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**FACTORS BEHIND INFANT MORTALITY: A COMPARATIVE DISCUSSION IN THE CONTEXT OF INDIA**

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**ABSTRACT**

*Infant Mortality Rate (IMR) is regarded as an important and sensitive indicator of the health status of a community. It also reflects the general standard of living of the people and effectiveness of interventions for improving maternal and child health in a country. Compared to other indicators like crude birth rate, maternal mortality rate and under-five mortality rate etc, this indicator has always been accorded greater importance by the public health specialists because infant mortality is the single, largest category of mortality. It is not a result of any one or two particular diseases rather it is the result of some socio-economic syndrome of the nation. To tackle this problem we have to locate the actual factors behind it. In this paper I have tried to find the relative impact of its various factors. For this purpose I have used some secondary data of 20 districts in India.*

**KEYWORDS**

infant mortality, fertility, literacy, first marriage age, per-capita income.

**INTRODUCTION**

Infant mortality is an indicator of the health status not only of infants, but also of the whole population and of their poverty ridden social and economic status in the country. They face excessive vulnerability, as underprivileged, to a hostile environment and suffer malnutrition and serious health problems; all this leads to high rates of infant mortality and morbidity. Infant mortality i.e. deaths under one year of age in a year per 1000 live births, is an important indicator of child health and development. The reduction in infant and child mortality was declared as the major goal of our official strategy to achieve 'Health for All' by 2000. One of the main objectives of the Government of India's Population Policy 2000 was to reduce the present level of high infant mortality and bring it down to less than 30 per 1000 live births by the year 2010. *A Report of Planning Commission of India 2006.*

**REVIEW OF LITERATURE**

Children are important assets of a nation, therefore reduction in infant and child mortality is likely the most important objective of the Millennium Development Goals (MDG). Infant and child mortality rates reflect a country's level of socio-economic development and quality of life and are used for monitoring and evaluating population, health programs and policies. It is an outcome rather than a cause and hence directly measures results of the distribution and use of resources, Haines (1995). While countries like Australia and Canada have IMRs well below 10 per 1,000 live births, most of the African countries are struggling with mortality levels over 50 and in some cases 100 deaths per 1,000 live births. According to the United Nations estimate, 10 million infant deaths occur annually in the world. India accounts for a quarter of those. Thus any study of Indian infant mortality has global significance.

India has experienced an impressive decline in infant mortality since the 1970s. From 130-140 deaths per 1,000 live births in the early 1970's, mortality levels have declined to as low as 60 deaths per 1,000 live births in 2000. This represents an annual rate of decline of around 2.6 percent. John C (1990). However the absolute levels of infant and child mortality are still too high (about 68 infant and 95 child deaths per 1,000 live births in 1998-99). According to the Registrar General of India, the IMR for the country as a whole is 57 infant deaths for every 1,000 live births in the year 2006. The National Population Policy 2000 aims at achieving IMR of 30 by the year 2010, Government of India (2000). The MDG is to reduce infant and child mortality by two-thirds between 1990 and 2015. In the case of India this would imply a reduction of the IMR to 27 and of the under-five mortality rate to 32 by 2015, The World Bank (2007). The latest data from the sample registration system shows that the infant mortality rates of India is 44 for every 1,000 live births in the year 2011, Data book for PC: 2<sup>nd</sup> December, 2014.

India is demographically a very diverse country. India is administratively divided into 28 states. There are variations in basic demographic indicators across states. At one end of the spectrum, Kerala, Delhi, Haryana Maharashtra etc. has demographic features which are similar to those of middle income countries like Bulgaria, Russia and Ukraine: Infant mortality rate is 12 per thousand live births; total fertility rate is 1.9 births per women. At the other end we have the large north Indian states like Uttar Pradesh, Madhya Pradesh, Odisha, Assam, Rajasthan etc. are the states of low income group, which have relatively higher IMR.

While there has been a significant decline in IMR in India over the last three decades, its performance with respect to other countries in Southeast Asia is not that impressive. India is not only described by heterogeneity across states but also by large demographic variations within states. While a number of studies have looked at the factors of infant mortality like mother's education, Fertility, Marriage age of the female etc. Such estimates miss an important point for policy makers: A comparative impact of such variables including family income. This paper seeks to address this shortcoming in the existing literature.

**OBJECTIVES**

The objectives of my study are:

1. To see the present condition of IMR in different states of India.
2. To see the relative impact of various socio-economic factors upon IMR.

