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Study on Child Mortality Determinants in EAG States and Assam

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Abstract: The universal assumption is, if there is improvement in status of society in terms of education, health, occupation and wealth, it generates reduction in child mortality. Study is considered for testing above assumption in perspective of EAG states and Assam. National Family Health Survey- III has been used to carry out for the study. Study data contains 22179 sampling units which is the number of children born reported within the 5 years. Different socio demographic variables selected as development indicators of society. Relative risk had been evaluated with help of Cox proportional hazard model to illustrate child mortality in reference of different social structure in scenario of EAG states and Assam.

Keywords: Infant Deaths, Under 5 Mortality, Logistic Regression, Cox Proportional Hazard Model, Pearson Coefficient of Association, Karl Pearson Correlation Coefficient

1 Introduction

India is a big country in which about its 50% of population is lies under 25 year age, 20% of them are less than 5 year age group. That scenario makes child mortality an important feature of population. Maternal status, Socioeconomic and health awareness factors might affect child mortality. In this study we consider multiple hazard model for analysis and justification of effect of Maternal, Socioeconomic and health awareness status on child mortality. The data which will consider for that study is taken from National Family Health Survey-III collected during 2005-06, Which use 22179 units for study.

The study of Hobcroft, McDonald and Rutstain (1984) based on multivariate analysis data from 16 countries described that relationship between maternal socio-economic status and under 5 year age mortality can mot be demonstrated by only basic reproductive concerns such as maternal age, ranking of births and spacing between births.

By implying Cox regression analysis Zerai(1996) implemented a multilevel frame for study influence on infant survival in Zimbabwe based on socio-economic and demographic variables obtained from 1992 Zimbabwe Demographic Health Survey(ZDHS) data, in which one of the most important finding was infant survival in a community is greatly influenced by mother's average educational level. Which seems very much supportable for ascertain that mass education give strong impact on child survival given by Cleland and Ginneken(1988). In Indian scenario there must arise many social variables who affect the under 5 year age mortality. This paper is about the study of impact of variables related to maternal status on child mortality in Indian context.

There are several studies done on child mortality in perspective of many countries for relevance between child mortality and social status, Manda (1999) used Malawi(1992) DHS data for relation between maternal status and infant and child mortality in case of with or without any explanatory variable. And impact of child mortality by direct and indirect effect of breastfeeding with the help of birth intervals.

In Haiti, determining of childhood mortality and estimating it trends Bicego (1990) used proportional hazard regression in three steps mortality, Morbidity and services utilization survey in Haiti(1987) which shows that age and education of mother have remarkable impact on neonate survival and decrease and health services also having great importance during childhood. Kempo and Ginniken (2009) given study on child mortality and maternal status in terms of maternal, socio-economic and sanitation variables with the help of non-parametric survival procedures for study by using Cox

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Proportional hazard model, in 3 classes of socio-economic status of models using 1992 DHS data for Zimbabwe one of the main finding was the child mortality highly related to maternal social status as well as water and sanitation facility available in Zimbabwe.
India is the vast country having so many social and cultural diversities and society divided in many dimensions. This study is concerns about the condition of influence of social, maternal and child perspective in under five year age mortality. EAG states which covers a large part of population as well as area, are consists with high rate of child mortality, which is highest resourceful part of India.North eastern state Assam which have about similar condition as EAG states wit high child mortality is also considered here for study along with EAG states to know the child mortality determinants
In non-parametric condition Cox-proportional hazard model is an acceptable method for the study in extensive manner because being a semi parametric model, this go with the flexibility of non-parametric model with pursuing that more powerful and extensive to any non parametric model. We use this model in study of below five year age mortality in Indian scenario with the help of NFHS- III (2005-06) data. We make consideration of several independent variables which is supposed to make influence on under five year age mortality and consider every variable association to the death of children with correlation to make study variables justified. In which our expectation for understanding the condition of under five year age mortality and improving them for country like India, And getting condition which must helpful for keeping hope alive for working for India, So for extensive study we move on the methodology of study.

2 Data and Methodology

2.1 Model Specification

Child mortality can be can be divided in three different terms as death within the first month as neonate death, death between 1-12 months of a child is called infant mortality and death occurred in between 13-60 months age is termed as child mortality, The risk of occurring death in both cases in age interval period for age in year from birth given in calendar year. Independent variables which are used in that study based on child mortality and morbidity framework given by Mosely and Chen (1984).
In several studies Bicego (1990), Zerai (1996), Manda(1999) shown that birth interval, parity, neonatal age have high impact on under five year age mortality we consider these variables. In our study to fit Cox- proportional hazard model for variables defined as:-

2.2 Outcome variable

mortality under age in years five year taken as dependent variable. Since we had divided mortality under 5 year age in 2 stages so our outcome variable consists with 2 different models at each outcome variable defined as Infant deaths and child deaths.

2.3 Independent variables

Birth order and Birth Interval For child health and survival how much birth had been given by mother and in which interval she had given the birth is important, as the frequent births in small interval may cause the immature births or anemic condition to women, which may affect the child survival in negative sense. for this study we consider birth interval in 3 scenario 1 small birth interval or SBI which shows birth interval in between 9-18 months of preceding birth. 2 Medium birth interval or MBI the interval between 18-60 months to preceding birth. 3 Large birth intervals or LBI or births interval of more than 60 months of preceding birth. And birth order is considered with 3 factors as 1. less than 2 births 2. 2-4 births 3. more than 4 births. The data of birth order will move with correspondingly with birth interval.

