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

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Abstract:

Public health spending varies greatly between Indian states. This study investigates the extent to which income and other socio-economic and demographic characteristics account for the disparity in health spending. The present study employed panel fixed effect model for examining the determinants of public health expenditure in India. The study used an annual panel data of 15 major Indian states (together contributing 90 percent of population) from 2004-05 to 2020-21. The empirical result show that per capita income is a major driver of the public health expenditure in India. The level of per capita income shows a positive and statistically significant relationship with the public health expenditure. The income elasticity of public health expenditure is greater than one indicating that health is a luxury good. Besides the level of income, health infrastructure and fiscal balance is also having a significant positive impact on the level of public health expenditure and 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 has 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 has better health outcome than countries low public health spending economies. 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). 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 (Novingnon 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 examines the factors 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 lowest among the worlds. The public health expenditure as a share of GDP is less than 1.5 percent (Rahman,2008). Further, the health system in India is privatized. The share of public health expenditure in total health expenditure is 36.6 percent in 2020. The following Table 1 shows the public health expenditure as a percent of total health expenditure in selected developing countries. The public health expenditure in India is low compared to the other developing countries of the world. Even Chinese government spent more than 50 percent of the health expenditure. This shows the variation in public health expenditure across the countries.

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)

The Table 2 displays the inter-state variation in the per capita public health expenditure in India from 2004-05 to 2019-20. Bihar is one among the lowest health spending states. On the other hand, Kerala and Tamil Nadu is found to spending a larger per capita expenditure on health care.

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. The study examines the impact of state's income, health status, demographic factors, fiscal balance on level of public health expenditure.

Review of Literature

There is a considerable amount of literature which has 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, the health care is considered to be luxury. For example, Newhouse (1977) has examined the impact of income on health expenditure and found a significant positive relation between the income and public health expenditure. Further study also shows the income elasticity of health expenditure is greater than one indicating health care is necessary. Matteo and Matteo (1998) examined the predicators of real per capita provincial government expenditure in Canada from 1965-1991. Where the authors identified per capita income, proportion of elderly population and federal revenue transfers are the factors determine government health expenditure. During the period health care is 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 shows that national income is the major driving factor of government health expenditure from 1960-1995. Further inflation will slow down the public health financing whereas increase in elderly population have a positive and 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 predicator of public health expenditure is per capita income. Besides this, in long run unemployment and urbanisation were significantly negative 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 85 low- and middle-income countries for a period of 2000-2013. The study used panel system Generalised Method of Moment (GMM). They found tax revenue is 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 government. On the other hand, debt service payment and fiscal imbalance will 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 has a significant impact on the public health expenditure. For instance, Protrafke (2010) made a study on 18 OECD countries to examine how the government ideology and electoral motives influence the government's expenditure on health care services for a period of 1971-2004. The empirical results of unit root and co-integration techniques 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) has 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 predicators 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, Fasoranti (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 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, education only whereas demographic structure, population per healthcare center and population per doctors are not an influential factor. Hooda (2016) has found the major determinants of public health expenditure in India are per capita income, fiscal capacity of the state, and national health policy initiated in 2005. Similarly, Lakshmi et al., (2012) has examined the determinants of public health expenditure in India from 1985 to 2005. The study found per capita income, literacy rate and population have a 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) has investigated the determinants of public health expenditure in India using a panel data from 2010-2021 of 16 major states in India. The study found per capita income, revenue receipts, capital receipts and internal debt has a significant positive impact on the level of health expenditure. The major limitation of the previous studies done in the Indian context are related to the selection of various important factors which influence the level of health spending and limited period of data.

