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Determinants of Under-Five Mortality (U5MR) in Al-Bayda City by Using the Logistics Regression Model

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Abdelghffar. F Abdelghffar.*, Saad, Akram M., Al Aoami, Ambrka., Al drogi.O. jamila

Department of Statistics, Faculty of Science, Benghazi University, Benghazi, Libya

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ABSTRACT

This study aimed to identify the factors that cause under-five mortality (**U5MR**) in the city of Al-Bayda. The study also aimed to try to reach a valid conclusion that helps to reduce the **U5MR** and to monitor progress as such. Libya like ,many other countries, aspired to reach (**MDG 4**) the[i] target of a two-thirds reduction in the rate of child mortality by 2015. Four years after this deadline, we need to evaluate the situation and try to find solutions to achieve this aim as other countries have. A random sample of 200 women was selected between July 2018 and October 2018 using cluster sampling from the city of Al-Bayda. The relevant descriptive statistics were obtained and then Binary Logistic Regression techniques were employed. The descriptive statistics have shown that the **U5MR** occurred among 26% of women in the sample. The logistic regression analysis has revealed that the factors, i.e. the mother's education, the mother's age at marriage, the number of children, and the average duration of breastfeeding are the most statistically significant in reducing **U5MR**. The results also revealed that the family income and the usual place of residence have a substantial impact on **U5MR**. Based on the present results, Libya is doing well. but more work must be done to help the country to get closer to achieving **MDG 4** on time. Finally, the study reached several interesting results. We recommend that further investigation be done based on the Census or a survey to support the findings of this study.

INTRODUCTION

Under-five child mortality **(U5MR**) is one of the most important factors in population dynamics where people increase by fertility and decrease by mortality and migration. To examine the changes of a population over time, we need to analyze factors that influenced child death. Hence, the rates of child death are not only important measures of the living and socio-economic conditions of a nation but also are powerful indicators of social-economic development and can be used to measure the overall health status of a nation (Kazemi, Shaahmadi, Arefi, & Meshkani, 2015). Efficient steps can be made to further reduce **U5MR** globally if the potential factors are well identified to improve child survival in developing countries.(Mosley & Chen, 1984).

Since 1990, the global community has decided to reduce the child mortality rate by two-thirds between 1990 and 2015. According to the United Nations reports, the **U5MR** decreased from 12.5 million in 1990 to 8.8 million in 2008. (Lawn, Gravett, Nunes, Rubens, & Stanton, 2010). Moreover, recent Libyan surveys indicate that the **U5MR** is 20.1 per thousand and rate under one mortality 17.6 per thousand (Group, 2014). To improve child survival in developing countries, this value indicates that much effort should be made to reach the targets set in the national population policy. Children are the wealth of a country so they count as future human capital, and every child has a right to have a better life. A child can have a better life when he/she could survive earlier years of his/her life or in other words, can survive before reaching the age of five. Thus, it is important to have a deeper look into the initial years of the life of the children, because they are considered to be very sensitive and crucial years (Qayyun, 2015). In other words, **U5MR** reflects the health status of countries; if the young people of a nation are healthy, then so is the nation. In developing countries, efforts have been made during the past three decades to reduce child mortality. Despite the socio-economic development and implementation of child survival involvements, the still-dominant high mortality may be due to the heterogeneity. This might have considerable implications for reproductive health and child survival programs (Gupta, 1997). This paper addresses, in detail, major findings and analytically explains methods for identifying socio-economic factors which affect the **U5MR**, depending on the use of logistic regression analysis. Logistic regression analysis is a technique based on examining the association between a categorical dependent variable and a set of independent

(explanatory) variables. The term logistic regression is used when the dependent variable has only two values, such as 0 and 1 or Yes and No.

Significance of the Study

The major impact of studying under-five mortality is to determine the socio-economic factors which cause child death by using thorough statistical analysis. Published reports (census or survey) usually give us only the numerical values of **U5MR**, without analysis or identifying the factors. Therefore, decision-makers cannot anticipate the expected impact of each factor. On the other hand, this paper is considered to be one of the few papers that utilize the logistic regression model to explain factors that affect under-five mortality in Libya. This potentially increases the importance of this study.

