbers of parameters to describe cluster effects grow with the number of clusters. Frailty models are used to make adjustments for over - dispersion/under - dispersion. When unobserved or unmeasured effects are ignored, the estimates of survival may be misleading. Therefore, corrections for this over-dispersion/under dispersion are needed in order to allow for adjustments for those important frailties.

A frailty model is a generalization of a survival regression model. In addition to the observed regressors, a frailty model also accounts for the presence of a latent multiplicative effect on the hazard function. This effect, or frailty, is not directly estimated from the data, but instead is assumed to have unit mean and finite variance, which is estimated. In cases where the frailty is greater than one, subjects experience an increased hazard (or risk) of failure and in this way, frailty models can provide a useful alternative to a standard survival model when the standard model fails to adequately account for all the variability in the observed failure times.

A frailty model in the univariate case introduces an unobservable multiplicative effect α on the hazard, so that conditional on the frailty

$$h(t|\alpha) = \alpha h(t)$$

where α is some random positive quantity assumed to have mean one (for purposes of model identifiability) and variance θ. Those individuals with $\alpha > 1$ are said to have an increased risk of failure while those individuals with $\alpha < 1$ are less frail and will tend to survive longer. Since α is a multiplicative effect, it is easy to see from (3.1) how one can think of a frailty as representing the cumulative effect of one or more omitted covariates. Given the relationship between the hazard and survival functions, it can be shown that the individual survival function conditional on the frailty is $S(t \mid \alpha) = \{S(t)\}^{\alpha}$, where S(t) is the survival function from a standard survival model and may include ancillary parameters and covariate effects.

3.4.1 Univarate frailty models

Univariate frailty models have long been used to account for heterogeneous times-to-failure. The term frailty was first proposed by Vaupel et al. (1979) in the context of mortality studies, and Lancaster (1979) incorporated the frailty concept into a study of duration of unemployment. Hougaard (1984) discusses the ramifications of the assumed distribution of the frailty, whether gamma or inverse Gaussian.

The univariate frailty model presents the population as a mixture in which baseline hazard is common to all individuals but each individual has their own frailty. Suppose we have a sample of j observations in a study. Some of these observations fail earlier than others due to unobserved heterogeneity. The proportional hazards model assumes that conditional on the frailty, the hazard function for an individual at time $t > 0$ is:

$$h_j(t) = h_0(t)exp\left(x^t\beta + w_j\psi\right); \qquad j = 1, 2, \dots, n$$

where, w_j is a frailty term from a probability distribution (equation 3.2). If w_j could be measured and included in the model, then would go to 0 and we would obtain the marginal Cox PH model.

The hazard function conditional on both covariates and frailty can be rewritten as:

$$h_j(t) = h_0(t)u_j exp(x^t\beta); \qquad j = 1, 2, \dots, n$$

where, $u_j = \exp(w_j\psi)$. This shows that the hazard of an individual also depends on an unobservable random variable, u_j, which acts multiplicatively on the hazard rate. If frailty is not taken in to account, then $u_j = 1$.

3.5 Test of Heterogeneity

In frailty models, θ is estimated to get an idea on heterogeneity in the outcome between clusters. When θ is large and differs significantly from zero, It reflects heterogeneity between clusters, i.e., regions in the study and there was a cluster effect among individuals in the same cluster. On the other hand, when θ is equal to zero, the frailties are identically equal to one which implies that the cluster effect are not present (Glidden and Vittingho, 2004). The likelihood ratio test comparing the models with and without frailties is normally used for testing the null hypothesis $\theta = 0$ versus the alternative hypothesis $\theta > 0$. Since the null hypothesis is at the boundary of the parameter space, a mixture of chi-square distribution with 0 and 1 degree of freedom was used (Duchateau and Janssen, 2008).

3.6 Frailty Distributions

There are various frailty models that have been developed and suggested in the literature and any distribution with a positive random variable can be used to model frailty (Ulviya, 2013). Several authors have noted that unlike standard random effects models, inferential methods have been less developed in frailty models because of censoring and truncation. The frailty distributions most often applied are the gamma distribution (Clayton, 1978; Vaupel et al., 1979; Oakes,1982; Hougaard, 2000; Wienke et al., 2002; Wienke et al., 2003a; Hanagal and Sharma, 2012), the positive stable distribution (Hougaard, 1986b), the power Variance function (PVF) distribution (Hougaard, 1986a), the inverse Gaussian 36 distribution (Hougaard, 1984), the compound Poisson distribution (Aalen, 1988) and the log-normal Distribution (McGilchrist and Aisbett, 1991). In this study, various frailty distributions were considered.

3.6.1 Gamma distribution

Gamma frailty model belongs to the power variance function family (Hougaard, 1986b) and can be expressed in terms of its Laplace transform (Duchateau and Janssen, 2008) from which properties such as mean and variance are easily derived. Assuming a two-parameter gamma density with δ > 0 and γ > 0 as shape and scale parameters, respectively, the density function is given by:

$$f_u(\mathrm{u}) = \frac{\exp(-\gamma \mathrm{u}^2)\gamma^{\delta}\mathrm{u}^{\delta-1}}{\Gamma(\delta)}; \text{ with } \delta > 0 \text{ and } \gamma > 0.$$

The distribution function of the frailty term u is therefore a one-parameter gamma distribution given by:

$$f_u(\mathrm{u}) = \frac{\mathrm{u}^{1/\theta}\exp\left(\frac{-u}{\theta}\right)}{\theta^{1/\theta}\,\Gamma^{\theta}}$$

where θ > 0 and u > 1 indicates that individuals in group *i* are frail, whereas u < 1 indicates that individuals are strong and have lower risk. The corresponding Laplace transform is given by:

$$\mathrm{L(s)} = (1 + \theta\mathrm{s})^{\mathbf{1/\theta}}$$

Once the frailty is integrated out, accounting for unobserved heterogeneity is reduced to estimating the variance of the frailty term. The variance θ of the frailty term represents the heterogeneity among clusters (Duchateau and Janssen, 2008).

