IDENTIFYING THE PREDICTORS ASSOCIATED WITH TIME TO DISCONTINUATION OF INTRAUTERINE DEVICE AMONG WOMEN OF REPRODUCTIVE AGE AT ARBA MINCH TOWN AND ZURIA WOREDA, GAMO ZONE, SOUTHERN ETHIOPIA

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ABSTRACT

BACKGROUND: Intrauterine device (IUD) is the world's most widely used long acting reversible birth control method. But, premature discontinuation of family planning remains common in many developing countries including Ethiopia. This study was aimed to assess predictors that influence the time to discontinuation of Intrauterine device among women who ever used IUD in Arba Minch Town and Zuria Woreda, Southern part of Ethiopia.

METHODS: A retrospective cohort study design was carried and stratified random sampling technique was used to determine sample of size 230 from a total population of 25,658 Women. The Kaplan-Meier estimation method was used to compare the survival experience of IUD discontinuation with respect to different covariates. Three parametric accelerated failure time models were compared by using Akaike information criterion (AIC) and Bayesian information criterion (BIC).

RESULT: Accelerated failure time model with Weibull distribution was found to be appropriate model to fit the data set. The results indicated that the baseline age group of the women's (25-35: HR= 1.266, P-value=0.0287; 36-49: HR= 1.770, P-value=0.0031), place of insertion (HR=0.192, P-value=0.006), HIV test (HR=0.731, P-value=0.004), income (HR=0.783, P-value=0.046) and educational level of women (HR=1.352, P-value=0.004) were significantly associated with time to discontinuation of IUD. Hence, illiterate women with low income and refused to test for HIV had higher hazard rate for time to discontinuation of IUD.

CONCLUSION: From these analyses we conclude that the covariates such as age, place of insertion, HIV test, income and education are associated with time to discontinuation of IUD in classical approach. So, we recommended that for all health care providers and responsible bodies these factors should be considered when planning and implementing IUD use to increase survival time of utilization. IUD insertion at health posts is not preferable and the performance of HIV test before the insertion of the device is recommended.

KEYWORDS: Intrauterine Device, Time to discontinuation, Accelerated failure time, Weibull distribution.

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INTRODUCTION

Intrauterine device (IUD) is the world's most widely used method of reversible birth control. It is currently used by nearly 163 million women worldwide[1]. It is a flexible frame that fits inside the uterus to prevent pregnancy and the most frequently used reversible family planning method[2]. Copper IUD (TCU380A) is that the first sort of IUD that's claimed to be highly effective in preventing pregnancy, with protection lasting up to 12 years. It represents the most cost-effective reversible method[3].

Globally, approximately 13% of all women of reproductive age use the IUD, making it the second popular contraceptive. However, fears about side effects, concerns about infection and infertility, lack of technical training for providers, and therefore the time and costs involved in providing services combine to discourage use of IUDs in many countries. Some studies revealed that up to 80 percent of IUD users complain of increased menstrual bleeding and pain[4]. Beside its popularity usage is low in many developing countries with a majority of women choosing other method for birth control. Even though it's ideal in numerous ways, the history of its development reflects continual adaptations to attenuate the side effects that cause discontinuations, and to maximize both contraceptive and non-contraceptive health benefits. The IUD should play a greater role than it does today in parts of the world, and especially in sub-Saharan Africa, where fertility rates, unintended pregnancies, and unmet need for contraception are high[5]. Improving the quality of the use of contraceptives is one of the main objectives of family planning programs and the discontinuation rates of their use is one among the foremost important indicators of their quality.

The low rate of IUD usage in Africa 1% was a function of a number of factors. Lack of knowledge of IUD and pelvic inflammatory diseases were noted as major barriers to the use of this contraceptive among women in the southern African region[6]. In the African region utilization of long- acting family planning methods such as IUD and implants are very low as compared to the global figure. In sub-Saharan African countries the proportion of girl's currently using long acting is significantly less than the proportion of using short-acting methods. In many countries in the region, fewer than 5 percent of women who are using contraception are using long- acting methods i.e., 0.7% IUD and 1.1% Implant[7].

