

## Determinants of Public Health Expenditure in India: A State- Level Panel Data Analysis

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### Abstract

*There is a large variation in public health spending among Indian states. This study investigates the extent to which income and other socio-economic and demographic characteristics account for disparity in health spending. The study employed panel fixed effect model for examining the determinants of public health expenditure in India using annual data of 15 major Indian states for the period from 2004-05 to 2020-21. The empirical result shows that per capita income is a major driver of the public health expenditure in India. The income elasticity of public health expenditure is greater than one indicating that health is like a luxury good in India. Besides the level of income, health infrastructure and fiscal balance are also having statistically significant positive impact on the level of public health expenditure. The health status, proxied by Infant Mortality Rate (IMR), is having a significant negative impact on public health expenditure. On the other hand, urbanisation and literacy have no significant impact on the public health expenditure.*

**Keywords:** *Public Health Expenditure, Fixed Effect Model, Per capita Income, Fiscal Balance, Health Infrastructure.*

### Introduction

The literature on health has always acknowledged the role of public health spending for combating major illness and attaining Millennium Development Goals (MDGs). Evidence shows that countries with higher level of government health financing have better health outcome than countries with low public health spending. For example, the government health expenditure constitute 70 percent of the total health spending in Thailand and the life expectancy and Infant Mortality Rate (IMR) is 76 and 7.1, respectively. Thailand has already achieved the Sustainable Development Goal (SDGs) related to IMR (World Bank,2020). On the other hand, in Afghanistan the government health expenditure is only less than 8 percent of the total health expenditure and the IMR in Afghanistan is 45 per 1000 live birth (World Bank,2020). Furthermore, the public health expenditure also enhances the economic growth in terms of increasing the productivity as well as reducing the poverty-deepening effects associated with Out-Of-Pocket Expenditure (OOPE) (Novington et al., 2012; Romer, 1996; Hooda,2016). Recognising the importance of public health expenditure both developed and developing countries has initiated series of measures to augment the public health expenditure to achieving better health. However, to use public health expenditure as a tool for achieving better health, it is necessary to examine the factors

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which influences the public health expenditure. Therefore, the present study has examined the major determinants of public health expenditure in India.

#### Public health expenditure in India

The public health expenditure in India is one of the lowest among all the countries in the worlds. The health system in India is mostly privatized. The public health expenditure as a share of GDP is less than 1.5 percent (Rahman,2008). The following Table 1 shows the public health expenditure as a percent of total health expenditure in selected Asian developing countries. The table 1 clearly depicts the variation in public health expenditure across the countries. The share of public health expenditure in total health expenditure is 36.6 percent in 2020 in India (World Health Organisation, 2023).While the public health expenditure out of the total health expenditure in China is about 55 percent.

Table 1. public health expenditure in selected developing countries.

Country	Public health expenditure (% of total health exp
China	54.7
Indonesia	55.0
Thailand	70.4
Sri Lanka	45.8
Pakistan	35.6
India	36.6
Nepal	30.1

Source: World Health Organisation (2023)

There also exist considerable differences in the public health expenditure among the Indian states. Table 2 displays the inter-state variation in the per capita public health expenditure in India from 2004-05 to 2019-20. Even though there is an increase in the public health expenditure in all the selected Indian states during the study period, there is a considerable variation in the per capita health expenditure across the Indian states. Bihar is one among the lowest health spending states. There is a three-fold differences in public health expenditure between Bihar and Kerala. The per capita public health expenditure is higher in Tamil Nadu (2463 rupee per capita) followed by Kerala (2417 rupee per capita).

Table 2. Inter state disparity in per capita public health expenditure in India from 2004-05 to 2020-21

State	2004-05	2010-11	2015-16	2020-21
ANDHRA PRADESH	190.23	494.46	594.02	1045.74
ASSAM	151.31	446.98	892.48	1845.94
BIHAR	71.73	172.96	444.98	844.53
GUJARAT	182.22	516.98	1147.71	1676.71
HARYANA	174.67	434.41	932.42	2016.21
KARNATAKA	190.06	475.57	943.32	1842.56
KERALA	281.67	601.34	1345.03	2417.57
MADHYA PRADESH	140.43	303.19	710.68	1179.39
MAHARASHTRA	195.28	419.10	843.48	1359.62

ODISHA	165.66	315.02	873.45	1799.41
PUNJAB	240.07	449.45	903.52	1280.14
RAJASTHAN	179.81	383.76	1077.88	1644.11
TAMIL NADU	210.93	656.79	1208.90	2463.18
UTTAR PRADESH	127.85	328.30	626.60	931.16
WEST BENGAL	169.95	394.99	847.54	1327.83

Source: Reserve Bank of India (2022)

The above discussion shows there is an inter-state variation in the public health expenditure in India. Therefore, the study investigates the extent to which income and other socio-economic and demographic characteristics account for the disparity in health spending. In other words, the study examines what are the factors determining the level of public health expenditure in the selected Indian states.

