How Effective is Public Health Care Expenditure in Improving Health Outcome? An Empirical Evidence from the Indian States

No. 300
06-March-2020
Ranjan Kumar Mohanty and Deepak Kumar Behera

National Institute of Public Finance and Policy
New Delhi

How Effective is Public Health Care Expenditure in Improving Health Outcome? An Empirical Evidence from the Indian States

Ranjan Kumar Mohanty and Deepak Kumar Behera*

Abstract

The literature on public health spending and health outcomes remain an important contribution in implementing public health policies in developing countries. The purpose of this study is to investigate the effects of public health expenditure on various proximate and ultimate health outcomes during 2005-2016 using panel fixed-effects models across 28 Indian States. The empirical results show that per capita public health care expenditure has an adverse effect on the infant and child mortality rate, malaria cases, and a favourable effect on life expectancy, immunization coverage across States, while this impact is relatively weak in the case of High-Focus States. The study is very relevant in the context of achieving the targets of Sustainable Development Goals and moving towards the universal health coverage at the State level in India. It suggests for enhancement of public health spending, and improvement of health infrastructure among the Indian States.

Keywords: Public Health Expenditure, Life Expectancy, Infant Mortality, Child Mortality, Fixed Effects Model, Indian States

JEL Classification Codes: H51, I10, I18, C23

* Mohanty is an Assistant Professor at National Institute of Public Finance and Policy, New Delhi-110067, India. Email: ranjanmohanty85@gmail.com & ranjan.mohnaty@nipfp.org.in . Behera is an Assistant Professor at Asian Institute of Public Health University, Bhubaneswar-753001, India. Email: deepakkumar.behera59@gmail.com

1. Introduction

With the transition from Millennium Development Goals (MDGs) to Sustainable Development Goals (SDGs), the literature on health spending and health outcomes has attracted the attention of researchers and policymakers around the globe, especially among developing countries. Studies on the linkage between public health spending and health outcomes remain an important contribution in implementing public health policies in developing countries. India, an emerging and developing economy, has taken a series of initiatives to augment public health care spending since 2000. It had adopted the MDGs[1] in September 2000, which set various health targets like reducing infant mortality, child mortality, improving maternal health, combating HIV/AIDS, malaria and other deadly diseases. It has introduced 'National Rural Health Mission (NRHM)' in 2005 for improving various proximate and ultimate health outcomes with a surge in public health spending.[2] In 2008, an insurance scheme named 'Rashtriya Swasthya Bima Yojana (RSBY)' was introduced. A High-Level Expert Group on Universal Health Coverage (UHC) in 2011 recommended an increase in public health care financing to 2.5 per cent of GDP by 2017 and 3 per cent of GDP by 2022.[3] National Urban Health Mission (NUHM) was launched in 2013.[4] Recently, Ayushman Bharat Mission has been launched in 2018.[5] These back to back measures have revealed the concern of Indian governments towards the neglected health sector. Despite a surge in health expenditure in recent time, there is a persistence of inequality in health-related developmental goals and target among the Indian States due to low level of government health expenditure, low spending priority, less absorption capacity and inefficiency in health expenditure (Durairaj and Evans, 2010; Tandon and Cashin, 2010). Therefore, the crucial question is whether spending on public health care has any impact on health outcomes in India? Does it affect adversely or favourably the health outcome? Which factors are important for improving health outcome in India? Does the impact of public health spending vary across different categories of states? The current study is motivated by the inconclusive debate on the relationship between public health expenditure and health outcomes with particular attention to the Indian States.

[1] The MDGs were eight international development goals for the year 2015 that had been established following the Millennium Summit of the United Nations in 2000, following the adoption of the United Nations Millennium Declaration.

[2] The main aim of this mission was to complement/support health expenditure in States, particularly poor performing States. Thus, Central Government plays a supportive role to States to provide equitable, affordable & quality health care services in each States.