3.6.2 Inverse Gaussian distribution

The inverse Gaussian density function is given by:

$$f_u(\mathrm{u}) = ((a/2\pi)^{1/2}\mathrm{u}^{-3/2}\exp\left(\frac{-a}{2u\mu^2}\right)^2 \quad \text{with } \mu > 0 \text{ and } \alpha > 0.$$

The corresponding Laplace transform is:

$$f_u(\mathrm{u}) = exp(\frac{a}{\mu} - \left(2\left(\frac{a^2}{\mu^2}\right) + 2as)^{\frac{1}{2}}\right)$$

For $\mu = 1$, $\theta = \mathrm{V\,ar(U)} = 1/\alpha$ (as $\alpha = \infty$ corresponds with no heterogeneity (i.e., $\theta = 0$).

3.7 Baseline hazard distributions for parametric frailty models

The risk of an event occurring can be constant over time or with more complicated hazard rates that increase and decrease over time or that increase or decrease at faster or slower rates. Exactly how the hazard rate varies with time is generally referred to as time dependency. The logic of parametric duration models is that they assume a particular shape for the hazard rate. Below are some of the commonly used baseline hazards distributions:

3.7.1 Exponential distribution

For the exponential model, the hazard rate is characterized by:

$$h(t) = \lambda$$

This implies that the conditional probability of an event is constant over time. The corresponding cumulative hazard is given by;

$$\mathrm{H(t)} = \lambda \mathrm{t}.$$

3.7.2 Weibull distribution

The baseline hazard, h(t) can be chosen to follow a Weibull(λ; ρ) distribution which is more general and flexible than the exponential distribution. The Weibull baseline hazard allows for hazard rates that are non-constant but monotonic (Jenkins, 2008). The probability density function is given by:

$$f(t) = \lambda\rho t^{\rho-1} exp(-\lambda t\rho)$$

where, $\lambda > 0$ and $\rho > 0$ are shape and scale parameters, respectively. The corresponding survival function is given by;

$$\mathrm{S(t)} = \exp(-\lambda \mathrm{t}\rho)$$

The corresponding hazard function is given by;

$$h(t) = \frac{f(t)x^2}{s(t)} = \frac{\lambda\rho t^{\rho-1} exp(-\lambda t^{\rho})}{exp(-\lambda t^{\rho})} = \lambda\rho t^{\rho-1}$$

and the cumulative hazard is:

$$H(t) = \int_0^{\infty} h(x)d\,x = \int_0^{x} \lambda\rho t^{\rho-1} d\,x \quad = \lambda t^{\rho}$$

The hazard rises if $\rho > 1$, constant if $\rho = 1$ and decreases if $\rho < 1$. Exponential distribution is a special case of Weibull distribution when the shape parameter λ is 1.

3.7.3 Gompertz distribution

The Gompertz distribution is characterized by the fact that the log of the hazard function is linear in t(Jenkins, 2008):

$$\ln h(t) = \rho t + c$$

and after transformation, the hazard function for Gompertz distribution is given by:

$$h(t) = \lambda e^{\rho t}$$

where, $\lambda = e^{X\beta}$ and ρ is the shape parameter. The corresponding survival function is

$$S(t) = e^{-\lambda\rho-1}(e^{\rho t-1})$$

The corresponding cumulative hazard is given by;

$$H(t) = \int_0^{\infty} h(x)dx = \quad \int \lambda e\rho x dx \quad = \lambda\rho\,(e^{\rho}t - 1)$$

3.8 Methods of Estimation in parametric frailty model

When a parametric baseline hazard is assumed, maximum likelihood estimates can be obtained by maximizing the likelihood function. This not only makes estimation easier, but also describe explicitly the effect of the frailty on hazard ratios over time. Survival data consist of event times and censored observations and the likelihood function under right censoring is given by:

$$L = \prod \left[\left(1 - H_j(t)\right) f_j(t)\right]^{\delta_j} \left[\left(1 - F_j(t)\right) h_j(t)\right]^{1-\delta j}$$

where, δ_j is the censoring indicator, h and H are the hazard function and the cumulative distribution function of the censoring time, respectively. f and F are the density function and the cumulative distribution function of the event time, respectively. The distribution of censoring times in the likelihood function can be ignored because it does not depend on the parameters of interest related to the survival function (Ulviya, 2013). Therefore, the likelihood function for the jth subject assuming right censoring is of the form;

$$L = \prod (f_j(t))\delta_j(S_j(t))^{1-\delta j}$$

3.9 Comparison of Models

Model comparison and selection are among the most common problems of statistical practice, with numerous procedures for choosing among a set of models (Kadane and Lazar, 2001) and (Rao and Wu, 2001). There are several methods of model selection. The most commonly used methods include Akaike information and likelihood based criteria. A data-driven model selection method such as an adapted version of Akaike's information criterion AIC (Akaike, 1974) is used to find the truncation point of a series of models. In some circumstances, it might be useful to easily obtain AIC value for a series of candidate models (Munda et al., 2012). In this study, we used the AIC criterion and log likelihood to compare three of parametric models. AIC is defined as $AIC = -2\log(L) + 2(K+C)$

Where log(L) is the log-likelihood, K is the number of covariates in the model and C is the number of model-specific ancillary parameters. The addition of 2(K+C) can be thought of as a penalty if non predictive parameters are added to the model. Small values of AIC suggest a better model.

