PRINT: ISSN 0970-9274 ONLINE: ISSN 2456-6608
J Hum Ecol, 71(1-3): 118-126 (2020)
DOI: 10.31901/24566608.2020/71.1-3.3218

Under-Five Mortality and its Determinants in Ethiopia, 2016

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KEYWORDS Binary Response. Odds Ratio. Survey Logistic Regression

ABSTRACT Although economic improvement in Ethiopian households resulted in a decrease of under-five mortality, this phenomenon still affects all regions in Ethiopia. Identifying factors affecti ng under-five mortality is an essential problem that requires consideration. This paper attempts to detect some contributing factors for deaths of children below the age of five. The data utilized in this investigation were acquired from the 2016 Ethiopian Demographic and Health Survey. Statistical approaches that consider the multi-stage features of the survey were implemented. The investigation of the overall significance revealed that some factors have a considerable impact on deaths of children below the age of five. The covariates gender of a baby and wealth (poor vs rich) were found to have substantial influences. This study suggests that increasing the standard of living in poor households can reduce deaths of children below the age of five in Ethiopia.

INTRODUCTION

Although numerous underdeveloped nations in every part of the globe experience a huge proportion of deaths for children below the age of five, the region to the south of Sahara Desert is the most affected. Deaths of children below the age of five is predominantly dependent on the living condition and the welfare of inhabitants (Honwana and Melesse 2017). Child death is among the grave problems encountered by those who are living to the south of the Sahara Desert as well as several other nations across the globe. Several efforts have been made all over the world to avert the increase in deaths of children below the age of five. One of these efforts was the Millennium Development Goal (MDG4). The MDG4 intended to cut deaths of children below the age of five by around sixty-six percent between 1990 and 2015 (United Nations 2010; Honwana and Melesse 2017). Throughout the 1990 – 2015 period, the deaths rates of children below the age of five dropped in excess of fifty percent (United Nations 2012; United Nations 2016; Honwana and Melesse 2017). This indicates that the MDG 4 objective to lower death rates of children below age five by sixty-six percent in the period 1990 to 2015 was left unattained. Later, the society across the globe effected Sustainable Development Goals (SDGs) for 2016-2030, in order to finalize the program that was left incomplete by the previous MDGs. SDGs reveal steadiness and strengthening of the MDGs at the same time crafting it to be more workable by improving conservational purposes (Kutmar et al. 2016). Besides, SDGs enjoy the advantages added by the experience and knowledge gained from the previous Millennium Development Goals. Consequently, at present the global society is giving attention to accomplish the Sustainable Development Goal 3 (SDG 3) as a substitute for MDG4. Studying the determinant of under-five mortality will help in achieving the goals of SDG3 that plans to guarantee healthiness and welfare for all humans (United Nations 2016; Honwana and Melesse 2017). Even though the region to the south of Sahara Desert has larger rate of child deaths in contrast to the other part of the globe, a quicker drop in its child death rate is registered, falling from 177 in 1990 to 98 in 2012 for every 1000 children born alive (UNICEF 2014; Honwana and Melesse 2017). This is an admirable achievement. However, it is necessary to take proper action to thwart the under-five mortality that is still disturbing the Sub-Saharan Africa and some developing regions related to the MDG4's 2015 levels.

Ethiopia is located in east Africa. It is among those nations in the south of the Saharan Desert, which is currently facing high death rate of children below the age of five. Like other Sub-Saharan African countries, Ethiopia has achieved substantial improvement in reducing deaths of children less than five years old. Based on the report by the Central Statistical Agency (Ethiopia) and ICF International (2012), death rates of

children below age five have lessened by forty seven percent over the 15-year period prior to the 2011Ethiopian Demographic Health Survey plummeting from 166 to 88 deaths for every 1000 children born alive. Due to the raised stages of death rates of children below the age of five, it is apparent from Ethiopia Demographic and Health Survey (EDHS) information that Ethiopia's present level of child death rate is more than expected. According to the EDHS (2016), one in every 15 children perishes prior to celebrating his/her fifth natal day. Some variation in death rates of children is observed between countryside and urbanized regions. For instance, the death rates were uppermost in Benishangul-Gumuz (a remote area near the border with Sudan) and bottommost in Addis Ababa (the capital city of the country). This might be because of the stage of development in Addis Ababa, which has better access to hospital infrastructures, well-trained health professionals, better education, and has a high level of income for some residents. This indicates the relevance of more interventions to decrease the under-five mortality rate in countryside of Ethiopia.

