International Journal of Medical, Medicine and Health Sciences
ISSN: 2517-9969
Vol:10, No:1, 2016

The Risk Factors Associated with Under-Five Mortality in Lesotho Using the 2009 Lesotho Demographic and Health Survey

T. Motsima

Abstract**—**The under-5 mortality rate is high in sub-Saharan Africa with Lesotho being amongst the highest under-5 mortality rates in the world. The objective of the study is to determine the factors associated with under-5 mortality in Lesotho. The data used for this analysis come from the nationally representative household survey called the 2009 Lesotho Demographic and Health Survey. Odds ratios produced by the logistic regression models were used to measure the effect of each independent variable on the dependent variable. Female children were significantly 38% less likely to die than male children. Children who were breastfed for 13 to 18 months and those who were breastfed for more than 19 months were significantly less likely to die than those who were breastfed for 12 months or less. Furthermore, children of mothers who stayed in Quthing, Qacha's Nek and Thaba Tseka ran the greatest risk of dying. The results suggested that: sex of child, type of birth, breastfeeding duration, district, source of energy and marital status were significant predictors of under-5 mortality, after correcting for all variables.

Keywords**—**Under-5 mortality, risk factors, millennium development goals, breastfeeding, logistic regression.

I. Introduction

GLOBALLY, in 2011, approximately 6.9 million (19 000 a day) children died, mostly from preventable diseases [1]. The global mortality for children under the age of five dropped by 41% from 87 per 1,000 live births in 1990 to 51 per 1,000 live births in 2011 [1]. Despite this enormous accomplishment, the highest under-5 mortality rate (U5MR) was found in sub-Saharan Africa during the same period [1] hence childhood mortality remains a major public health concern in this region. Reducing U5MR has drawn a global concern [2] which has led to the development of the global anti-poverty strategy, the Millennium Development Goals (MDGs). The heads of States and Governments gathered at the United Nations in New York from 6 to 8 September 2000, and they adopted the United Nations Millennium Declaration committing their nations to a global partnership aimed at reducing extreme poverty. They set a number of time-bound and quantified targets with 1990 as a baseline period and 2015 as a target period. These targets and their corresponding indicators are known as MDGs [3]. The MDGs detail basic human rights such as the rights of each person to health, education, shelter and security as pledged in the Universal Declaration of Human Rights and the United Nation Millennium Declaration [4]. One of the MDG targets or indicators is to reduce child mortality by two thirds from 1990 to 2015. Lesotho is one of the countries that had committed itself to the MDGs [5]. This implies that the country has set its sight on reducing its U5MR by two thirds from 1990 to 2015 [1].

By 1990, the Lesotho's U5MR and infant mortality rates (IMR) were 88 per 1,000 live births and 71 per 1,000 live births, respectively [6]. Based on the MDG target of reducing the U5MR and IMR by two-thirds between 1990 and 2015, the U5MR and IMR's targets for the country are 29.3 per 1,000 live births and 23.7 per 1,000 live births, respectively. According to the World Health Organization (WHO), in 2011 the U5MR and IMR for Lesotho were 86 per 1,000 live births and 63 per 1,000 live births respectively [6] and these were still very high.

Despite the improvement in medical technology [7] and the implementation of the Prevention of Mother To Child Transmission (PMTCT), [8] the country's U5MR and IMR remain high and it is unlikely that the country will achieve the 2015 MDG4 targets. In terms of the U5MR rankings, Lesotho is ranked number 35 amongst the countries with the highest U5MR [9] (UNICEF, 2012: 89). Other than Mozambique (103 per 1,000 live births) and Swaziland (104 per 1,000 live births), Southern African countries such as Botswana (26 per 1,000 live births), Namibia (42 per 1,000 live births), South Africa (47 per 1,000 live births), Zambia (83 per 1,000 live births) and Zimbabwe (67 per 1,000 live births) had lower U5MRs in 2011 than Lesotho [6].

It is evident that the risk factors associated with under-5 mortality have been widely investigated in most parts of the world, particularly in developing countries. However, little research has been conducted in Lesotho to determine the risk factors that are associated with under-5 mortality.

The objective of the study is to determine the risk factors associated with under-5 mortality in Lesotho using the 2009 Lesotho Demographic and Health Survey data. The study sought to investigate whether under-5 mortality occurs by chance or due to certain risk factors. The results of the study could be used to inform government in their policy making or in their review of the child health programmes. It would enable them to monitor progress of under-5 mortality towards the achievement of the MDG goal 4 target. In addition, this study will provide an understanding of under-5 mortality in Lesotho.