[3] Recently constituted National Health Policy (2017) also recommended an increase of health expenditure by Government as a percentage of GDP from the existing 1.15 per cent to 2.5 per cent by 2025. Various five year plans like 10th, 11th and 12th five year plan has also taken steps for enhancing public health expenditure in India.

[4] Both NRHM and NUHM is subsumed under one broad central sponsored scheme named National Health Mission (NHM) in India.

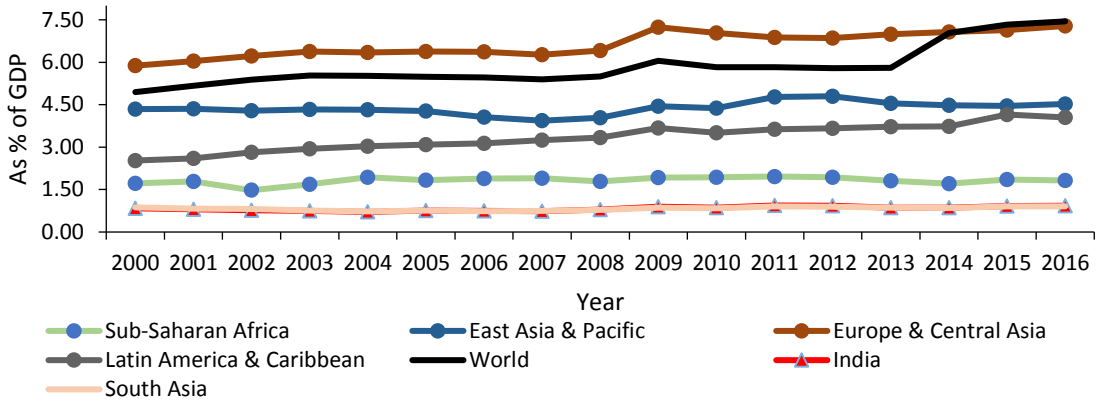
[5] It will cover 10 crore poor and vulnerable families by providing insurance coverage up to 5 lakh rupees per family in a year for secondary and tertiary care hospitalization.

The impact of public health spending on improving/deteriorating health status has received relatively less attention in the literature. Government intervention into the health-care sector is necessary, and it has been argued on several grounds such as positive externalities associated with health, and the inability of private markets to meet existing demand for health-care (Self and Grabowski, 2003). Literature on the linkage between public health care spending and health outcome have mixed opinion: as some study find a positive effects (Wolfe, 1986; Anand and Ravallion, 1993; Bhalotra, 2007; Farahani et al., 2009; Hojman, 1996), while other studies find a negative or statistically insignificant effects (LeGrand, 1987; Hitiris and Posnet, 1992; Judge et al., 1998; Filmer and Pritchett, 1999; Kaur and Misra, 2003; Deolalikar et al., 2005). Public health expenditure may improve health outcome via higher access to health care or may worsen the health outcome if it leads to inefficient production of health care (Farag et al., 2013). Hence, it needs an empirical analysis to truly capture its impact on health outcome. However, along with public health expenditure, other factors like income level, health infrastructure, demographic factors, country-specific factors, etc. have a greater impact on improving health outcomes, which is partly addressed (based on data availability) in this study.

India has partially achieved the target set by the MDGs.[6] India's position with respect to health indicators is very abysmal (its rank lies in the bottom 30 per cent group) as per the Human Development Report (2018). Rao and Choudhury (2012) believed that the low level of public health spending might be one of the possible causes for India's relatively worse performance on health indicators. India has been experiencing a very low share of public health expenditure in its GDP and total health expenditure (Figure 1 & 2). Low level of public spending has particularly resulted in poor health infrastructure in India. Other regions of the world like Europe & Central Asia, East Asia & Pacific, Latin America & Caribbean, etc. and even Sub-Saharan Africa have much higher share public health expenditure in their GDP and total health spending than India. Public health expenditure of the world economies has been increasing in the recent period, while India's share in GDP has remained almost stagnant (hovering around 1 per cent) from 2000 to 2016. Public health expenditure has constituted slightly higher than one-fourth of its total health spending during this period. Other regions like Europe & Central Asia and East Asia & Pacific, public health spending have been almost three fourth of their total health spending. Even Sub-Saharan Africa has more than one-third share of public health spending. One crucial question arises here, i.e., has this low public health spending any effect on the health outcome of India? For the policy perspective, if an increase of public health spending has a favourable impact on health outcome, then India could rapidly achieve a better health status by enhancing its public health expenditure.

