Under-Five Mortality of Children and its Determinants in Ethiopian Somali Regional State, Eastern Ethiopia

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Abstract

Background: Under five mortality is a leading indicator of child health and overall development of a nation. It also reflects the social, economic and environmental conditions in which children (and others in society) live, including their health care. The main aim of this study was to identify and analyze socioeconomic, demographic and environmental factors that may have a significant influence on under-five mortality in Ethiopian Somali regional state, eastern Ethiopia.

Methods: The study was a retrospective analysis of existing data from 2000, 2005, and 2011 Ethiopia demography health survey data. A total number of live births considered for this study were 515, 563 and 729 with 98 (19.03%), 103 (18.29%), and 104 (14.27%) of under-five deaths occurred during the preceding five years of the study periods (1996-2000, 2001-2005, 2006-2011), respectively. Survival analysis was conducted to find out the determinants of under-five mortality.

Results: According to the final cox regression model, factors that significantly predict under-five mortality included family size, preceding birth interval, birth order, type of birth, breastfeeding status, source of drinking water, mother age at first birth, sex of a child (1996-2000), family size, preceding birth interval, birth order, type of birth, breastfeeding status, source of drinking water, mother age at first birth (2001-2005), and family size, preceding birth interval, birth order, breastfeeding status, source of drinking water (2006-2011), respectively.

Conclusion: Our study suggested that family size, preceding birth interval, birth order, breastfeeding status, and source of drinking water were significant determinants of under-five mortality in the region. Community-based intervention is required and should focus on child spacing, feeding breast milk, improve access to safe/pipe drinking water and poverty eradication programs, particularly in rural areas, to reduce avoidable under-five mortality in region.

Keywords: Demographic; Socio-economic; Determinants; Under-five mortality; Somali region

Abbreviations

CI: Confidence Interval; CSA: Central Statistical Agency; EDHS: Ethiopian Demographic Health Survey; DF: Degree of Freedom; HR: Hazard Ratio; SAS: Statistical Analysis Software; SDGs: Sustainable Development Goal; SPSS: Statistical Package for Social Science; U5D: Under-Five Death; U5M: Under-Five Mortality

Introduction

Back Infant and child mortality rates are important indicators of societal and national development as they serve as key markers of health equity and access [1,2]. Child mortality rates also reflect a country's level of socio-economic development and quality of life and are used for monitoring and evaluating population, health programs and policies. In the past few decades there is decline in under-five mortality in almost all countries of the world, regardless of initial levels, scio-economic circumstances and development strategies. In spite of this substantial drop in global child mortality rate, about 5.9 million children still die every year before their fifth birthday worldwide which implies 16000 under-five children die each day [3].

Identifying determinants of under-five mortality (U5M) is important for formulating appropriate health programmes and policies in order to meet the United Nations the sustainable development goal (SDGs) (i.e., aiming to reduce under-five mortality to at least as low as 25 per 1000 live births by 2030). Several studies have been conducted to identify the

determinants of U5M. Studies have identified strong associations between maternal factors and childhood mortality. Birth interval has been identified by numerous studies as a major determinant of childhood mortality [4,5]. Studies have also shown that children of educated mothers will survive better than children of non-educated mothers [6-8].

There are huge differences in child mortality among low and middle income countries and the industrial world with Sub-Saharan Africa and South East Asia carrying the highest burden of under-five mortality [9,10]. The highest rates of child mortality are still in Sub-Saharan Africa-where 1 in 8 children dies before age 5, more than 17 times the average for developed regions (1 in 143)-and Southern Asia (1 in 15) [11]. Ethiopia being one these country under five mortality still remain high, 88/1000 live birth, [12]. In Ethiopia, mainly in the Somali region under-five mortality were well above the national average [12-14] also there are limited studies that focused on the association between determinant factors and under-five mortality.

Objectives

General objective

To identify and analyze socioeconomic, demographic and environmental factors that may have a significant influence on under-five mortality in Ethiopian Somali regional state.

Specific objectives

To estimate the survival time of under-five children.

To show the pattern of under-five mortality in the region.