T. Motsima is with the Faculty of Science, Tshwane University of Technology, Pretoria, South Africa (phone: +27(0)12 382 5911; e-mail: MotsimaT@tut.ac.za).

II. Theoretical Consideration

Evidence has shown that sex of the child has a significant impact on under-5 mortality. In a study conducted in South Africa, [13] it was reported that a boy child was 1.3 times more likely to die before the age of five years than a girl child. The length of preceding birth interval was previously reported to be associated with under-5 mortality. The type of birth is also an important factor to avoid under-5 mortality. Previous research has shown that children of multiple births ran a significantly greater risk of dying in Malawi, Mozambique, Tanzania and Zambia [15].

Low birth weight has been associated with mortality, strongly with infant mortality and weight at birth was correlated with nutrient deficiency [13]. Children born with low birth weight as a result of under nutrition face the risk of dying after birth. Maternal age is another factor that contributes to mortality in children under the age of five. Previous studies have found that children of younger mothers and those of old mothers have a higher risk of mortality than those of middle aged mothers [12]. In Kenya, it was found that maternal age was a significant determinant of under-5 mortality, with the highest likelihood of survival being among the children of mothers aged 32 years or more [12]. In addition, breastfeeding duration is a determinant of under-5 mortality. Findings of the study conducted in South Africa revealed that children who were not breastfed were 3.09 times more likey to die than those who were breastfed [18]. In South West Ethiopia, it was found that children who were not breastfed were six times more likely to die compared to those who were breastfed [11]. Moreover, it was found that the duration of breastfeeding had an influence on under-5 mortality in Kenya. Children who were breastfed for more than six months had a significantly lower probability of mortality than those who were breastfed for less than six months [12].

Many developing countries are characterized by the existence of regional disparities. Some countires are economically advanced while others are economically and socially deprived. Evidence suggests that living in economically and socially deprived community is associated with the risk of under-5 mortality [7]. For instance, mothers who reside in rural areas are economically and socially disadvantaged. Also, there is a scarcity of jobs in rural areas and when such are available the wages are often too little to cover the basic needs. In Lesotho, the majority of men including husbands or partners of rural women work in urban areas, particularly in the mines of South Africa and only visit their families after a period of time. Often the women and children live on their own whilst the men work in urban areas for the majority of the time. Accessing basic health services due to long distances that pregnant women have to travel and the associated cost remains a challenge to rural women. This places their children at risks of morbidity and mortality. In Nigeria, it was found that the risks of death were significantly higher for children of mothers who were residing in the North-Central, South-South and almost two-fold higher for children of mothers residing in the North-West, North-East and South-East areas when compared with children in the Southwest [7]. Risks were also higher for children raised in the rural areas compared to their counterparts in urban areas [7]. In contrast, the risks of death were significantly lower for children whose mothers had access to prenatal care by doctors or hospital deliveries [7].

Maternal education level can affect the child's survival. A mother's level of education will influence her choices and increase her desire to learn more about practices related to contraception, nutrition, hygiene, preventative care and disease treatment [13]. However, higher education levels may also be associated with occupation, larger household incomes, larger birth spacing and therefore access to better medical services. Previous research has shown that maternal education is significantly associated with under-5 mortality [2]. Environmental factors such as source of drinking water, toilet facility, source of energy and type of dwelling also have a significant influence on under-5 mortality. Increased risk of fatal diarrhoeal diseases is expected among households with no clean drinking water or safe sanitation [13]. Furthermore, children raised in a community that lacks electricity, good drinking water and health facilities were likely to suffer from this deprivation which could directly or indirectly influence their health outcomes [7].

Marital status is a predictor of under-5 mortality. Children from single or divorced mothers may face a risk of dying due to the fact that it may be economically difficult for single or divorced mothers to look after children mainly because the running cost of the households may be high. Although previous research has shown that children of divorced mothers face higher risks of death than those of unmarried mothers [7], it was found that the risks of under-5 death were significantly lower for children of single and divorced mothers when compared to the children of married mothers [10]. Furthermore, in South Africa it was found that a married mother was 1.74 times as likely to have lost a child compared to a woman who was not married [18].

Children not delivered by trained professionals face the highest risks of dying because some children are delivered at home where there are no trained professionals. This mostly occurs in socially and economically disadvantaged areas where there are no health facilities and adequate transport to transport patients to the nearest health facilities. Hospital care greatly contributes to successful maternal and child health outcomes and is an important determinant of under-5 mortality [10]. It was reported that the risks of under-5 mortality was significantly lower for children of mothers who lived in communities with a high level of hospital deliveries compared with children of mothers living in communities with a lower level of hospital deliveries [10].