3.10 Model Diagnostics

The use of diagnostic procedures for model checking diagnostics is an essential part of the modeling process. There are different commonly used model diagnostics to evaluate whether the appropriate functional form for a covariate is used in the model to assess the fitted model.

3.10.1 Cox-Snell Residuals

The Cox-Snell residual for the individual with observed survival time that a hazard plot versus the Nelson-Alan estimator of the cumulative hazard of the residual should be a straight line with slope unity and zero intercept. In general, Cox-Snell residual provides a check of the overall fits of the model (Cox and Snell, 1968).

Chapter 4: Data Analysis

4.1 Descriptive Result

Table 4.1 shows the descriptive results of time to use modern contraceptive method among all women in terms of socio – economic and demographic factor. The total number of women in the study was 7,890. Out of 7,890 women, about 6,829(86.55%) didn't use modern contraceptive methods or censored while 1,061(13.45%) used modern contraceptive method during the follow-up period. The minimum and maximum value of time to use modern contraceptive method of women were 1 and 30 years, respectively. The overall mean and median uptake time were 23.45006 and 22 years, respectively, during the study period.

Among the age category about 20.69% of the women aged between 25-29 year have used modern contraceptive method. It is 20.52% of the women aged between 20-24 year have used modern contraceptive method. It is 19.83% of the women aged between 30-34 year used modern contraceptive method. It is 5.56% of the women aged between 45-49 years used modern contraceptive method. With regards to place of residence, it is 6.83% of women in urban areas used modern contraceptive method whereas 6.62% were found in rural areas.

The use of modern contraceptive method by religious categories, about 23.9% of orthodox religious followers women were used modern contraceptive method and 17.99% of protestant women were used modern contraceptive method and also 7.53% of Muslim women used modern contraceptive method. 13.57%, 19.51% and 11.07% of marital status of women who used modern contraceptive methods for married, never married and others have use modern contraceptive method respectively. It is 14.24%, 11.07% and 10.97% of women have illiterate, primary education and above secondary education level used modern contraceptive method respectively.

With regard to region about 25.44% of women who live in Addis Ababa have used modern contraceptive method. It is 29.20% of women who live in SNNPR have used modern contraceptive method. And also 18% of women who live in Oromia have used modern contraceptive method. It is 0.67% and 6.20% of women who live in Somali and Gambella have less used modern contraceptive method respectively.

With regards to wealth index, about 23.10%, 14.07% and 6.44% of women have rich, middle and poor respectively were used modern contraceptive methods.

Table 4.1: Descriptive results for socio-economic and demographic characteristics of modern contraceptive method among women in Ethiopia: EDHS (2016)

No.	Covariate	Categories	Status of censoring and event		Total (%)
			Event	**Censored**	
1	Age	15-19	10 (11.24%)	79(88.76%)	89 (1.13%)
		20-24	95(20.52%)	368 (79.48%)	463 (5.87%)
		25-29	204(20.69%)	782 (79.31%)	986 (12.50%)
		30-34	284(19.83%)	1148 (80.17%)	1432 (18.15%)
		35-39	260(14%)	1597 (86%)	1857 (23.54%)
		40-44	122(8.05%)	1394 (91.95%)	1516 (19.21%)
		45-49	86(5.56%)	1461 (94.44%)	1547 (19.61%)
2	Type of place of residence	Urban	539(6.83%)	4,306 (54.58%)	4845 (61.4%)
		Rural	522(6.62%)	2,523 (31.98%)	3045 (38.6%)
3	Religion	Orthodox	450(23.91%)	1432 (76.09%)	1882(23.85%)
		Muslim	328(7.53%)	4030 (92.47%)	4358(55.23%)
		Protestant	270(17.99%)	1,231(82.01)	1501(19.02%)
		Other	13 (8.72%)	136 (91.28 %)	149 (1.90%)
4	Marital status	Never married	8(88.89%)	1 (11.11%)	9 (0.12%)
		Married	953 (13.57%)	6,069 (86.43%)	7022 (88.99%)
		Other	107 (12.46%)	752 (87.54 %)	859 (10.90%)
5	Educational level	Illiterate	844 (14.24%)	5,081 (85.76%)	5925 (75.10%)
		Primary	168(11.07%)	1,350 (88.93%)	1518 (19.24%)
		Secondary and above	49(10.98%)	398(89.04%)	447 (5.67%)
6	Wealth index	Poor	267(6.44%)	3,881 (93.56%)	4148 (52.60%)
		Middle	109(14.05%)	667 (85.95%)	776 (9.84%)
		Rich	685(23.10%)	2281(76.90%)	2966 (37.60%)
7	Region	Tigray	128 (20.88%)	485(79.12%)	613 (7.77%)
		Afar	49 (4.79%)	974(95.21%)	1023 (13%)
		Amhara	65(22.11%)	229(77.89%)	294 (3.73%)
		Oromia	132 (18%)	599(82%)	731 (9.3%)
		Somali	11 (0.67%)	1633(99.33%)	1633 (20.84%)
		Benishangul	74 (14.40%)	440(85.60%)	514 (6.51%)
		SNNPR	218(25.44%)	639(74.5%)	857 (10.86%)
		Gambela	48(6.20%	727(93.8%)	775 (9.82%)
		Harari	76(19.64%	311(80.36%)	387 (4.90%)
		Addis Adaba	146(29.20%)	354(70.80%)	500 (6.33%)
		Dire Dawa	114(20.65%)	438(79.35%)	552 (6.996%)
8	Work status	No	57(12.20%)	410(87.80%)	467 (5.92%)
		Yes	1004(13.53%)	6419(86.47%)	7423 (94.08%)
9	Heard family planning on radio	No	706 (10.90%)	5767(89.10%)	6473 (82%)
		Yes	355(25.05%)	1062(74.95%)	1417(17.9%)