Maternal mortality is one of the major health problems in many less developed countries including Ethiopia. The majority of maternal deaths are the direct result of complications encountered during pregnancy and arising from unsafe terminations of pregnancies[8]. Worldwide, every day, approximately 830 women die from preventable causes related to pregnancy and childbirth. Nearly all these deaths occur in developing countries, due to unsafe abortions[9]. In different countries, a significant number of women become exposed to the risk of conception after discontinuation of IUD. Consequently, the majority of unintended pregnancies ended with abortion or miscarriage [10]. Despite the improvement in availability and utilization of IUD, discontinuation is becoming a major problem. From the available limited research, it was indicated that side effects and health concerns like irregular bleeding, lower abdominal pain, and vaginal discharge play an important role in discontinuation[11].

Premature discontinuation of family planning remains common in many developing countries including Ethiopia. Contraceptive discontinuation is common, occurring most often during the first 12 months of adoption of a method. Actual levels of discontinuation vary according to country. In Ethiopia, according to Ethiopian Demographic Health survey (EDHS) in 2016, all modern contraceptive methods discontinuation rate was 35% and among them IUD discontinuation rate within 12 months was just 13%[12,13]. Therefore, this study intended to assess the factors that are associated with time to discontinuation of IUD

among women of reproductive age group at Gamo Zone, in the case of Arba Minch Town and Zuria Woreda, Southern part of Ethiopia.

METHODOLOGY

Study Setting and Design

A retrospective cohort study design was carried by record review of mothers who have used IUD between September 2014 to December 2019 at Arba MinchTown and Zuria Woreda Public Health facilities, Gamo Zone, Southern part of Ethiopia. Health facility-based cohort study design using secondary data from the retrospective records of mother's who had used IUD was conducted based on data from the family planning registration books.

Study Population

From the family planning unit, IUD removal records were retrieved and reviewed during the period of study. All women who had used their IUD between September 2014 to December 2019 were included while women those whose insertion date before September 2014, and after December 2019 was excluded.

Sample Size Determination

In this study all mothers that follow-up their IUD was considered and stratified sampling technique was used to select the sample. During this method, stratification was based on the place of residence. So, that the whole heterogeneous population is spilt in to varity of homogeneous groups, usually referred to as strata, each of those groups is homogeneous within itself, then stratum or subgroup are chosen using simple random sampling because evidence is out there that they're associated with outcome. Sample size was computed by using formula for stratified sampling technique. A sample of size 230 women was used from a total of 25658 women's who were utilized IUD between a specified time.

Variables in the Study

The outcome variable of this study was the survival time to discontinuation of IUD from September 2014 to December 2019.For Women who were using IUD at the cut-off date i.e., at December 2019 or removal of IUD at recommended time in the study period, the outcome was censored otherwise the outcome was an event. By event, we mean that discontinuation of IUD in the study period and censoring mean removal of IUD at recommended time in the study period or using IUD at the cut-off date i.e., at December 2019. Predictors variables that are considered in this study are: age group of women, place of insertion, status of HIV test, HIV test result, place of residence, experience of utilization of IUD, income level of women and educational status of women.

Data Collection Methods

Data relating to the most important variables was collected from selected records of mothers who have used IUD from family planning removal registration books in Public Health facilities in Gamo Zone Arba Minch Town and Zuria woreda between September 2014 to December 2019.

Data Quality Control

The data was collected and checked for completeness and consistency. The validity of data relating to the most important variables collected from all selected records of mothers who have used IUD from family planning registration book was checked and also mothers who would have incomplete records and who was used IUD but whose record lack the insertion and/or removal data was checked. Arrangement made to enter data after each day field work was complete.