III. Data and Methods

A. Data

The data used for this analysis come from the nationally representative household survey called the 2009 Lesotho Demographic and Health Survey (LDHS). The survey was

conducted by the Ministry of Health and Social Welfare (MOHSW) with the purpose of collecting population based-data to inform the Health Sector Reform Programme (2000-2009), evaluate the strides made since the first LDHS was conducted in 2004, set baselines for programmes and provide information for policy and strategic planning [14]. Also, the 2009 LDHS was designed to provide estimates of health and demographic indicators at the national level, for urban-rural areas, and for each of the ten districts of Lesotho, namely; Butha-Buthe, Leribe, Berea, Maseru, Mafeteng, Mohale's Hoek, Quthing, Qacha's Nek, Mokhotlong, and Thaba-Tseka [14]. A total of 9 391 households were sampled and 7 624 women aged 15 to 49 years were interviewed [14].

Information about their dwellings such as source of water, type of toilet facility, source of energy, materials used to construct their houses and ownership of various consumer goods were collected [14]. Women were asked questions about their background characteristics (such as age, education, employment, religion, place of residence, district and child mortality), birth history and childhood mortality, knowledge and use of family planning methods and infant feeding practices; amongst others [14].

B. Methods

Information on socio-demographic and bio-demographic factors was collected. These socio-demographic and bio-demographic variables are regarded as independent or explanatory variables in this study. The dependent or outcome variable of the study was the death of a child under five years of age and was dichotomous (coded 1 for death and 0 for alive). Odds ratios were used to measure the effect of each independent variable on the dependent variable. Independent variables were regarded as significant if the level of significance was smaller than 0.05.

Bio-demographic factors such as sex of child, length of preceding birth interval, multiple birth, birth weight, maternal age and breastfeeding duration, as well as socio-demographic factors such as district (region), place of residence, maternal education, main source of water, toilet facility used, main source of energy, type of dwelling, marital status, whether the mother or guardian used snuff and place of delivery were considered for analysis. The outcome variable is under-5 mortality and was coded 0 if the child was alive at the time of the interview and 1 otherwise. These variables are commonly used to analyse childhood mortality in developing countries.

The length of preceding birth interval was categorized into first births, 9-24 months, 25-36 months, and 37 months or more while type of birth was converted into a binary variable as singleton for single births and multiple for multiple births of two and more. A cut-off point for distinguishing low and high birth weight is 2.5 kg. The weight of children who weighed below 2.5 kg at birth was classified as low birth weight and for those who weighed 2.5 kg and more was classified as high birth weight. For breastfeeding duration, four categories were created. These were 0-12 months, 13-18 months, 19 months or more, and never breastfed. Maternal age also had four categories, namely; 15-19 years, 20-29 years, 30-39 years, and 40-49 years of age. Also, maternal education was transformed into four classifications and were higher education, secondary education, primary education and none while for place of delivery of birth a binary variable was created, births that took place in government hospitals, government health centres, government health posts, other public sector domains, private hospitals/private clinics and other private medical sectors were grouped together in the health facility category and were coded zero (0) while deaths that occurred at homes, other homes and other places were also combined and categorized as home births and coded one (1). Main source of drinking water, toilet facility and main source of energy were all converted into binary variables. On one hand, piped water inside dwelling, piped water inside yard and public tap were regarded as piped water. On the other hand, water from tube wells or boreholes, protected wells, unprotected wells, protected spring, unprotected springs, rain water, tanker truck water, carts with small tanks of water, surface water, irrigation channeled water, bottled water and other water were categorized as other. In the toilet facility category, flush or pour flush toilets, flush to piped sewerage systems, flush to septic tanks, flush to pit latrines, flush to somewhere else and flush to do not know where, were categorized as flush toilets. Ventilated improved pit latrines, pit latrines with slab, pit latrines without slabs/open pits, composting toilets, bucket toilets, hanging toilets/hanging latrines, no facility/bush/field and other were categorized as other. For type of dwelling, the dwelling was regarded as formal if it was walled up by either of the following; cement, stone with lime/cement, bricks and cement blocks and grounded by either parquet/polished wood, vinyl or asphalt strips, ceramic tiles, cement or carpets. Also, the dwelling was regarded as formal if it was roofed by any of the following: metal, wood, celamine/cement fibre, ceramic tiles or roofing shingles. Dwellings which did not conform to these criteria were regarded as informal.

The logistic regression is determined as:

$$\pi_{ijk}\left(\boldsymbol{x}\right)=\frac{e^{\beta_0+\beta_k \boldsymbol{X}_{ijk}}}{1+e^{\beta_0+\beta_k \boldsymbol{X}_{ijk}}} \quad (1)$$

where π_{ijk} is the probability of dying for the *i*th child from the *j*th mother in the *k*th community, β_0 is the intercept, β_k are the regression coefficients of the independent variables and $\boldsymbol{X}_{ijk}$ is the vector of independent variables.