	last few months				
10	Heard family planning on TV last few months	No	667(10.33%)	5787(89.67%)	6454(81.8%)
		Yes	394(27.44%)	1042(72.56%)	1436(18.20%)
11	Heard family planning in newspaper/magazine last few months	No	982(12.88%)	6645(87.12%)	7627(96.70%)
		Yes	79 (30.04%)	184(69.96%)	263(3.33%)

4.1.1 The Kaplan-Meier Estimator

Figure 4.1 shows that the median time for the occurrence of the event is estimated from the kaplan-meier curve as the X- axis (time) value at the point where a horizontal line at the 50% survival probability on the y -axis crosses the survival curve is approximately 22.

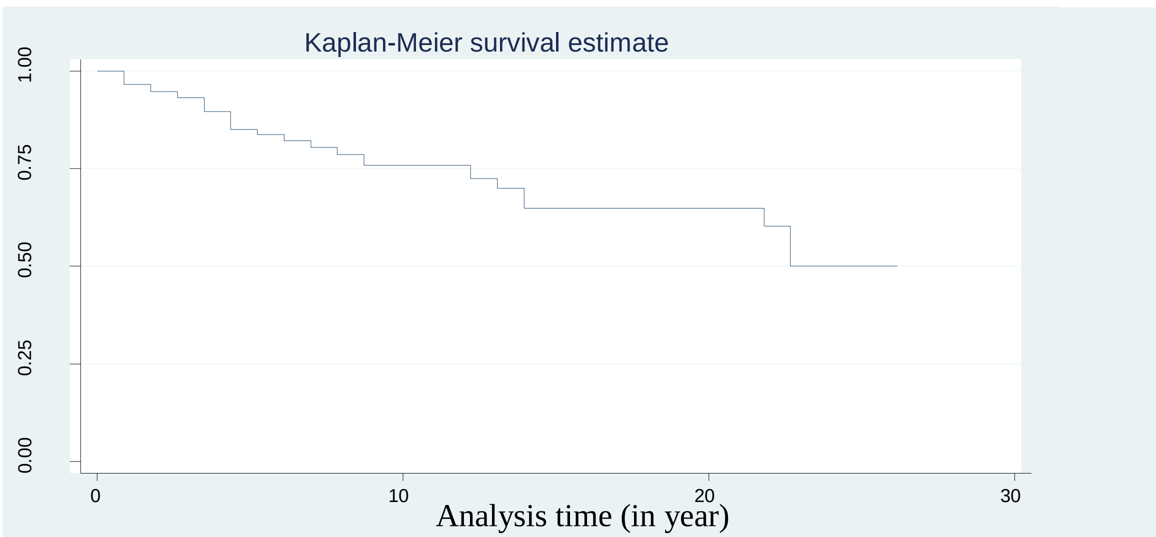

Figure 4.1: Overall estimate of Kaplan-Meier survivor function of the use of modern contraceptive method among women in Ethiopia

As shown in Figure 4.2, women who live in urban areas use modern contraceptive method for longer time than women who live in rural areas after they start sexual intercourse.

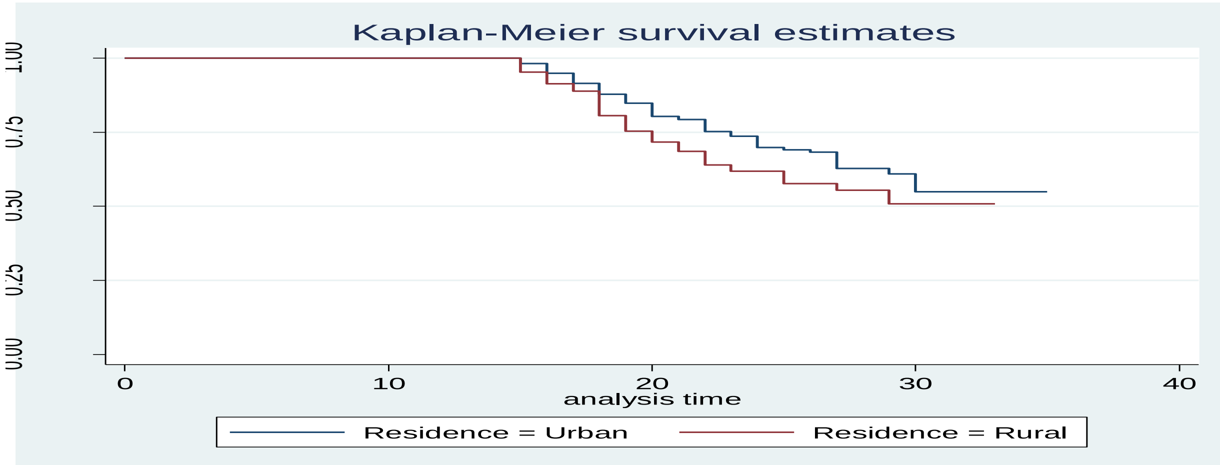

Figure 4.2: The plot of Kaplan-Meier survivor function by place of residence

The log-rank test shows the test that the two survival function are equal and log-rank test of the result were use of modern contraceptive method in different categories of age, place of residence, wealth index, marital status, religion, region, and educational status and heard family planning on radio, TV and newspaper were significantly different at 5% level. And there were no significant differences in survival function between the categories of work status (Table 4.2).