## Review of Literature

There exists a large volume of literature that investigated the determinants of public health expenditure. Major research in this area is concentrated on examining the impact of level of income on health expenditure and tried to examine whether the health care in a country is necessity or luxury, by comparing the income elasticities. The health care is considered to be necessity if the income elasticity is less than one whereas, if the income elasticity of public health expenditure is greater than one, the health care is considered to be luxury. For example, Newhouse (1977) examined the impact of income on health expenditure in 13 developed countries and found a significant positive relation between the income and public health expenditure. Further the study also showed that the income elasticity of health expenditure is greater than one indicating health care is necessary. Matteo and Matteo (1998) examined the predictors of real per capita provincial government expenditure in Canada from 1965-1991, and identified per capita income, proportion of elderly population, and federal revenue transfers as the major factors determining government health expenditure. During the period, they found health care as a necessary commodity with income elasticity 0.77.

In another study, Chawla et al. (1998) investigated the relation between economic and demographic factors and government health expenditure. The regression result showed that national income is the major driving factor of government health expenditure from 1960-1995. Further inflation slows down the public health financing, whereas increase in elderly population has a positive significant impact on government health finance. Thus, income, inflation, and demography are the deciding factors of government health expenditure in Poland. To distinguish the macroeconomic determinants of public health financing Abbas and Hiemenz (2011) employed a co-integration and error correction models on different socio- economic, demographic, and political variables on public health expenditure in Pakistan from 1972-2006. They found main predictor of public health expenditure as per capita income. Besides this, in long run unemployment and urbanisation has a significant negative impact on health expenditure of state.

Behera and Dash (2019) evaluated how the macro fiscal factors (revenue mobilization, fiscal balance, debt, per capita GDP, aging) affect the government health expenditure in 85 low- and middle-income countries for the period 2000-2013. The study used panel system Generalised Method of Moment (GMM). They found tax revenue as the major driver behind the public health expenditure. There is a direct and positive relation between tax revenue and public health expenditure. Similarly, per capita income and aging are positively related to allocation of resources to the health sector by the government. On the other hand, debt service payment and fiscal imbalance adversely affect health spending of

government. Similarly Sfakianakis et al. (2020) analysed the impact of macro-fiscal policies, private health insurance financing and demography on government health expenditure in OECD countries from 2000 to 2017. The results were drawn with the support of random effect model and GMM. In consistent with Behera and Dash (2019) the study reveals a positive relation between public health expenditure and national income, fiscal discipline, demography, tax revenue while the relation between unemployment and private health insurance financing are negative.

Along with income, the literature also identified several non-income factors which have significant impact on the public health expenditure. For instance, Protrafke (2010) made a study on 18 Organisation for Economic Cooperation and Development (OECD) countries to examine how the government ideology and electoral motives influence the government's expenditure on health care services for the period 1971-2004. The empirical results of unit root and co-study reveals that political ideologies are statistically insignificant in explain the growth of public health expenditure whereas the electoral motives are the main influential factor behind public health expenditure. The author argued that during the election years the optimistic incumbent governments will increase the spending on health services. Imoughele and Ismaila (2013) examined factors determining the health care expenditure in Nigeria from 1986 to 2010. The study found healthcare is price inelastic, and demographic structure and government development policy are main predictors of public health expenditure. Whereas the level of national income, unemployment rate, population per physicians, political factors and inflation have no significant impact on public health expenditure. Ilori (2015) found that per capita income is insignificant in explaining public health expenditure in Nigeria. The study applied Error Correction Model to the annual time series data from 1981-2014. The results show demography, unemployment and tuberculosis are factors of consideration in public health expenditure while income per capita and Sickle-Cell Anaemia and Human Immuno-Deficiency virus are not related to government spending on health. Similarly, Fazoranti (2015) evaluated the causality between health care expenditure and Socio – economic factors in Nigeria for a period of 1970-2012 using Johnsen co-integration test with pairwise Granger Causality test. The study exhibited a long run causality between level of education, health expenditure shares in total government expenditure and inflation while no causality between level of income, demographic structure, and health status.