Two logistic regression models were fitted. In the first model a bivariate logistic regression analysis was conducted on each risk factor to ascertain the relationship between each explanatory variable and under-5 mortality whereas in the second model multivariate logistic regression analyses was performed on a combination of a set of all predictor variables to assess the effect of a set of explanatory variables on under-5 mortality.

IV. Results

The analysis was carried out on the 3 999 children aged between 0 and 59 months using STATA 11.0. A total of 7 624 women aged 15-19 years of age [14] were asked questions concerning the mortality of children born to them and/or under their parental guidance.

A. Descriptive Analysis

Descriptive statistics of the predictors of under-5 mortality is presented in Table I where information on the number of children at risk together with their corresponding percentages are demonstrated. Furthermore, mortality specific risk factors together with 95% confidence intervals (95% CI) and levels of significance are presented in Tables II and III (bivariate analysis) whilst the results of the multivariate logistic regression analysis are demonstrated in Tables IV A and B.

As demonstrated in Table I, the ratio of girls and boys is almost equal and about 38% of the children were first borns while nearly 10% had a preceding birth interval of 9-24 months and 16% had a preceding birth interval of 25-36 months. More than 90% of children were singleton and three percent (3%) were children of multiple births. About 90% of the children had a high birth weight (2.5kg and above). Almost 11% of the children were never breastfed and 34% of them were breastfed for a period of one year or less whilst 57% of the maternal parents were aged 20-29 years and 27% of them were aged 30-39 years. The majority of children was evenly distributed between Maseru, Mokhotlong and Thaba-Tseka, and 83% of the children were from mothers who resided in the rural areas of Lesotho. The majority of children (90%) came from households with no access to electricity.

TABLE I
Descriptive Statistics of the Covariates Considered for Analysis

Covariates		**N (%)**	**Covariates**		**Percentage**
Bio-demographic			***Socio-demographic***		
Sex of child	Male	2 011 (50.3)	District	Maseru	498 (12.5)
	Female	1 988 (49.7)		Butha-Bothe	357 (8.9)
Length of preceding birth interval	First births	1 494 (37.5)		Leribe	427 (10.7)
	9-24	361 (9.0)		Berea	358 (9.0)
	25-36	636 (16.0)		Mafeteng	357 (8.9)
	37+	1 494 (37.5)		Mohale's hoek	362 (9.1)
Type of birth	Singleton	3 880 (97.0)		Quthing	332 (8.3)
	Multiple	119 (3.0)		Qacha's Nek	317 (7.9)
Birth weight	High	2 615 (90.6)		Mokhotlong	482 (12.0)
	Low	270 (9.4)		Thaba_Tseka	509 (12.7)
Maternal age	15-19	327 (8.2)	Maternal education	Higher	126 (3.1)
	20-29	2 287 (57.2)		Secondary	1 365 (34.1)
	30-39	1 080 (27.0)		Primary	2 418 (60.5)
	40-49	305 (7.6)		None	90 (2.3)
Breastfeeding duration	0-12	916 (34.1)	Place of residence	Urban	672 (16.8)
	13-18	540 (20.1)		Rural	3 327 (83.2)
	19+	942 (35.0)	Source of water	Piped	2 193 (57.8)
	Never	289 (10.8)		Not piped	1 600 (42.2)
			Toilet facility	Flush & Pit	1 790 (47.2)
				No facility	2003 (52.8)
			Source of energy	Electricity	375 (9.9)
				Other	3 418 (90.1)
			Type of dwelling	Formal	1 411 (52.0)
				Informal	1 305 (48.0)
			Marital status	Married	3 155 (78.9)
				Formerly married	386 (9.6)
				Never married	458 (11.5)
			Snuff	No	3 550 (88.8)
				Yes	449 (11.2)
			Place of delivery	Health facility	2 219 (55.5)
				Other	1 780 (44.5)

B. Results of the Bivariate Analysis

Logistic regression analysis was fitted for each independent variable. This was done to assess the relationship between each independent variable and the dependent variable (under-5 mortality). The dependent variable was categorized as 1 to indicate that the child died before reaching age of five years and 0 to indicate that the child was alive.