Table 4.2: Results of the log-rank test for each categorical variables of modern contraceptive method among women in Ethiopia: EDHS (2016)

Covariate	Df	Chi-Square	Sig
Age	5	306.465	.000
place of residence	1	143.129	.000
Wealth index	2	415.774	.000
Marital status	2	13.121	.022
Religion	5	293.869	.000
Region	10	546.551	.000
Education	2	8.842	.031
Work status	1	0.187	0.665
Heard family planning on radio last few months.	1	138.098	.000
Heard family planning on TV last few months.	1	164.510	.000
Heard family planning on newspaper last few months	1	34.980	.000

4.2 Univariate Parametric Survival Analysis

We used univariate analysis in order to see the effect of each covariate on the time-to-use modern contraceptive method before proceeding to the multivariable analysis at 25% level of significance. The results in Appendix 1 show that age, place of residence, wealth index, educational status, heard family planning by TV were significant whereas work status, religion, marital status and heard family planning on newspaper were not significant.

4.3 The Multivariable Analysis and Model Comparisons

4.3.1 Model Comparisons

The aim of model comparison is to obtain a model that describes the dataset well. Multivariable analysis of exponential, Weibull and Gompertz parametric models were compared by using all significant covariates in univariate analysis. Weibull distribution with Gama shard frailty model were appropriate to fit the time to use modern contraceptive method among women in Ethiopia (Table 4.3).

Table 4.3: Model comparisons

Model	-2LL	AIC
Exponential with Gamma frailty	-2600.987	5229.973
Gompertz with Gamma frailty	-1350.345	2730.691
Weibull with Gamma frailty	**-1162.281**	**2354.562**
Exponential with Inverse Gaussian frailty	-2604.631	5237.263
Gompertz with Inverse Gaussian frailty	-1354.294	2738.588
Weibull with Inverse Gaussian frailty	-1166.437	2362.874

4.3.2 Test of heterogeneity

The variance of the frailty term θ are significantly different from zero, meaning that there is heterogeneity between subjects. We can deduce this by using a Wald test: $W_m(\theta) = 0.426 /0.178= 2.40> 1.64$ with 1.64 the critical value for a normal one-sided test. And the likelihood ratio test for the hypothesis $\theta=0$ was significant with p-value of 0.001. This indicates that the frailty component had significant contribution to the model.

4.3.3. Multivariable Analysis of Weibull Gamma Shared Frailty Model

In order to decide whether or not a variable is significant, the p-value less than 5% significance level was considered. As shown in Table 4.4, time to use modern contraceptive method was significantly associated with age, type of residence, wealth index and education level and heard information on TV. The estimated random effect (the frailty term), 0.426 was also significant which indicate the use modern contraceptive method differences across the regions and which was an indication for the existence of unobservable heterogeneity in the data.

The estimated coefficients of weibull gamma shared frailty model can also interpret by using time ration. The time ration for the case of weibull regression survival model represents the relative risk which was interpreted.

Table 4.4 shows there was a significant association between women age group and time to use modern contraceptive methods. The estimated time to modern contraceptive uptake for the age group between 35-39 years, 40-44 years and 45-49 years increased by 21.6%, 28.5%, 46.6%, respectively, as compared with women whose age group were between 15-19 years, holding the effect of other variables constant. In Ethiopian context most of the time women who do not get medical help is women's who resides in rural areas and the result of this study also revealed that residence has significant effects which showed that women residing in rural area the estimated time to use modern contraceptive method were decreased 15.5% in comparison with women residing in urban areas.

Table 4.4 also shows the wealth index has significant effect on time to use modern contraceptive method. The relative risk of time to use modern contraceptive method were decreased by 8.3% and 17.3% for middle and rich as compare with the women who had poor wealth index categories, respectively, holding the effects of other variables constant.

The educational level of women had a significant effect on time to use modern contraceptive method. The estimated time to modern contraceptive uptake were increased by 5.5% and 5.6% for primary, secondary and above, respectively, as compared with illiterate women while holding other variables constant in the model. With regards to the significant effects of heard information on TV, the relative risk of time to use modern contraceptive method decreased by 5.2% as compared with no heard family planning by TV women which were holding the effects of other variables constant.

