

**PUBLIC HEALTH EXPENDITURE AND HEALTH  
OUTCOME IN TERMS OF INFANT MORTALITY RATE  
IN INDIAN STATES**

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**Abstract**

***Keywords:***

Infant mortality rate;  
Public health expenditure;  
Public health related  
social service expenditure;  
Millennium Development  
Goals.

This paper provides statistical evidence linking per capita public health expenditure and per capita public social service expenditure related to health outcome in terms of infant mortality rate in selected states of India. The relationship is examined, using time series data from six selected states of India namely Assam, Chhattisgarh, Madhya Pradesh, Odisha, Rajasthan and Uttar Pradesh between 2001 and 2013. Public health expenditure has a statistically significant effect on infant mortality rate in the selected states of India. Our results imply that public health expenditure have a major impact on the health outcome on infant mortality rate. We find, Public health expenditure and Public health related social service expenditure has a significant impact on the reduction in IMR in all the states. These results have important implication to correct the failure of the government to achieve the target intended in Millennium development goals.

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## 1. Introduction

In a developing country like India, enhancing the quality of growth is a vital objective of development paradigm. Human capital acts a key role in promoting economic development and health has an important partfor human capital. According to WHO (1946) definition of Health, “A state of complete physical, mental and social being and not mere the absence of disease or infirmity.” The health outcome is generally measured in terms of different incators such as life expectancy at birth, infant mortality rate (IMR), crude birth rate (CBR), crude death rate (CDR), maternal mortality rate (MMR) and under-five mortality rate and so on. These indicators of health are determined by various determinants such as per capita income (PCI), nutrition, housing, sanitation, safe drinking water, socioeconomic development, health and medical care provided by government, physical environment, occupational status, the incidence of poverty.

The relation between development and health is mutually strengthening, while health contributes to economic development and on the other hand economic development tends to increase the health status of the country. According to Todaro and Smith, “the dual role of health as an input and output of the aggregate production function play a central part in the economic development.” According to UNICEF, improvement in the health of children play a major role in their contribution to economic development, as a healthy child becomes healthy adults who creates better lives for themselves, their communities and for their countries.

The Alma-Ata Declaration (1978)strongly affirms, “Health is a fundamental human right and the attainment of the highest possible level of health is a most important world-wide social goal whose realization requires the actions of many other social sectors in addition to the health sector. Primary health care is the key to attaining this target as a part of development in the spirit of social justice”.

One of the major problems of health in India is high infant mortality. In 2000 the United Nations along with 189 other countries started the Millennium Development Goals to eradicate social problems exist in different countries. Among those goals, the goal-4 is to reduce the infant mortality rate and under-five mortality rate to two third up to 2015. Although, India has not reached the Millennium Development Goal yet, it is nearly close to this. However, some of the states of India are far away from millennium development goals. So far as the goal-4 is

concerned, infant mortality rate in India is 44 in 2013, which is close to the achievement level in 2015. The infant mortality rate in major states like Assam, Madhya Pradesh, Utter Pradesh, Odisha, Rajasthan are 56, 57, 53, 53 and 51 respectively in 2013, which are above the national level and far away from MDG.

The important issue of this context is the part of government policies, which help countries to meet Millennium Development Goals through public expenditure. In many countries, public sector acts a principal part in providing the basic amenities such as health and education to build human capital. Therefore, to find out the effect of spending on social services might help country to meet MDGs is of main interest. In India, the states like Assam, Utter Pradesh, Madhya Pradesh, Odisha, Rajasthan and Chhattisgarh are far away from the MDGs. So the reason behind this should be found out. The studies showed that the states like Uttar Pradesh, Madhya Pradesh, Bihar have higher infant and child mortality but they spend less in the health sector and the states like Haryana and Tamil Nadu which have low burden of infant and child mortality, they expend nearly 2-3% more than the highest burden states (Kaushal and Singh et.al. in 2013). Besides, in India most of the state health expenditure is dominated by private expenditure i.e more than 70%. Therefore, the role of public expenditure on both health and related to health in reducing infant mortality rate should be evaluated.

The remainder of the paper is structured as follows. In section-II, review of existing literature is provided. In section-III, explanation of data and methodology is given. Section-IV provides the empirical results. Section-V contains conclusion and policy suggestion.