Sex of child In Indian scenario Sex of child is an important aspect because in Indian Tradition have lot preference to the birth of son and have more possession to health of son. so we consider son and daughter for our study to the scenario of child death.

Type of birth Multiple births are affect the child survival as there is always a risk of death to child and mother when more than 1 births occur as there health and other nutrition factor affect the child death. Here we consider 3 types of births 1. single birth, 2. Twins and 3. Multiple births to the study.

Maternal Age Child bearing capacity of a women is also related with her age, as we consider the early age we get that she is not properly fit to giving birth to a child and in later ages the risk of child death may go higher as she comes near of her age of menopause. So considering it may have a significant on child death, here we consider 4 groups of ages as up to 20 years, 20-29 years, 30-39 years, 40-49 years.

Maternal Education As there is common assumption that educated society moves to a healthy life and it extend the life expectancy of child, so we consider that factor for our study to much important. we divide this scale in 3 categories 1. illiterate, 2. primary education, and secondary and Higher education.

occupation In any society occupational status directly leads to the economical status of family which is onto the health access and awareness of the family, here we divide occupational status in 4 divisions (1) not working (2) Unskilled worker (3) semiskilled worker (4) Skilled worker for the phenomenon of Child deaths.

Economical Status This is one of the important factors to consider in our society related to health. As the common assumption about wealth status is that if you have as much money than you have much better accessibility to health services. in that scenario considering wealth status becomes more prominent figure to consider for the phenomenon of child mortality. here we consider the 3 status of society as (1) Poor (2) Middle class and (3)Rich in this context.

Residential Status In Indian context specially in EAG States Availability of health facility of such as PHC, CHC etc is dependent on residential status for example in EAG states there are lots of Villages which do not have proper health facility so considering residential status may show may show big effect on contion of child mortality. Here Taken Residential status are (1) Urban and (2) Rural for the study.

Religious Status In our Indian Society discrimination between different religions is assumed to be a proper cause of child death. so considering it may give a proper relation to child deaths here we had taken religion in 3 stages (1) Hindu (2) Muslim and (3) others. Since Hindus and Muslim share largest population part of Population in India So we considered them as main religious part and other religions as Sikhs, Buddhist, Christians etc. Which share a very less contribution in Indian scenario.

Caste Structure Since caste is a very important issue in EAG states in general condition caste factor is assumed to directly related to economical condition. Here on governmental basis we consider caste in 4 section (1) Schedule Caste (2) Schedule Tribes, (3) Other Backward Caste (4) Others to the study in dimension of child deaths.

Family type In society there is hypothetical situation that there are different chance of survival of a child in joint and nuclear family, so considering that factor may lead to proper justification to child deaths. Here we take families as (1) Joint Family (2) Nuclear family for the study.

Household Structure In this phenomenon we consider three types of household (1) Pucca House (2) Semi pucca (3) Kachchha house. In such manne social context it considered house structure leads to better health environment and survival chances to kids.

Sanitation facility Sanitation facility is one of the important part of the population to study, as sanitation facility may be the cause of spreading disease in population and may increase the chance to child deaths, so we must consider it as a facility to know the scenario of child deaths. Here we made 5 types to study the sanitation facility (1) No Facility, (2)Flushed Toilet, (3) Pit Toilet, (4) Dry toilets (5) Non- Dejure Residents for the study.

Water Facility Most of the spreading disease to child as diarrhea and cholera etc which are spread due to water. Which is the one of the biggest reason of child death in EAG states and Assam here we consider main types of water facility to study as (1) Piped Water Facility (2) Tubewell (3) well (4) others and (5) Non- dejure residents for the study.

Birth Weight Birth weight is an important aspect to study about the phenomenon of child mortality as weight of babies are commonly related to the child immunity and child health in common assumption so we might consider its effect on child mortality. birth weight had taken in 4 forms (1) doesn't know the weight (2) less than 2.5 kg or underweight (3) average weight or 2.5 kg (4) overweight or more than 2.5 kg.

Caldwell (1989) shows education of mother is highly influencing factor of child health because an educated mother is able to adjust in any traditional and social custom and she have higher ability to make extensive use of health care resources which may increase the autonomy for her child in and outside of house. In similar manner wealth status play an important role in in under 5 year age mortality it shows the availability of nutritional resources specially when a child needs to have special care.
Indian scenario is very different scenario from the world because it contains lot of differences in social status such as region, religion, caste each and every factor gives greater influence on under 5 year age mortality, occupation of females also play a crucial role in under 5 year age mortality. In some cases there have been observed that mortality of child whose delivery occurred in modern facilities is higher than other deliveries, because that facilities are used under the condition of pregnancy complication become high.
Household status and sanitation facility are taken as some other important influencing factors of under 5 year age mortality. There is saying that water is in the root of most of the disease in India largest no. of people lives in rural areas where most of the people doesn't have a proper house to live, and they live in kachha houses and they do not have proper water and sanitation facilities. These are conditions of having the high incidence rate of mortality under 5 year age.
Household structure is also a case that affects the child mortality as it has been seen that if there is a joint family than care and control of a child is high so it shows the risk of under 5 year age mortality lower than nuclear family. In this paper we study the impact on mortality under 5 year age on the basis of variables selected as maternal, socio-economic, household scenario discussed in Indian context and that variables were being tested on the relevance of hazard regarding consideration in 2005-06 NFHS data.

