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Statistical Study on the Linkage of Child (Under-5) Mortality and Bio-Demographic Variables

Research Article

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Abstract. In this study we tried to find out the factors which are affecting the child mortality in state Uttar Pradesh and importance of such factors into predicting child mortality. For this study, the latest births by 'ever married women' of Uttar Pradesh were considered from District Level Household and Facility Survey (DLHS-3) data. Factors were checked for association with child mortality by using of chi-square test. Further logistic regression analysis applied to find out adjusted effect of each factor. For checking the predictive capability of logistic regression model we applied R^2 statistic. It was found Wealth index quintile, type of birth, mother's age at time of birth, and father's education were significantly effect to child mortality. The value R^2 is (2.3%).

Keywords. Bio-Demographic Variables; Child mortality

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Introduction and Background

Study of child mortality becomes one of the most important research areas for those countries where child mortality is high. It is true that there has been significant progress in child mortality rate in India in the last two decades (RGI, 2009; NFHS-3, 2007), but current child mortality rates are still alarmingly high compared to those of other countries with similar socioeconomic conditions.

It has been documented that the child mortality is affected by a numbers of socio-economic, demographic and biological factors. In their study Mosley and Chen (1984) determined that there were two important groups of independent variables; socio-economic (i.e. cultural, social, economic, community, and regional factors) and biomedical (i.e. breastfeeding patterns, hygiene, sanitary measures, and nutrition) factors which have an effect on child mortality. Numerous other studies also have examined child mortality (Hobcraft et al., 1984; Hill, 1991; Hossain and Yadava, 2003; Koissi and Hogans, 2005), including a number of studies conducted in India (Jain and Visaria, 1988; Pandey et al., 1998; Bhattacharya, 1999; Baqui et al., 2006; Singh et al., 2008). In recent study Singh et al. (2013) examine the effect of socio-economic and bio-demographic variable on Neo-natal mortality in Uttar Pradesh, India using Cox-proportional hazard (PH) model. But the lack of checking PH model suitability on data found similarly Uddin et al. (2008) applying logistic regression model to find out factor effecting child mortality in Bangladesh but they have not discussing about model suitability. The purpose of current study is to apply a logistic regression model to determine the factors which are affecting child mortality and to check the suitability of model. It was important to conduct this study because the intensity of the effects of socio-economic and bio-demographical factors on child mortality changes with time (report-2012). Therefore the model developed based on these independent variable needs to be checked for suitability.

Objective of the Study

In this study, an attempt has been made to examine the predictors of child mortality in Uttar Pradesh (biggest state of India in terms of population). Uttar Pradesh is lagging behind most of the states of the country in terms of the major indicators of social and health development including life expectancy, infant mortality and literacy (HDI-2 report). Geographically it lies within a region of central India that is marked by substantially high level of child mortality (Singh et al., 2011).

Methodology

In the study we took the probability of child death and studied its relationship to various independent variables. The probability of an event lies between 0 and 1. Therefore, the logistic regression model was applied by linking the range of real numbers to the 0 to 1 range. For checking the model R^2 (Nagelkerke, 1991) statistic was used. Value of R^2 lies between 0 to 1. The value 0 shows that model provide no explanation and value 1 show that model explains 100% about the variability of the dependent variable.

We considered six independent variables father's education, mother's education, type of birth, birth order, mother's age at time of birth, and wealth index quintile. Each selected variable was checked for association with child mortality by using of chi-square test at 5% level of significance. The variables which were showed a significant ($p < 0.05$) association with child mortality placed into a logistic regression model to determine the strength of the relationship

when other variables were held constant. The software SPSS 16.0 version has used to perform the analysis.

Data

Data for study was taken from the District Level Household and Facility Survey (DLHS-3). DLHS-3(2007-2008) was designed to provide estimates on maternal and child health, family planning and other reproductive health indicators. The Data was collected from 34 states and union territories of India in 2007-2008. The DLHS-3 adopted a multi-stage stratified probability proportion to size sampling design. For this study, the latest births by 'ever married women' of Uttar Pradesh were considered. The selected data shown in the Table 1 describe the total 37680 'ever married women' gave birth. Of the 37680 women, 35973 reported having a child who survived while 1707 women reported having a child that had died.