MATERIALS AND METHODS:

Data Source

Unfortunately, there was no updated data available (either census or survey), that could help to achieve the aim of this study. Therefore, the data used in this study were selected from 200 Libyan women aged between (15-45). A well-design questionnaire was used, and a multi-cluster random sample was selected to interview (face to face) in different areas in Al-Bayda. The data of this research can be considered to have been randomly selected from the population.

Variables of interest are two types:

Response variables:

The variable of interest is under-five mortality. This information is obtained by asking the mother “Have you had an incidence of under-five child mortality or not?”. Therefore, the variable here is dichotomous.

Independent (explanatory) variables:

The independent (explanatory) variables consist of baseline socio-economic and demographic variables, which are collected from the respondents (women). The main socio-economic variables are as follows: the mother's educational and the father's education, the sex of the child,

the age of the mother at marriage, the place of residence, and the average duration of breastfeeding.

Statistical methods

This study used the logistic regression method. This method was adopted because of the nature of the response (outcome) variables described by the women with under-five mortality and the woman without under-five mortality. When the response variable is categorical with two possible outcomes known as dichotomous or binary outcomes, we give the dependent variable (1) with probability (P) and zero with probability (1-P). The dichotomous variable is a binary value, taking on values 0 or 1, and to model such variable, one must use the Bernoulli distribution *Y*. (Schaefer, 1983). It is worth noting that there are three types of discrete logistics regression models, namely: the Binary Response Model, the Categorical Model, and the Non-Categorical Model. As mentioned above, the Binary Response Logistic Regression Model is of prime interest.

The model of logistic regression is written as follows:

$$Y = b_0 + b_1 X + e$$

Suppose that the mean of Y equals E(Y) where (e) represents the error, then

$$E(X / Y) = b_0 + b_1 X$$

Hence the right side of the equation takes the value between $(-\infty, \infty)$. Whereas if we have a binary variable (Y), this indicates that simple linear regression is not suitable to use due to

$$E(X / Y) = P(Y=1) = P$$

Here, the right side of the equation is located between [1, 0]. For this reason, we cannot use the simple linear regression to solve the problem; instead, we use the transformation method to transform the dependent variable (Y) and as we know:

$0 \leq P \leq \infty$ then $\frac{P}{1-Pv}$ or $\frac{P}{q}$ absolute value between $(0, \infty)$

$$0 \leq \frac{P}{q} \leq \infty$$

$$-\infty \leq log_e \frac{P}{q} \leq \infty$$

In this case, the model one independent variable is written as follows :

$$log_e\left(\frac{P}{q}\right) = b_0 + b_1 X + e$$

In general, for more than one independent variable, the model is written as follows:

$$log_e\left(\frac{P}{q}\right) = \sum_{i=1}^{K} b_0 + b_1 X + e$$

Where :

$i = 1,2, \dots n$

$j = 1,2, \dots K$

After the transformation of the previous equation, the Binary Logistic Regression Model can be seen as the probability fitted as:

$$P = \frac{1}{1+exp[b_0+\sum_{i=1}^{K} b_{ij} X_{ij}]}$$

This model is called logistic regression where both $log_e n\left(\frac{P}{q}\right)$ or $log_e\left(\frac{P}{q}\right)$

Are called logit transformations defined as a continuous functions. This function takes the value (0,1) converges to each other:

$$\underline{Y} = \frac{e^{(X'\underline{\beta})}}{1+e^{(X'\underline{\beta})}} + \underline{\xi}$$

Are the parameters of the model and Where $\underline{\boldsymbol{\beta}} = (\beta_0, \beta_1, \beta_2, \dots, \beta_k)$

X is the Regression Matrix of the Independent (Explanatory) Variables

It is important to note that the Binary Logistic Regression Model does not assume normality in the error terms.

Objectives:

The main objective of this study is to determine the socio-economic factors that influence under-five mortality in Al-Bayda City. Such analytical statistics would be of great assistance to the government, project planners, and policymakers to reduce under-five mortality.

Research Hypotheses:

After reviewing the literature, the following hypotheses have been made:

1. **U5MR** is not affected by the level of education of the father and the mother.
2. **U5MR** is not affected by the age of the mother.
3. **U5MR** is not affected by the Family income.
4. **U5MR** is not affected by the duration of breastfeeding.
5. **U5MR** is not affected by the number of under-five mortality.
6. **U5MR** is not affected by the age of the mother at marriage.
7. **U5MR** is not affected by the health care of the mother and her children.
8. **U5MR** is not affected by the sex of the child.