Demographic aspects such as mum's age at the time of delivery of a baby, may impact the wellbeing and development of a new born. Babies produced by mature mums and babies produced by juvenile mums are at high risk of mortality. This is ascribed to natural procreative adulthood. Delivery difficulties are sometimes documented for matured mums, subsequent in offspring that have basic health problems. Juvenile mums are unqualified to look after their toddlers (Kibet 2010; Honwana and Melesse 2017). Some studies indicated that babies below the age of five delivered by juvenile mums (below 19 years of age) possess a greater likelihood of passing away (1.68 times) contrasted to babies delivered by mums in the age range 20 to 24 years (Honwana and Melesse 2017; Sinha et al. 2016). To investigate the factors affecting under-five mortality, many researchers used the systematic structure of child existence factors in unindustrialized nations (Mosley and Chen 1984). According to Mosley and Chen (1984), fourteen bio-medical covariates (proximate factors) were established. Numerous investigators indicated that mother's schooling level has a statistically substantial impact on deaths of children below the age of five. Desai and Alva (1998) employed an initial phase of Demographic and Health Survey data for twenty-two unindustrialized nations, and they indicated mother's schooling level was strongly related to death of children below the age of five in many nations. This raises the responsiveness of health care services (Honwana and Melesse 2017). The study by Ayele et al. (2015) introduced a structured additive logistic regression model in order to assess the contributing factors to high death rates for children below the age of five in Ethiopia. They indicated that death of a child is lesser with a bigger family income, and babies from mature mums are less probable to perish in contrast to those babies from younger mothers. On the other hand, the study by Esher et al. (2015) employed three successive Demographic and Health Surveys in Nigeria (namely 2003, 2008 and 2013). They employed the Cox regression model, and indicated that humble families, residing in countryside and mothers without proper schooling had a significant influence on death rate of Nigerian children. Susuman (2012) conveyed comparable results by making use of the 2000 and 2005 Ethiopian Demographic Health Survey data that pinpoint factors affecting death of children below age five in Ethiopia. The research conveyed that countryside residents and unprivileged families are the utmost influential features of baby deaths in Ethiopia.

Consequently, referring to the information at hand, the key factors affecting deaths of children below the age of five may be grouped into three categories: Mum, baby, and family features (Negera et al. 2013; Honwana and Melesse 2017). Mother's features include age at birth, and mother's educational status. Similarly, family features include household residence, region and wealth.

The design of the Ethiopian Demographic and Health Survey was convoluted in nature. Stratified two-stage sampling design that considers different sampling weights was employed in this survey. Numerous investigations utilized simple dichotomous or regression with ordered response categories, which exclude the multistage feature of the sampling procedure. The rationale behind our research paper is to pinpoint some factors that affect deaths of children below the age of five in Ethiopia by bearing in mind the complexity of the sampling design.