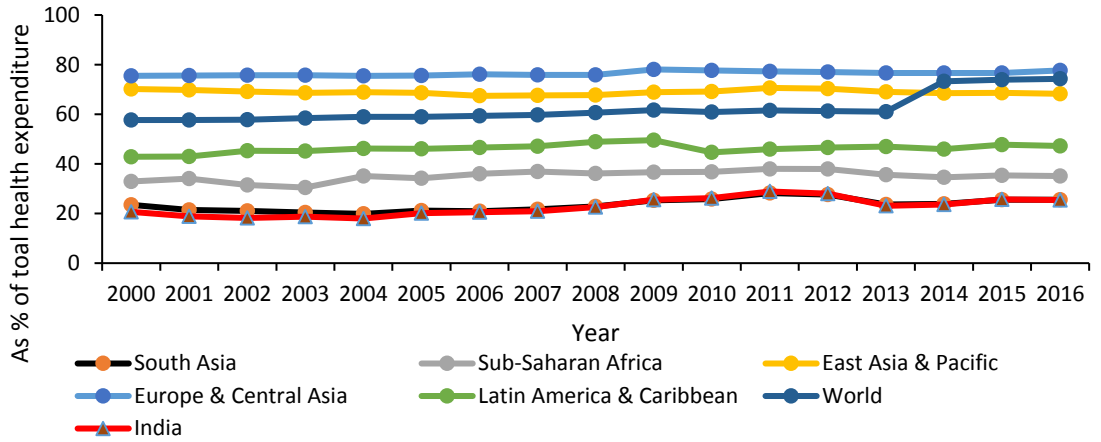
[6] India has been lagging behind on targets to reduce child and infant mortality (Goal 4); improving maternal health (Goal 5); improving access to adequate sanitation facilities (goal 7). (Source: https://www.unescap.org/sites/default/files/India_and_the_MDGs_0.pdf.

Figure 1: Public Health Expenditure as per cent of GDP



Source: World Development Indicators, World Bank

Figure 2: Public Health Expenditure (% of total health expenditure)



Source: World Development Indicators, World Bank

There is a scarcity of literature which has been conducted on this crucial issue among the Indian States.[7] Under the Indian Constitutional structure, State governments have predominant responsibility for providing health care services in India.[8] The role of the Central government is to assist or supplement the health spending of States.[9] Based on resource availability, priority, fiscal space, etc., there is a huge variation in per capita health expenditure and the health indicators across States. The availability of data across States is

[7] A detailed review of literature is presented in the section 2.

[8] Health is in concurrent list of Indian constitution, which is the joint domain of both the Central and State Governments.

[9] Central government accounts for nearly one third of total public health spending in India.

consistent and comparable. Investigating the health care outcomes in the States of India is of significant importance for achieving SDGs targets and moving towards universal health coverage (UHC). Thus, for policy relevance, this issue is addressed by focusing on the India States. With this backdrop, the purpose of this study is to investigate the effects of public health expenditure on selected health outcomes using panel fixed-effects models across 28 Indian States for the period of 2005 to 2016.[10]

The paper has progressed in three stages: first, we examine the effect of spending on the ultimate goals, namely, life expectancy at birth, as well as infant and child mortality rates. Second, with the understanding that health spending has specific targets, we examine its effects on some of the proximate targets, which are immunization, and prevention and treatment of diseases such as malaria. Third, this analysis is being carried out for both high focus states (HFS) and Non-high focus states (NHFS) to verify the differential impact of public health spending. To the best of our knowledge, this is one of the earliest studies to verify public health expenditure on various proximate and ultimate health outcomes among the Indian States. Along with all States, the objective of the study is also examined by dividing Indian States into HFS and NHFS, which is a novel attempt. This will help the policymakers as these classifications are based on the prevalence of health indicators in the States.