2.4 Source of Data

In this study we use the National Family Health Survey (NFHS- 2005-06) kids file which is highly reliable in Indian context the data is based on 22179 observation recorded for last five years with 6277 deaths to the women in between 15-49 years which was collected with the collaboration of International Institute of Population Studies (IIPS) and Demographic Health Survey (DHS), Which are the rich source of women and child status data that gives the sufficient number of information in that category to ensure the reliability of data.

2.5 Methods

Kids data file is being used constructed from women respondents in 2004-06 national family health survey using statistical analysis software with using sampling weights. Cox Model is used in survival analysis with proportional hazard models. Significance level is being performed over $p < 0.001, p < 0.01, p < 0.05$ for the hazard models.
Karl Pearson Correlation is used to know the relation level in between Independent variables and child mortality defined as-:

$$r = \frac{Cov(X,Y)}{\sigma_x \sigma_y} \tag{1}$$

where X is independent Variable and y is Child Mortality.
and with Karl Pearson correlation, pearson Chi-square coefficient of association to get the significant association in between independent variable and child morality. Since in consideration the measures of survival Cases Cox is considered as the better measure in respect to other methods such as life table in which we can find the survival scenario in case of equally divided constant age intervals, which is being improvised in Kaplan-Meier estimate with varying age interval or variable failure timings. Their are better estimates but there have some problems with that estimators such as they only can evaluate survival chances with respect to only one respective independent variable. and also they all are

non- parametric models which are considered week models with respect to any parametric models. Cox Proportional hazard model is preferred over that such as it is a semi parametric model which is more powerful than any non parametric model in any case. And more it consists the liberty to any non parametric model to number of variables.
Cox proportional model is defined as-:

$$h_i(t_i X_i) = h_0(t) e^{\Sigma_{i=1}^{n} \beta_i x_i} \tag{2}$$

where $h_0(t)$ is base line hazard which can be approximated through by any distribution such as exponential or weibull distribution but they will provide the similar results for the same data due to that property cox regression is considered as semi parametric model. and for the value if relative we did not have to defined the baseline hazard certainly we can go for the results by using the $e^{\Sigma_{i=1}^{n} \beta_i x_i}$ for given time t to occurring the event. We apply hazard model after proceeding checking the proportionality assumption of hazard models with the help of chi-square test.

3 Results

Considering the independent variable for the model to get the information regarding child deaths within the last 5 years we have the table of basic variables in such a manner-:

On studying the basic characteristics we get the proper frequency to the phenomenon of child deaths in EAG states and Assam.

3.0.1 Association

Now going for the correlation and association in between child living status to independent variables to get the information about the significant association and relation to the child deaths of different status variables to put in regression model to approach to proper results.
Pearson Correlation Table of children living status and different independent variables.
From Table 3 we get information about relation in between died Children variable used in that case we see that birth order to corresponding birth interval have significantly positive relation to children died with value $r = .073$ and significance value 0. In case of sex of child there is insignificant correlation with children ever died. Going with the case of birth type there is positive significant correlation with died children. For maternal age to child died we found significantly positively related. Considering the maternal education level to child deaths we found that there exists significantly negative correlation in between them. Considering the scenario of occupation level we find the significantly positive correlation in between them. With the help of economical status we evaluated that the correlation of it with children died is significantly negative. Moving to residential status we get significantly positive relation to the died children. In study of religious status relation to child mortality we get a positively significant relation in between them. Considering the caste factor we get significantly negative correlation in between died children and caste of household head. In spite of child death relation to household structure gives the negative correlation in between them with proper significance. In case of household type it also shows that negatively significant relation to children died. In consideration of relation of toilet facility to children died we get a significantly negative relation in between them. Water facility status shows that significantly positive relation of it to children died. Considering the factor of birth weight for the relation with children died we get a significant negative correlation in between them. After that we had move to the study of association in between the considered variables with respect to the child died to being considered with their significance level of association in regression models study.
Pearson Chi-square coefficient of Association in Table of children living status and different independent variables. From Table 4 with the help of Pearson chi-square We get association such as birth order with corresponding birth interval is significantly associated with 8 degree of freedom. Sex of child shows the insignificant association to children died in the EAG states and Assam. Birth Type scenario it shows the significant association with children died with 2 degree of freedom. In maternal age to child died shows the significant association in between them with corresponding 3 degree of freedom. With respect to highest education level of mother shows high degree of association with child died with 2 degree of freedom. Taking the occupation level with children died we get high association with 2 degree of freedom. Going with the economical status we get significantly associated with died children to 2 degree of freedom. For Residential status we get with 1 degree of freedom highly significant association. Going with the religion consideration association with children died is significant with 2 degree of freedom. In case of Caste we get the significant association of it with children died in 3 degree of freedom. In consideration of household structure with children died we get a significant association in between them with 2 degree of freedom. Causing the study for the children died with household type have significant association 3 degree of freedom. Considering the toilet facility association with children died we get a highly significant