**RESEARCH QUESTIONS**

1. Which factor is most important for IMR in the context of India?
2. Is there any difference in factor intensities among various economic conditions?

In this respect my Null Hypotheses against four independent factors (Female Literacy, Fertility Rate, First Marriage age of female and Annual per-capita income of the family) are that:

1. H<sub>0</sub>1: Female Literacy has no impact on IMR.
2. H<sub>0</sub>2: Fertility rate do not affect IMR.
3. H<sub>0</sub>3: Marriage age has no impact on IMR.
4. H<sub>0</sub>4: Annual per-capita has no impact on IMR.

This analysis will help the researchers to discover impacts of independent variables on the dependent variable (Infant Mortality Rate).

**METHODOLOGY**

Using a unique dataset (at the state level) from India, I have made the linear regressions (separately on each factors) to analyze the relative effect of factors on IMR. It is tried to correlate the demographic, socio-economic and other factors as the relevant causes of infant mortality. Here I have not done the multivariate regression of IMR on all factors together in order to avoid the multi-co-linearity problem. Note that, my pilot study revealed the fact that each factors of IMR are highly interrelated to others. For factor analysis, first I have sub-divided the data set in to two clubs; Club 1; which consists of relatively high per-capita income states and club 2; consists of relatively low per-capita income states. After that I have run linear regression (OLS) on each group separately in order to get the



relative impact of different factors in different economic conditions. After that, I have made Linear Regression on overall data to get the relative impact different factors.

There may have a large number of factors behind IMR, but for the analytical simplicity we have consider only four important factors. These four factors (Female Literacy, Fertility, First Marriage age and Per-capita income) however may influence other norms of society. In that sense these are playing a representative role of any other probable factors of IMR.

TABLE 1: DATA SET OF CLUB 1(H)

Name of the states (according to per-capita income)	Female Literacy (2011)	Fertility Rate (2011)	Infant Mortality (2011)	First Marriage age of Women (2009)	Annual Per-capita income of the family in Lakh (2011-12)*
Delhi	86.34	1.90	2.80	22.40	1.67
Haryana	76.64	2.40	4.40	20.60	1.06
Maharashtra	82.91	1.90	2.50	20.50	0.94
Tamil Nadu	80.33	1.70	2.20	22.40	0.89
Gujarat	79.31	2.60	4.10	20.90	0.87
Kerala	93.91	1.90	1.20	22.70	0.78
Punjab	76.68	1.80	3.00	22.10	0.77
Himachal Pradesh	83.78	1.80	3.80	22.20	0.75
Andhra Pradesh	67.66	1.90	4.30	19.90	0.70
Karnataka	75.60	2.00	3.50	20.60	0.68

Source: Data book for PC 2nd December 2014, \* Directorate of Economics and Statics of respective State Govt.

TABLE 2: DATA SET OF CLUB 2(L)

Name of the states (according to per-capita income)	Female Literacy (2011)	Fertility Rate (2011)	Infant Mortality (2011)	First Marriage age of Women (2009)	Annual Per-capita income of the family (2011-12)*
West-Bengal	77.08	1.90	3.20	19.90	0.53
Rajasthan	67.06	3.20	5.20	19.80	0.53
Chhatisgar	71.04	2.90	4.80	20.90	0.48
Jambu&Kasmir	68.74	2.10	4.10	23.60	0.47
Odisha	73.45	2.30	5.70	21.40	0.42
Madhya-Pradesh	70.63	3.30	5.90	21.00	0.38
Jharkhand	67.63	3.20	3.90	20.00	0.37
Assam	73.18	2.60	5.50	21.10	0.36
Uttar Prasesh	69.72	3.60	5.70	20.20	0.30
Bihar	63.82	3.70	4.40	20.10	0.23

Source: Data book for PC 2<sup>nd</sup> December 2014, \* Directorate of Economics and Statics of respective State Govt.

FACTORS OF INFANT MORTALITY

1. ECONOMIC FACTOR

Economic factors influence infant mortality in a gigantic way. Child survival depends on the ability of the parents to offer good care. If they are in the BPL category, their capacity for child care is minimal. The general standard of living and life style of people, the persisting poverty in every household, the feeble capacity of the head of the household to provide food for all the members and women and girl children of the family, and allied environmental and social factors do influence adversely the infant mortality in a community. Factors which are remote to the existing life styles, e.g. the availability and utilization of medical health facilities, also fall under socio-economic imperatives. Economic factors too or thus important indicators to assess and understand the cause and determinant of infant mortality. We may easily understand such relationship between family income and infant mortality with the help of following diagram.