Literature Review

It is needless to say that many researchers around the world have attempted to explain the factors influencing **U5MR**, and their studies depended on different models.

Abdelhadi (1994) aimed to find the relationship between socio-economic factors and infant mortality and also had aimed to determine indicators that contribute to reducing child death, using the multivariate analysis. The main result of the study had shown that there was a strong

statistical relationship between the age of the mother at marriage and infant mortality and also there was a relationship between the age of the mother during pregnancy and infant mortality.

Mori *et al.* (2017) employed the logit regression to empirically investigate the factors that affect **U5MR**. The key findings of this study, which is based on the multivariate results, indicate that: the mother's age at birth, the child's gender, the number of children under-five, the level of wealth, the mother's level of education, the region in which a mother resides as well as smoking cigarettes and the use of contraception are significant factors in under-five mortality.

Gebretsadik & Gabreyohannes's (2016) study was a secondary analysis of existing data from the 2011 Ethiopia Demographic and Health Survey data. The Multivariable Cox Proportional Regression Models were fitted to a selected number of the factors affecting **U5MR** in these regions. The models had revealed that under-five mortality was significantly associated with preceding birth interval, family size, birth type, breastfeeding status, source of drinking water, and income of mother. Children born after a preceding birth interval of 2-3 years and 3 years and above were significantly less likely to have died before their fifth birthday than those born within two years.

Ettarh & Kimani (2012) studied the effect of geographical location and maternal factors on the likelihood of mortality among under-five children in rural and urban areas in Kenya. Available data from the 2008-2009 Kenya Demographic and health survey was used to determine mortality among under-five children. Multivariate analysis was used to compare the influence of key risk factors in rural and urban areas. Overall results indicated that the likelihood of death among under-five children in the rural areas was significantly higher than that in the urban areas ($p < 0.05$). Household poverty was a key predictor for mortality in the rural areas, but the influence of breastfeeding was similar in the two areas. The likelihood of **U5MR** was significantly higher in rural areas.

Kanmiki *et al*. (2014) conducted a cross-sectional study using the World Health Organization (WHO) and World Bank datasets. The data on under-five mortality consists of health expenditure, Gross National Income (GNI) per capita, physician and nurses' density, ratio of female to male primary, secondary and tertiary school enrollment. Pearson correlation and

regression models were used for analyzing the data. Regression analysis showed that all variables, except the ratio of female to male primary enrollment, harmed **U5MR**.

Almnifi (2006) used multivariate analysis to identify the most important socio-economic factors that cause the incidence of under-five mortality. The results revealed a direct strong relationship between the education of mother with child death, thus there was an indirect relationship between the occupation of the mother and the number of the previous **U5MR**.

Aheto (2019) observed 289 (4.91%) deaths among children aged below 5 years in Ghana. Additionally, the children who were born in multiple births and residing in certain geographical regions of Ghana were associated with increased odds of under-five mortality. Maternal education and being a female child decreased the odds of under-five mortality. No significant unobserved household-level variations in under-five mortality were found. The spatial map revealed regional differences in crude **U5MR** in the country.

Syamala (2004) attempted to demonstrate the relationship between socio-demographic factors and child survival. The results showed that demographic factors such as the age of the mother, birth order and birth interval, and socio-economic factors such as maternal education and standard of living significantly affect the probability of the survival of the child. Therefore, postponement of the female age at marriage to 20 years with the view to delay the onset of childbearing and proper spacing of births would have a noticeable effect in bringing down the level of infant mortality and thereby improving the health of the women.

Ettarh & Kimani (2012) used multivariate analysis to compare the influence of key risk factors in rural and urban areas in Kenya. The study showed that the factors affecting under-five mortality differ in rural and urban areas in Kenya. Innovative strategies are required to address rural poverty and province-specific sociocultural factors to improve child survival in rural Kenya.

Alrub (2015) used the descriptive analytical approach to provide a picture of the population study. This study proved that the social and demographic variables mentioned in the death reporting certificate including sex, age, marital status, place of death, place of treatment, and religion, had obvious statistically significant relationships to **U5MR**.