Table 1: Basic characteristics with respect to living and died Children

birth order and birth interval	living children	died children	Total
$\leq$ 2 births in SBI	561	232	793
2-4 births in SBI	492	340	832
$\geq$4 births in SBI	185	423	608
$\leq$2 births in MBI	3538	526	4064
2-4 births in MBI	3390	1478	4868
$\geq$ 4 births in MBI	1204	2225	3429
$\leq$2 births in LBI	458	49	507
2-4 births in LBI	413	179	592
$\geq$4 births in LBI	122	225	347
Sex of child	living children	died children	Total
Male	8253	3207	11460
Female	7649	3070	10719
birth type	living children	died children	Total
single birth	15739	6086	21825
twins	80	95	175
multiple births	83	96	179
maternal age	living children	died children	Total
$\leq$20 years	1070	182	1252
20- 29years	11509	3319	14828
30-39 years	3151	2378	5529
40- 49 years	172	398	570
highest education level	living children	died children	Total
no education	7662	4580	12242
primary	2233	742	2975
secondary and higher	6006	955	6961
occupation level	living children	died children	Total
no occupation	10573	3480	14053
semi skilled	4895	2675	7570
skilled	431	122	553
Economical Status	living children	died children	Total
poor	6920	4034	10954
middle class	2863	1058	3921
rich	6119	1185	7304
Residence	living children	died children	Total
Urban	5465	1504	6969
Rural	10437	4773	15210
Religion	living children	died children	Total
Hindu	12781	4912	17693
Muslim	2680	1199	3879
others	325	73	398
Caste or tribe	living children	died children	Total
Scheduled caste	2993	1478	4471
Scheduled tribe	1413	848	2261
Other backward class	6800	2709	9509
None of above	4351	1088	5439

with 4 degree of freedom. In constructing association in between children died and drinking water facility we get the significantly high Association with 4 degree of freedom. Going with the case of association in between birth weight and children died they have highly significant association in between them with degree of freedom 3.

From the study of Pearson chi square and karl pearson correlation coefficient we get that there is only one case sex of child has not significant association with children died so we did not consider the sex of child as independent variable in our regression model studies and we will take the phenomenon od infant and child deaths with Cox proportional hazard model with time constrain had been taken with variables which are time independent.

Table 2: Basic characteristics with respect to living and died Children

Household structure	living children	died children	Total
Nuclear	6343	3486	9829
Non-nuclear	8125	2446	10571
Not dejure resident	1434	345	1779
House type (as defined in NFHS-2)	living children	died children	Total
Kachha	2209	1376	3585
semi-Pucca	6392	3179	9571
Pucca	5762	1339	7101
Not dejure resident	1434	345	1779
toilet facility type	living children	died children	Total
no facility	8273	4289	12562
flushed toilet	5194	1215	6409
pit toilet	759	287	1046
dry toilet	200	123	323
non dejure resident	1456	351	1807
drinking water facility type	living children	died children	Total
piped water	3973	1040	5013
tubewell	8203	3712	11915
well	1763	906	2669
other	528	272	800
non dejure resident	1434	345	1779
birth weight	living children	died children	Total
doesn't know	11428	5456	16884
underweight	983	232	1215
average weight	913	150	1063
overweight	2541	411	2952

Table 3: Correlation in between variables with Children deaths

	Pearson's Correlation		
	Value	S. E.	Sig.
birth order in birth interval vs children died	0.073	0.008	0
Sex of child and children died	0.007	0.007	0.278
birth type and children died	0.068	0.008	0
maternal age and children died	0.247	0.007	0
highest education level and children died	-0.237	0.006	0
occupation level and children died	0.095	0.007	0
wealth index and children died	-0.204	0.006	0
Residence and children died	0.101	0.006	0
Caste or tribe and children died	-0.106	0.007	0
Religion and children died	0.047	0.007	0.033
Household structure and children died	-0.138	0.007	0
House type and children died	-0.162	0.006	0
toilet facility and children died	-0.095	0.006	0
drinking water facility and children died	0.013	0.006	0.045
birth weight and children died	-0.158	0.006	0

3.1 Proportionality Assumption

Applying the proportionality assumption we get such as
It Presents for children it for 14 degree of freedom, we get significant of that. And for infant we get with 14 d.f. with significant with value 24.96. i.e. all variables can be applied in the model.