METHODOLOGY

At the beginning 10 641 households were selected at national level for EDHS. From the selected households, females in the age range fifteen to forty nine that were obtainable in a single day afore the start of the study, who were regular occupants were qualified to be included in the study. Two stage sampling design was utilized in the 2016 EDHS. All administrative provinces were classified into urbanized areas and countryside. This resulted in 25 groups. Separate samples of Enumeration Areas (EAs) were chosen in each group via two stage sampling. Inherent classification and proportionate division were realised for every lower level of administration by organizing the sampling frame inside each sampling group afore choosing the sample, according to administrative units in different levels, and by applying probability proportional to size approach at primary sampling stage. The dependent (response) variable is death child below age five that is dichotomous (kid is alive or not alive) and the explanatory factors from the EDHS are classified into two sets: socioeconomic and demographic aspects. Socio-economic aspects include wealth index, type of dwelling (countryside or urbanized area), region, size of a child at birth, place of delivery and educational status of the mother. Place of delivery has been categorized into two: no hospital and hospital. The wealth index is catalogued into three sets (poor, middle and rich). Size of a child at birth has been categorized into three: small, average and large. Educational status of mam was classified into two: uneducated and educated. Demographic factors include sex of a child (male or female) and women's age. Women's age was classified into seven age intervals. Each interval is a 5-year range with the youngest group being fifteen to nineteen and the oldest group being forty five to forty nine.

Logistic Regression Approach

The logistic regression approach is intended to model a probability of an event that permanently fall in the interval zero to one. In this particular research at hand, the probability describes the possibility of death for an under-five child. Logistic regression is a proper method to study of the relationship between a dichotomous dependent variable and a single or multiple explanatory variables. For a single explanatory variable X, for example, age of a child (age), and a single binary response variable *Y*, for instance, death of a child, the logistic model predicts the log odds of the response from the explanatory variable *X*. The log-odds is the natural logarithm (ln) of odds of *Y*.

The simplest form of the logistic model can be given by

$$\log it\,(\pi(x)) = In\left(\frac{\pi(x)}{1-\pi(x)}\right) = In\,(odds) = a+\beta x \qquad (1)$$

Another form of the simple logistic regression model that express the probability of the response as a function of covariate has the following form.

$$\pi(x)=p(Y \text{ is outcome of interest}|X=x) = \frac{e^{a+bx}}{1+e^{a+bx}} \qquad (2)$$

Where $\pi(x)$ is the probability that a child will die at a given value of the covariate x, α is y-intercept, β is coefficient of X and X is either continuous or categorical predictor. Model (1) indicates there is a linear relationship between the log-odds of the probability and the explanatory variable (X) . Model (1) can be extended to multiple logistic regression model.

$$log\ it\,(\pi\,(x)) = \mathrm{In}\left(\frac{\pi\,(X)}{1-\pi\,(X)}\right) = \alpha + \sum_{i=1}^{k} \beta_i\ x_i \qquad (3)$$

$$\pi\,(X) = \frac{e^{a}+\sum_{i}^{k} \beta_i x_i}{1+e^{a}+\sum_{i=1}^{k} \beta_i x_i} \qquad (4)$$

Where $\pi\,(X)$ is the probability that a child will die at a given value of the covariate *x*, α is y-intercept, β_s = the parameters indicating the effect of each explanatory variable, X_s= are set of explanatory variables. The estimations of the unknown parameters of model (3) is the main aim of logistic regression procedure. The maximum likelihood (ML) estimation method is employed to accomplish the goal of estimation. This method finds the estimates of the parameters that maximize the likelihood function (Melesse et al. 2016). Logistic regression approaches are suitable for the evaluation of the influence of explanatory variables on the response of interest for data realized by simple random sampling method. Nevertheless, employing logistic regression for data obtained through more convoluted sampling procedures, can result in the point estimates, confidence intervals, p-values and

standard errors that are not valid. (Vittinghoff et al. 2011; Honwana and Melesse 2017). Therefore, to analyse data from complex survey design, it is recommended to employ a survey logistic regression that incorporates the cluster, the stratification, and the weights in the sampling design (Agresti 1996; Anthony 2002; Binder and Roberts 2003; Vittinghoff et al. 2011; Moeti 2007; Mukhopadhyay 2016; Honwana and Melesse 2017).

