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Abstract

Introduction

Early cessation of EBF has the short and long term effect for the welfare of infants including the life-long impacts of poor school performance, reduced productivity, and impaired intellectual development. **Objective of the study:** the main objective of this study was to compare the performance of CPH model and AFT models in analyzing EBF data in Ethiopia, 2016 EDHS. Specifically, the study aimed to identify the major predictor variables of the duration of EBF based on 2016 EDHS data.

Methodology: The secondary data is obtained from Ethiopian Demographic and Health Survey (EDHS), 2016. The outcome variable of this study was the duration of EBF in month. To achieve the objective of the study, descriptive survival analysis like the median survival time, Kaplan Meier survival estimate and log-rank test were used to compare the estimated survival probability among different levels of predictor variables at 5 percent significant level. The Cox proportional hazard regression and Accelerated failure time model were fitted and their results were compared using model comparison criterion such as AIC, BIC.

Results: of 1092 interviewed mothers, 15.3 % of them were discontinued EBF and 84.7% of them were exclusively breastfed (censored). The estimated median duration of EBF was 3 months. Based on estimated Kaplan Meier survival curve and log-rank test, it was found that there was a statistically significant difference in survivor experience of discontinuing EBF over

each duration with respect to place of delivery, maternal education, husband education, mode of delivery and employment status. The fitted CPH and AFT model indicated that mode of delivery, wealth index, and employment status was found as significant predictors of EBF duration. Moreover, comparatively Weibull AFT model performed better in analyzing EBF data. According to the fitted model, mothers who were in poor wealth index category and who gave birth by cesarean shortens the duration of EBF by 16% and 29% respectively. On the other hand, employed mothers were improved the duration of EBF by 26%.

Conclusion: Weibull AFT model is performed better in analyzing EBF data. A mother who was unemployed, poor wealth index, and gave birth by cesarean shortens the duration of EBF than their counterparts. Therefore, special emphasis should be given for mothers who are unemployed, who are economically poor, and give birth by cesarean to improve the duration of EBF.

Keywords: Exclusive breastfeeding, Cox proportional hazards model, AFT model, duration of EBF.

1. INTRODUCTION

Exclusive breastfeeding is the practice of feeding only breast milk (including expressed breast milk) and allows the baby to receive vitamins, minerals or medicines and water, breast milk substitutes, other liquids and solid foods are excluded [1]. Fatty acids needed for the infant's growing brain, eyes, and blood vessels are the only contents of breast milk that are not available in other types of milk. Moreover, breast milk helps against multiple diseases, such as gastrointestinal and acute respiratory infections [2], thus, reduces infant mortality and helps faster recovery during illness. In recognition of these benefits, WHO and the United Nations Children's Fund (UNICEF) recommends all mothers should breastfeed exclusively for the first six months of life and continued breastfeeding for two years or more in conjunction with complementary food as human milk alone is no longer sufficient for both nutritional and developmental reasons [3].

Globally approximately 40% of infants and in developing countries 38% of infants were exclusively breastfed respectively [2, 5]. Among 96% of all infants' death occur in the world each year non-exclusive breastfeeding share 55% of diarrheal death and 53% of acute respiratory

deaths which is much higher in Asia and Africa [6, 25]. On the other hand, exclusive breastfeeding practice is the most effective intervention to save the lives of infants and children. Nearly, 13%-15% of deaths of children aged less than five years could be prevented if universal coverage of EBF were increased to 90% among infants aged less than six months [4]

Even though the Ethiopian Health Sector Transformation Plan (HSTP IV) had planned to increase the proportion of exclusive breastfeeding from 52% to 72% by the end of 2020, only 58% of infants exclusively breastfed with a median duration of 3.1 months (EDHS, 2016) and other available studies in different parts of Ethiopia indicated that the prevalence is ranges from 40.6% to 81.1 % [1, 2, 3, 6, 7, 10-18, 22, 24, 25, 27].