Table II demonstrates the results of the impact of bio-demographic variables from the bivariate logistic regression analysis. The results reveal that bio-demographic factors sex ($p < 0.05$), length of preceding birth interval ($p < 0.05$), type

of birth ($p < 0.05$), birth weight ($p < 0.001$), maternal age ($p < 0.05$) and breastfeeding duration ($p < 0.001$) were influential predictors of under-5 mortality. Boys had at a higher risk of dying than girls. The odds of boys dying were 1.39 times higher than the odds of girls dying in Lesotho. Children with a preceding birth interval of 9 to 24 months and those with a preceding birth interval of more than 36 months had a significant higher risk of dying than the first births. Short birth spacing is associated with under-5 mortality. The children who were not first births had the highest risk of dying. In addition, children of multiple births had a significantly higher probability of dying than their counterparts. The odds of children of multiple births dying were 5.17 times higher than the odds of those of single births. Children with a low birth weight were two times more likely to die before turning five years than their counterparts. Furthermore, maternal age was a predictor of under-5 mortality. Children born to mothers aged 40 to 49 years of age had a greater risk of dying than those born to younger mothers aged 15 to 19 years of age. Another risk factor of under-5 mortality found was breastfeeding duration. On one hand, children who were never breastfed were nearly three times more likely to die than those who were breastfed for 12 months or less. On the other hand, children who were breastfed for more than 12 months period were not at risk of dying than those who were breastfed for a 12 months period or less. The results imply that the longer the child is breastfed, the lower the risk of death.

TABLE II
ODDS RATIOS ESTIMATES OF BIO-DEMOGRAPHIC FACTORS FROM THE BIVARIATE ANALYSIS

Covariates		**Odds Ratio**	**95% CI**	**Significance (P-value)**
Bio-demographic				
Sex of child	Male	1 (-)	1 (-)	1 (-)
	Female	0.72	(0.5869 – 0.8939)	0.003
Length of preceding birth interval	First births	1 (-)	1 (-)	1 (-)
	9-24	1.80	(1.2720 – 2.5523)	0.001
	25-36	0.95	(0.6798 – 1.3411)	0.790
	37+	1.30	(1.0198 – 1.6683)	0.034
Type of birth	Singleton	1 (-)	1 (-)	1 (-)
	Multiple	5.17	(3.5540 – 7.8096)	< 0.001
Birth weight	High	1 (-)	1 (-)	1 (-)
	Low	2.08	(1.4404 – 3.0142)	< 0.001
Maternal age	15-19	1 (-)	1 (-)	1 (-)
	20-29	1.27	(0.8271 - 1.9588)	0.273
	30-39	1.23	(0.7806 - 1.9465)	0.370
	40-49	2.37	(1.4249 - 3.9374)	0.001
Breastfeeding duration	0-12	1 (-)	1 (-)	1 (-)
	13-18	0.14	(0.0919 – 0.2235)	< 0.001
	19+	0.03	(0.0158 – 0.0610)	< 0.001
	Never	2.78	(2.1113 – 3.6731)	< 0.001

In Table III, the results of the effect of socio-demographic factors from the bivariate logistic regression analysis are demonstrated. It was found that marital status ($p < 0.05$), main source of energy ($p < 0.05$), snuff inhalation ($p < 0.05$) and place of delivery of birth ($p < 0.05$) were significant predictors of under-5 mortality. Children of mothers who were formerly married were almost two times more likely to die than those of married women. Children born to women who were never married were not at risk of dying than those of married women, but not significant. Furthermore, children born to women who snuffed tobacco were at the highest risk of dying. The odds of children born to women who snuffed tobacco were 1.59 times more than the odds of their counterparts. In addition, children who were not delivered at a health facility were 40% more likely to die than their counterparts and those born to mothers who were residing in households with no access to electricity were at an increased risk of dying than those born to mothers who had access to electricity.

C. Results of the Multivariate Analysis

The method of selecting significant variables at a certain level of significance from the bivariate logistic regression to the multivariate logistic regression analysis was not applied (that is, stepwise logistic regression was not applied). The reason for not applying this method was that district was not significant in the bivariate logistic regression model, but was significant in the multivariate logistic regression analysis with all the variables included in the model. The results of the multivariate analysis are presented in Tables IV A and B.