### **Review of Literature**

Several socio-economic factors found to be the major determinant for the lessening of infant mortality rate. The most commonly sighted in the literature are per capita public health expenditure, per capita public social service expenditure. Anyanwu and Erhijakpor (2007) found significant relationship for both under-five mortality rate and infant mortality rate with total health expenditure and government health expenditure in per capita in 1999-2004 for 47 African countries and found a negative relation between female literacy and health outcome like IMR and U5MR. Bradley and Elbel (2011), found that the empirical relationship between the quotient of health expenditure to social service expenditure and health outcome influence more

than that of health expenditure only in 1995-2005 for 30 OECD countries. Conley and Spinger (2001) have studied for rich OECD countries, who have found an inverse tie-up between health investment and infant mortality rate where public spending is too robust. Gupta Verhoeven and Tiongson (2001) have found public health spending as a consistent and significant determinant of infant and child mortality rate among the poor in 70 developing and transition economies. Anand and Barnighausen (2004) have found humane resource density as noteworthy in accounting health outcome like IMR, U5MR and MMR across the country. Novignon (2013) have observed the connection between health care expenses and health outcomes in the framework of 48 Sub-Sahara African (SSA) nations over the period of sixteen years dated from 1995 to 2011 and found that health care expenditure as a major contributing factor to reduce infant mortality in SSA.

Reddy (1992) in his study of health expenditure of India, have found that expenditure on medical and public health along with other social service expenditure reduce IMR significantly. Kaushal and Singh (2013) have found a significant connotation between health expenditure and health outcome in India. S Bhalotra (2007) has found that health expenditure has significant impact on IMR in rural India but in urban India it has no impact. Makela and Dandona (2013) have found no connection between per capita public health expenditure and IMR in India. Prachitha and Shamungam (2012) have also found that per capita income and per capita health expenditure significantly contribute to health performance and reduce IMR.

## 2. Research Method

We used coefficient of correlation to measure bivariate association between the per capita public health expenditure and per capita health related social service expenditure with infant mortality rate.

The Karl Pearson correlation coefficient is given by the formula:

$$r_{xy} = \frac{\sigma_{xy}}{\sigma_x \cdot \sigma_y}$$

Where  $\sigma_{xy}$  = covariance between x and y

$\sigma_x$  = standard deviation of x  $\sigma_y$  = standard deviation of y

In order to investigate the impact of public health expenditure on infant mortality rate in India, we stipulate the following multiple regression model:

$$Y_t = \beta_0 + \beta_1 \cdot X_{1t} + \beta_2 \cdot X_{2t} + U_t \quad \dots\dots\dots(1)$$

Where  $Y_t$  = infant mortality rate (IMR)

$X_{1t}$  = ln (PCPHE),  $X_{2t}$  = ln (PCHRSSE),  $U_t$  = Error term

OR

$$IMR_t = \beta_0 + \beta_1 \cdot \ln(PCPHE)_t + \beta_2 \cdot \ln(PCHRSSE)_t + U_t$$

Where  $Y_t$  = Infant mortality rate,  $X_{1t}$  = log of per capita public health expenditure and  $X_{2t}$  = log of per capita public health related social service expenditure. The data used for this study covers the period from 2001-02 to 2012-13 and from two main sources. The data of IMR for selected states is taken from the Sample Registration System, Registrar General of India and the data of Public health expenditure and health related social service expenditure is taken from the State Finances of Reserve Bank of India. For the estimation of this model, lin-log specification is used in which regressand (IMR) is linear and repressors (Public health expenditures) are logarithmic.

### 3. Results and Analysis

The results of correlation indicates that, both per capita public health expenditure and per capita public health related social service expenditure have a high negative correlation with infant mortality rate in all the states except Rajasthan. In Rajasthan, both per capita public health expenditure and per capita public health related social service expenditure have a very low degree of positive correlation.

**TableNo.4.1 Pearson's Correlation results.**

S.No	States	$r_{xy}^1$	$r_{xy}^2$
1	Assam	-0.87	-0.53
2	Chhattisgarh	-0.88	-0.88
3	Madhya Pradesh	-0.94	-0.96
4	Odisha	-0.91	-0.92
5	Rajasthan	0.05	0.19
6	Uttar Pradesh	-0.95	-0.61

Source: Author's estimation

Note:  $r^1_{xy}$  = Pearson's correlation coefficient between per capita public health expenditure and IMR

$r^2_{xy}$  = Pearson's correlation coefficient between per capita public health related social service expenditure and IMR

The equation-1 is estimated for six selected states of India and the results are given in the Table-2.