Following the introduction, the remaining part of the study is structured as follows: some selected review on this issue is presented in section 2. The data and methodology of the study are discussed in section 3. The empirical analysis and the discussion of the result is the main thrust of section 4. The conclusion and policy implications are drawn in section 5.

2. Literature Review

A brief review of the literature on the relationship between health care inputs and health outcomes was done by Nixon and Ulmann (2006). Literature suggests that health care expenditure has a mixed impact on achieving potential health outcome.[11] The impact of health spending on health outcome is analysed using cross-country data (Akinkugbe and Mohanoe, 2009; Yaqub et al., 2012; Gupta et al., 2002; Weitzman, 2017), at the regional/household level within the country (Hughes and Dunleavy 2000; Kishor, 1993; Schultz, 1993; Cremieux et al., 1999). Many studies are also based on a panel data framework, such as the African countries (Ssozi and Amlani, 2015; Anyanwu and Erhijakpor, 2009; Novignon, 2012), the OECD countries (Hitiris and Posnet, 1992; Berger and Messer, 2002; Linden and Ray, 2017), Asian countries (Narayan et al., 2010), European countries (Lippi et al., 2016; Van den Heuvel and Olaroiu, 2017; Becchetti et al., 2017).

Many cross-country studies find little effect of public health spending on health outcomes, while level of income plays a crucial role for determining better health status (Kim

[10] This study has focused only on public health spending because time series data on private health spending across Indian States are not available and public health spending is an important policy variable.
[11] A summary of many relevant studies in this context are also presented in the table 1 (see Apendix).

and Moody, 1992; Filmer and Pritchett, 1999; McGuire et al., 1993; Gupta et al., 2002), and socioeconomic factors are often found to be highly associated with health outcomes (Demery and Walton, 1998; Young, 2001; St Leger, 2001). Rajkumar and Swaroop (2008) studied the impact of good governance (the level of corruption and the quality of bureaucracy) on the effectiveness of public spending on health and education in 91 developed and developing countries using annual data for 1990, 1997 and 2003. They found that public spending becomes more effective in achieving health and education outcomes in countries with good governance, while it has virtually no impact on health and education outcomes in poorly governed countries. Berger and Messer (2002) examined the determinants of health outcomes across 20 OECD countries from 1960 to 1992. They showed an increase in health care expenditures is associated with lower mortality in developed countries, but if the share of publicly financed health expenditures increases, it will increase mortality rates. Ssozi and Amlani (2015) examined the effectiveness of health expenditure on the proximate and ultimate goals of healthcare in 43 nations of Sub-Saharan African countries, using the General Method of Moments technique from 1995 to 2011. They found a higher effect of health expenditure on the proximate targets and a lower effect on the ultimate goals.

Anyanwu and Erhijakpor (2009) found that health expenditures had a statistically significant effect (negative) on infant mortality and under-five mortality using data from 47 African countries between 1999 and 2004. Cremieux eta al. (1999) analysed the relationship between health care spending and health outcomes (gender-wise) in 10 Canadian provinces over the period 1978-1992 and found that lower health care spending was associated with an increase in infant mortality and a decrease in life expectancy in Canada. Murthy and Okunade (2016) found that per capita real income, the per cent of the aged population (above 65 years) and the level of research & development expenditure in health care exerted positive effects on the U.S. per capita health expenditure. Using panel data of the five BRICS nations form 1995 to 2010, Kulkarni (2016) found a positive relationship between health outcome and GDP per capita, adult literacy rate, and out of pocket expenditure. The results confirmed that higher public expenditure indicated higher IMR or lower health outcomes, indicating significant improvement in the quality of delivery and finance system for the effectiveness of public health expenditure. Self and Grabowski (2003) found that public health expenditures were quite ineffective in improving health in developed countries but effective in the middle-income countries and LDCs. Farag et al., (2013) found that public health spending had a significant effect on reducing infant and under-5 child mortality using data from 133 low and middle-income countries for the years 1995-2006.