Result and Discussion

The distribution of child mortality by selected variables (socio-economic and bio-demographic) variables are shown in Table 1. Among the selected variables, each variable was found to have a strong relationship with child mortality. Table 2 presents the estimated coefficients (β), Standard errors (S.E.), odds ratios (OR) with related confidence intervals (CI) for independent variables. The results of the logistic regression analysis indicated that most of the variables significantly affected child mortality. The variables Wealth index quintile, type of birth, mother's age at time of birth and father's education were significant in all categories. In the variable "father's education" category illiterate and Primary having 1.22 and 1.19 time more of the risk of child death when compared to fathers who were educated above the primary level. In the case of mother's education the risk of child death was higher for illiterate mother in comparison to those mothers who had been educated above the primary level. In case of mothers who had multiple births, there was 5.31 times more risk of child death as compared with single birth mothers. This finding was consistent with findings from previous studies (Chowdhury et al., 2010; Singh et al., 2013). The first birth order has more risk in comparison to other birth orders also consistent with previous findings (Becher et al., 2004). The mothers who experienced birth in the below 19 age group have 35% lower risk than mothers who were older than 35, while the mothers in the age-category 20-34 having lowest risk of child death. This finding also was supported by a previously conducted meta analysis study (Charmarbagwala et al., 2005; Becher et al., 2004). In comparison to the richest category, the other category had nearly a 1.45 times higher risk of child death. This result also supported by previous research (Adeleke and Halid, 2012; Singh et al., 2013). The value R^2 is very small (2.3%) which shows that the model describes very low variability in phenomena under study. This finding was similar to that of (Chin and Montana, 2007).

Table 1. Women experiencing Child death and surviving pattern in different categories of variables.

	Death (n = 1707)		Survive (n = 35973)		Total (n = 37680)		% Death	(p) value
	No	%	No	%	No	%		
Father Education								
Illiterate	613	35.9	10901	30.3	11514	30.6	5.3	
Primary	277	16.2	5165	14.4	5442	14.4	5.1	
Above Primary	817	47.9	19907	55.3	20724	55.0	3.9	< 0.0001
Mother Education								
Illiterate	1170	68.5	22574	62.8	23744	63.0	4.9	
Primary	198	11.6	4379	12.2	4577	12.1	4.3	
Above Primary	339	19.9	9020	25.1	9359	24.8	3.6	< 0.0001
Type of Birth								
Single	1630	95.5	35636	99.1	37266	98.9	4.4	
Multiple	77	4.5	337	0.9	414	1.1	18.6	< 0.0001
Birth order								
1	444	26	7481	20.8	7925	21.0	5.6	
2	296	17.3	7299	20.3	7595	20.2	3.9	
3	237	13.9	6477	18	6714	17.8	3.5	
≥ 4	730	42.8	14716	40.9	15446	41.0	4.7	< 0.0001
Mother age								
≤ 19	246	14.4	4116	11.4	4362	11.6	5.6	
20-34	1227	71.9	28754	79.9	29981	79.6	4.1	
≥ 35	234	13.7	3103	8.6	3337	8.9	7.0	< 0.0001
Wealth index quintile								
Poorest	442	25.9	8355	23.2	8797	23.3	5.0	
Second	399	23.4	7732	21.5	8131	21.6	4.9	
Middle	358	21	7299	20.3	7657	20.3	4.7	
Fourth	328	19.2	6865	19.1	7193	19.1	4.6	
Richest	180	10.5	5722	15.9	5902	15.7	3.0	<0.0001

Table 2. The outcome of logistic regression analysis.

	Estimate of β	SE of β	Odds Ratio	95% CI for OR	
				Lower	Upper
Intercept	−1.584	0.164			
Father Education					
Illiterate	0.199*	0.063	1.220	1.079	1.38
Primary	0.174*	0.075	1.190	1.028	1.379
Above Primary	#				
Mother Education					
Illiterate	0.155*	0.077	1.168	1.003	1.358
Primary	0.091	0.096	1.095	0.908	1.321
Above Primary	#				
Type of Birth					
Single	−1.671*	0.13	0.188	0.146	0.243
Multiple	#				
Birth order					
1	0.445*	0.078	1.560	1.34	1.819
2	0.039	0.077	1.040	0.894	1.209
3	−0.106	0.08	0.899	0.769	1.052
≥ 4	#				
Mother age					
≤ 19	−0.433*	0.114	0.649	0.519	0.81
20-34	−0.513*	0.08	0.599	0.511	0.701
≥ 35	#				
Wealth index quintile					
Poorest	0.36*	0.102	1.433	1.173	1.75
Second	0.372*	0.101	1.451	1.191	1.767
Middle	0.358*	0.1	1.430	1.177	1.739
Fourth	0.362*	0.098	1.436	1.186	1.74
Richest	#				

Reference category,* Significant at p value < 0.05, Naglkerke $R^2 = 0.023$

Conclusion

From the findings of our study it is clear that to better control child mortality, attention should be given to parent education, and parent wealth status. In addition Women should be encouraged to give birth while they are between the ages of 20 and 34. Providing Special medical care for those mothers who are experiencing their first birth or having multiple birth outcomes also would reduce the risk of child mortality in Uttar Pradesh. The majority of the variables examined in the analysis were significant; however the variation explained by this model is fairly low. This is a confirmation of the difficulties in predicting child mortality with very limited cross-sectional data.

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Competing Interests

The authors declare that they have no competing interests.

Authors' Contributions

All the authors contributed equally and significantly in writing this article. All the authors read and approved the final manuscript.

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