Esmial (2010) focused on using advanced statistical methods for studying the most important factors affecting infant mortality in Palestine (the West Bank and the Gaza Strip). Logistic regression was applied as well as the Cox regression in this study. The results indicated that despite the different regression coefficients in somewhat to logistic regression and Cox regression, they concluded to the same variables that have an impact on the phenomenon. Also, the most important demographic and social factors which influence the life of the baby are the sex and the nature of the newborn (whether single or part of multiple births), the mother's education, iron tablets taken by the mother during pregnancy, and breastfeeding. All these are the most important variables of the nutritional status of the mother and child in the interpretation of the case of survival of the infant baby. Moreover, the results indicated that the health care that mothers get during pregnancy and low birth weight at birth has a significant effect on the life of the infant.

RESULTS AND DISCUSSION

The detailed results of the analysis are presented in two sections, namely: the descriptive analysis of the data, and the Binary Logistics Regression Model results.

The Descriptive Statistics

Table (1) presents the summary statistics of the sample data that consists of 200 mothers. Although these numerical values, in themselves, do not tell us much and we could not draw a solid conclusion, they provide a quick overview of the incidence of **U5MR** according to the different characteristics.

Table (1) Characteristics of the Sample

Characteristic	Description	Number	Percentage(%)
Level of Mother's Education	Primary	36	18.0
	Secondary	56	28
	University or more	108	54
Level of Father's Education	Primary	57	28.5
	Secondary	47	23.5
	University or more	96	48
Mother's occupation	Housewife	56	28.0
	Teacher	71	35.5
	Employee	64	32.0
	Other jobs	9	4.5
Family Income	Less than 1500	79	39.5
	1500-3000	102	51.0
	More than 3000	19	9.5
Age of Mother at Marriage	20 or less	52	26
	20-30	126	63
	More than 30	22	11
Breastfeeding	Without breastfeeding	14	7.0
	1-6	19	9.5
	More than six months	82	41.0
	More than one year	85	42.5

Source: author's calculations

In terms of the level of education of the mother, 54% were university and higher graduates, 28% were secondary graduates and the lowest level of education were 18 % represented at the primary school level. The father's education was also important in this study; a total of 48% were university and higher and 28.5% and 32.5% were primary and secondary school graduates respectively. Of the 200 mothers used in the study, 26%, 63%, and 11 % were aged less than 20, between 20-30, and more than 30 years old, respectively. Regarding the family income, the

highest percentage at 51% was women whose family earns between 1500-3000 Libyan dinars, and the lowest percentage at 9.5% were women whose family earns more than 3000 Libyan dinars.

Regarding the age of the mother at marriage, the highest percentage was 63% for subjects between 20-30 years old, while the lowest percentage at 11% was for subjects who were 30 years old. Regarding breastfeeding, the vast majority of the participants in the study did more than six months of breastfeeding at approximately 80%, but 9.5% of the participants did 0 to 6 months, in addition to 7% of the participants who did not do any breastfeeding.

The Binary Logistics Regression Model Results

Assessing the fit to see if the model is a good fit by using either the log-likelihood ratio test or the χ^2test. Table (2) presents the test statistics of χ^2 and its p-value. The results in Table (2) support the high statistical significance of the model at the level of significant $\alpha = 0.01$.

Table (2) The Binary Logistic Model fitting

	Chi-square	Df	Sig.
Model	59.417	13	.000

Source: authors' calculations using SPSS package

Table (3) presents the test statistics of -2log likelihood as well as Cox and Snell $R^2$and Nagelkerke R^2.

Table (3) the calculated values of -2LL, **Cox and Snell $R^2$and Nagelkerke R^2**

-2log likelihood	Cox & Snell Rsquare	Nagelkerke Rsquare
169.806	0.257	0.377

Source: authors' calculations using SPSS package

The results in Table (3) support the high statistical significance of the model at the level of significant $\alpha = 0.01$. In the model, the value of -2LL is less than the constant value of model 229.223 which indicates the quality of the model

Another way to see if the model is a good fit is by using Cox and Snell R^2or Nagelkerke's R^2. These two measures are analogous statistics in logistic regression to the coefficient of determination R^2 in linear regression, but not exactly.