TABLE III
ODDS RATIOS ESTIMATES OF SOCIO-DEMOGRAPHIC FACTORS FROM THE BIVARIATE ANALYSIS

Covariates		**Odds Ratio**	**95% CI**	**Significance (P-value)**
Socio-demographic				
District	Maseru	1 (-)	1 (-)	1 (-)
	Butha-Bothe	0.91	(0.5673 - 1.4678)	0.706
	Leribe	1.27	(0.8353 - 1.9389)	0.262
	Berea	0.88	(0.5433 -1.4178)	0.594
	Mafeteng	1.18	(0.7518 - 1.8422)	0.476
	Mohale's hoek	1.26	(0.8110 -1.9558)	0.304
	Quthing	1.13	(0.7128 -1.7939)	0.602
	Qacha's Nek	0.97	(0.5944 - 1.5708)	0.890
	Mokhotlong	0.89	(0.5752 - 1.3837)	0.610
	Thaba_Tseka	1.02	(0.6711 - 1.5568)	0.919
Place of residence	Urban	1 (-)	1 (-)	1 (-)
	Rural	1.27	(0.9418 – 1.7087)	0.118
Maternal education	Higher	1 (-)	1 (-)	1 (-)
	Secondary	1.21	(0.5971 - 2.4415)	0.600
	Primary	1.56	(0.7821 - 3.1096)	0.207
	None	1.44	(0.5495 - 3.7966)	0.456
Main source of water	Piped	1 (-)	1 (-)	1 (-)
	Not piped	1.06	(0.8511 – 1.3115)	0.618
Toilet facility	Flush & Pit	1 (-)	1 (-)	1 (-)
	No facility	1.12	(0.8993 – 1.3835)	0.320
Main source of energy	Electricity	1 (-)	1 (-)	1 (-)
	Other	1.73	(1.1216 – 2.6833)	0.013
Type of dwelling	Formal	1 (-)	1 (-)	1 (-)
	Informal	1.08	(0.8367 – 1.3964)	0.552
Marital status	Married	1 (-)	1 (-)	1 (-)
	Formerly married	1.95	(1.4549 - 2.6097)	< 0.001
	Never married	0.70	(0.4760 - 1.0253)	0.067
Snuff	No	1 (-)	1 (-)	1 (-)
	Yes	1.59	(1.1924 – 2.1271)	0.002
Place of delivery	Health facility	1 (-)	1 (-)	1 (-)
	Other	1.39	(1.1286 – 1.7127)	0.002

TABLE IV A
RESULTS OF THE MULTIPLE LOGISTIC ANALYSIS

Covariates		**Odds Ratio**	**95% CI**	**Significance (P-value)**
Bio-demographic				
Sex of child	Male	1 (-)	1 (-)	1 (-)
	Female	0.62	(0.4232 - 0.9152)	0.016
Length of preceding birth interval	First births	1 (-)	1 (-)	1 (-)
	9-24	1.71	(08473- 3.4415)	0.135
	25-36	0.68	(0.3073 – 1.4854)	0.329
	37+	1.04	(0.6070 – 1.7941)	0.877
Type of birth	Singleton	1 (-)	1 (-)	1 (-)
	Multiple	2.72	(1.0201 – 7.2359)	0.046
Birth weight	High	1 (-)	1 (-)	1 (-)
	Low	1.51	(0.8455 – 2.6919)	0.164
Maternal age	15-19	1 (-)	1 (-)	1 (-)
	20-29	0.57	(0.2536 – 1.3029)	0.185
	30-39	0.53	(0.2073 – 1.3778)	0.195
	40-49	0.73	(0.2358 – 2.2591)	0.585
Breastfeeding duration	0-12	1 (-)	1 (-)	1 (-)
	13-18	0.14	(0.7277 – 0.2748)	< 0.001
	19+	0.02	(0.0064 – 0.0684)	< 0.001
	Never	0.91	(0.5432 – 1.5269)	0.723

TABLE IV B
RESULTS OF THE MULTIPLE LOGISTIC ANALYSIS

Covariates		Odds Ratio	95% CI	Significance (P-value)
Socio-demographic				
District	Maseru	1 (-)	1 (-)	1 (-)
	Butha-Bothe	1.25	(0.5014 – 3.0931)	0.636
	Leribe	1.50	(0.7012 – 3.2178)	0.295
	Berea	1.66	(0.7509 – 3.6828)	0.210
	Mafeteng	2.11	(0.9331 – 4.7588)	0.073
	Mohale's hoek	2.01	(0.8304 – 4.8843)	0.121
	Quthing	2.64	(1.1447 – 6.1093)	0.023
	Qacha's Nek	2.60	(1.1028 – 6.1453)	0.029
	Mokhotlong	1.42	(0.5503 – 3.6478)	0.470
	Thaba_Tseka	3.99	(1.7030 – 9.3299)	0.001
Place of residence	Urban	1 (-)	1 (-)	1 (-)
	Rural	0.69	(0.4036 – 1.1728)	0.169
Maternal education	Higher	1 (-)	1 (-)	1 (-)
	Secondary	1.17	(0.4716 – 2.8924)	0.737
	Primary	1.50	(0.5856 – 3.8397)	0.398
	None	1.04	(0.2053 – 5.3152)	0.958
Main source of water	Piped	1 (-)	1 (-)	1 (-)
	Not piped	1.44	(0.9477 – 2.1998)	0.087
Toilet facility	Flush & Pit	1 (-)	1 (-)	1 (-)
	No facility	0.91	(0.5105 – 1.6366)	0.762
Main source of energy	Electricity	1 (-)	1 (-)	1 (-)
	Other	2.54	(1.3266 – 4.8568)	0.005
Type of dwelling	Formal	1 (-)	1 (-)	1 (-)
	Informal	1.15	(0.6198 – 2.1368)	0.656
Marital status	Married	1 (-)	1 (-)	1 (-)
	Formerly married	2.62	(1.5625 – 4.3787)	< 0.001
	Never married	1.21	(0.6678 – 2.1970)	0.528
Snuff	No	1 (-)	1 (-)	1 (-)
	Yes	0.91	(0.4394 – 1.8830)	0.799
Place of delivery	Health facility	1 (-)	1 (-)	1 (-)
	Other	0.95	(0.5831 – 1.5514)	0.841