To identify factors tend to be the most influential in explaining the observed high under-five mortality.

Materials and Methods

Study area

This regional level research was conducted in Ethiopian Somali regional state. Ethiopian Somali Regional State is the second largest region in the country next to Oromia and covers a total area of 350,000 km square. It is located in the east and southeast of the country and lies between 4 and 11 degrees north latitude and 40 and 48 degrees east longitude. The Region has 11 administrative zones consisting of 93 woredas (districts). The zones are Dhaawe, Erer, Fafan, Siti, Liban, Afder, Shabelle, Korahe, Dolo, Jarar and Nogob. It shares borders with Somalia to the east and southeast, Kenya to the south and Djibouti to the north. To the northwest and west, it borders with Afar and Oromia Regions, respectively [15]. According to central statistics agency the population was projected at 5.7 million in 2017. Of the total, 46% and 54% are females and males respectively [16].

Source of data

Data obtained from complete registration of births and deaths often provide the best basis for the direct estimation of child mortality. Unfortunately, most African countries lack functioning vital registration systems for health and other data. Estimates of childhood mortality in these countries are, therefore, largely based on cross-sectional surveys that collect complete birth histories from respondents. This study was based on a database that has been compiled as part of the 2000, 2005, and 2011 EDHS. The data set consists of a national representative sample of household level data.

Study design

The study design was a retrospective study design.

Variables in the Study

The response (dependent) variable

Under-five child mortality is defined as mortality from the age of 1 month to the age of 59 months. Therefore, the dependent variable in this study is "the risk of death occurring in an age interval in the 1–59 month period". The outcome variable was thus survival time in months of the children under the age of five.

Explanatory (covariates) variables

Based on [16] the following covariates: Child's sex (SEX) (1=Male, 2=Female); Type of birth (BTYPE) (0=Single birth, 1=Multiple birth); Mother's age at first birth (MAGEB) (0 ≤ 16 years, 1 ≥ 16 years); Family size (FSIZE) (0=1-3 members, 1=4-6 members, 2 ≥ 7members); Breastfeeding status (BFDINGS) (0=No, 1=Yes); Preceding birth interval (PBITVAL) (0 ≤ 2 years, 1=2 -3 years, 2 ≥ 3 years); Birth order (BORD) (1st order, 2-4 order, >4 order); Mother's education (MEDU) (0=No education, 1=Primary and above); Father's education (FEDU) (0=No education, 1=Primary and above); Area of residence (ARISD) (1=Urban, 2=Rural); Literacy of a women (LTRCY) (0=able to read, 1=can't read at all); Marital status (MSTAT) (0=Married, 1=Not married); Source of drink water (SDWTR) (0=Pipe, 1=others); and Toilet facility (TOLF) (0=No, 1=Yes) were considered in this study.

Method of Data Analysis

The data analysis is done using SPSS 20, STATA and SAS statistical (software) packages. In this study survival analysis is conducted to find out the determinants of under-five mortality in Ethiopian Somali region state, eastern Ethiopia.

Results

Descriptive analysis of the survival data

After removal of observations with missing values, a total number of live births considered for this study were 515, 563

and 729 with 98 (19.03%), 103 (18.29 percent), and 104 (14.27%) of under-five deaths occurred during the preceding five years of the study periods (1996-2000, 2001 -2005, 2006-2011), respectively. Of the total live birth, 54 (22.2%), 44 (16.2%), 55 (18.5%), 48 (18.0%), 63 (15.9%), and 41 (12.3%) of under-five death have occurred for male and female, respectively. Regarding mothers' age at birth, 246 (47.77%), 164 (29.13%), 200 (27.43%), of children were from mothers of age less than 16 years while the remaining 269 (52.23%), 399 (70.87%), 529 (72.57%) were from mothers with age 17 years and above. When we come to education of mothers, the under-five mortality was 91 (18.5%), 101 (19.3%), 88 (14.0%) and 7 (30.4), 2 (5.0%), 16 (15.8%) for children whose mothers have no education and primary and above education, respectively. Of the total of 515, 563 and 729 children included