Age at Early cessation of EBF before six months in developing countries like Ethiopia leads to risk of pathogens contamination and over dilution of milk leading to increased risks of morbidity, under nutrition and mortality, by reducing the ingestion of protective factors present in breast milk and increasing the exposure to sources of contamination [4]. However, several studies show the age at termination of EBF is less than that of WHO recommendation. For instance, the median duration of EBF in India, south Gujarat region of India, and Indonesia was 4.2, 6 and 2.03 respectively [7, 8, 9]. Moreover, the median duration of EBF in Brazil, Congo Kinshasa, China, was 3 months, 10.9 weeks, 4.5 months respectively [28, 29, 31]. In Ethiopian context, few studies reported that the duration of EBF ranges from 1 month in Addis Ababa to 4.77 months in Afar region of Ethiopia [8, 10, 11, 18, 23, 24].

Since the age at Early cessation of EBF has the short and long term effect for the welfare of infants including the life-long impacts of poor school performance, reduced productivity, and impaired intellectual development it is very important variable to determine the important factors of EBF duration. Survival analysis is used for this purpose, statistical methods frequently used to analyze time to event data and has an advantage of controlling censoring observation than any other statistical methods. Cox Proportional Hazard model is the popular model in analyzing survival data, which assume constant hazards. However, the assumption of constant hazards in PH model is not always satisfied by the survival data. The misinterpretation of parameter estimation and decreasing the power of statistical tests are associated with violation of the PH assumptions. On the other hand, Accelerated Failure Time models can be used as the alternative to Cox PH model if the constant hazards' assumption is violated, that is why we want to compare

the CPH and AFT models for the analysis of current EBF data. To the best of our knowledge, no study had been conducted to determine the determinants of EBF duration by comparing CPH regression and AFT model. Therefore, the main objective of this study was to compare the performance of CPH model and AFT models in analyzing EBF data in Ethiopia, 2016 EDHS. Moreover, the major factors of early cessation of EBF would be identified.

2. METHODOLOGY

2.1. Data Source

The secondary data was obtained from Ethiopian Demographic and Health Survey (EDHS) 2016. The survey is conducted from January 18, 2016-June 27, 2016 jointly by the Central Statistical Agency (CSA), Ministry of Health (MoH), the Ethiopian Public Health Institute and the United States Agency for International Development (USAID) funded the survey (EDHS, 2016).

2.2. Study Design and Source population

The 2007 Ethiopia population and Housing Census (PHS) is used as a sampling frame of 2016 EDHS and in the first stage 202 in urban areas and 443 rural areas within the nine regions and two administrative cities and thereafter as a second stage, 28 households per cluster were selected with equal probability. Finally the sample used for this study is taken from women's data and total number of children included was 1092. Sampling unit of this study was women whose last child is younger than six months and living with their mothers only.

2.3. Study Variables

The duration of EBF was the outcome variable (survival time) and breastfeeding status was an event indicator dichotomized as 1, if a child is given any type of food or liquid other than breast milk before six months and 0, otherwise. The main independent variables taken from available studies related to duration of EBF and its determinants [8, 26-34] are husband educational level, wealth index of household, place of residence, mother educational level, employment status, age at first birth, age of mothers during the last birth, place and mode of delivery, birth order, previous birth interval, sex of a child, infant antenatal check-up (ANC).

2.4. Method of Data Analysis

2.4.1. Descriptive Survival analysis

Kaplan Meier survival estimators, median survival time, log-rank test, were used for analysis of survival data. Kaplan Meier survival estimator is used to compare survivor experience of event among different level of predictor variables and log-rank test is used to evaluate whether there is statistically a significant difference among KM survival curves. At null hypothesis log-rank statistic is approximately distributed as chi-square distribution with k-1 degree of freedom, and we conclude that there is a significant difference among KM survival curves if p-value is less than 5 percent significance level. All data analysis was performed using stata version 14.2.