Data Processing and Analysis

Survival analysis is the analysis of time-to-event data. Such data describe the length of time from a time origin to an endpoint of interest. Survival analysis methods are usually used to analyze data when major interest is time to occurrence of an event. Such event may be death, recovery, employment, marriage and so on. However, not all individuals could have experienced the event of interest before end of study, implying that real time of event is not available for some individuals, this is called censoring. Survival models fall into parametric, non-parametric and semi-parametric schools of thought[14,15]. The differences in the classes of models lie mainly in assumptions made regarding

the distribution of the survival time[16]. Hence, in this study descriptive analysis, Kaplan Meier estimator which readily comes to mind when discussing nonparametric approach and accelerated failure time parametric survival models under Weibull, lognormal and log-logistic statistical distributions were used to identify the factors associated with time to discontinuation of intrauterine device among women of reproductive age at Gamo Zone, Arbaminch town and zuria Woreda, Southern part of Ethiopia. To select the appropriate parametric family of model for time to discontinuation of IUD, Akaike information criterion (AIC) and Bayesian information criterion (BIC) are employed as model comparison criterion[17,18].

Ethical Consideration

After thorough revision of the thesis by Arba Minch University Ethical review board, Ethical clearance was obtained. Official letter was written to Arba Minch Town Administration and Zuria district health office and respective Keble public health services administration. Public health is going to be informed the advantage of the study and therefore the time it will deem obtaining data and the information was kept anonymously and confidentially.

RESULTS

Descriptive Analysis

From a total 230 sample of women considered, 84(36.5%) were in the age group 15-25 years who experienced events of interest, i.e., discontinued using IUD in a study period, i.e., between September 2014 to December 2019while the remaining 6(2.6%) were censored. The majority of the discontinuation were observed at the age group of 26-35 years,i.e., 97(42.2%) were discontinued using IUD in a study period whereas 16(7%) were censored. Regarding place of insertion 38(16.5%) were inserted IUD at Hospital who are discontinued using IUD in a study period and 8(3.5%) women were censored, i.e., removed IUD at recommended time within the study period or found using IUD at the cut-off date i.e., at December 2019. The majority of discontinuation, 136(59.12%) were observed among those who were inserted at health center, 20(8.7%) were censored, i.e., were removed IUD at recommended time within the study period or found using IUD at the cut-off date i.e., at December 2019.

Table 1: Descriptive summary of different categories of predictors by time to discontinuation of IUD IUD among women of reproductive age group at Gamo Zone, in the case of Arba Minch Town and Zuria Woreda, Southern part of Ethiopia during study time.

Predictors	Category	Survival status	
		Event (%)	Censored (%)
Age group	15-25	84(36.5%)	6(2.6%)
	25-35	97(42.2%)	16(7%)
	36-49	20(8.6%)	7(3.03%)
Place of insertion	Hospital	38(16.5%)	8(3.5%)
	Health center	136(59.12%)	20(8.7%)
	Health post	27(11.74%)	1(0.43%)
Status of HIV test	Performed	77(33.5%)	13(5.7%)
	Refused	124(53.92%)	16(7%)
Place of residence	Rural	112(48.7%)	9(3.9%)
	Urban	89(38.7%)	20(8.7%)
Experience of utilization of IUD	Yes	26(11.33%)	2(0.9%)
	No	175(76.1%)	27(11.7%)
Income of women	Low	136(59.14%)	25(10.9%)
	Medium	46(20.01%)	3(1.3%)
	High	19(8.3%)	1(0.4%)
Educational level of women	Literate	106(46.1%)	9(3.9%)
	Illiterate	95(41.3%)	20(8.7%)

Regarding to place of residence, 112(48.7%) women were from rural who were experienced event, i.e., discontinued using IUD in a study period, i.e., between September 2014 to December 2019 while 9(3.9%) were censored. 89(38.7%) of women were from urban area who were discontinued using IUD in a study period, i.e., between September 2014 to December 2019while 20(8.7%) were censored. Hence, it appeared that proportion of discontinuation of IUD was higher in a rural than the urban (see Table 1).

Among 230 women, 201(87.4%) were discontinued using IUD in a study period, i.e., between September 2014 to December 2019 while the remaining 29(12.6%) were censored i.e., removed IUD at recommended time within the study period or found using IUD at the cut-off date i.e., at December 2019.