Table (3) presents the calculated values of -2LL, Cox and Snell R^2 and Nagelkerke R^2. These approximations of R^2statistic in logistic regression attempts to imitate multiple R^2 based on 'likelihood'. In this study, Cox and Snell R^2 indicate that 25.7% of the variation in the response (outcome) variable, child mortality status is explained by explanatory variables. On the other hand, Nagelkerke'sR^2 is 0.377, which indicates that 37.3% of the variability in the child mortality status is explained by the independent (explanatory) variables.

Table (4) The Binary Logistic Regression Analysis of U5MR

Statement / **Factor**	**Coefficient (B)**	***Sig.***	**EXP(B)**	**Confident Interval 95%**	
				Lower limit	**Upper limit**
Mothers' educational	*-0.642	0.036	0.526	0.289	0.957
Mother's job	-0.239	0.313	0.787	0.494	1.253
Mother's age at marriage Less than 21)(	-----	0.016	-----	و-----	-----
Mother's age at marriage 21-30)(	-1.394*	0.041	0.248	0.065	0.947
Mother's age at marriage More than 30	-1.758*	0.004	0.172	0.052	0.572
Family income Less than 1500	-----	0.002	-----	-----	-----
Family income 1500-3000	1.636*	0.032	5.136	1.148	22.903
Family income More than 3000	-0.054	0.940	0.947	0.230	3.902
Level education of the father	0.205	0.453	1.228	0.718	2.100

Number of children (Less than 5)	-----	0.000	-----	-----	-----
Number of children 5-8)(	-3.207*	0.000	0.040	0.008	0.216
Number of children 9 or more	-1.805*	0.020	0.165	0.036	0.752
Place of residence	0.237	0.183	1.267	0.894	1.795
Average breastfeeding without breastfeeding	-----	0.002	-----	-----	-----
Average breastfeeding 1 to 7 months	2.291*	0.002	9.883	2.365	41.298
Average breastfeeding 7 t0 12 months	2.187*	0.003	8.909	2.094	37.912
Average breastfeeding More than one year	0.891	0.051	2.438	0.994	5.980

*significant at 0.05

Source: authors' calculations using SPSS package

Table (4) presents the fitting of the Binary Logistic Regression Model that includes the estimated values of the coefficients, their significant test statistics, the odds ratio of the estimated coefficients as well as their 95% confidence intervals. This study showed that the following factors (mother's job, father's education, and place of residence) are insignificant on **U5MR**. This result is consistent with the findings of Mori *et al.* (2017).

Mothers' educational achievement has a significant contribution to **U5MR**. Mothers whose educational level is primary and above level were 0.526 times less likely to have child mortality than those who have no formal education.

This could be because women or mothers with no or low educational enrollment are unable to access modern health knowledge and practices, which are basic requirements for enhancing a child's health. This is consistent with the findings of Esmial (2010) and Almnifi (2006). Child

mortality is higher among women with no education and lowers among women with higher education.

As shown in the analysis, a mother's age at marriage is another significant factor affecting child mortality indicated in this study. Mothers who were aged (21-30) at marriage are 0.248 times less likely to experience child mortality compared with their corresponding counterparts who deliver at age 30 or more. This result has shown that children born to mothers either at the very early or late reproductive age are more likely to experience a high risk of death of their babies.

The study has reinforced the concept that older women have more experience in health care compared with younger women. The overall risk factors in determining mortality with a mother's age at marriage (21-30) are more. This result is consistent with the findings of Alrub (2015).

This study also has revealed that the risk of **U5MR** in mothers in the first or second family income levels is significant compared with those whose income is more than 3000 Libyan dinars. This could be because a family who earns more has the chance to spend more money to provide better care for their child. This result supports the formal finding, that children born to well-earning mothers are well cared for which reduces the risk of mortality among them. This result is consistent with the findings of Syamala (2004).

The results have also shown that multiple birth type is a significant factor for **U5MR** in all levels of multiple births; it has been found that 0.04 more likely to die before the interval (5-8) as compared with baseline interval (less than 5) This result is consistent with the findings of Mori *et al*. (2017).

It is important to mention that this study also revealed that the average duration of breastfeeding is a significant factor that affects **U5MR** in the first three levels while it is not significant in the last level. Mothers whose duration of breastfeeding is 1 to 7 months are 9.883 times less likely to experience child mortality than those who breastfed 7 to12 months. The interesting result is that as the duration of breastfeeding increases, the **U5MR** decreases. This result is consistent with the findings of Ettarh & Kimani (2012) and Esmial (2010).