The theory behind survey logistic regression model is similar to the ordinary logistic regression model (Ayele et al. 2012; Yirga et al. 2019). The model parameters in survey logistic regression model can be estimated by fitting logistic regression for binary outcome that takes into consideration the complexity of the survey sampling. The survey logistic regression approach uses a modified maximum likelihood estimation called "pseudo-maximum likelihood estimation (PMLE)". It includes element weights in the estimating equation.

Let $u= \{1,2,...n\}$ be a fixed number of entities that is divided into $h=1,2,...H$ groups, each group is additionally partitioned into $j=1,2,...n_h$ primary sampling units (PSU) that is established by $i=1,2,...n_{hj}$ secondary sampling units (SSU), involving members. Suppose the perceived data comprises SSU selected among n'_h PSU in the group h. Therefore, the whole observations will be

$$n = \sum_{h=1}^{H} \sum_{j=1}^{n_h} \sum_{i=1}^{n_{hj}} n_{hji} \quad (5)$$

Suppose $\pi_{hji}=P(Y_{hji}=1|X_{hji})$, that is the probability of an event (child death) in the sample, the sampling weight in each sampling unit is denoted by W_{hji}, for the $(hji)^{th}$ unit. Therefore, the survey logistic model is given by

$$\log it\,(\pi_{hji}) = \log\left(\frac{\pi_{hji}}{1=x_{hji}}\right) = X'_{hji}\beta \quad (6)$$

Where Y_{hji}, X_{hji} and β are the categorical dependent variable, the matrix of explanatory variables and the vector of regression coefficients respectively. Pseudo maximum –likelihood estimation method usually called weighted maximum likelihood can be used to estimate the parameter vector β of the logistic regression model when data are obtained via multi-stage sampling. The weighted maximum likelihood approach integrates the sampling design and the various sampling weights in the estimation of β (Ayele et al. 2012; Hien and Hoa 2009; Yirga et al. 2019). The pseudo-likelihood function for the contribution of a single observation in complex sampling design is given by

$$\pi_{h_{ji}}^{W_{hji}Y_{hji}} (1-\pi_{hji})^{(1-W_{hji}Y_{hji})} \quad (7)$$

Thus the pseudo-likelihood function with weight W_{hji} for a set of **n** observation is given by

$$L(\beta|W_{hji}Y_{hji}) = \prod_{h=1}^{H}\prod_{j=1}^{n_h}\prod_{i=1}^{n_{hj}} \pi_{hji}^{Wh_{ji}Y^{hji}} (1-\pi_{hji})^{(1-W^{hji}Y^{hji})} \quad (8)$$

The estimation of the parameters associated with the explanatory variables was accomplished by employing SAS version 9.3, SURVEYLOGISTIC procedure.

RESULTS

The findings obtained by using the survey logistic regression model and simple logistic regression are exhibited in this section. Table 1 describes the characteristics of the variables in the study. The probability of deaths for babies below the age of five is modelled as a function of these explanatory variables. The study contains 10,641 households. More than three-quarters of the mothers were residing in the countryside (81.4%) and 54.3 percent of them were living below the breadline (poor), as shown in Table 1. The majority of the women were in the age range 25-29 years and this accounts for 29.7 percent of the women, whereas less women were in the age range 45-49 (1.9%). Based on Table 1, most infants' mothers (64.3%) are uneducated. Many children were average in size at birth (41.5%), followed by large at birth (30.2%) and small at birth (28.3%), while most infants' mothers came from Oromia (14.9%), Somali (14.1%) and SNNP (12.0%) regions. In addition, 51.5 percent of the children were males and most infants' mothers did not deliver their children in a hospital (67.2%).

The logistic regression models with and without complex survey design are fitted by using the explanatory variables in Table 1. The results for logistic regression without complex survey design are presented in Table 2. The predicted probability of deaths for under-five child is a function of the explanatory variables. It is given by

$$\hat{P} = \frac{\exp\left(-2.768 + \sum_{i=1}^{K} \hat{\beta}_i X_i\right)}{1 + \exp\left(-2.768 + \sum_{i=1}^{K} \hat{\beta}_i X_i\right)} \quad (8)$$

Where β_j are the estimated coefficients of the explanatory variables that have significant effect on the response variable.