Table 4: Pearson Chi-square coefficient of Association in variables with living status of Children

	Chi-Square Tests		
	Pearson's Chi-square	DF	Aprox. Sig.
birth order and birth interval vs children died	2874.045	8	0
Sex of child vs children died	1.176	1	0.278
birth type vs children died	116.688	2	0
maternal age vs children died	1446.602	3	0
highest education level * children died	1246.741	2	0
occupation level vs children died	281.932	2	0
wealth index vs children died	920.746	2	0
Residence vs children died	226.17	1	0
Religion vs children died	34.856	2	0
caste or tribe vs children died	329.329	3	0
Household structure vs children died	457.098	2	0
House type vs children died	674.997	3	0
toilet facility vs children died	572.912	4	0
drinking water facility vs children died	313.114	4	0
birth weight vs children died	591.55	3	0

Table 5: Proportional Assumption result for Children

test	Chi-square	d.f.	P-value
value	24.22	14	0.043

Table 6: Proportional Assumption result for infants

test	Chi-square	d.f.	P-value
value	24.96	14	0.035

Table 7: Cox Proportional for Infant children died

Variables	P-value	Relative Risk	95% C.I.
Birth order in Birth intervals			
$\leq$2 births in short birth interval		1	
2-4 births in sbi	0	0.991	(0.703-1.399)
$\geq$4 births in sbi	0.006	1.024	(0.717-1.462)
$\leq$2 births in mbi	0	0.99	(0.735-1.334)
2-4 births in mbi	0	0.927	(0.691-1.245)
$\geq$4 births in mbi	0	1.056	(0.765-1.457)
$\leq$2 births in lbi	0	1.098	(0.64-1.884)
2-4 births in lbi	0	1.191	(0.74-1.915)
$\geq$4 births in lbi	0.003	0.855	(0.429-1.701)
birth Type			
single birth		1	
twins	0.046	1.139	(0.815-1.593)
multiple births	0.008	1.078	(0.748-1.553)
maternal Age			
$\leq$20 years		1	
20- 29years	0.081	1.005	(0.651-1.554)
30-39 years	0	0.97	(0.61-1.542)
40- 49 years	0	1.08	(0.604-1.931)

Table 8: Cox Proportional for Infant children died

Variables	P-value	Relative Risk	95% C.I.
Maternal Education			
no education		1	
primary	0.003	0.999	(0.816-1.222)
secondary and higher Occupation Level	0.031	1.119	(0.898-1.395)
no occupation		1	
unskilled	0.008	1.101	(0.956-1.27)
skilled	0.019	0.961	(0.587-1.573)
Economical Status			
poor		1	
middle class	0.002	1.058	(0.856-1.306)
rich	0.026	1.183	(0.881-1.588)
Residense			
Urban		1	
Rural	0.046	0.993	(0.808-1.22)
Religion			
hindu		1	
muslim	0.012	0.961	(0.681-1.048)
others	0.038	0.937	(0.518-1.696)
Caste			
Scheduled caste		1	
Scheduled tribe	0.001	0.963	(0.754-1.229)
Other backward class	0.042	1.07	(0.906-1.264)
None of above	0.007	1.016	(0.816-1.264)
Household Type			
Nuclear		1	
Non-nuclear	0.009	1.053	(0.91-1.218)
Not dejure resident	0.576	0.659	(0.153-2.846)
Household structure			
Kachha		1	
semi-Pucca	0.044	0.929	(0.776-1.113)
Pucca	0.029	0.936	(0.714-1.226)
Toilet Facility			
no facility		1	
flushed toilet	0.046	0.96	(0.75-1.229)
pit toilet	0.031	0.758	(0.5-1.151)
dry toilet	0.046	1.232	(0.706-2.152)
non dejure resident	0.048	1.682	(0.397-7.121)
Water Facility			
piped water		1	
tubewell	0.005	1.062	(0.873-1.292)
well	0.027	1.174	(0.905-1.522)
other& nonjure residents	0.029	1.058	(0.733-1.525)
Birth Weight			
doesn't know		1	
underweight	0.006	0.988	(0.705-1.386)
average weight	0.028	1.03	(0.66-1.607)
overweight	0.037	0.847	(0.612-1.172)

3.2 Infant and Child Death cases

Considering the infant and child mortality as dependent variable the Cox proportional model gives their results as given below-

3.2.1 Cox Proportional Hazard Model results in case of infant deaths

Cox proportional hazard model is a properly used model for the survival study with consideration of time, here we move with the phenomenon of infant deaths with that explanatory variables which are not changed due to time, after fitting infant deaths we get for the independent variable birth order with respect to birth interval we get the results such as if we consider up to 2 births in short interval as reference level we get for 2-4 births in short birth interval approximately similar risk with significant state with 95% confidence interval from 0.703 to 1.399. For more than 4 births in short interval with significant states we get 2% higher risk of death with respect to reference level with 95% confidence interval from 0.717 to 1.462. For less than 2 births in medium birth interval we have the risk of child death is 0.1 times lower with respect to reference level on significant state with 95% confidence interval from 0.735 to 1.334. For 2-4 births in medium birth interval risk of infant death is 0.073 times lower with respect to reference level of up to 2 births in short birth interval at significant state with 95% confidence interval up to 1.245 from 0.691. For more than 4 births in medium birth interval risk of infant death is 5% higher with respect to reference level with 95% confidence interval from 0.765 to 1.457 at significant state. For up to 4 births in large birth interval risk of infant death is 1.09 times higher with respect to reference level on significant state with 95% confidence interval from 0.64 to 1.884. for 2-4 births in large birth interval risk of death is 19% higher with respect to reference level with 95% confidence interval from 0.74 to 1.915 at significant state. For more than 4 births in large birth interval risk of infant death is 0.14 times lower on behalf of reference level on significant status with 95% confidence interval from 0.429 to 1.701.