CONCLUSION

In summary, even though **U5MR** in Libya had decreased steadily over the last three decades, the analysis of the study for the factors that affect **U5MR** in Al-Bayda city revealed that 26% out of the 200 women involved in the sample have had a child death. Also, the results have shown clear differences between the four regions under study. Moreover, this study has concluded that the major factors that affect the **U5MR** in the Al-Bayda are as follows: the mother's education, the age of the mother at marriage, the number of children, and the average duration of breastfeeding. Therefore, we recommend more detailed studies regarding these attributes to reduce **U5MR**.

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REFERENCES

1. Abdelhadi, A. (1994). *The Relationship between Social and Economic Factors and Child Mortality in El Fayoum.* (MS.c), Cairo University, Unpublished.
2. Aheto, J. M. K. (2019). Predictive model and determinants of under-five child mortality: evidence from the 2014 Ghana demographic and health survey. *BMC public health, 19*(1), 64.
3. Almnifi, a. (2006). Using multivariate analysis to identifying the most important socioeconomic factors causes incidence under five mortality. Unpublished phd Thesis.
4. Alrub, N. H. A. A. A. (2015). *Levels and Factors Affecting Mortality Rates in Jenin Governorate During The Period 2004-2013 from the Vital Registration of the Palestinian Ministry of Health* (MS.c), An-Najah National University, Nablus, Palestine.
5. Esmial , S. (2010). *Using logistic regression was chosen and Cox regression to determine socioeconomic on Child Mortality.* (MS.c), Palestine University (2015 Vol.5 Issue 1, pp.39-62)
6. Ettarh, R., & Kimani, J. (2012). Determinants of under-five mortality in rural and urban Kenya. *Rural & Remote Health, 12*(1).
7. Gebretsadik, S., & Gabreyohannes, E. (2016). Determinants of under-five mortality in high mortality regions of Ethiopia: an analysis of the 2011 Ethiopia demographic and health survey data. *International Journal of Population Research, 2016*.
8. Group, W. B. (2014). *World development indicators 2014*: World Bank Publications.
9. Gupta, M. D. (1997). Socio-economic status and clustering of child deaths in rural Punjab. *Population Studies, 51*(2), 191-202.
10. Kanmiki, E. W., Bawah, A. A., Agorinya, I., Achana, F. S., Awoonor-Williams, J. K., Oduro, A. R., . . . Akazili, J. (2014). Socio-economic and demographic determinants of under-five mortality in rural northern Ghana. *BMC international health and human rights, 14*(1), 24.
11. Kazemi, Z., Shaahmadi, F., Arefi, Z., & Meshkani, Z. (2015). The main determinants of under 5 mortality rate (U5MR) in OECD countries: A cross-sectional study. *International Journal of Pediatrics, 3*(1.2), 421-427.
12. Lawn, J. E., Gravett, M. G., Nunes, T. M., Rubens, C. E., & Stanton, C. (2010). Global report on preterm birth and stillbirth (1 of 7): definitions, description of the burden and opportunities to improve data. *BMC pregnancy and childbirth, 10*(1), S1.

13. Mori, A. T., Kampata, L., Musonda, P., Johansson, K. A., Robberstad, B., & Sandøy, I. (2017). Cost-benefit and extended cost-effectiveness analysis of a comprehensive adolescent pregnancy prevention program in Zambia: study protocol for a cluster randomized controlled trial. *Trials*, *18*(1), 604.
14. Mosley, W. H., & Chen, L. C. (1984). An analytical framework for the study of child survival in developing countries. *Population and development review*, *10*, 25-45.
15. Qayyun.A, R. s. a. (2015). Comparative Analysis of Factor Affecting Child Mortality in Pakistan. *Pakistan Institute of Development Economics (PIDE) Pakistan*.
16. Schaefer, R. L. (1983). Bias correction in maximum likelihood logistic regression. *Statistics in Medicine*, *2*(1), 71-78.
17. Syamala, T. (2004). Relationship between socio-demographic factors and child survival: evidence from Goa, India. *Journal of human ecology*, *16*(2), 141-145.