Table 4.4: Results of the multivariable analysis of weibull regression and gamma shared frailty models

Covariate	Categories	Time Ratio	Std. Err	P>|z|	[95% Conf. Interval]	
					LCL	UCL
Age	15-19(Ref)					
	20-24	1.036	0.058	0.531	0.928	1.156
	25-29	1.112	0.061	0.053	0.999	1.237
	30-34	1.099	0.060	0.081	0.988	1.223
	35-39	1.216	0.066	0.000	1.093	1.353
	40-44	1.285	0.071	0.000	1.153	1.433
	45-49	1.466	0.082	0.000	1.313	1.637
Place of residence	Urban (Ref)					
	Rural	0.845	0.012	0.000	0.823	0.868
Wealth index	Poor (Ref)					
	Middle	0.917	0.018	0.000	0.882	0.954
	Rich	0.827	0.013	0.000	0.802	0.852
Education level	Illiterate (Ref)					
	Primary	1.055	0.015	0.000	1.025	1.085
	Secondary and above	1.056	0.026	0.027	1.006	1.109
Heard family planning on TV	No (Ref)					
	Yes	0.948	0.014	0.000	0.921	0.975
Intercept		25.780	1.669	0.000	22.708	29.267
P		5.984	0.150		5.696	6.286
that		0.426	0.178		0.188	0.964

Likelihood-ratio test of theta=0: chibar2(01) = 325.79 Prob>=chibar2 = 0.000 β= coefficient, s.e= standard error, 95% CI=Confidence Interval for β, LCL=lower Class Limit, UCL=Upper Class Limit, Ref=Reference, Z= Score statistic, AIC= Akaike Information Criteria.

4.4 Model Diagnostics

The Cox- Snell residuals had been obtained from fitting using the Weibull gamma shared frailty model. It can be seen that the plot of the cumulative hazard function against Cox-Snell residuals is straight lines through the origin which indicates that the model best fits the data.

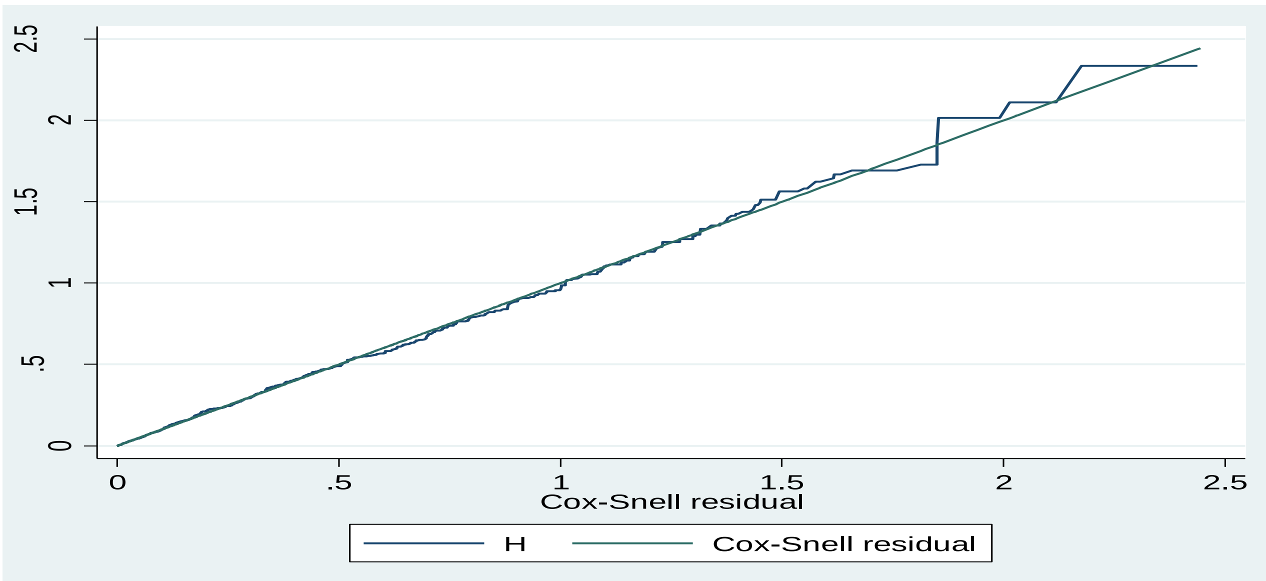

Figure 4.3: Cox Snell residual for Weibull gamma shared frailty model

Chapter 5: Discussion

5.1 Discussion

The main objective of this study was to identify the main factors associated with the time to use modern contraceptives method among all women in Ethiopia. The associated risk factors by applying an appropriate frailty survival model were considered for the study.

Currently, provision of safe, effective and affordable modern contraceptive methods for family planning is emphasized to achieve high levels of demand satisfied through addressing both women's and men's sexual and reproductive health needs. The descriptive results show that out of total 7,890 women, about 6,829 (86.55%) didn't use modern contraceptive methods while 1,061(13.45%) were using modern contraceptives method at the time of survey. In the final model, a total of five variables had significant association with time to use modern contraceptive among women.

Women in the age categories of 35-39, 40–44 and 45-49 years took modern contraceptives method for longer time as compared to women in the age categories of 15–19 years. A study by Tamerat and Sheweno (2020) showed that women aged 35 years and below were less likely to use modern contraceptive method as compared to those above 35 years. With regards to place of residence, women from urban areas had used modern contraceptive methods for longer period than in rural areas. This finding agree with results by Tilahun (2013) in which women who live in urban areas use modern contraceptives better than those in rural counter parts.

Women who attended primary, secondary and higher education use modern contraceptive method longer as compared to illiterate women. This finding was agrees with a study conducted by Susan Ontiri, (2020). In that a woman with primary, secondary and above level of education were more likely to use modern contraceptives. Women who watch TV used modern contraceptive method. This finding was agreement with a study conducted by Shaweno and Kura (2020). And variables such as marital status, partners working, frequency of listening to radio did not use of modern contraceptive method. A study by Tamrat and Zerihun (2020) showed that marital status, partners working, frequency of listening to radio used modern contraceptive methods.