2.4.2. The Cox proportional hazard (CPH) regression model

CPH regression model is a semi-parametric survival model and used to identify the effect of several factors on the duration of EBF. The Cox proportional hazard model is expressed as $h(t|X) = h_0(t)exp^{X^T\beta}$, where $X = (X_1, X_2, \dots, X_p)^T$, X is a $p \times 1$ vector covariate and β is a $p \times 1$ vector of regression coefficients. The parameters were estimated by partial likelihood functions and significance of the coefficients was tested using the partial likelihood ratio test, Wald test, and score test. We used Hosmer and Lemeshow and Collet recommendations for a variable selection: including all variables that are significant in the uni-variable analysis at the 20 to 25 percent level and multivariable analysis at 5 percent level.

2.4.3. Overall goodness of fit

Testing proportional hazards assumption: this can be assessed by log-log plot and schoenfel residual. If the plot of $\log(-\log(S(t)))$ versus $\log(S(t))$ for each covariate shows non-parallel curve, the ph assumption won't met. On the other hand, the ph assumptions are also examined by evaluating whether there is a correlation between schoenfeld residual and survival time. A correlation of zero indicates that the model met the proportional assumptions. In addition, Cox-Snell residual is used to assess the overall model fit. If the model fits the data, the plot of the cumulative hazard versus Cox Snell should approximate straight line with slope 1.

Model comparison: Akaike information criteria (AIC) and Bayesian information criteria (BIC) are used to compare CPH model and AFT model, and they are given by, $AIC = -2(\log - likelihood) + 2(p + k)$, $BIC = -2(\log - likelihood) + (p + k) * \log(n)$ where p is number of parameter and k is a number of coefficients (excluding constant) in the model.

Accelerated failure time model

AFT model provides an alternative to CPH model for statistical modeling of survival data when the proportional hazard assumption of Cox model is do not satisfied (Wei, 1992). In this model, the logarithm of survival time is response variable and includes an error term which is assumed to follow specific probability distribution such as exponential, Weibull, log-normal, log-logistic, etc. The assumption of AFT model is that the effects of covariates act multiplicatively with respect to survival time. The log linear representation of AFT model is given by

$\log T_i = \mu + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_p x_p + \sigma \varepsilon_i$, where $\log T_i$ is log transformed survival time for individual i , X' and β_i' represents vector covariates and coefficients respectively; ε_i is unexplained variation of log transformed survival time and μ and σ are intercept and scale parameter respectively. The unknown $p+2$ parameters of the model are estimated by maximum likelihood estimation.

Results

Summary of Socio demographic characteristics of Respondents

Among 1092 interviewed mothers used for this study, 15.3% of them discontinued EBF and 84.7% of them were continued EBF (censored).

Almost half (49.3%) of the babies were males, of whom those who exclusively breastfed accounts for 47.8% and 57.8% of them were didn't exclusively breastfed. In contrast, of 545 female babies 52.2% were exclusively breastfed and 42.4% were didn't exclusively breastfed. The percentage of exclusively breastfed babies was higher (46.7%) for those first born than those born in the 2nd and 3rd and 4th and above. The percentage of EBF was higher (55.3%) for those mothers delivered at home than for those mothers delivered at health facility (44.7%). Regarding the number of births for each pregnancy, almost all single births (99%) were exclusively breastfed and only 1% of multiple births were exclusively breastfed. The percentage of EBF for the employment status was 63% and 37% for unemployed and employed mothers respectively. The highest percentage of EBF in Mode of birth variable was observed for women who gave birth vaginally than those who gave birth by Cesarean. Regarding the wealth index of mothers the highest (51.2%) and lowest percentage of EBF (13%) was observed for Poor and medium class of mothers respectively. The highest percentage of EBF was observed for those mothers from rural areas (81%) than for those mothers from urban areas (19%). Regarding the proportion of EBF in age group the highest proportion was observed for mothers in the age group <20 years (57.6%) followed by those in the age group of 20 to 29 (41.5%) and 30 and above years (0.9%)

respectively. The percentage of EBF for those mothers attended ANC for fewer than four times (80%) was observed as four times higher than those attended ANC for at least four times (20%). Finally, the proportion of EBF for the number of children ever born was higher for mothers who had one to three children (53.3%) followed by those who had 4 to 6 (31.1%) and 7 and higher (15.6%) respectively (Table1).