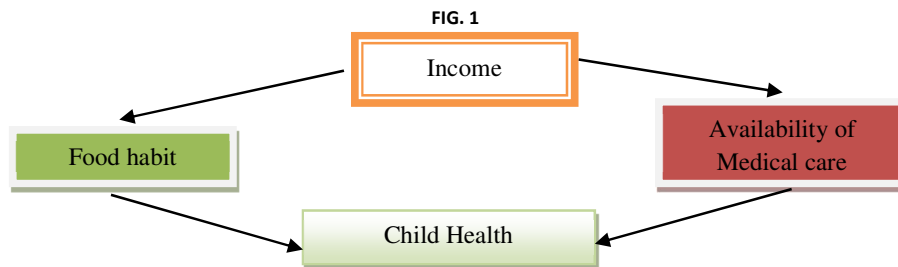
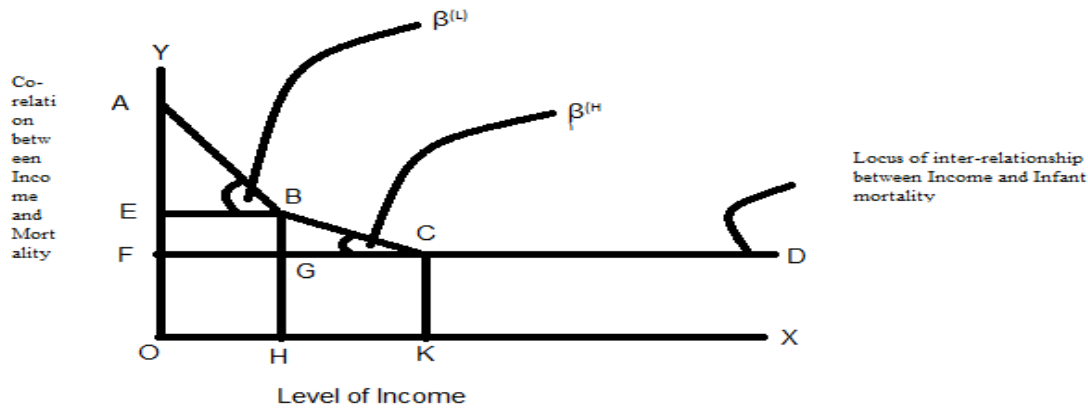


FIG. 1

Moreover, at different levels, income may have the different intensity to affect Mortality. For example, a certain (socially and economically desired) level of income can realize the basic medical and nutritional requirements of mother and her baby. After such level, the incremental income may have less use for health purpose, result of which less impact on mortality. But it is not right to think that, at this level of income infant mortality is nil. Rather, still infant may die because of other than income factors. Therefore there will be a downward slopping trend of infant mortality rate in accordance with the rise in income up to a certain point. After that the curve starts to become flatter and ultimately it tends to be horizontally straight line. Our data shows that the club of ten relatively high per-capita income states in India has less  $\beta$  co-efficient in compare with less per-capita income states. The regression equations of two clubs are –

$IMR^{(H)} = 3.501 - 0.353(I), \dots(1)$ , where I = per capita income  
 Here, R = .099<sup>9</sup>, stn. Err. = 1.248, AnnovaSig.(F) = .019  
 $IMR^{(L)} = 5.941 - 2.705(I) \dots\dots(2)$   
 Here, R = 0.291, Stn. Err. = 1.311, AnnovaSig.(F) = .002  
 Since in equation (2) the mod value of  $\beta$  is much greater than in equation (1) then we may say that income is much more co-related with IMR in less per-capita income states than that of relatively high per-capita income states. Here the value of the  $\beta$  indicates the intensity of relationship. Let us consider the following figure –  
 Income – IMR relation:

FIG. 2



Here, ABCD is the locus of inter-relationship between Income and infant mortality. Up to a certain range the slope of this curve is negative after which it becomes horizontal. From the data we see that which state has low per-capita income their  $\beta I$  is high. In figure at OH level of income the Mortality – Income locus is much steeper. Such steepness has decreases along with the rise in per-capita income. After OK level of income the Mortality-Income locus become horizontal. At this level incremental income do not affect infant mortality at all. At this level if we need to curb IMR below FO, then we must have to nurture the social factors of it.