Furthermore, K-M estimator survival curve which gives the estimate of survivor function among different groups of covariates was used to describe time to discontinuation of IUD as depicted below:

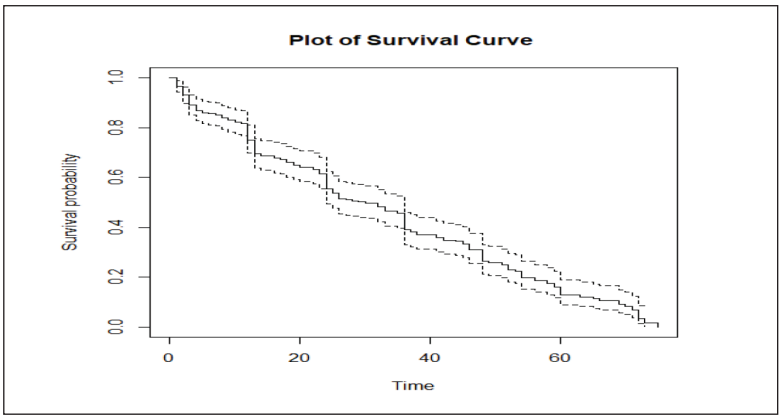

Figure 1:Kaplan Meir survival curve for time to discontinuation of IUD

In general survival probability of time to discontinuation of IUD appeared decrease with increase in follow up time (see Figure 1).When comparing survival probability of time to discontinuation of IUD by subgroups of covariates, women's who reside in rural area seems to have low survival probability of time to discontinuation of IUD than the women who reside in urban area (see Figure 2). Moreover, it appeared that illiterate women had higher survival probability of time to discontinuation of IUD than women with literate educational status (see Figure 3).

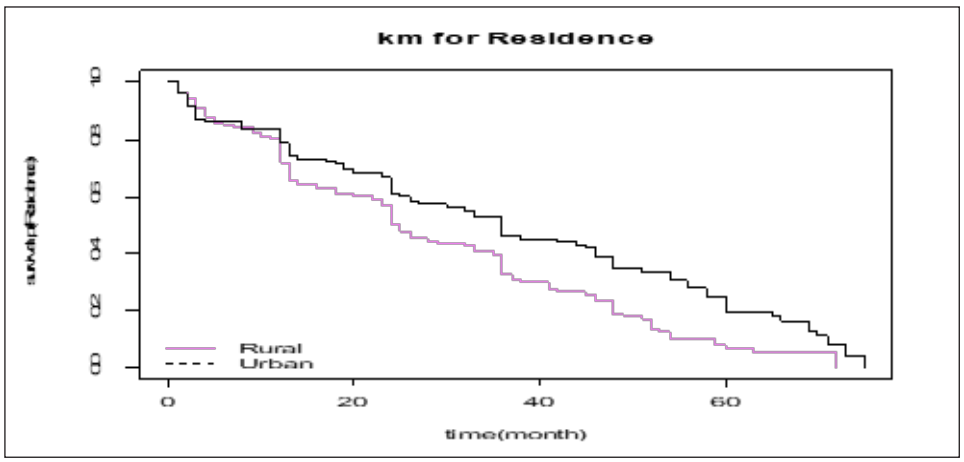

Figure 2:Kaplan Meir survival curve for time to discontinuation of IUD by place of residence