**Table No.2 Karl Pearson Correlation Results.**

States	Intercept ( $\beta_0$ )	Coefficient of $X_1$ ( $\beta_1$ )	Coefficient of $X_2$ ( $\beta_2$ )	$R^2$	F-Statistics
Assam	174.41*** (5.44)	-14.03*** (-4.02)	7.55* (1.79)	0.78	0.001***
Chhattisgarh	358.55*** (7.78)	-13.97* (-2.23)	-3.73 (-0.53)	0.85	0.0002***
Madhya Pradesh	423.96*** (20.02)	-14.66** (-2.80)	-6.4 (-0.18)	0.97	0.00000003***
Odisha	465.51*** (10.54)	-12.29* (-2.25)	-11.12** (-2.53)	0.91	0.00002***
Rajasthan	86.18 (1.24)	-21.62** (-2.47)	19.54* (2.15)	0.4	0.097*
Uttar Pradesh	301.03*** (9.71)	-12.49*** (-5.70)	-1.53** (-2.33)	0.9	0.00002***

It is clearly seen in the (Table.2) that values of  $R^2$  are significantly high (0.78, 0.85, 0.97, 0.91, 0.9) in case of Assam, Chhattisgarh, Madhya Pradesh, Odisha and Uttar Pradesh respectively. But in the case of Rajasthan, it is poor i.e. 0.40. This indicates that the impact of health expenditure is more in all the states except in Rajasthan. The overall  $R^2$  varies from 0.78 to 0.97 that means about 78 to 97 percent variation in IMR. Here in all the selected states, the coefficient of per capita public health expenditure is negative, that means per capita public health expenditure has a negative relation with the infant mortality rate. In Assam, an 1% change in per

capita public health expenditure is associated with a 0.14 % reduction in infant mortality rate and is significant at the 1% level. In Chhattisgarh, 1% change in PCPHE is associated with a 0.14% reduction in IMR and is significant at the 10% level. In Madhya Pradesh, 1% increase in PCPHE is related with 0.15% reduction in IMR and it is significant at the 5% level. In Odisha, 1% increase in PCPHE is associated with 0.12% significant reduction in IMR at the 10% level. In Rajasthan, 1% increase in PCPHE is associated with 0.21% significant reduction in IMR at 5% level. In Uttar Pradesh, 1% increase in PCPHE is associated with 0.12% significant reduction in IMR at 1% level. However, the coefficient of PCPHRSSE is positive in the case of Assam and Rajasthan but negative in other states. This indicates a positive association between PCPHRSSE and IMR in Assam and Rajasthan but a negative association between the two in other states. In Assam and Rajasthan, an 1% change in PCPHRSSE is associated with 0.08% and 0.20% change in IMR respectively and are significant at the 10% level. However, in Chhattisgarh, Odisha, Madhya Pradesh and Uttar Pradesh, an 1% increase in PCPHRSSE is associated with 0.04%, 0.06%, 0.11% and 0.02% reduction in IMR respectively, but the relationship is only significant for Odisha and Uttar Pradesh at 5% level and not significant in Chhattisgarh and Madhya Pradesh. The F-statistics indicates, whether a significant relationship exists between the dependent variable and the set of all the independent variables. Nevertheless, the F-statistics for the states Assam, Chhattisgarh, Madhya Pradesh, Odisha and Uttar Pradesh are significant at 1% level and for Rajasthan; it is significant at 10% level. Thus, there is significant relationship between infant mortality rate and per capita public health expenditure and per capita health related social service expenditure in all the selected states.

#### **4. Conclusion**

Though many researchers support the policy of higher expenditure on health sector, a little evidence exists on the beneficial impact of public health expenditure and health related social service expenditure on health outcome like Infant mortality rate. Using time series analysis for the time period 2001-02 to 2012-13 in six selected states in India, our paper provides support for the proposition that health expenditure is more essential for the reduction of infant mortality rate, although in a development process of a state, private expenditures increase and crowd-out public expenditure over the time.

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