The studies on Indian context have identified per capita income, demographic factors, and other socio-economic factors as the major determinants of health expenditure. For example, Bhat and Jain (2006) examined the determinants of public health expenditure in 14 major states in India and found per capita income is a significant determinant of public health expenditure. The income elasticity of public health expenditure is found to be less than one indicating health care is a luxury good. Similarly, Rahman (2008) used a panel data to determine the factors affecting public health expenditure in India from 1971-1991 where he found health expenditure of the government is determined by level of income and education only whereas demographic structure, population per healthcare center and population per doctors are not influential factors. Hooda (2016) found per capita income, fiscal capacity of the state, and national health policy initiated in 2005 as the major determinants of public health expenditure in India. Similarly, Lakshmi et al., (2012) examined the determinants of public health expenditure in India from 1985 to 2005. The study found per capita income, literacy rate and population have no significant impact on the public health expenditure while, the fiscal deficit and health outcome has no significant effect on health expenditure. In the latest study by Khan (2022) using a panel data from 2010-2021 of 16 major states in India, showed per capita income, revenue receipts, capital receipts and internal debt have significant positive impact on the level of health expenditure.

The major limitation of the existing studies in the Indian context is related to the selection of various important factors that influence the level of health spending and these studies have mostly used limited period of data. Moreover, the existing literature has mainly

concentrated on estimating the income elasticity of public health expenditure. Apart from income, the inter-state variation in the public health expenditure can arise due to the fiscal disability of the states. This may be due to unequal capabilities in raising the revenue or may be due to increased cost of providing health services (Hooda,2016). Therefore, this study attempts to examine how the discrepancy in health expenditure among the Indian states are explained by the differences in state's per capita income, health status, fiscal balance, literacy rate and other demographic factors.

## Methods

### *Variables and Data sources*

The study used panel data of 15 major states (together contributing 90 percent of population) in India from 2004-05 to 2020-21. This time period has a greater significance in health sector because of the introduction of National Health Mission (NHM) and the Millenium Development Goals (MDGs). Therefore, this time framework will enable us to capture the financial upsurge in the health care. The per capita public health expenditure has been taken as the dependent variable. The data for public health expenditure has obtained from RBI state finance documents. In accordance with the previous literature, per capita income, Infant Mortality Rate (IMR) as a proxy for health status of the population, literacy rate, number of health infrastructure, fiscal deficit/surplus and urbanisation have been identified as the explanatory variable (Siddiqui et al.,1995; Newhouse,1997; Chawla et al.,1998; Vatter and Rüeßli,2003; Boachie et al.,2014; Hooda,2016). Literacy rate (LITERACY) is taken as the literacy of person aged 7 years and above who can read and write in any language with understanding, The health infrastructure variable (Health\_Infra) is constructed by taking the total number of Sub Centers, Primary Health Centers (PHC) and Community Health Centers (CHC). The level of urbanisation (Urban) is calculated by the total number of persons living in urban areas. The data on per capita income, IMR, and fiscal balance is obtained from Reserve Bank of India (RBI) publication on state finance. The health infrastructure variable and the literacy variable are constructed using data from Economic and Political Weekly Research Foundation (EPWRF) India Time Series. Urbanization details are obtained from the Population Projection Report 2001, published by Census of India.

### *Model*

Based on the existing literature the study postulates the following functional model for examining the determinants of public health expenditure.

$$Public\_exp_{it} = f(Income_{it}, IMR_{it}, FD_{it}, INFRA_{it}, URBAN_{it}, LITERACY_{it}) \dots \dots \dots (1)$$

Where, Public\_exp = Per capita public health expenditure, Income = Per capita income, IMR = Infant Mortality Rate, FD = Fiscal deficit/ surplus, URBAN= Urbanization, INFRA = health infrastructure and LITERACY is the literacy rate. The subscript 'i' and 't' stands for state and time, respectively

### *Estimation Model*

The functional form equation (1) has been converted to log-log model for empirical estimation. One of the advantages of log-log model is coefficients can be directly interpreted as the elasticities while correcting the skewness in the data (Boachie et al.,2020; Gani,2009). Hence, the determinants of public health expenditure in India are estimated using the following equation.

$$\ln Public\_exp_{it} = \alpha_0 + \alpha_1 \ln income_{it} + \alpha_2 \ln IMR_{it} + \alpha_3 \ln FD_{it} + \alpha_4 \ln INFRA_{it} + \alpha_5 \ln URBAN_{it} + \alpha_6 \ln LITERACY_{it} + \varepsilon_{1it} \dots \dots \dots (2)$$

where, 'ln' denotes log transformation and 'ε' refers to the error term which captures the unobservable factors that affects the public health expenditure