Table 1: Spread of babies by different attribute for EDHS data 2016

Attribute	*Category*	*Sample size*	*Percentage*
Gender of Baby	Male	5483	51.5
	Female	5158	48.5
Age Range of Mum during Delivery	15–19	404	3.8
	20–24	2171	20.4
	25–29	3161	29.7
	30–34	2360	22.2
	35–39	1697	15.9
	40–44	647	6.1
	45–49	201	1.9
Region	Tigray	1033	9.7
	Afar	1062	10.0
	Amhara	977	9.2
	Oromia	1581	14.9
	Somali	1505	14.1
	Benishangul-Gumuz	879 3	8.
	SNNPR	1277	12.0
	Gambela	714	6.7
	Harari	605	5.7
	Addis Ababa	461	4.3
	Dire Dawa	547	5.1
Area of Residence	Urban	1974	18.6
	Rural	8667	81.4
Educational Attainment of Mother	Uneducated	6838	64.3
	Educated	3803	35.7
Wealth Index	Poor	5775	54.3
	Middle	1466	13.8
	Rich	3400	32.0
Size of a Child at Birth	Small	3008	28.3
	Average	4419	41.5
^	Large	3214	30.2
Place of Delivery	No Hospital	7155	67.2
	Hospital	3486	32.8

Survey logistic regression model was fitted by employing the variables presented in Table 1. Model selection was implemented and the significance of possible explanatory variables was examined. Subsequently it was learned that some covariates have significant influence in foreseeing the chance of death for children below the age of five. The significant parameter estimates connected to each explanatory variable along with the estimated odds ratios (OR) is indicated in Table 3. The association between the probability of mortality for children below the age of five and the explanatory variables considered in the study was assessed by means of odds ratios.

Table 3 exhibits that there was a meaningful association connecting under-five mortality to sex of child (females compared to males), since the p-value is <0.0001. Wealth index (poor versus rich) has a significant effect on child mortality. Mother's age has shown no statistically significant association with under-five mortality compared to those in the 25-29 years age group. Table 3 demonstrates that all regions have shown no significant effect on the probability of under-five mortality as compared to Oromia (since p-values are >0.05). Place of residence (rural/urban), educational level of mothers (educated vs no education), wealth index (middle vs poor) have shown no statistically significant association with under-five mortality (since p-values are >0.05). Wealth index (rich vs poor) displays a significant influence on mortality of children below the age of five. Place of delivery (hospital vs no hospital) and child size during birth (small vs average and large vs average) have shown no significant influence on deaths of children below the age of five.

DISCUSSION

In this research, the Ethiopian Demographic and Health Survey 2016 (EDHS) data were analyzed to assess the covariates influencing mortality of children below the age five in Ethiopia. The EDHS data includes demographic and socioeconomic variables (gender of a baby, age of mum, woman's wealth index, and educational status of the mother, type of place of residence (urban/rural), place of delivery, region, and child size during birth). The identified covariates may aid policymakers to distinguish the areas they want to concentrate on to boost the organization and appraisal of health programs to avert death of children below the age of five in Ethiopia. The results of this study are in agreement with the results of several researchers that undertook research on the factors influencing under-five mortality in many countries, comprising Ethiopia. This includes Desai and Alva (1998), Negera et al. (2013), Susuman (2012), Chowdhury (2013), Ezeh et al. (2015) and Ayele et al. (2015).