Table1. Cross tabulation of Socio-demographic characteristics of mothers who had infant aged below six months by Breastfeeding status, 2016 EDHS data

Variable	Category	Breastfeeding Status		
		EBF(percentage)	Non-EBF(percentage)	Total (percentage)
Sex	Male	435(47.8%)	95(57.6%)	530(49.3%)
	Female	475(52.2%)	70(42.4%)	545(50.7%)
Birth order	First	196(21.5%)	35(21.2%)	231(21.5%)
	2 nd and 3 rd	289(31.8%)	41(24.8%)	330(30.7%)
	4 th +	425(46.7%)	89(53.9%)	514(47.8%)
Place-delivery	Home	494(55.3%)	118(71.5%)	612(57.8%)
	Health facility	400(44.7%)	47(28.5%)	447(42.2%)
Birth type	Single	902(99.1%)	162(98.2%)	1064(99%)
	Multiple	8(0.9%)	3(1.8%)	11(1.0%)
Emp _status	Unemployed	575(63.2%)	131(79.4%)	706(65.7%)
	Employed	335(36.8%)	34(20.6%)	369(34.3%)
Birth method	Normal	883(97.0%)	151(91.5%)	1034(96.2%)
	Cesarean	27(3.0%)	14(8.5%)	41(3.8%)
Wealth index	Rich	326(35.8%)	43(26.1%)	369(34.3%)
	Medium	118(13)	8(4.8%)	126(11.7%)
	Poor	466(51.2%)	114(69.1%)	580(54%)
Residence	Urban	173(19%)	37(22.4%)	210(19.5%)
	Rural	737(81.0%)	128(77.6%)	865(80.5%)

Age -birth	<20	524(57.6)	93(56.4)	617(57.4)
	20-29	378(41.5)	68(41.2)	446(41.5)
		8(0.9)	4(2.4)	
	>=30			12(1.1)
ANC	<4	726(79.8)	138(83.6)	864(80.4)
	4+	184(20.2)	27(16.4)	211(19.6)
Num_chil	1-3	485(53.3)	76(46.1)	561(52.2)
	4-6	283(31.1)	53(32.1)	336(31.3)
		142(15.6)	36(21.8)	
	7+			178(16.6)

Descriptive survival analysis

The baby's survival time was determined as the time in month from birth until end of EBF or was censored (continued) at the end of the study. The median duration of EBF was 3 months, 25% of children terminated the EBF in the first 1 month and 75% of children terminated EBF in the first 4 months (Q1=1 month, Q3=4 months).

4.2. Kaplan Meier Survival curve estimates

A plot of Kaplan Meier survival probability corresponding to each duration of exclusive breastfeeding in month is shown on figure 1 below for two or more groups of women. Women in the medium and poor level category had higher and lower survival probability respectively than those in the rich level. Regarding the mode of birth, mothers who gave birth through their vaginal or Normal had higher survival probability than those who gave birth by means of caesarean. Similarly Employed mothers had longer survival probability than unemployed mothers.

The result of log-rank test (Table 2) showed that there was a significant difference between the different level of wealth index ($\chi^2 = 11.33$, p-value=0.004), mode of delivery ($\chi^2 = 5.95$, p-value=0.015), employment status ($\chi^2 = 10.64$, p-value=0.001), maternal education ($\chi^2 = 8.38$, p-value=0.015), husband education ($\chi^2 = 12.62$, p-value=0.0018), and place of delivery ($\chi^2 = 4.39$, p-value=0.036). On the other hand, there was no a significant difference between the different level of frequency of antenatal care, sex, residence, age at birth, and birth type.