**2. SOCIAL FACTORS**

(A) Education: The education of the mother is considered as another important factor for the health outcome of children. The empirical evidence and health statistics do show that the educated mothers are usually healthier and give birth to healthier babies. They also provide healthier environment to children and their own health care. Even the illiterate but informed women can take better care of the child. Here the “Akshar Gyan” a symbol of education is not essential rather the awareness about healthy behavior and self-confidence are more essential particularly for a developing society.

The effect of education on infant mortality has been analyzed separately on two clubs. In club 1 and 2 the regression equations are;

$IMR^{(H)} = 11.975 - 0.110(L), \dots(1)$ , Where L stands for female literacy rate.

Here,  $R = .750^{\circ}$ , st.Er. = .724, Anova Sig.(F) = .013

$IMR^{(L)} = 5.579 - 0.011(L) \dots\dots(2)$

Here,  $R = .043^{\circ}$ , st.Er = .966, Anova Sig(F) = .905

Here the  $\beta$  coefficient in both groups is negative. This means education is inversely related with IMR. But the Mod value of  $\beta$  is greater in group 1 than in group 2. Therefore, the result shows that the effect of education on infant mortality is more powerful in relatively high income states than that of low income states.

(B) Higher rate of fertility: The higher rate of fertility may causes of higher infant mortality. The fertility and Mortality are related in two ways – i) more fertility results more health hazards of mother which creates less care of child. ii) More fertility demands more family expenditure consequently less medical expenditure of both mother and baby. Therefore, there is somehow positive relationship between fertility and infant mortality.

The regression equation shows;

$IMR^{(H)} = -0.745 + 1.973(F), \dots\dots(1)$  where F stands for Fertility rate,

Here,  $R = .544^{\circ}$ , st.Er. = .919, Anova Sig.(F) = .104

$IMR^{(L)} = 3.206 + .567(F) \dots\dots(2)$

Here,  $R = .391$ , st.Er. = .890, Anova Sig.(F) = .264

Here the  $\beta$  coefficients of both cases are positive. This implies, In both group of states Fertility is directly related with IMR. But the value of  $\beta$  is much higher in group 1 than group 2. Therefore other thing remaining same the Fertility rate affect more adversely to IMR in high income states than in low income one.

(C) Marriage age: It is also an important factor of infant mortality. Many research in medical science proved that the early marriage is unhealthy both for baby and mother. Our statistical observation gives us the following equations;

$IMR^{(H)} = 17.59 - 0.673(M), \dots(1)$  where M stands for first marriage age,

Here,  $R = .666^{\circ}$ , st.Er. = .817, Anova Sig.(F) = .036

$IMR^{(L)} = 3.929 + .044(M) \dots\dots(2)$

Here,  $R = .055^{\circ}$ , st.Er. = .965, Anova Sig.(F) = .881

Here we have got a peculiar result that, though the marriage age is inversely related in group 1 states but it is directly related in club 2. Such peculiarity of low income states may arise due to the nutritional deficiency of girls’ child. Due to the financial crisis they suffer from negligence of their family. The socio-economic culture and attitude to girls’ child create a deficiency in their physical fitness. In such a situation let marriage may cause of more IMR.

Now I shall try to compare the impact of various factors in both groups of states separately. First I shall consider the club 1:

TABLE 3 (CLUB-1)

Factors	Mod value of $\beta$ Coefficient	Rank
Education	$ \beta  = 0.110$	4
Fertility	$ \beta  = 1.973$	1
Marriage age	$ \beta  = 0.673$	2
Per-capita income	$ \beta  = 0.353$	3

Source: Calculated by the researcher from secondary data.

The table 3 shows that, in relatively high income states the most powerful factor of IMR is higher fertility of women. It follows by Marriage age. Here the impact of per-capita income is on the third position. It should be noted here, fertility and Marriage age are strongly controlled by social customs and values rather formal education. Therefore, in such states (with relatively high per-capita income) social factors are dominating than economic factors in the context of infant mortality. Now we shall draw our attention to relatively low income states (club 2).

TABLE 4 (CLUB-2)

Factors	Mod value of $\beta$ Coefficient	Rank
Education	$ \beta  = 0.011$	4
Fertility	$ \beta  = 0.567$	2
Marriage age	$ \beta  = 0.044$	3
Per-capita income	$ \beta  = 2.705$	1

Source: Calculated by the researcher from secondary data.