444 (86.21%), 477 (84.72%) and 554 (75.99%) were born in rural part of Ethiopian Somali region and 154 (29.90%), 188 (33.39%) and 449 (61.59%) were breastfed. Among the mothers of under-five children, 501 (97.28%), 553 (98.22%) and 695 (95.34%) were married. There were 48, 16, and 28 households of size 1-3 members, 244, 283, and 288 had household size 4-6 and 223, 264 and 413 of households had more than 6 members. In addition, 55 (10.68%), 26 (4.62%), and 130 (17.83%) households had piped water while 460 (89.32%), 537 (95.38%), and 599 (83.17%) used water from unprotected source of water. Finally, children with preceding birth interval shorter than 2 years are subject to higher risk of under-five mortality (19.9, 28.2 and 13.5%) during the preceding five years of the study periods (1996-2000, 2001-2005, 2006-2011), respectively **(Table 1)**.

Table 1 Trends in proportion of under-five survival/deaths and associated factors in preceding five years of 2000, 2005, and 2011.

Covariates	Categories	For the previous five years period before 2000			For the previous five years period before 2005			For the previous five years period before 2011		
		Censored	U5D	Total	Censored	U5D	Total	Censored	U5D	Total
Child's sex	1 (Male)	189	54	243	242	55	297	333	63	396
	2 (Female)	228	44	272	218	48	266	292	41	333
Mother's age at 1st birth	0 (≤ 16)	191	55	246	130	34	164	173	27	200
	1 (>16)	226	43	269	330	69	399	452	77	529
Breast feeding status	0 (No)	294	67	361	288	87	375	239	41	280
	1 (Yes)	123	31	154	172	16	188	386	63	449
Birth order	0 (1st order)	48	13	61	110	28	138	103	17	120
	1 (2-4 order)	66	12	78	164	46	210	194	33	227
	2 (> 4order)	303	73	376	186	29	215	328	54	382
Family Size	0 (1-3 size)	31	17	48	6	10	16	25	3	28
	1 (4-6 size)	200	44	244	218	65	283	247	41	288
	2 (≥ 7 size)	186	37	223	236	28	264	353	60	413
Preceding birth interval	0 (≥ 2 years)	161	40	201	204	80	284	269	42	311
	1 (2-3 years)	100	55	308	154	18	172	197	28	225
	2 (≥ 3 years)	153	6		102	5	105	159	34	193
Type of birth	0 (Single birth)	411	94	505	456	95	551	614	100	714
	1 (Multiple birth)	6	4	10	4	8	12	11	4	15
Mother education	0 (No Education)	401	91	492	422	101	523	540	88	628
	1 (Primary and above)	16	7	23	38	2	40	85	16	101
Father Education	0 (No Education)	366	86	452	416	91	507	416	72	488
	1 (Primary and above)	51	12	63	44	12	56	209	32	241

Mother's working status	0 (No)	297	69	366	356	83	439	531	92	623
	1 (Yes)	120	29	149	104	20	124	94	12	106
Marital status	0 (Married)	405	96	501	454	99	553	593	102	695
	1 (Others)	12	2	14	6	4	10	32	2	34
Literacy	0 (Can't read at all)	396	90	486	444	103	547	543	96	630
	1 (Able to read at all)	21	8	29	16	0	16	91	8	99
Area of residence	1 (Urban)	58	13	71	68	18	86	145	30	175
	2 (Rural)	359	85	444	392	85	477	480	74	554
Source of drinking water	0 (Pipe)	41	14	55	22	4	26	112	18	130
	1 (Others)	376	84	460	438	99	537	513	86	599
*U5D: Under-Five Death										

The probability of survival of a child is 65%, 54%, and 79% with a standard error of 0.045, 0.37, and 0.038 during the preceding five years of the study periods (1996-2000, 2001-2005, 2006-2011), respectively for the follow-up period of time. In addition, the result of the over all of Kaplan Meier estimation indicate that most child death occurs at the earlier months and then gradually declined to as the age of child advanced to 60 month **(Figure 1)**.