Table 2: Parameter estimates of the logistic regression analysis

Coefficients	*Maximum likelihood estimates*			*Odds ratio*		
	Estimate	*Standard error*	*P-value*	*Estimate*	*95% confidence interval*	
Intercept	-2.768	0.155	<0.001			
Gender of Baby (Reference=Male) Female	-0.342	0.084	<.0001	0.709	0.601	0.836
Age Interval of Mum at Delivery (Reference= 25-29)						
15-19	0.176	0.214	0.413	1.192	0.783	1.814
20-24	0.051	0.120	0.673	1.052	0.832	1.331
30-34	- 0.123	0.122	0.311	0.884	0.696	1.122
35-39	0.161	0.126	0.202	1.174	0.918	1.503
40-44	-0.052	0.190	0.784	0.949	0.654	1.377
45-49	0.504	0.251	0.045	1.655	1.012	2.707
Region (Oromia = Reference)						
Addis Ababa	0.164	0.333	0.622	1.179	0.613	2.265
Afar	0.357	0.166	0.031	1.429	1.033	1.979
Amhara	-0.095	0.185	0.608	0.909	0.632	1.307
Benishangul-Gumuz	0.337	0.172	0.050	1.401	0.999	1.964
Dire Dawa	0.343	0.224	0.126	1.409	0.908	2.188
Gambela	0.261	0.198	0.187	1.299	0.881	1.914
Harari	0.389	0.200	0.052	1.475	0.996	2.183
SNNPR	0.071	0.166	0.669	1.074	0.776	1.486
Somali	0.278	0.157	0.077	1.321	0.970	1.798
Tigray	-0.196	0.200	0.328	0.822	0.555	1.217
Area of Residence (Rural = Reference) Urban	-0.585	0.178	0.001	0.557	0.393	0.790
Wealth Index (Poor = Reference)						
Middle	-0.098	0.134	0.465	0.907	0.698	1.179
Rich	-0.017	0.125	0.893	0.983	0.769	1.256
Place of Delivery (No Hospital = Reference)						
Hospital	-0.197	0.114	0.085	0.822	0.657	1.028
Size of a Child at Birth (Average = Reference)						
Small	0.320	0.101	0.002	1.377	1.129	1.679
Large	0.161	0.103	0.120	1.174	0.959	1.437
Level of education of mum (uneducated = Reference)						
Educated	-0.0863	0.109	0.427	0.917	0.742	1.135

Binary multiple logistic regression and survey logistic regression models were used in this study to pinpoint the covariates influencing mortality of children below the age of five . Firstly, the fitting of logistic regression model was made by using the EDHS data. This fit is an application of the usual generalized linear models, where the response variable is dichotomous (child is alive/dead). In addition, this model allows the probability to be modelled as a function of the predictor variables. Furthermore, logistic regression models assume the data are from simple random sampling. Ezeh et al. (2015) and Chowdhury (2013) indicated that children of comparatively juvenile mums have more likelihoods of death. Nevertheless, the logistic analysis in this paper revealed that the probability of deaths surges as the mums get older (45-49 years age group). This could be because of numerous causes; poor mothers at older age could have many children, consequently the insignificant allocation of limited supplies to meet the necessities of nurturing babies may distress the juvenile ones, for this reason, the likelihood of under-five mortality could be greater for children below the age of five. On the other hand, the logistic analysis has revealed that Afar region was more likely to experience mortality of