5.2 Conclusions

The study identify there were the estimated time to use modern contraceptive method by age, place of residence, wealth index, marital status, education, media including newspaper, radio and TV based on the result of log rank test of Kaplan-Meier estimated survival curve. Among the fitted frailty models weibull gamma shared frailty model was an appropriate fit of time to use modern contraceptive method.

The result of multivariable analysis using the weibull regression survival model with gamma frailty model showed that age group, place of residence, wealth index, educational level and heard family planning on TV were significant factors for the time-to-use modern contraceptive method.

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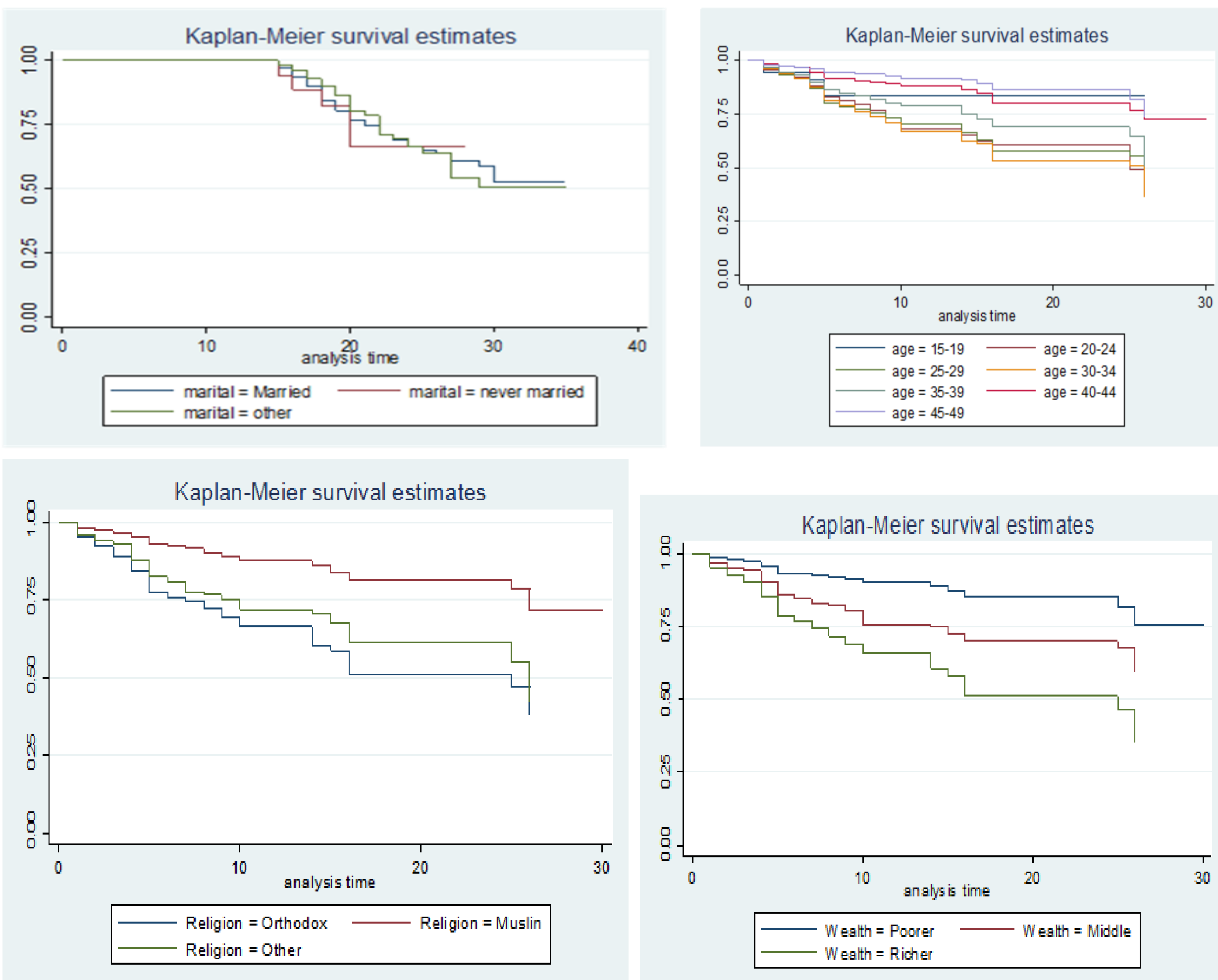
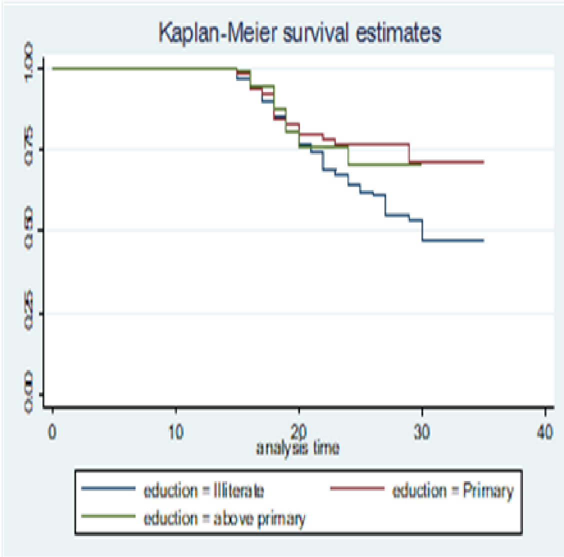
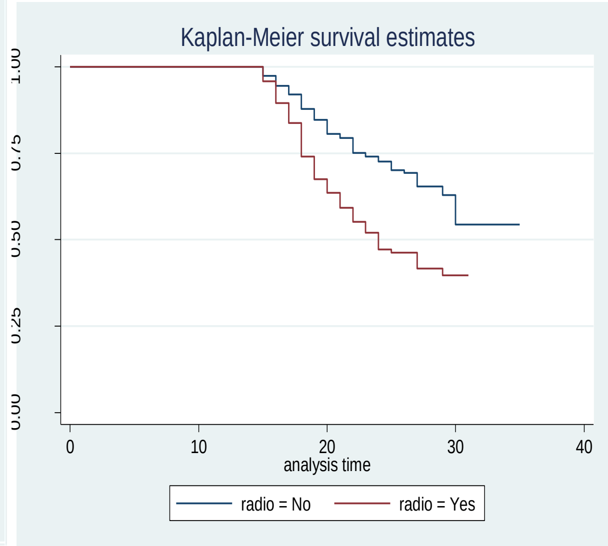
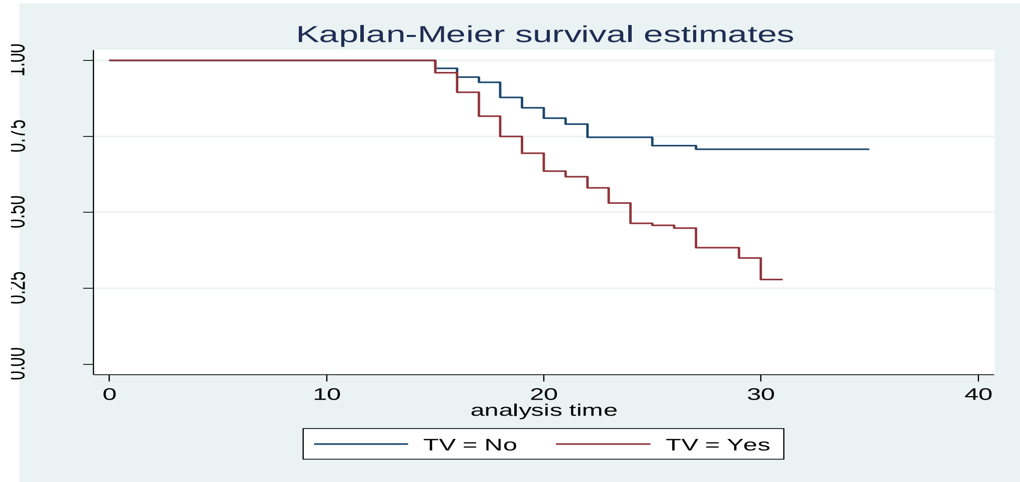
Appendix 1 **Figure 1 : Plots of Kaplan-Meier survivor functions based on different factors,**