Figure 1 Overall product limit estimate of survival function.
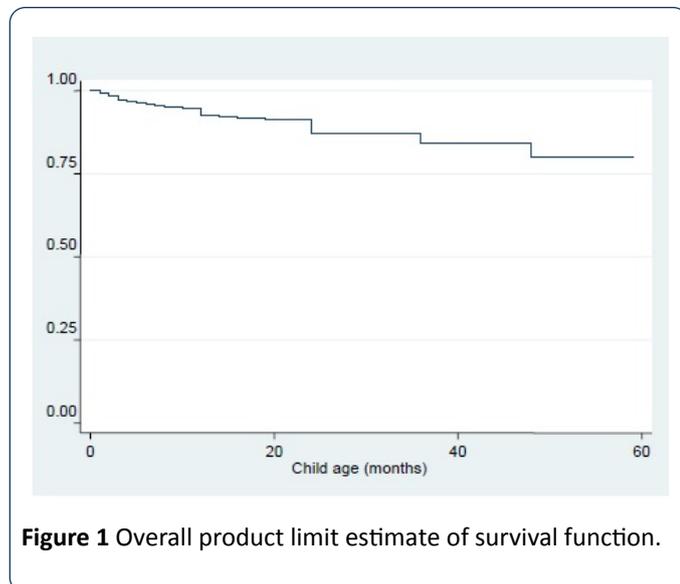
The log-rank test was performed to see if there is a significant difference among survival experience of two or more groups of the covariates **(Table 2)**.

According to the above **Table 2** the variables were found to be statistically significant difference in experiencing death event were: preceding birth interval, family size, type of birth, breastfeeding status, source of drinking water, literacy of mother, area of residence, mother's age at first birth, marital status and birth order during the preceding five years of the study periods (1996-2000, 2001-2005, 2006-2011), respectively.

Bivariate and multivariate analyses

We start with fitting univariable Cox proportional hazards regression model. The following **Table 3** summarizes result obtained from SAS and SPSS output of univariable Analysis.

From **Table 3** we can identify candidate covariates to be considered for the multivariable model. Including preceding birth interval, birth order, family size, type of birth, breastfeeding status, source of drinking water, literacy of mother, area of residence, mother's age at first birth, marital status and birth order (1996-2000), preceding birth interval, birth order, family size, type of birth, breastfeeding status, source of drinking water, literacy of mother, area of residence, mother educational level (2001-2005), and preceding birth interval, birth order, family size, type of birth, breastfeeding status, source of drinking water, marital status (2006-2011), respectively, in the model, one at a time, result in a significant reduction in p-value. Also the covariates toilet facility, sex of a child and mother educational level, father educational level (1996-2000), toilet facility, father educational level (2001-2005), and area of residence, toilet facility, mother education level (2006-2011), are significant at the 25% level of significance, respectively. Hence, all these covariates are considered in the multivariable Cox regression model **(Table 3)**.

Discussion

In survival analysis the measure of effect is the hazard ratio. It is interpreted in the same way as the odds ratio. The higher

the hazard ratio the lower is the survival probability, and vice versa.

Table 2 Result of log-rank test of equality of survival distribution for the different categorical covariates.

Covariates	For the previous five years period before 2000			For the previous five years period before 2005			For the previous five years period before 2011		
	Chi-square	Df	p-value	Chi-square	Df	p-value	Chi-square	Df	p-value
Preceding birth interval	48.384	2	0.000	32.522	2	0.000	6.958	2	0.031
Family size	24.982	2	0.000	46.233	2	0.000	9.444	2	0.000
Type of birth	11.388	1	0.000	79.87	1	0.000	8.853	1	0.003
Breastfeeding status	10.076	1	0.000	34.648	1	0.000	9.266	1	0.000
Source of drinking water	14.993	1	0.000	24.427	1	0.000	8.049	1	0.004
Mother education	0.196	1	0.567	5.127	1	0.024	2.116	1	0.146
Literacy of mother	21.921	1	0.000	4.466	1	0.026	0.641	1	0.423
Area of residence	9.098	1	0.001	8.844	1	0.003	4.568	1	0.033
Father education.	0.197	1	0.557	2.217	1	0.137	1.021	1	0.312
Mother's age at first birth	9.123	1	0.005	0.000	1	0.000	11.018	1	0.000
Marital status	11.236	1	0.000	12.832	1	0.000	7.220	1	0.009
Birth order	12.986	2	0.000	12.767	2	0.000	12.946	2	0.000
Sex of child	5.586	1	0.085	0.033	1	0.855	0.029	1	0.865
Toilet facility	3.536	1	0.232	3.721	1	0.054	2.256	1	0.133
Mother working status	3.974	1	0.143	0.233	1	0.629	0.503	1	0.478