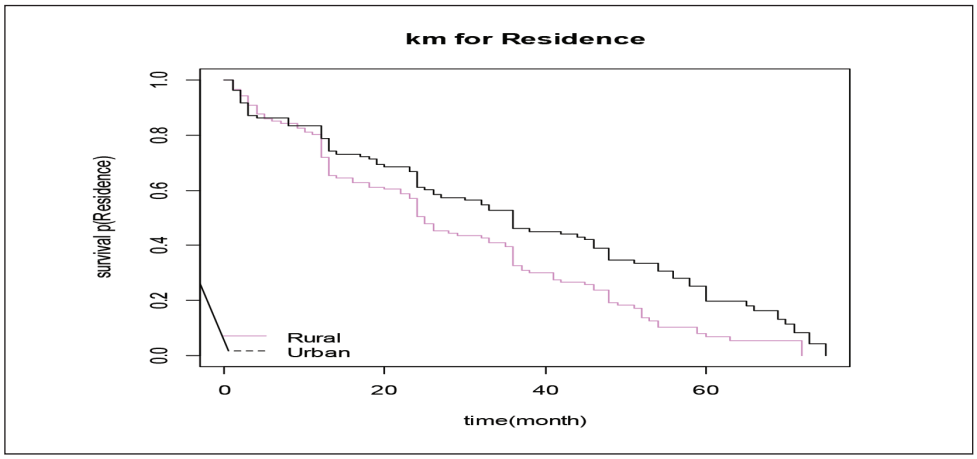

Figure 3: Kaplan Meir survival curve for time to discontinuation of IUD by educational level of women.

Accelerated Failure Time Analysis

Multivariable analysis of several key covariates that affect the survival time to discontinuation of IUD is vital to ascertain cumulative effect on survival of the women. Accelerated failure time models are parametric models that the basis to avoid having to specify the hazard function completely. However, there may be settings in which the distribution of the survival time is in specific parametric distribution that justifies the use of a fully parametric model to better address the goal of the analysis.

We applied three parametric models namely Weibull, Lognormal and Log-logistic models as a parametric distribution model of survival time. That is, we assume that the survival time for the ith subject follows either the Weibull, lognormal or log-logistic distribution.

Table 2: The values AIC and BIC for model comparison of time to discontinuation of IUD IUD among women of reproductive age group at Gamo Zone, in the case of Arba Minch Town and Zuria Woreda, Southern part of Ethiopia during study time

Comparison criterion	Models		
	AFT under Weibull	AFT under Loglogistic	AFT under Lognormal
AIC	1710.6	1750.8	1761
BIC	1715.3	1755.5	1765.7

Accelerated failure time models under three parametric distributions namely Weibull, Lognormal and Log-logistic were fitted and compared by using Akaike Information Criterion (AIC), and Bayesian Information Criterion (BIC). Hence, accelerated failure time(AFT) model under Weibull distribution has smaller AIC and BIC indicating Weibull AFT model is a better model fit data on time to discontinuation IUD (see Table 2).

Table 3: Accelerated failure time Weibull regression model parameter estimates of time to discontinuation of IUD IUD among women of reproductive age group at Gamo Zone, in the case of Arba Minch Town and Zuria Woreda, Southern part of Ethiopia during study time

Predictors	Categories	β	S.E(β)	HR=exp(β)	p-values
Age group	15-25(ref)				
	25-35	0.236	0.1080	1.266	0.0287*
	36-49	0.571	0.1930	1.770	0.0031*
Place of insertion	Hospital(ref)				
	Health center	-0.229	0.135	0.795	0.090
	Health post	-0.521	0.1920	0.593	0.006*
Reason for removal	Recommended time(ref)				
	Side effect	-13.941	2211.0933	8.821	0.995
	Want to pregnant	-13.764	2211.0933	1.052	0.995
	Misconception	-15.021	2211.0933	2.995	0.994
	Yes(ref)				
Status of HIV test	No	-0.312	0.1084	0.731	0.004*
Income level of women	Low(ref)				
	Medium	-0.244	0.1230	0.783	0.046*
	High	-0.178	0.1832	0.836	0.329
Educational level	Literate(ref)				
of women	Illiterate	0.302	0.1035	1.352	0.004*

Note:β is estimated parameters, S.E(β) represent standard error of estimated parameters, HR=exp(β) represent hazard rate, * represent significant p-values at 5% and ref denotes reference category.

Table 3 presents the estimates (estimated parameters, standard error of estimated parameters, hazard rate (HR) and p-values) from accelerated failure time Weibull regression model. Among the potential independent variables explored, educational status of mothers, age of women, income status of women, place of insertion and status of HIV test were statistically significant factors that are associated with time to discontinuation of IUD at 5% level of significance. Thus, when all the other predictor variables are controlled, the hazard rate of the women's whose age group is 36-49 years was higher discontinuation of IUD (HR=1.770) than women's whose age group is 15-25 years. The hazard rate of women's whose place of insertion is at health post was higher discontinuation of IUD(HR=0.593) than women's whose place of insertion place is Hospital, this implies that those women whose place of insertion was at hospital had better probability of utilization of IUD than those inserted at health post.