Table 2. Log-rank and Wilcoxon test result showing the difference in survival functions among the groups of women

Predictor variable	Log-rank statistic	LP-value	Wilcoxon statistic	Wp-value
ANC	0.11	0.740	0.22	0.640
Sex	1.25	0.264	1.34	0.248
Maternal education	8.38	0.015	5.88	0.053
Husband education	12.62	0.0018	9.24	0.010
residence	1.76	0.184	1.10	0.295
Age at birth	3.38	0.185	0.18	0.913
Place of delivery	4.39	0.036	5.39	0.020
Birth type	2.29	0.131	1.17	0.280
Wealth index	11.33	0.004	14.40	0.001
Mode of delivery	5.95	0.015	3.43	0.064
Employment status	10.64	0.001	6.97	0.008
Number of children ever born	5.11	0.078	2.36	0.307

Figure 1: KM survival curves by wealth index, employment status, number of children ever born, and mode of delivery

4.3. Cox Proportional Hazard Regression analysis

Based on the contribution of each covariate to the maximized log partial likelihood of the model (-2LL), the significant change in -2LL is observed for place of delivery, wealth index, mode of

delivery, number of children ever born, mother education and employment status comparing with that of null model ($-2LL=1688$). Equivalently, by using Wald chi-square test, the variables above are significant at 25 percent level and candidate for the inclusion in the multivariate model (Table 3). On the other hand omitting the variables ANC, Sex, Birth interval, husband education, age at birth, residence, birth type, and age of mother does not bring a significant change on the value of $-2LL$. Once again, the number of children was significant at 5% level at multivariate analysis. Therefore the main effects of the final model were wealth index, mode of delivery, employment status, and number of children ever born (Table 4\$5).

Table 3.Univariate Cox proportional Hazard Regression Analysis

Covariates	-2LL	LR	LR-pvalue	Z-value	Z-pvalue
ANC	1688.02	0.10	0.7528	0.32	0.751
Place-delivery	1678.46	4.12	0.0424	-1.99	0.047
Sex	1686.98	1.14	0.2863	-1.06	0.287
Birth interval	1298.78	1.06	0.3022	-1.03	0.303
Wealth index	1682.96	5.16	0.0231	2.23	0.026
Mode-delivery	1683.79	4.33	0.0375	2.27	0.023
Num-children	1683.65	4.47	0.0345	2.14	0.032
Husband education	1597.01	1.34	0.2471	-1.14	0.253
Age -1 st birth	1685.83	2.29	0.1303	1.52	0.128
Mother education	1683.98	4.14	0.0420	-1.97	0.049
Residence	1686.59	1.53	0.2155	-1.26	0.206
Birth type	1686.55	1.57	0.2102	1.42	0.156
Emp-status	1677.76	10.37	0.0013	-3.06	0.002
Age-mother in group	1687.68	0.44	0.5059	0.66	0.507

-2loglikelihood for the null model=1688.12142

Table 4. Multivariate Cox proportional hazard regression analysis for EBF, 2016 EDHS data

Covariates	Haz. Ratio	Std. Err.	z	P>z	[95% Conf. Interval]
pla_delivery	.8263781	.2013846	-0.78	0.434	.5125601 1.332333
Wealth_Ind	1.293562	.1608867	2.07	0.038	1.013722 1.650651
Birth_method	3.309976	1.151116	3.44	0.001	1.674176 6.54408
Num_children	1.202646	.1424024	1.56	0.119	.9535625 1.516794
Husband_education	1.084809	.1672199	0.53	0.597	.8019427 1.46745

Moth_Educa	.8294718	.1552497	-1.00	0.318	.5747577	1.197067
Occ_wom	1.786384	.6773961	1.53	0.126	.8495705	3.756212
Emp_mother	.2586527	.1695989	-2.06	0.039	.0715456	.9350846