Results from the multiple logistic regression analysis illustrated that sex ($p < 0.05$), type of birth ($p < 0.05$) breastfeeding duration ($p < 0.05$), district ($p < 0.05$), main source of energy ($p < 0.05$) and marital status ($p < 0.05$) had a significant influence on under-5 mortality. Female children were 38% significantly less likely ($p < 0.05$) to die than male children. Furthermore, children of multiple births had the greatest risk of dying. Children of multiple births were 2.72 times more likely to die than children of single births. In addition, children who were breastfed for 13 to 18 months ($p < 0.001$) and those who were breastfed for more than 19 months ($p < 0.001$) were significantly less likely to die than those who were breastfed for 12 months or less. Children of preceding birth intervals of 9 to 24 months and those of 36 months or more and children with low birth weights were more at risk of dying than their counterparts, but not significant. The results of the multivariate analysis showed that children born to mothers aged from 20 to 49 years of age were not at risk of dying than those of mothers aged 15 to 19 years of age, but not significant. Furthermore, the results recorded under place of residence were not in the expected direction. In Lesotho, children born to rural mothers were not at a greater risk of dying than those born to urban mothers, but not significant. District was not significant in the bivariate analysis. However, in the multivariate analysis, it showed that children of mothers who stayed in Quthing ($p < 0.05$), Qacha's Nek ($p < 0.05$) and Thaba Tseka ($p < 0.05$) were significantly at a higher risk of dying than those of mothers who stayed in Maseru. In addition, children of poorly educated mothers were at risk of dying than those of mothers with higher education, but not significant. The children from households with access to electricity ($p < 0.05$) were significantly more likely to die than their counterparts with no access electricity in their homes. Children from households with no access to piped water and those from informal dwelling houses were more likely to die than their counterparts, but not significant. However, the results for toilet facility were not in the expected direction, children from households with no access to toilet facility were less likely to die than their counterparts, but not significant. Findings reveal that children whose mothers were formerly married ($p < 0.001$) were significantly at a higher risk of dying than those from married mothers.

V. Discussion

The objective of the study was to determine the risk factors associated with under-5 mortality in Lesotho using the 2009 LDHS data. Findings of the study indicated that sex of the child was a significant predictor of under-5 mortality in Lesotho. Boys were 1.61 times more likely to die before reaching the age of five than girls. This supports the findings of earlier studies [13] which showed that the genetic and biological makeup of infant boys causes them to be biologically weaker and more susceptible to diseases and premature death [17].

Bivariate analysis results showed that the length of preceding birth interval was significantly associated with under-5 mortality. Children of birth interval 9 to 24 months and those of higher birth interval of 37 months or more were respectively 1.8 and 1.3 times more likely to die compared to those of first births. However, those of birth interval of 25 to 36 months were not at risk of dying when compared to first births, but not significant. These findings may suggest that birth interval of 25 to 36 months between children is advisable and that parents should avoid having more than five children in order to reduce under-5 mortality.

Earlier research has reported that mortality was higher in children of multiple births than those of single births [15]. The findings of this study were consistent with those earlier studies in that children of multiple births were found to have a higher risk of dying than their counterparts. This was significant on the bivariate analysis. Multiple births are associated with higher mortality due to higher risks in pregnancy and delivery complications, greater probability of birth defects and complications [16]. The results of the multivariate analysis showed that children born to mothers aged from 20 to 49 years of age were not at risk of dying than those of mothers aged 15 to 19 years of age. The reason for this could be that young mothers have reproductive systems that are not completely mature and this leads to underweight babies, whereas older mothers have declining maternal resources due to aging [19].