India specific studies on the impact of public health spending on health outcome are inconclusive. Barenberg et al. (2015) investigated the impact of public health expenditure on the infant mortality rate using an unbalanced panel of 31 Indian States and Union Territories from 1983–84 to 2011–12. Using a simultaneous equation model, they found that public health expenditure helps in reducing IMR among the Indian States. Farahani et al. (2010) evaluated the relationship between State-level public health spending of India and individual mortality across all age groups using household-level data from the National Family Health

Survey (NFHS) II conducted in 1998–1999. The probit regression results showed that a 10% increase in public spending on health decreases mortality by about 2%, with effects mainly concentrated on women, the young, and the elderly. Deolalikar (2005) finds that current health expenditure does not have a significant effect on mortality rates using the Indian State panel for 1980–1999. Bhalotra (2007), on the other hand, restricts the sample to rural households and allows for lagged effects, and finds a significant effect of health expenditure on infant mortality rates by using rural households' sample. Some other health expenditure related studies are the impact decentralization on rural infant mortality rates in India (Asfaw et al., 2007), the cyclicality of public health expenditure (Behera et al., 2019), causality from health expenditure to economic growth in selected Indian States (Behera and Dash, 2019; Rajeshkumar and Nalraj, 2014).

After this brief review, it is found that most of the studies are analysed in the developed countries like European Union, OECD, USA, Canada, etc., while others are focused on developing or low-income countries. India, one of the fastest-growing and developing economy, has a very limited number of studies on this issue. Most of the studies have focused on the impact of health expenditure on a single indicator, i.e., infant mortality. None of the studies has examined this issue by using different crucial health outcomes at a time like life expectancy at birth, infant, and child mortality rate, and other preventive and curative disease such as malaria, immunisation, etc., which is studied in this paper. This issue has also not been studied among the Indian States by dividing all States into two important clusters based on their achievement of health indicators and infrastructure. Having discussed the evidence available and the gaps identified, this study voids these gaps by covering these unnoticed issues among the Indian States.

3. The Data and Methodology

3.1: The Data

The study has used annual panel data for the 28 Indian States covering the period from 2005 to 2016.[12] The time period 2005-2016 could enable us to capture the surge in health expenditure due to the launch of the National Health Mission (NHM)[13] and also the enactment of the MDGs in the Indian health system. The study period is chosen from 2005 onwards because of the introduction of NHM and MDGs, which allows examining the effectiveness of the financial upsurge into the health sector. Apart from all 28 States, the objective of the study is also analyzed by dividing the total sample into two categories, i.e., HFS and NHFS.[14] As the

[12] Telangana State is excluded from the analysis as it was founded on June 2014. In India, the financial year begins from April and ends in March. Therefore, the year 2000 means 2000-2001 & so on.

[13] The NHM is a central sponsored scheme comprising of two sub-mission, i.e., National Rural Health Mission launched on April 2005 and National Urban Health Mission introduced on May 2013. The basic objective is to provide accessible, affordable and quality health care to all population of the country.