Table 5. Multivariate Cox proportional hazard regression result for the main effects, 2016 EBF, EDHS data

Covariates	Haz.	Ratio	Std. Err.	Z p-value	95% CI.Int	
Wealth_Ind	1.262262	.1298539	2.26	0.024	1.03177	1.544244
Birth_method	2.727933	.8412134	3.25	0.001	1.490557	4.99251
Emp_mother	.5529215	.1118176	-2.93	0.003	.3719842	.8218686
Num_children	1.264253	.1361631	2.18	0.029	1.023664	1.561387

4.4. Model Adequacy

log – log Plot and Schoenfeld residual are used to check ph assumption. $\log(-\log(S(t)))$ Plot showed that even though wealth index, mode of birth, employment of status had satisfied assumptions relatively the parallel is not enough (figure2). The result of Global test and individual proportional hazards test shown below (Table 6) indicated that except for wealth index (p-value=0.0473), the test do not suggests the violation of ph assumption for birth method and employment status. In addition from Cox-Snell residual analysis we observed that the Cox model does not fit the data well; as it departed from 45° reference line which suggests the need of alternative accelerated failure time (figure 4).

Table 6. Global and individual proportion hazard assumption test result

	Rho (ρ)	Chi-square	Df	p-value
Wealth index	0.16950	3.94	1	0.0473
Birth method	-0.02816	0.10	1	0.7517
Employment status	-0.04612	0.29	1	0.5882
Global test		4.17	3	0.2438

4.5. Performance of CPH regression and AFT models and effect of significant factors

Among the compared models Weibull model (AIC=675.255) was found to be better to fit the effect of covariates on the duration of exclusive breastfeeding (Table7). Accordingly, the estimated coefficient of poor level wealth index is -0.1745, which suggests poor level mothers decrease the duration of EBF approximately by 16 percent

($\exp(-0.1745)=0.84$, 95% *CI*: (0.72,0.98) compared to those in the rich level. The estimated coefficient of employed mothers is 0.233, which suggests the employed mothers increase the duration of EBF approximately by 26 percent (($\exp(0.233) = 1.262$), 95% *CI*: (1.08,1.48)) compared to unemployed mothers. Moreover, the mothers who gave birth by cesarean shorten the duration of EBF approximately by 29 percent ($\exp(-0.3421) = 0.71$, 95% *CI*: (0.56,0.90)).

Figure 4. Cox Snell residual plot for the fitted Cox proportional hazard regression model

Table 7. Model comparison b/n CPH and AFT model result

Model	AIC	BIC	Log-likelihood	LR
CPH	1669.851	1689.048	-830.92571	26.27
Weibull	675.2551	704.0494	-331.62754	26.72
Exponential	802.7637	826.7589	-396.38183	26.77
Log-Normal	703.919	732.7134	-345.95951	26.59
Log-logistic	687.16	715.9544	-337.58002	25.06

Table 8. The result of Weibull Accelerated failure time Model

Covariate	Coef.	Std.Err	Zvalue	P Z value	95% Conf.Int	
Wealth_Ind						
Medium	.2233288	.1504696	1.48	0.138	-.0715861	.5182438
Poor	-.1744783	.0777315	-2.24	0.025	-.3268292	-.0221275
Emp_mother						
Employed	.2332747	.0795491	2.93	0.003	.0773613	.3891882
Birth_method						
Cesarean	-.3420697	.1218089	-2.81	0.005	-.5808108	-.1033287
_cons	2.022595	.081769	24.74	0.000	1.86233	2.182859
/lnp	.9536262	.069747	13.67	0.000	.8169245	1.090328
p	2.595103	.1810007			2.263528	2.975249
1/p	.3853412	.0268764			.3361063	.4417883