Kaplan-Meier survival estimates
1.00
0.75
0.50
0.25
0.00
0
10
20
30
40
analysis time
eduction = Illiterate
eduction = Primary
eduction = above primary


Kaplan-Meier survival estimates
1.00
0.75
0.50
0.25
0.00
0
10
20
30
40
analysis time
radio = No
radio = Yes


Kaplan-Meier survival estimates
1.00
0.75
0.50
0.25
0.00
0
10
20
30
40
analysis time
TV = No
TV = Yes

Appendix 2

Results of univariable analysis using exponential gamma shared frailty univariate Analysis

Covariate	Categories	Time Ratio	Std. Err	Z	P>|z|	[75% Conf. Interval]	
						LCL	UCL
Age	15-19(Ref)						
	20-24	0.744	0.248	-0.886	0.376	0.507	1.092
	25-29	0.971	0.316	-0.089	0.929	0.668	1.412
	30-34	1.003	0.324	0.010	0.992	0.692	1.455
	35-39	1.557	0.504	1.368	0.171	1.073	2.260
	40-44	2.380	0.787	2.623	0.009	1.627	3.482
	45-49	3.701	1.242	3.901	0.000	2.516	5.444
Type residence	Urban (Ref)						
	Rural	0.538	0.038	-8.800	0.000	0.496	0.583
Religion	Oertodex(Ref)						
	Muslin	1.542	0.141	4.746	0.000	1.388	1.713
	Protestant	0.982	0.103	-0.171	0.864	0.871	1.108
	Others	1.896	0.543	2.234	0.025	1.364	2.636
Wealth index	Poor (Ref)						
	Middle	0.815	0.096	-1.728	0.084	0.711	0.934
	Rich	0.438	0.036	-9.929	0.000	0.398	0.482
Marital status	Never married (Ref)						
	Married	0.767	0.768	-0.265	0.791	0.242	2.428
	Others	0.761	0.766	-0.272	0.786	0.239	2.421
Education	Illiterate(Ref)						
	primary	1.263	0.107	2.755	0.006	1.146	1.393
	Secondary and above	1.261	0.186	1.575	0.115	1.064	1.493
Heard family planning on radio last few months.	No (Ref)						
	Yes	0.643	0.045	-6.277	0.000	0.593	0.697
Heard family planning on TV last few months.	No (Ref)						
	Yes	0.499	0.039	-8.862	0.000	0.456	0.546
Heard family planning on newspaper last few months	No (Ref)						
	Yes	0.637	0.077	-3.748	0.000	0.554	0.731

β= coefficient, s.e= standard error, 95% CI=Confidence Interval for β, LCL=lower Class Limit, UCL=Upper Class Limit, Ref=Reference, Z= Score statistic