[14] High focus States are Bihar, Chhattisgarh, Himachal Pradesh, Jammu and Kashmir, Jharkhand, Madhya Pradesh, Odisha, Rajasthan, Uttar Pradesh, Uttarakhand, Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. Non-high focus States include Andhra Pradesh, GOA, Gujarat, Haryana, Karnataka, Kerala, Maharashtra, Punjab, Tamil Nadu and West Bengal. HFS have relatively poor

analysis needs to link public health expenditure to the health outcomes, the considered variables are Public health expenditure[15], Gross state domestic product (GSDP), Population, Health service infrastructure[16], Infant mortality rate (IMR)[17], Child mortality rate (CMR)[18], Life expectancy at birth (LE), Malaria[19], and Immunisation achieved[20]. Data on public health expenditure is collected from the National Institute of Public Finance and Policy (NIPFP) databank as well as 'State Finances :A study of budget,' Reserve Bank of India. Data on GSDP is obtained from National Accounts Statistics, Central Statistics Office. Mid-year population figures are obtained from a report entitled as "Population Projections for India and States 2001-2026", Office of the Registrar General & Census Commissioner, Government of India . Data on health service infrastructure, malaria cases, and various immunisation achieved are from EPW Research Foundation (EPWRF) India Time Series, and on health-related indicators such as IMR, CMR, and LE are collected from Sample Registration System (SRS) Bulletins, Office of the Registrar General & Census Commissioner, Government of India.

The study has divided the health outcomes into two categories such as ultimate and proximate target. The life expectancy, the infant and child mortality rates are considered under ultimate health outcome, while variables like malaria and immunization are considered under proximate targets. The summary statistics and pair-wise correlation of selected variables are presented in Table 2 (Appendix). It shows that per capita health spending and percapita GSDP are positively correlated with life expectancy and negatively correlated with infant and child mortality, immunisation and malaria in the Indian States. Infrastructure has a positive relationship with immunization and malaria. Since correlation coefficients are not very informative, we apply econometric technique (fixed effect method) for measuring true relationships. Before proceeding towards the empirical analysis, let us discuss the trend of public health expenditure and health outcome for the selected period in the next section.

health indicators and also poor infrastructure than the NHFS. NHM funds were primarily meant to support health spending in poor performing States (HFS). Thus, a separate analysis for these two groups are being carried out to verify the objective.

[15] It includes medical & public health, and family welfare expenditure from current and capital account of the respective State budget.

[16] It is derived by adding total number of Sub-Centres (SC), Primary Health Centre (PHC) and Community Health Centre (CHC).

[17]IMR is the number of infants dying under one year of age per 1,000 live births.

[18] It is the probability per 1,000 live births that a newborn baby will die before reaching age five. Here, 0-4 years of age (mortality) is considered.

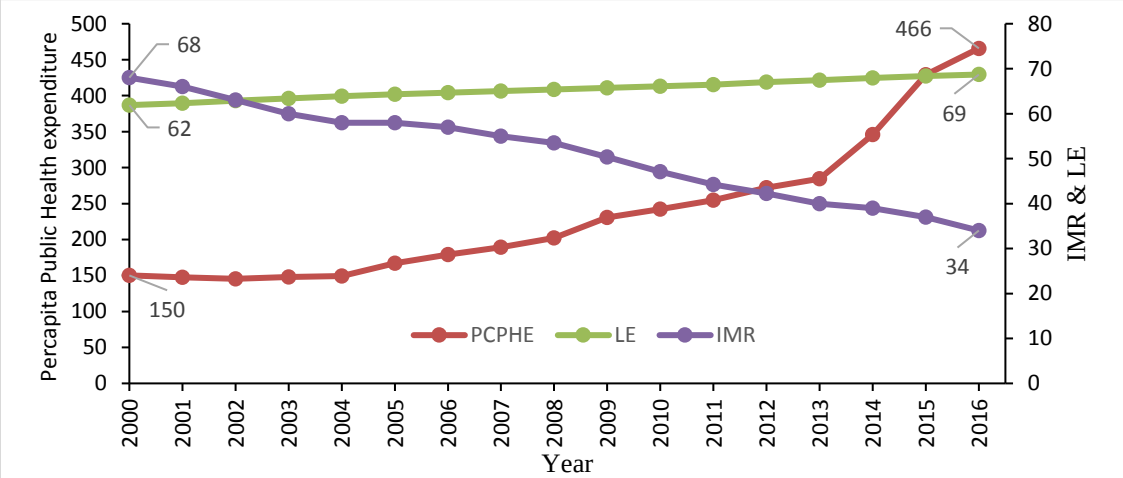
[19] Total number of malaria cases reported during a year.