Moving with the birth type and considering the single births as reference level we get with respect to reference level the risk of infant deaths is 1.13 times higher when twin birth occur with 95% confidence interval from 0.815 to 1.593 at significant state. For multiple births occurring the relative risk with respect to reference is 7% higher with 95% confidence interval from 0.748 to 1.553 on significant state. Going with the mothers age and taking up to 20 year age women as reference status we get for the women in between 20 to 29 years we get an insignificant relative risk. For 30-39 year age group we get significantly 3% lower risk of infant death with respect to reference level with 95% confidence interval from 0.61 to 1.542. For 40 to 49 year age grouped women risk of infant deaths is 1.08 times higher with respect to reference level at significant status and with 95% confidence interval 0.604 to 1.931. Considering the maternal education to knowing about the risk of infant deaths when we consider not educated status as reference level we get for primary educated women infant death is approximately similar to reference level at significant state with 95% confidence interval from 0.816 to 1.222. When we consider the level of secondary and higher education we get on significant state risk of infant deaths in 12% higher with respect to reference level with 95% confidence interval from 0.898 to 1.395.

Taking occupation level for study firstly we consider the not working or no occupation as reference level by that we get on significant state in unskilled worker risk of infant deaths is 1.101 times is relatively high to reference level with 95% confidence interval from 0.956 to 1.27. And for skilled workers on significant state relative risk of infant deaths is 4% lower with respect to reference level. and 95% confidence interval is from 0.587 to 1.573. Now moving to economical status considering poor class on reference level stage we get for middle class risk of infant death is 5% high with respect to reference level on significant state with 95% confidence interval from 0.856 to 1.306. And for rich class risk of infant death is 1.18 times higher with respect to reference level at significant state with 95% confidence interval from 0.881 to 1.588. For residential status when we consider urban livings as reference level we get in cox model in rural living infants have similar risk of death as reference level at significant state with 95% confidence interval from 0.808 to 1.22.

Moving to religious factor with Hindus are considered as reference population im Muslims risk of infant deaths is 0.04 times lower with respect to reference level with 95% confidence interval from 0.681 to 1.048 at significant state. In other religions relative risk of infant death is 0.07 times lower with respect to reference level at significant state with 95% confidence interval from 0.518 to 1.696. Now going on caste status with the reference level of scheduled caste as reference level we get that in scheduled tribes risk of infant deaths is 0.04 times lower with respect to reference level on significant state with 95% confidence interval from 0.754 to 1.229. For other backward castes risk of infant deaths is 7% higher with respect to reference level with 95% confidence interval from 0.906 to 1.264 at significant state. In remaining castes with respect to reference level on significant state the risk of infant deaths is 1.01 times higher with 95% confidence interval from 0.816 to 1.264. In consideration of household type with considering nuclear families as reference status we get relative risk of infant deaths on significant state is 1.05 times higher with respect to reference level and 95% confidence interval from 0.91 to 1.218, and for non- dejure residents in that case we get the insignificant results.

Going for the house hold structure with consideration of kachha house as reference level we get the relative risk of infant deaths in the semi pucca houses livings is 8% lower with respect to reference level on significant state with 95% confidence interval 0.776 to 1.113. For pucca house livings the risk if infant deaths is 0.044 times lower with respect to reference level with 95% confidence interval from 0.714 to 1.226 at significant level. Considering the toilet facility assumption with reference status that no toilet facility available we get in the families who have flushed toilet have 0.04 times lower risk of infant deaths with respect to reference level with 95% confidence interval 0.75 to 1.229 on significant state. At significant state risk of infant deaths in pit toilet users is 0.24 times fewer with respect to reference level with 95% confidence interval from 0.5 to 1.151. Considering the fact of using the dry toilets on significant status we get it shows relative risk of infant deaths is 1.232 times higher with respect to reference level with 95% confidence interval from 0.706 to 2.152. For the case of non dejure residents in that consideration we get the risk of infant deaths are 68% higher in them with respect to reference level on significant state with 95% confidence interval from 0.397 to 7.121.

For water facilities with piped water facility as reference status we get the facility to using the tube well water tends to relative risk of infant deaths on significant state with 95% confidence interval from 0.873 to 1.292 shows 1.06 times higher than reference level. For consideration of well water facility we get risk of infant deaths is 1.17 times higher with respect to reference level on significant state with 95% confidence interval from 0.905 to 1.522. And for others in that study we get that the risk of infant deaths is 1.058 times higher with respect to reference level on significant state with 95% confidence interval from 0.733 to 1.525. Consideration of birth weight factor for the study and considering the not having the knowledge of birth weight as reference level we get that the babies who are underweight have approximately similar risk of death to reference level on significant state with 95% confidence interval from 0.705 to 1.386. Going with the average weight babies the relative risk on significant status is 1.03 times higher with respect to reference level with 95% confidence interval 0.66 to 1.607 at significant state. And for overweight children on significant state the risk of infant deaths is 0.157 times lower with respect to reference level with 95% confidence interval from 0.612 to 1.172.

3.3 Results for Children deaths

The results of Cox proportional hazard model is given as below which indicates the interpreted results given below.