The table 4 shows that the per-capita income is most powerful factor for influencing the condition of IMR in low income states. It is follows by fertility rate of the state. Here also we see that the formal education is not important factor at all. But the result shows something different also. In such group, economic factor dominates on other social factors in the context of IMR.

### ANALYSIS OF OVERALL DATA (HYPOTHESIS TESTING)

This section assesses the available data with respect to the predetermined four hypotheses. Hypotheses No.1:H0: There is no significant relation between Education and IMR, Hypotheses No.2:H0: There is no significant relation between Fertility and IMR, Hypotheses No.3:H0: There is no significant relation between Marriage age and IMR. Hypotheses No.4: H0: There is no significant relation between Per-capita income and IMR. This analysis will help the researchers to discover impacts of independent variables on the dependent variable (IMR). Accordingly the result will be discussed against existing literature. The table 5, gives the simple linear regression results. The table 5 shows the R Square (for Education) =.538 means that more than 53% of the variation in Y (dependent variable, IMR) is explained by X (Literacy rate). Also, ANOVA shows that P value is.000 and the level of significant is 0.05,  $P < 0.05$ . So, the null hypothesis is rejected and the alternative hypothesis is accepted. **There is a significant relation between Education and IMR.**  $\beta = -.124$ ,  $P < 0.05$ , where there is opposite impact on Education and IMR. For variable 'Fertility', table shows that, the R Square=.462 means 46% of the variation in Y (IMR) is explaining by X (Fertility). Also, ANOVA shows, P value is.001 and the level of significant is 0.05  $P < 0.05$ . So, **there is significant relation between Fertility and IMR.** The null hypothesis is rejected and alternative hypothesis is accepted. Also,  $\beta = 0.742$ ,  $P < 0.05$ , where is a positive impact on awareness and IMR. For variable 'Marriage age' table shows that the R Square =.172 means that 17.2% of the variation in Y (IMR) is explaining by X (Marriage age). Also, ANOVA shows P value is.069 and the level of significant is 0.05,  $P > 0.05$ , so the null hypothesis is accepted and the alternative hypothesis is rejected. So **there is no significant impact of Marriage age on IMR.** Also,  $\beta = -.480$ ,  $P > 0.05$ , where there is an opposite relation between Marriage age and IMR. For variable 'Per-capita income' table shows that the R Square =.336 means that 33.6% of the variation in Y (IMR) is explaining by X (Per-capita income). Also, ANOVA shows P value is.007 and the level of significant is 0.05,  $P < 0.05$ . So the null hypothesis is rejected and alternative hypothesis is accepted. **There is a significant relation between Per-capita income and IMR.**  $\beta = -2.212$ ,  $P < 0.05$ , where the relation is of opposite direction. Therefore, among 4 factors only three i.e., Education, Fertility, and Per-capita income have significant impact on IMR. The 'Marriage age' has no or very little impact on Infant Mortality rate in the context of Indian Economy.

TABLE 5: REGRESSION ANALYSIS: (FOR COMBINED DATA)

Variable	R square	Anova (sig.) / P-value	Coefficient	
			$\beta$	Sig.
Education	.538	.000	-.124	.000
Fertility	.462	.001	1.315	.001
Marriage age	.172	.069	-.480	.069
Per-capita income	.336	.007	-2.212	.007

Source: Calculated by the researcher from secondary data.

### CONCLUSION AND RECOMMENDATION

From the study we find that, the dominating factors behind the infant mortality are different in different socio-economic conditions of the states. Where economic condition is good, IMR is dominated by social factors like Education, Fertility and Marriage age which are indirectly influenced by existing social customs, values, norms etc. On the other hand, in an economically backward state, per-capita income is the primal cause of IMR.

Therefore as a policy measures against high IMR we have to take different decisions in different economic conditions of various regions. In case of a less developed economy like India we should take care about the creation of income opportunity particularly for female, so as they become vocal about their own problems. In opposite side, an economically advanced state can curb its infant mortality related problems by changing socio-cultural and religious attitude of the people. Therefore, to eliminate the problems related with IMR in the development process, first we should improve the financial condition of the people and then other social superstructures of the society. Lack of food is the primal cause of IMR rather than lack of knowledge.

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