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 be arise due to the fiscal disability of the states. This may arise due to unequal capabilities in raising the revenue or may be due to increased cost of providing health services (Hooda,2016). Therefore, present study tries 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 introduction of 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

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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 has been identified as the explanatory variable (Siddiqui et al.,1995; Newhouse,1997; Chawla et al.,1998; Vatter and Rüefli,2003; 2Boachie et al.,2014; Hooda,2016). The data on per capita income, IMR, and fiscal balance is obtained from Reserve Bank of India publication (RBI) 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 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$_{it}$) …………… (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.

lnPublic_exp$_{it}$ = α_0+$\alpha_1$lnincome$_{it}$ + α_2 lnIMR$_{it}$ + $\alpha_3$lnFD$_{it}$ +$\alpha_4$lnINFRA$_{it}$ +$\alpha_5$lnURBAN$_{it}$ +$\alpha_6$lnLITERACY$_{it}$ + ε_{1it}... *(2)*

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

Empirical Result

Descriptive Statistics

The major features of the dependent and independent variables are discussed in the descriptive statistics. Table 1 shows the descriptive statistics of the dependent and independent variable used in the study. Between 2004-05 to 2020-21, the public health expenditure (public_exp) has varied from 72 to 2463 with a mean value of 686 rupees. This indicates that on an average, the government has spent 686 rupees per capita during the study period. The mean value of per capita income (Income) is 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 41 infants per thousand live births died before turning one year old. The average fiscal deficit is 16645 crores with a standard deviation 15429. The higher standard deviation shows larger variation in the data. Income per capita and Fiscal deficit/surplus has larger variation across the states.

Table 1. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Public_exp	255	686.433	491.934	71.732	2463.18
Income	255	91204.717	61859.649	8357.014	255958
IMR	255	40.071	16.824	6	79
URBAN	255	225.049	242.474	37.61	3348.5
FD	255	16645.395	15428.943	-11082.7	93983.1
LITERACY	255	74.593	9.169	52	96.5
INFFRA	255	10339.667	5132.974	2913	24964

Source: Author's computation. Statistics from the raw data

Correlation Matrix

The correlation matrix helps to display the relationship between different set of variables. Further it helps to show the pattern of relationship between the variables. The association of public health expenditure with the selected explanatory variables are displayed in Table 2.

<div align="center">**Table 2. Pairwise correlations**</div>

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, theses 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 with Chi-square value of 184.81 and p value 0.000. therefore, the study used fixed effect model for the empirical estimation. Further, to check the heteroscedasticity, Breusch pagan test is employed on equation (2). 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 3. 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 3. Determinants of public health expenditure in Indian states: Panel regression result

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
lnincome	1.068***	1.159***	1.17***	1.076***	
	(0.139)	(0.087)	(0.092)	(0.055)	
lnIMR	-0.206				-1.908***
	(0.139)				(0.191)
lnURBAN	0.095*	0.1*		0.087	
	(0.053)	(0.056)		(0.061)	
lnLITERACY	-0.819	-0.924*	-0.89		
	(0.6)	(0.521)	(0.531)		
lnINFRA	0.689**	0.693**	0.697**	0.61**	0.693**
	(0.249)	(0.238)	(0.242)	(0.253)	(0.241)
lnFD	0.089**	0.097**	0.099**	0.097**	0.202***
	(0.038)	(0.039)	(0.038)	(0.037)	(0.046)
Constant	-9.008***	-10.446***	-10.243***	-12.665***	4.903**
	(2.684)	(2.508)	(2.58)	(2.144)	(1.989)
R^2	0.971	0.971	0.970	0.969	0.912
No. of obs	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 1 percent increase in the IMR has reduced the public health expenditure by 1.9 percent. Further, the result reveals that, the number of health infrastructure is a significant factor influencing the public health expenditure. The health infrastructure 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 Fiscal deficit/ Surplus has found to be a significant factor influencing the public health expenditure. The fiscal deficit/surplus has a significant (at 5 percent level) positive impact on public health expenditure (in all models). A 1 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.

Discussion

The present study examines the determinants of public health expenditure in India. The panel data estimation has been carried out for 15 major states in India for the period of 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 predicator of the public health expenditure. The per capita income has a significant positive impact on the level of 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 is 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 the IMR has a significant negative impact on the public health expenditure. The increase in IMR has reduced 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).

Conclusion

The study examines the determinants of public health expenditure in India. For empirical estimation, the study used panel data from 15 major states of India from 2004-05 to 2020-21. The result revels that per capita income, IMR, number of 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. And also, the study shows the heath care is luxury good with income elasticity of public health expenditure more than one.

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