## Empirical Result

### *Descriptive Statistics*

The major features of the dependent and independent variables are discussed in the descriptive statistics provided in Table 3. Between 2004-05 to 2020-21, the public health expenditure (public\_exp) has varied from 72 to 2463 with a mean value of rupees 686 among the Indian states. This indicates that the selected state government have spent on an average rupee 686 per capita during the study period. The mean value of per capita income (Income) is rupees 91205 with a standard deviation of 61859. The IMR varies between 6 to 79 with mean 40 and standard deviation 16. In otherwards, on an average 40 infants per thousand live births died before turning one year old. The average fiscal deficit is rupees 16645 crores with a standard deviation of 15429. The higher standard deviation shows larger variation in the data. The variables income per capita and fiscal deficit/surplus have larger variation across the states.

Table 3. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Public_exp	255	686.43	491.93	71.73	2463.18
Income	255	91204.71	61859.64	8357.01	255958
IMR	255	40.07	16.82	6	79
URBAN	255	225.04	242.47	37.61	3348.5
FD	255	16645.39	15428.94	-11082.7	93983.1
LITERACY	255	74.59	9.16	52	96.5
INFFRA	255	10339.66	5132.97	2913	24964

Source: Author's computation.

### *Correlation Matrix*

The Table 4 provides correlation matrix that displays the relationship between different set of variables. Further it helps to show the pattern of relationship between the variables and to make inferences about the possibility of multicollinearity among the explanatory variables.

Table 4. Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) lnpublic_exp	1.000						
(2) lnincome	0.890	1.000					
(3) lnIMR	-0.652	-0.702	1.000				
(4) lnURBAN	0.121	0.210	-0.170	1.000			
(5) lnLITERACY	0.601	0.647	-0.733	-0.084	1.000		
(6) lnFD	0.694	0.627	-0.524	0.593	0.285	1.000	
(7) lnINFRA	-0.084	-0.244	0.177	0.660	-0.408	0.339	1.000

Source: Author's computation. ln: Natural logarithm

The dependent variable public health expenditure has a positive association with per capita income, urbanisation, literacy rate, and fiscal deficit/ surplus. This indicates, increase in these variables will increase the level of public health spending. Similarly, the matrix exhibits a negative association between the public health expenditure and IMR and health infrastructure. In this case, an increase in IMR and health infrastructure will reduce the

level of health care expenditure. The matrix also shows the strong correlation between income, IMR and literacy rate. Therefore, to avoid the problem of multicollinearity, these variables are estimated in separate models.

#### *Empirical result on determinants of public health expenditure in India*

The study uses panel data estimation method (fixed and random) to examine the impact of different socio-economic variables on the level of public health expenditure in India. The fixed effect model controls all the time invariant heterogeneity among the states, whereas the random effect model assumes state specific effects or the variation across the states as a random term that is not correlated with the explanatory variables. The choice between the fixed and random effect model is carried with Hausman Specification Test. The Hausman Specification Test on equation (2) has rejected the null hypothesis in favour of fixed effect model for the empirical estimation. Further, to check the heteroscedasticity, Breusch pagan test is employed. The result rejected the null hypothesis of homoscedasticity. Hence, the robust method of estimation is carried out to tackle the problem of heteroscedasticity. The estimation result of fixed effect is given Table 5. The  $R^2$  value lies between 91 percent to 97 percent. The per capita income is found to be major determinant of public health expenditure in Indian states.

The per capita income has a significant (at one percent level) positive association with public health expenditure. More precisely, one percent increment in per capita income has increased the public health expenditure by more than 1 percent in all models.

**Table 5. Determinants of public health expenditure in Indian states: Panel regression result**

<i>Variables</i>	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>	<i>Model 4</i>	<i>Model 5</i>
<i>lnincome</i>	1.068*** (0.139)	1.159*** (0.087)	1.17*** (0.092)	1.076*** (0.055)	
<i>lnIMR</i>	-0.206 (0.139)				-1.908*** (0.191)
<i>lnURBAN</i>	0.095* (0.053)	0.1* (0.056)		0.087 (0.061)	
<i>lnLITERACY</i>	-0.819 (0.6)	-0.924* (0.521)	-0.89 (0.531)		
<i>lnINFRA</i>	0.689** (0.249)	0.693** (0.238)	0.697** (0.242)	0.61** (0.253)	0.693** (0.241)
<i>lnFD</i>	0.089** (0.038)	0.097** (0.039)	0.099** (0.038)	0.097** (0.037)	0.202*** (0.046)
<i>Constant</i>	-9.008*** (2.684)	-10.446*** (2.508)	-10.243*** (2.58)	-12.665*** (2.144)	4.903** (1.989)
<i>R<sup>2</sup></i>	0.971	0.971	0.970	0.969	0.912
<i>No. of obs</i>	255	255	255	255	255

ln: natural logarithm; robust standard errors in parentheses, \*\*\*p<0.01, \*\*p<0.05, \*p<0.1

Source: Author's Computation.