The duration of breastfeeding was found to be a significant predictor of under-5 mortality. It was found that children who were breastfed for 12 months or less were significantly at higher risk of dying than those who were breastfed for more than 12 months after correcting for all the factors. These results are in agreement with those of the previous research conducted in Kenya which found that the children who were breastfed for less than six months had a higher likelihood of dying than those who were breastfed for more than six months [12]. This shows that it is important for children not to be only breastfed, but to be breastfed for a longer period. Increasing the duration of breastfeeding will reduce the risk of death. Breastfeeding protects children from illnesses and ease the burden from parents by minimising costs of buying milk formula.

In sub-Saharan Africa, social and economic disparities have been largely attributed to differences in regional distributions of social services, health facilities, housing conditions and other essential services [7]. In this study under-5 mortality in various geographical areas of Lesotho were also compared and findings from the bivariate analysis did not show significant differences amongst these districts of Lesotho, as well as between the urban and rural areas of the country. However, controlling for all other variables, the results showed significant differences between districts (regions). Children of mothers who resided in Quthing, Qacha's Nek and Thaba Tseka were significantly more at risk of death than those of mothers who resided in the Maseru district. There were no significant urban-rural differences.

The main source of drinking water and type of toilet facility were not outwardly linked to the high mortality rates. However, children in households with no access to piped water were at a higher risk of death than their counterparts with no access to piped drinking water. The consumption of unclean water is unhealthy, as it leads to diseases such as diarrhoea, cholera, typhoid and hepatitis. Clean water is healthy and therefore should be made available to the community. In addition, the results from the multivariate analysis showed that children who stayed in households without access to electricity were significantly 2.6 times more likely to die than their counterparts. This is because where there is no electricity the households use either wood, gas, or paraffin for heating and cooking. These types of fuel produce harmful gases and those who stay in these households, including children inhale these unhealthy gases, thereby affecting their health. Their lungs get affected and this leads to death. Furthermore, the study revealed that the children of women with a higher level of education were less likely to die than those of women with only secondary or primary or no education, but not significant. This is because women who are not educationally equipped lack knowledge of how to treat or prevent their children from being infected by preventable diseases such as cough, diarrhoea and fever. They are unable to read health and environmentally related issues in newspapers, magazines or pamphlets. Also, children who stayed in informal dwellings and those from women who snuffed tobacco were at a higher risk of dying than their counterparts, but the difference was not significant. Results from the bivariate analysis showed that place of delivery was a significant predictor of under-5 mortality as children not delivered in a health facility ran a significantly higher risk of death than those who were delivered at a health facility. However, adjusting for all factors the results were in an unexpected direction, but not significant. Another significant predictor of under-5 mortality identified was marital status. Children of women who were never married were at risk of dying than those of married women, but not significant. Moreover, children of formerly married women were significantly at a higher risk of dying than those of married women. This is because hatred grows between the parents when they are in the divorce process or have divorced. In many instances the paternal parents will refuse to support or maintain the children and it becomes economically difficult for the newly single mother to support the child from a single salary, especially if the mother is unemployed. Another reason could be the mother's refusal to allow the father to see his

children, thereby leading to the father refusing to support and maintain his children.

VI. Conclusion

The primary objective of the study was to determine the factors associated with under-5 mortality in Lesotho. The results suggested the following: sex of child, type of birth, the duration of breastfeeding, district (region), main source of energy and marital status of the mother were significant predictors of under-5 mortality, after correcting for all variables. The study emphasised the importance of breastfeeding, as children who were breastfed and those who stayed in households with access to electricity were at a lowest risk of dying.

VII. Recommendations

In order to reduce under-5 mortality rate and realize MDG4 in Lesotho, the government of Lesotho's attention should be focused on community-level interventions aimed at improving child survival, particularly in the country's socially and economically deprived areas. Also, basic education should be made affordable for poor people so that all parents are able to read. Parents should be educated about the importance of breastfeeding, in particular breastfeeding for a longer period. In addition, the government of Lesotho should ensure that all households have access to electricity and educate people about the danger of using wood, gas and paraffin for cooking and heating. Furthermore, free basic health should be provided and adequate mobile clinics should be made available to socially and economically deprived areas. Policies aimed at improving child health should be developed.

VIII. Limitations

The use of LDHS data may have some limitations. First of all, the reporting of children's deaths was dependent on the mothers or guardians, therefore their recalling of birth and death dates may not have been accurate, particularly in cases where the guardian was unable to produce the birth and death certificates for verification purposes. Births and deaths that may have occurred a few days prior to the cut-off date may have been reported. Also, births and deaths that may have occurred a few days post the cut-off date may not have been reported. Some deaths could have occurred because the parents had died of human immunodeficiency (HIV) and their children may have become infected and died.

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