Table 3 Results of the univariable proportional hazards Cox regression model.

Covariates	For the previous five years period before 2000		For the previous five years period before 2005		For the previous five years period before 2011	
	Sig.	Exp(B)	Sig.	Exp(B)	Sig.	Exp(B)
BORD (1st order)	0		0		0 .000	
2-4 order	0.007	1.575	0	1.053	0.043	1.477
> 4 order	0.001	1.934	0	1.973	0.021	2.004
PBITVAL (≤ 2 years)	0		0		0	
2-3 years	0	0.812	0	0.704	0	1.17
≥ 3 years	0	0.517	0	0.504	0	0.96
FSIZE (1-3)	0		0		0	
04-Jun	0.01	1.449	0	0.496	0.005	1.905
≥ 7	0.04	2.226	0.008	1.4	0.034	2.056
BTYPE (single birth)	0	4.751	0	4.364	0.007	4.043
MAGEB (> 16 yrs)	0.005	1.368	0	1.2	0.002	1.028
BFDINGS (yes)	0	1.037	0.033	1.8	0.001	1.906
SDWTR (pipe)	0.001	1.805	0	1.723	0.04	1.054

MSTAT (married)	0	2.574	0.002	5.204	0.008	1.72
ARSID (urban)	0.001	1.328	0.004	2.152	0.052	1.526
TOLF (has a facility)	0.232	1.013	0.062	0.946	0.177	1.765
LITRACY (Able to read)	0	1.433	0.029	1.048	0.455	1.758
SEX (male)	0.085	0.704	0.865	0.967	0.876	1.032
MWORK (yes)	0.143	1.719	0.639	1.128	0.513	0.817
MEDU(primary and above)	0.567	0.398	0.047	1.238	0.175	1.451
FEDU (primary and above)	0.557	0.804	0.171	1.527	0.353	1.221

For the previous five years period before 2000

Mortality risk of child increases as size of family increases. The risk of dying for a child born in family of size 4-6 is higher by 45 percent relative to those born in family with size of 1-3 (reference category). Children born in a family with size of seven and above have a significantly higher hazard rate than children born in a family with size of 1-3, i.e., children born in a family of size seven and above have a 2.226 times higher risk of death as compared with children in the reference category. In contrast, a study conducted in Ethiopia by Desta obtained a negative relationship between family size and child mortality (as the family size increased, child mortality becomes lower) [17,18].

Preceding birth interval has a significant negative association with under-five mortality. Children born 2-3 years and more than 3 years after the previous birth have a reduced risk of child mortality by 19 and 48 percent, respectively, relative to children born less than 2 years after the previous birth. This finding is consistent with a study conducted in Ethiopia by Belaineh et al. and Desta [18,19].

Higher birth orders (>4) have the highest mortality risk. Child with these characteristics are 93% more likely to die in infancy relative to the reference group births of order one (HR=1.934, 95% CI: 1.415 to 2.638). Child of order two through four are dying at a rate 57.5% higher than child of order one (HR=1.575, 95% CI: 1.060 to 2.842). The confidence intervals for higher birth order and birth order two through four indicate that the rate could actually be as high as 2.638 and 2.842 and as low as 1.415 and 1.060, respectively. This result is in accordance with study conducted by Samuel [20].