Table 3: Parameter estimates of the survey logistic regression analysis

	Maximum likelihood estimates			*Odds ratio*		
Coefficients	*Estimate*	*Standard error*	*P-value*	*Estimate*	*95% confidence interval*	
Intercept	-2.6899	0.206	<0.0001			
Gender of Baby (Reference=Male)						
Female	-0.5050	0.1272	<.0001	0.604	0.470	0.775
Age Interval of Mum during Delivery (Reference=25-29)						
15-19	-0.0915	0.4711	0.8461	0.913	0.362	2.302
20-24	-0.0932	0.2190	0.6706	0.911	0.593	1.401
30-34	-0.3608	0.1893	0.0571	0.697	0.481	1.011
35-39	0.1375	0.1972	0.4859	1.147	0.779	1.690
40-44	-0.0408	0.2750	0.8822	0.960	0.559	1.648
45-49	-0.0881	0.3898	0.8213	0.916	0.426	1.969
Region (Reference=Oromia)						
Addis Ababa	-0.2751	0.4514	0.5424	0.759	0.313	1.843
Afar	0.4192	0.2174	0.0543	1.521	0.992	20331
Amhara	-0.1333	0.2022	0.5101	0.875	0.588	1.302
Benishangul-Gumuz	0.2640	0.1761	0.1344	1.302	0.921	1.840
Dire Dawa	0.2498	0.3961	0.5285	1.284	0.590	2.795
Gambela	0.1947	0.2611	0.4562	1.215	0.728	2.029
Harari	0.2253	0.2604	0.3872	1.253	0.751	2.089
SNNPR	-0.00259	0.2229	0.9908	0.997	0.644	1.545
Somali	0.1597	0.1843	0.3866	1.173	0.817	1.685
Tigray	-0.2042	0.2331	0.3814	0.815	0.516	1.289
Area of Residence (Rural = Reference)						
Urban	-0.2469	0.3119	0.4289	0.781	0.423	1.441
Wealth Index (Poor = Reference)						
Middle	-0.0709	0.1834	0.6990	0.931	0.650	1.334
Rich	-0.3473	0.1694	0.0408	0.707	0.507	0.984
Place of Delivery (No Hospital = Reference)						
Hospital	-0.1734	0.1694	0.3065	0.841	0.603	1.173
Size of a Child at Birth (Average = Reference)						
Small	0.1770	0.1727	0.3058	1.390	0.987	1.959
Large	0.3296	0.1745	0.0595	1.194	0.850	1.675
Educational Attainment of Mother (No Educated = Reference)						
Educated	-0.1872	0.1657	0.2592	0.829	0.599	1.148

children below the age of five. The standard of living and availability of health services for this region could have a significant influence on mortality of children below five years. Furthermore, the logistic model exhibited that female babies had smaller chance of death than males. The justification for this could be natural reasons (Ezeh et al. 2015). A research on roots of neonatal deaths in Spain indicated that this could be because of delayed lung development generating a breathing difficulty in male babies in contrast to females (Alonso et al. 2006).

In addition, the findings of the study under the logistic model showed significantly larger probability of mortality for babies born in countryside than those born in urban areas. This result supports the findings by Negera et al. (2013), Ezeh et al. (2015) and Chowdhury (2013). Higher mortality rates for children born in countryside may be due to delivery in unhygienic conditions, poor condition of living and limitation of public health services (Chowdhury 2013). Children with small size at birth had greater chances of mortality than average sized children at birth. These findings were also supported by Negera et al. (2013), Desai and Alva (1998) and Chowdhury (2013). In addition, model checking was performed using the Hosmer-Lemeshow goodness

of fit test statistic and concluded that there is no evidence of lack of fit. When complex survey logistic regression is considered, the wealth index have a significant influence on the mortality of children below five years.

CONCLUSION

The findings of this study support that identifying the determinants of mortality of children below the age of five is a vital concern in Ethiopia. The outcomes of this study suggested that living in a poor household with male children is a commonly significant factor affecting mortality of children in Ethiopia. Some explanatory variables in the study showed no significant relationship with child mortality. However, these factors might show significant relationship with mortality of children below five years, if different survey data is considered. This investigation recommends that upgrading the economic status of the mother help to improve the health status of under-five children, which will result in the reduction of mortality among children. Hence, interferences that focus on poor mothers residing in the countryside of all regions, in all 5-year age groups with male children are crucial for successful child survival in Ethiopia.

RECOMMENDATIONS

Based on this study and other findings, the following recommendations are made: the government of Ethiopia needs to implement poverty reduction strategies and programs designed to support the very poor families. Bringing rapid economic growth that has fair income distribution may help alleviate under-five mortality.

ACKNOWLEDGEMENTS

The researchers thank the University of KwaZulu-Natal for funding this research work. The researchers also thank ORC Macro and Measure DHS for allowing them to use the data file.

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Paper received for publication in August, 2019
Paper accepted for publication in November, 2019