DISCUSSION

This study attempted to identify the factors that affect the duration of exclusive breastfeeding by comparing the performance of CPH regression and AFT model. No studies have been conducted to compare the performance of CPH regression and AFT model for EBF data in Ethiopia. In this study prevalence of EBF was higher (84.7%). This is higher as compared to the prevalence of EBF in different parts of Ethiopia, which ranges from 20.9% in Gondar to 81.1% in Dubti town of Afar region [[1, 2, 3, 6, 7, 10-18, 22, 24, 25, 27](#)]. The median duration of EBF in this study was 3 months which is shorter than that of a study found by Chudasamaa et al, Agampodi et al, and Giashuddin et al, 6,4, and 3.67 months respectively[30-33]. In contrast, it was higher than the median duration of EBF in Indonesia, Conko kinshasha and it was consistent with study done in Brazil (3 months) and Gobba district of Ethiopia [23, 29, 36].

The present study found that the mode of delivery is a significant predictor of duration of EBF. The estimated coefficient of mothers who gave birth by cesarean is -0.3421:TR= $\exp(-0.3421) = 0.71$ which suggests the mothers who gave birth by cesarean decrease the duration of EBF approximately by 29 percent compared to mothers who gave birth vaginally. Similar findings obtained by [[1, 4, 22, 24](#)] revealed that mothers who gave birth vaginally were more likely to practice EBF than those who gave birth by cesarean section. In contrast, a study by [[28](#)] found that children of mothers who experienced cesarean section had 29% lower risk of finishing EBF before six months (HR=0.71, 95% CI:(0.55,0.91)) compared with children whose mothers had vaginal delivery.

This study found that the employed mothers increase the duration of EBF approximately by 26 percent ($TR = \exp(0.233) = 1.262$), 95% *CI*: (1.08,1.48)) compared to unemployed mothers. This might be unemployed mothers early discontinued EBF to search a job for their daily food. This study agreed with the study done in Goba, and Somali regional state of Ethiopia [23, 37]. In contrast, the study found by Hunegnaw et al., indicated that government employee mothers decreased the time of breastfeeding by 2.8 times ($AHR=2.8$, 95%: 1.80,4.40) compared to housewives and study in Debre berhan district found that employed mothers were 0.36 times less likely to practice EBF($AOR=0.36$, 95%*CI*: 0.18,0.73) than housewives [13,19].

A study by Tika Dwi Tama and Erni Astatuk (2018), Adugna et al.(2017), and Seid et al (2013) found that Place of delivery was significantly associated with duration of exclusive breastfeeding. In these studies, Mothers who gave birth in health facilities have longer duration in breastfeeding practice compared as mothers who gave birth in other places. In contrast, the present study showed that place of delivery and mother's education level had not significant effect on the duration of exclusive breastfeeding [8, 22, 36].

According to our study, mothers whose wealth index is in poor level decrease the duration of EBF approximately by 16 percent ($TR = \exp(-0.1745)=0.84$), 95% *CI*: (0.72,0.98) compared to those in the rich level. This is similar with that found by Chekol et al [16].

Conclusion: being unemployed and gave birth by cesarean shortens the duration of EBF. On the other hand, poor mothers discontinued EBF early than rich mothers. Therefore special emphasis should be given for unemployed and poor mothers and also for those gave birth by cesarean. On the other hand, Weibull accelerated failure time model was better than CPH model to determine the associated factors of EBF duration. Therefore, the study recommends this model as alternative of CPH model.

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Abbreviations

EBF: Exclusive breastfeeding; EDHS: Ethiopian Demographic and Health Survey; AFT: accelerated failure time; WHO: World Health Organization; CPH: Cox proportional Hazard; TR: time ratio

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Authors' contribution

BE wrote the proposal, organized, coded, entered, and analyzed, interpreted the data, and wrote the conclusion and manuscript in consultation with the TB. TB collected the data from CSA, read, edited, and gave critical comments on data analysis and manuscript. Finally, both authors read and approved the final manuscript.

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Availability of data and materials

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