[20] It is the average of four major types of immunization, i.e., BCG immunization for children achieved, Measles immunization achieved, Polio immunization achieved and Tetanus immunization for expectant mothers achieved.

3.2: The Trends of Per-capita Public Health Expenditure and Selected Health Outcome in India, 2000-2016

The trends of per capita public health expenditure (PCPHE), IMR and LE in India are shown in Figure 3. It shows that PCPHE was stagnant up to 2004 and then started an increasing trend, which might be due to the introduction of NHM in the Indian economy in 2005. The PCPHE has increased almost more than threefold during 2000-2016. LE has also increased from nearly 62 to 69 years during this period. IMR has shown a downward trend from 68 to 34 during this time. Thus, a preliminary observation shows a positive relationship between PCPHE and LE and a negative relationship between PCPHE and IMR in India. The inter-State inequalities in health spending have increased as there is a wide variation in the per capita public health spending across Indian States (Rao & Choudhury, 2012). The scatterplot of PCPHE against IMR, and PCPHE against LE for all the selected States from 2000 to 2016 are shown in Figure 4 (Appendix). A linear regression line is also included in the graph. Figure 4 shows that States with high PCPHE has witnessed lower IMR (the line slopes downward in "A"), while higher PCPHE States has witnessed higher LE (the line slopes upward in "B"). In the next section, the methodology of the study is discussed.

Figure 3: Relationship Between Per Capita Public Health Spending, Life Expectancy And Infant Mortality Rate in India



Note: PCPHE- per capita public health expenditure, LE- Life expectancy at birth and IMR- Infant Mortality rate. Source: Authors interpretation.

3. 3. The Methodology

As discussed, the basic objective is to examine the impact of public health expenditure on the health outcome of the Indian States. Higher health care expenditure is expected to have a higher life expectancy at birth and lower infant and child mortality rates. Along with it, the

study has also included other control variables that have any impact on the health outcome.[21] Following the literature, other selected chosen variables are per capita GSDP (Pritchett & Summers, 1996), and total health service infrastructure. It is believed that higher per capita income is expected to have a favourable impact on health outcome as State can prioritize their health spending due to enhanced fiscal capacity. Generally, wealthier individuals, on average, can invest/spend more on medical expenditures, prefer a more healthy diet, lead a healthier lifestyle, and have lower morbidity rates than individuals with less income. Thus, higher per capita income is expected to have a favourable impact on health outcome. Availability of health infrastructure provides easy access and affordable health care facility, which helps in improving the health status in an economy. Thus, along with public health expenditure, per capita income and health service infrastructure are also added as explanatory variables in the regression model as follows.

The Model:

$$Y_{it} = \alpha_i + \beta_1 X_{it} + \beta_2 Z_{it} + v_i + \epsilon_{it} \ldots\ldots\ldots\ldots\ldots (1)$$

Where,

'i' represents States and "t" refers to the time period. Y_{it} represents all the selected health outcomes like life expectancy, infant mortality, child mortality, malaria, and immunization. X_{it} is the variable of interest, i.e., per capita public health expenditure. Z_{it} is the other selected explanatory variables like per capita GSDP (PCGSDP) and health infrastructure (INFRA). α_i represents intercept or constant. v_i - shows the effects of excluded variables in the model which are invariant over time and might have some impact on the State's health outcome. So, it assumes that the State-specific effects v_i are treated as fixed rather than random. In this study, some unobserved factors such as changing technology and medical practices, literacy level, other health infrastructures, public policies etc. could contribute to an improvement of health outcome. Therefore, the model is called an unobserved effects model or a fixed-effect model (FE).[22] ε_{it} is an error term, often called the idiosyncratic error or time-varying error because it represents unobserved factors that change over time and affect y_{it}.