3.3.1 Cox Proportional Hazard model results

After fitting children deaths we get for the independent variable birth order with respect to birth interval we get the results such as if we consider up to 2 births in short interval as reference level we get for 2-4 births in short birth interval 0.15 times lower risk with significant state with 95% confidence interval from 0.611 to 1.182. For more than 4 births in short interval with significant states we get 4% lower risk of death with respect to reference level with 95% confidence interval from 0.683 to 1.356. for less than 2 births in medium birth interval we have the risk of child death is 0.14 times lower with respect to reference level on significant state with 95% confidence interval from 0.641 to 1.114. for 2-4 births in medium birth interval risk of children death is 0.19 times lower with respect to reference level of up to 2 births in short birth interval at significant state with 95% confidence interval up to 1.079 from 0.606. For more than 4 births in medium birth interval risk of children death is 9% lower with respect to reference level with 95% confidence interval from 0.666 to 1.248 at significant state. For up to 2 births in large birth interval risk of infant death is 0.23 times lower with respect to reference level on significant state with 95% confidence interval from 0.645 to 1.616. For 2-4 births in large birth interval risk of death is 2% higher with respect to reference level with 95% confidence interval from 0.645 to 1.616 at significant state. For more than 4 births in large birth interval risk of children death is 0.22 times lower on behalf of reference level on significant status with 95% confidence interval from 0.411 to 1.499.

Moving with the birth type and considering the single births as reference level we get with respect to reference level the risk of children deaths is 1.3 times higher when twin birth occur with 95% confidence interval from 0.939 to 1.801 at significant state. For multiple births occurring the relative risk with respect to reference is 27% higher with 95% confidence interval from 0.888 to 1.815 on significant state. For consideration of maternal age considering less than 20 year of maternal age as reference level we get the risk of children deaths in between the age of 20-29 years is 3% more with respect to reference level of maternal age with the significant status and 95% confidence interval from 0.679 to 1.567. On the significance level maternal age in between 30-39 years shows 0.07 times lower risk of child deaths with respect to reference level and 95% confidence interval of 0.6 to 1.457. For the age interval of 40-49 with respect to reference

Table 9: Cox Proportional Hazard Model of Children Died

Variables	Sig.	Relative Risk	95% Confidence interval
Birth order in Birth interval			
≤2 births in short birth interval		1	
2-4 births in short birth interval	0	0.85	(0.611-1.182)
≥4 births in short birth interval	0.005	0.963	(0.683-1.356)
≤2 births in medium birth interval	0	0.856	(0.641-1.144)
2-4 births in medium birth interval	0	0.809	(0.606-1.079)
≥4 births in medium birth interval	0	0.912	(0.666-1.248)
≤2 births in large birth interval	0	0.772	(0.471-1.263)
2-4 births in large birth interval	0	1.021	(0.645-1.616)
≥4 births in large birth interval	0.001	0.785	(0.411-1.499)
birth Type			
single birth		1	
twins	0.019	1.3	(0.939-1.801)
multiple births	0.003	1.27	(0.888-1.815)
maternal age			
≤20 years		1	
20- 29years	0.087	1.032	(0.679-1.567)
30-39 years	0	0.935	(0.6-1.457)
40- 49 years	0	0.969	(0.559-1.679)
Maternal Education			
no education		1	
primary	0.002	1.089	(0.899-1.32)
secondary and higher	0.035	1.147	(0.929-1.415)
Occupation Level			
no occupation		1	
unskilled	0.004	1.041	(0.911-1.19)
skilled	0.015	1.057	(0.655-1.704)
Economical Status			
poor		1	
middle class	0	1.041	(0.855-1.266)
rich	0.028	1.12	(0.847-1.48)
Residence			
Urban		1	
Rural	0.037	1.021	(0.843-1.236)
Religion			
hindu	0.003	1	
muslim	0.017	0.88	(0.719-1.078)
others	0.034	0.785	(0.46-1.339)

level of maternal age risk of children deaths is likely to 3% lower with 95% confidence interval from 0.559 to 1.679 at significance level. Considering the education level of mothers and taking illiterates or not educated as reference level we get that women those who have primary education the risk of their children deaths is 8% higher to the women who are not educated at significant level with 95% confidence interval from 0.899 to 1.32. Considering the education level as secondary and higher we get the risk of children deaths is 14% higher with respect to reference level with 95% confidence interval from 0.929 to 1.415 at significance level.

Moving to occupation status and considering not working or no occupation as reference level we get for risk of children deaths in unskilled worker is 4% higher with respect to reference level with 95% confidence interval from 0.911 to 1.19 at significant level. For skilled workers with respect to reference level risk of children death is about to 5% higher with 95% confidence interval from 0.655 to 1.704 at significant status. For economical status taking poor class as reference level we get for middle class significant case of risk in that case with 4% higher with 95% confidence interval 0.855 - 1.266. Considering the rich class on significant level with respect to reference level risk of children deaths is 12% high with 95% confidence interval from 0.847 to 1.48. On study of Residential status considering urban living as reference level we get