The hazard ratio of a child who was not breastfed as compared to those who were breastfed is 1.037. This means the risk of under-five mortality for children who were not breastfed is about 1.037 times higher than children who were breastfed. The 95% confidence interval also suggests that the risk of death for children who were not breastfed is 1.029 times as low and 2.656 times as large as those who were breastfed. Breastfeeding is positively related with child's survival chances. In literature most of the studies also suggest positive relation between child health and breastfeeding [6,7,21].

The risk of dying for a child born in a family without access to pipe drinking water is higher by 80.5% relative to those born in a family with access to pipe drinking water. The 95% confidence interval (1.753, 3.524) implies that the risk of death of children whose source of water is not pipe water is 1.753 as low and 3.524 as high as those in the reference group. This result is in accordance with Tibebu [21].

Type of birth (single vs. multiple) is also a significant predictor of under-five mortality. Children of multiple births are 4.751 more likely to die before age 5 relative to the reference group of single birth. The 95% confidence interval (2.086 to 5.714) indicates that the risk of death for a child who is of multiple births is 2.086 times as low and 5.714 times as large as those who were single birth. Several studies also identified birth type to be related with child death as multiple birth is associated with a higher risk of child mortality [18,21].

The reference category for the mother age group is age >16. The estimated hazard ratio for the covariate mother age less than 16 is 1.368. This implies that child who are born to mothers of age group of less than 16 are dying at a rate 37% higher than those who are in the elder age group (age ≥ 16). The confidence interval suggests that the hazard ratios are as low as 1.007 and as high as 1.926. This result is in accordance [21].

The hazard ratio for female is 0.704. Thus, female child's have a 30% lower risk rate of death than male child's. The confidence interval indicates that the risk of death for female infants could be as low as 0.015 and as high as 0.980. This result is in accordance with [20,22].

For the previous five years period before 2005

Mortality risk of child increases as size of family increases. The risk of dying for a child born in family of size 4-6 is higher by 6.736 time percent relative to those born in family with size of 1-3 (reference category). Children born in a family with size of seven and above have a significantly higher hazard rate than children born in a family with size of 1-3, i.e., children born in a family of size seven and above have a 7.049 (HR 7.049, 95% CI: 4.586, 11.880) times higher risk of death as compared with children in the reference category. In contrast, Desta obtained in Ethiopia a negative relationship between family size and child mortality (as the family size increased, child mortality becomes lower) [18].

Preceding birth interval has a significant negative association with under-five mortality. Children born 2-3 years

and more than 3 years after the previous birth have a reduced risk of child mortality by 66 and 41.4%, respectively, relative to children born less than 2 years after the previous birth. This finding is consistent with Belaineh et al. [19] and Desta [18].

Higher birth orders (>4) have the highest mortality risk. Child with these characteristics are 83% more likely to die in age less than 5 relative to the reference group births of order one (HR=1.832, 95% CI: 1.801 to 6.374). Child of order two through four are dying at a rate 67.5% higher than child of order one (HR=1.675, 95% CI: 1.247 to 12.123). The confidence intervals for higher birth order and birth order two through four indicate that the rate could actually be as high as 6.374 and 12.123 and as low as 1.801 and 1.247, respectively. This result is in accordance with [7].

The hazard ratio of a child who was not breastfed as compared to those who were breastfed is 2.248. This means the risk of under-five mortality for children who were not breastfed is about 2.248 times higher than children who were breastfed. The 95% confidence interval also suggests that the risk of death for children who were not breastfed is 1.584 times as low and 3.007 times as large as those who were breastfed. Breastfeeding is positively related with child's survival chances. In literature most of the studies also suggest positive relation between child health and breastfeeding [4,6,7].

The risk of dying for a child born in a family without access to pipe drinking water is higher by 53.5% relative to those born in a family with access to pipe drinking water. The 95% confidence interval (1.446, 5.286) implies that the risk of death of children whose source of water is not pipe water is 1.446 as low and 5.286 as high as those in the reference group [18].

Type of birth (single vs. multiple) is also a significant predictor of under-five mortality. Children of multiple births are 1.062 more likely to die before age 5 relative to the reference group of single birth. The 95% confidence interval (1.011 to 3.359) indicates that the risk of death for a child who is of multiple births is 1.011 times as low and 3.359 times as large as those who were single birth. Several studies also identified birth type to be related with child death as multiple births is associated with a higher risk of child mortality [7,18].