The IMR is also found to be a significant determinant of public health expenditure. A one percent increase in the IMR has reduced the public health expenditure by 1.9 percent. However, one should be cautious about the causality as increased public health expenditure may also cause a reduction in IMR, thus, expecting the possibility of two-way causality.

Further, the result reveals that, the number of health infrastructure is a significant factor influencing the public health expenditure. The variable has a significant positive impact on public health expenditure in all the models. The public health expenditure has increased by 0.61 to 0.69 percent with one percent increase in the health infrastructure. Similarly, the fiscal deficit/surplus also has a significant positive impact on public health expenditure in all models. A one percent increase in the fiscal deficit/ surplus has increased the public health by 0.08 to 0.2 percent. Other explanatory variables like urbanization and literacy

rate are found to have no significant impact on public health expenditure among the Indian states.

## Discussion

The present study examines the determinants of public health expenditure in India. A panel data estimation has been carried out for 15 major states in India for the period from 2004-05 to 2020-21. The empirical estimation reveals that per capita income is a major determinant of public health expenditure in India. Contrary to the findings of Fasoranti (2015), Ilori (2015) and Imoughele and Ismaila (2013) the study confirms that the per capita income is a major predictor of the public health expenditure. As the level of income increases, the government will have more ability to spend for the health sector. This finding is consistent with previous literatures that per capita income as a major determinant of public health expenditure (Newhouse,1997; Chawla et al.,1998; Abbas and Hiemenz,2011; Behera and Dash,2019). Further, the study found the income elasticity of public health expenditure is greater than one indicating that health care is a luxury good in India. This is consistent with previous studies by Newhouse,1977; Hitiris and Posnett,1992; Wilson,1999.

The study confirms that, rising fiscal deficit/ surplus has a significant positive impact on the public health expenditure. In contrary to Behera and Dash (2018) and Lora and Olivera (2007), the study shows an increased fiscal deficit is resulted in increase in public health expenditure. The positive relation between fiscal deficit/ surplus shows generally the expenditure on healthcare is funded by continuously rising the government borrowing from the private sector (Chen et al.,2013; Liu et al.,20110). Similarly, Behera et al. (2020) has found in many Indian states, the health spending is beyond their means. In this case, the public health expenditure will increase even with fiscal deficit.

The number of health infrastructure is found to be another determinant of public health expenditure in India. As the number of Primary Health Center (PHC), public hospitals will increase, the operational, maintenance and other associated cost will increase and the allocation of resources to health will increase. The existing literature supports the positive impact of health infrastructure on health expenditure (Oaikhenan and Umoru,2012).

The empirical result also shows that reduction in IMR is associated with an increase in the level of public health expenditure in Indian States. Previous research suggests that the negative coefficient estimates between PHE and IMR might be due to other unobserved factors that are adversely linked with changes in public healthcare spending (Sen,2005). Another argument is that when countries achieve better health outcomes (e.g., lower child mortality and increased life expectancy) in the short run through health spending, they will produce a healthier population in the long run. As a result, demand for healthcare services will eventually reduce, which is related with a marginal decrease in the percentage of health spending (Jaba et al.,2014). The findings of the study are consistent with previous studies (Behera and Dash,2019; Khan,2022). Furthermore, the coefficient value of the result shows that the health status of the population is the major determinant of the level of public health expenditure in India rather than the level of per capita income.

## Conclusion

The study examined the determinants of public health expenditure in India. Using panel data from 15 major states of India for the period of 2004-05 to 2020-21. The result reveals that per capita income, IMR, health infrastructure and fiscal deficit/ surplus are the major determinant of public health expenditure in India. The per capita income, health infrastructure and fiscal deficit/surplus has increased the public health expenditure while, the IMR has reduced the public health expenditure during the study period. The study also showed that the health care is like a luxury good among the Indian states with income



elasticity of public health expenditure being more than one. Moreover, the study points out that the major determinant of public health expenditure in India is the health status of the population rather than the level of income.

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