Table 10: Cox Proportional Hazard Model of Children Died

Variables	Sig.	Relative Risk	95% Confidence interval
Caste			
Scheduled caste	0.001	1	
Scheduled tribe	0.003	0.955	(0.765-1.192)
Other backward class	0.038	1.07	(0.917-1.249)
None of above	0.005	1.06	(0.866-1.297)
Household Type			
Nuclear		1	
Non-nuclear	0.017	1.103	(0.963-1.262)
Not dejure resident	0.537	0.633	(0.148-2.709)
Household structure			
Kachha		1	
semi-Pucca	0.046	0.94	(0.797-1.109)
Pucca	0.026	0.951	(0.741-1.22)
Toilet Facility			
no facility		1	
flushed toilet	0.045	1.073	(0.847-1.36)
pit toilet	0.021	0.787	(0.537-1.155)
dry toilet	0.047	1.087	(0.664-1.78)
non dejure resident	0.044	1.749	(0.416-7.355)
Water Facility			
piped water		1	
tubewell	0.006	1.04	(0.863-1.255)
well	0.038	1.114	(0.872-1.423)
other& nonjure residents	0.021	1.256	(0.878-1.796)
Birth Weight			
doesn't know		1	
underweight	0.03	1.191	(0.855-1.659)
average weight	0.041	1.195	(0.776-1.84)
overweight	0.031	0.857	(0.635-1.157)

the risk of children deaths are 1.021 times higher in rural area with 95% confidence interval from 0.843 to 1.236 with significant status.

Religious status consideration shows that if we take Hindus as reference level we get Muslims have 12% less risk to children deaths with respect to reference level at significant status with 95% confidence interval from 0.719 to 1.078. For other religions the risk of children deaths is 0.21 times lower with respect to reference level at significant status with 95% confidence interval from 0.46 to 1.078. Now going on caste status with the reference level of scheduled caste as reference level we get that in scheduled tribes risk of children deaths is 0.045 times lower with respect to reference level on significant state with 95% confidence interval from 0.765 to 1.192. For other backward castes risk of infant deaths is 7% higher with respect to reference level with 95% confidence interval from 0.917 to 1.294 at significant state. in remaining castes with respect to reference level on significant state the risk of children deaths is 1.06 times higher with 95% confidence interval from 0.866 to 1.297. In consideration of household type with considering nuclear families as reference status we get relative risk of children deaths on significant state is 1.103 times higher with respect to reference level and 95% confidence interval from 0.963 to 1.262, and for non- dejure residents in that case we get the insignificant results.

Going for the house hold structure with consideration of kachha house as reference level we get the relative risk of children deaths in the semi pucca houses livings is 6% lower with respect to reference level on significant state with 95% confidence interval 0.797 to 1.109. for pucca house livings the risk of children deaths is 0.049 times lower with respect to reference level with 95% confidence interval from 0.741 to 1.22 at significant level. Considering the toilet facility assumption with reference status that no toilet facility available we get in the families who have flushed toilet have 1.073 times higher risk of children deaths with respect to reference level with 95% confidence interval 0.847 to 1.36 on significant state. At significant state risk of children deaths in pit toilet users is 0.22 times fewer with respect to reference

level with 95% confidence interval from 0.537 to 1.155. Considering the fact of using the dry toilets on significant status we get it shows relative risk of children deaths is 1.087 times higher with respect to reference level with 95% confidence interval from 0.664 to 1.78. for the case of non dejure residents in that consideration we get the risk of children deaths are 74% higher in them with respect to reference level on significant state with 95% confidence interval from 0.416 to 7.355.

Considering water facility with piped water for reference level for tube well facility risk of infant deaths is 0.7 times lower at significant level with 0.693 to 1.25 at confidence interval with 95%. For well water facility risk of infant deaths is 1.217 times higher with respect to reference level with 95% confidence interval from 0.825 to 1.797 at significant state. for other facility risk of infant deaths shows 29% higher with respect to reference level with 95% confidence interval from 0.757 to 2.22 with significance state. Now going with the case of birth weight with consideration that not having birth weight knowledge as reference level we get the risk of infant deaths in babies who are under weight is 22% higher with respect to reference level with 95% confidence interval from 0.687 to 2.166 at significance level. For average weight babies risk of infant deaths at significant status is 30% lower with respect to reference level and 95% confidence interval 0.377 to 1.313. For overweight children with respect to reference level risk of infant deaths is 17% higher with 95% confidence interval 0.816 to 1.668.at significant state.

4 Discussion And Conclusion

Results we get from the Cox Proportional hazard model for infant and children deaths separately for different independent variables for study to know about their risk on different level with respect to reference level. Starting with first variable of birth order with corresponding birth interval we found that this is one of the most effective variable to understand child mortality. Birth types, Maternal age shows a proper effect on under 5 mortality. Women's education, Occupation level shows that it has not proper effect of it. We get for economical status is that, economic class is very effective in chances of child survival. For residential status we found that does not very effect on under 5 mortality. When it comes religious composition in population it have better effect on under 5 mortality. Study of caste factor, household type in our result corresponding to under 5 mortality have not such effect. Household structure, toilet, water facility have very strong and significant effect on under 5 mortality. Birth weight have effect on under 5 mortality in very extensive manner.

Study indicates that several demographic, maternal, economical, social, household and child related factors can be very helpful to understanding child mortality. Condition of child mortality can be improved by proper implementation of justification of these in development of country and child health related program as our initial assumption considered.

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