The reference category for the mother age group is age >16. The estimated hazard ratio for the covariate mother age less than 16 is 1.008. This implies that child who are born to mothers of age group of less than 16 are dying at a rate 8% higher than those who are in the elder age group (age ≥ 16). The confidence interval suggests that the hazard ratios are as low as 1.001 and as high as 3.720. This result is in accordance with [4,7].

For the previous five years period before 2011

Mortality risk of child increases as size of family increases. The risk of dying for a child born in family of size 4-6 is higher by 1.879 time percent relative to those born in family with size of 1-3 (reference category). Children born in a family with size of seven and above have a significantly higher hazard rate than children born in a family with size of 1-3, i.e., children born in a

family of size seven and above have a 2.164 (HR=2.164, 95% CI: 1.987, 8.215) times higher risk of death as compared with children in the reference category. In contrast, Desta obtained in Ethiopia a negative relationship between family size and child mortality (as the family size increased, child mortality becomes lower) [18].

Preceding birth interval has a significant negative association with under-five mortality. Children born 2-3 years and more than 3 years after the previous birth have a reduced risk of child mortality by 31 and 52.5%, respectively, relative to children born less than 2 years after the previous birth. This finding is consistent with [4,6,7].

Higher birth orders (>4) have the highest mortality risk. Child with these characteristics are 2.067 times more likely to die in age less than 5 relative to the reference group births of order one (HR=2.067, 95% CI: 1.098 to 8.256). Child of order two through four are dying at a rate 23.6% higher than child of order one (HR=1.236, 95% CI: 1.031 to 12.199). The confidence intervals for higher birth order and birth order two through four indicate that the rate could actually be as high as 8.256 and 12.199 and as low as 1.098 and 1.031, respectively. This result is in accordance with [6,18].

The hazard ratio of a child who was not breastfed as compared to those who were breastfed is 1.530. This means the risk of under-five mortality for children who were not breastfed is about 1.530 times higher than children who were breastfed. The 95% confidence interval also suggests that the risk of death for children who were not breastfed is 1.006 times as low and 6.568 times as large as those who were breastfed. Breastfeeding is positively related with child's survival chances. In literature most of the studies also suggest positive relation between child health and breastfeeding [6,7,18].

The risk of dying for a child born in a family without access to pipe drinking water is higher by 76% relative to those born in a family with access to pipe drinking water. The 95% confidence interval (1.421, 9.373) implies that the risk of death of children whose source of water is not pipe water is 1.421 as low and 9.373 as high as those in the reference group. This result is in accordance [4,6].

In conclusion, the finding of this study agreed, to great extent, with the finding of the studies discussed above. However, in this study mother educational level is not found as a determinant factor- a result is not in line with literature. Moreover finding discussed above about family size opposite when it comes to Desta [18].

Conclusion

Our study suggests that family size, preceding birth interval, birth order, breastfeeding status, and source of drinking water were significant determinants of under-five mortality in the region. Community-based intervention is required and should focus on child spacing, feeding breast milk, improve access to safe/pipe drinking water and poverty eradication programs,

particularly in rural areas, to reduce avoidable under-five mortality in Somali region.

Ethics Approval and Consent to Participate

Ethical considerations. The protocol for the EDHS was approved by the Ethiopia Health and Nutrition Research Institute Review Board, National Research Ethics Review Committee (NRERC) at the Federal Democratic Republic of Ethiopia Ministry of Science and Technology, the Institutional Review Board of ICF Macro, and the Centers for Disease Control and Prevention (CDC) in Atlanta.

Availability of Data and Materials

The raw dataset is available from the corresponding author on reasonable request.

Competing Interests

The authors declare that they have no competing interests.

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Authors' Contributions

SG and FG have contributed from initial to final stage of the study equally. Moreover, SG participated in the data analysis. FG involved on critically reviewed the manuscript. All authors read and approved the manuscript.

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