Likewise, Women's who had not tested for HIV had higher discontinuation of IUD (HR=0.731) than women's who had tested for HIV. Regarding income level of women, the hazard rate of women's whose income level was medium was higher discontinuation of IUD (HR=0.783) than women's whose income level was low. Regarding educational level, women's who were illiterate had higher discontinuation of IUD (HR =1.352) than women's who were literate, this showed that literate women had less discontinuation rate than that of illiterate (Table 3).

DISCUSSION

The aim of this study was to assess the factors that associated with time to discontinuation of IUD among women of reproductive age the case of Arba Minch Town and Arba Minch Zuria Woreda, Gamo Zone Southern part of Ethiopia. The factors where age, place of insertion, HIV test, income and educational status were significantly associated with discontinuation.

The findings in our study are close to the earlier findings of reasons for discontinuation of intrauterine device in three provinces of Pakistan: a result of a 24-month prospective client follow-up regards to the association between age 36-49 years and education (illiterate) has significant effect on discontinuation of IUD. But it contradicts with findings on factors associated with IUD use among reproductive age women in Addis Ababa[20]. This study result was similar with findings conducted in Pakistan[4] that revealed age of the women had significant association with discontinued of IUD. But contradict with level of income that it revealed low level of income has statistically significant while in this finding medium level of income has statistically significant[19].

This study result was similar with findings conducted in Indian regarding of educational level of the women's discontinuation rate highest found in illiterate women and therefore the lowest among literate[1]. There were statistically significant difference regards to level of education and specific counseling with earlier studies of IUD Survival and its Determinants; a Historical Cohort Study in Iran. But it had similar with this finding regards to age[21]. As regards reasons for removal, age and level of education there was no statistically significant difference with found in Bahir Dar, Ethiopia[22]. But contradict with this finding in level of income and place of residence was statistically significant. The finding of Contraceptive use and discontinuation among women in rural North-West Tanzania were agree with this finding in HIV test results and age of the client which revealed that there is no significant difference in the use of contraception method[23].

Hence, from empirical results it can be concluded the age of women, place of insertion, status of HIV test, place of residence, income level of women and educational level of women are statistically significant factors that are associated with time to discontinuation of IUD in the study area. From these analyses we conclude that the covariates such as age, place of insertion, HIV test, income and education are associated with time to discontinuation of IUD in classical approach. So, we recommended that for all health care providers and the responsible bodies should be considered when planning and implementing against women's who utilize IUD to increase survival time of utilization, awareness creation for long-acting contraception method especially IUD should not preferable for health post and the performance of HIV test before the insertion of the device should be important.

DECLARATIONS

Limitation of the study

This is an examined factor that influence the utilization of IUD among women of reproductive age the case of Arbaminch Town and Arbaminch Zuria Woreda Gamo Zone users. Taking into account its results cannot be generalized to all health facilities in the mentioned zone that offer IUD services. However, they provided insight into factors that could influence the use of IUD.

The study faced a number of limitations regarding to explanatory variables as it intended on secondary data some potential variables with no record data had ignored from the study. And it does not include primary data related effect on discontinuation of IUD.

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Availability of data and materials

The dataset supporting conclusions of this article is available by contacting authors.

Disclaimers

The authors are solely responsible for the research and the findings do not represent the opinions or endorsement of any of the funders.

Authors' Contributions

TPK designed the study and analyzed the data. BBA KTG and MAE drafted the manuscript and critically reviewed the article. All authors read and approved the final manuscript.

Ethical Considerations

The study was carried out after getting permission from the ethical clearance committee of College of Natural Sciences, Arba Minch University. After Ethical clearance and approval of the University Ethical Committee and up on the permission of local government administration bodies of the town, the actual research activities was undertaken in the study area.

Competing Interests

The authors declare that they have no competing interests.

Consent for publication

Not applicable

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