In using fixed effects, the goal is to eliminate v_i because we believe that it is correlated with one or more of x_{it}. But suppose, we found that a_i is uncorrelated or independent with any explanatory variables in all time periods, the equations (1a-5b) becomes a random-effects model (RE). Comparing the FE and RE estimates that whether there is a correlation between the v_i and the x_{it}, it also assumes that the idiosyncratic errors and explanatory variables are uncorrelated across all time periods, so it will be verified through the Hausman

[21] The inclusion of other factors which affect the health outcome might yield a more precise estimate of the relationship between public health care spending and outcome.

[22] We have done the empirical analysis by using fixed effects regression approach. This statistical method helps in controlling for time-invariant unobservable characteristics of each State. These characteristics of States are very difficult to measure and if we ignore it, the regression might face the problem of omitted variable bias.

test (Wooldridge, 2013). In this study, the sample of Indian States is not selected through randomly rather systematically/purposefully. Therefore, we have applied the FE model and there is no need to verify through the Hausman test.

The estimated panel fixed effect regression equations (1a-5b) as follows:[23]

$lnLE_{it} = \alpha_i + \beta_1 lnPCPHE_{it} + \beta_2 lnPCGSDP_{it} + v_i + \in_{it}$ .....(1a)

$lnLE_{it} = \alpha_i + \beta_1 lnPCPHE_{it} + \beta_2 lnPCGSDP_{it} + \beta_3 lnINFRA_{it} + v_i + \in_{it}$ .....(1b)

$lnIMR_{it} = \alpha_i + \beta_1 lnPCPHE_{it} + \beta_2 lnPCGSDP_{it} + v_i + \in_{it}$ .....(2a)

$lnIMR_{it} = \alpha_i + \beta_1 lnPCPHE_{it} + \beta_2 lnPCGSDP_{it} + \beta_3 lnINFRA_{it} + v_i + \in_{it}$ ..... (2b)

$lnCMR_{it} = \alpha_i + \beta_1 lnPCPHE_{it} + \beta_2 lnPCGSDP_{it} + v_i + \in_{it}$ .....(3a)

$lnCMR_{it} = \alpha_i + \beta_1 lnPCPHE_{it} + \beta_2 lnPCGSDP_{it} + \beta_3 lnINFRA_{it} + v_i + \in_{it}$ ..... (3b)

$lnMALARIA_{it} = \alpha_i + \beta_1 lnPCPHE_{it} + \beta_2 lnPCGSDP_{it} + v_i + \in_{it}$ .....(4a)

$lnMALARIA_{it} = \alpha_i + \beta_1 lnPCPHE_{it} + \beta_2 lnPCGSDP_{it} + \beta_3 lnINFRA_{it} + v_i + \in_{it}$ ..... .(4b)

$lnIMMU_{it} = \alpha_i + \beta_1 lnPCPHE_{it} + \beta_2 lnPCGSDP_{it} + v_i + \in_{it}$ .....(5a)

$lnIMMU_{it} = \alpha_i + \beta_1 lnPCPHE_{it} + \beta_2 lnPCGSDP_{it} + \beta_3 lnINFRA_{it} + v_i + \in_{it}$ ..... .(5b)

Where,

$lnLE$: log of life expectancy at birth; $lnIMR$: log of infant mortality rate; $lnCMR$: log of child mortality rate; $lnMALARIA$: log of malaria cases; $lnIMMU$: log of average immunization; $lnPCPHE$: log of per capita public health expenditure; $lnINFRA$: log of health infrastructure which includes total number of SC, PHC and CHC. All other variables are explained before. For each health outcome, two separate models are estimated. The first model explains the impact of PCPHE and PCGSDP on selected health outcomes, whereas the second model estimates the impact of PCPHE, PCGSDP, and INFRA on selected health outcomes. The motivation behind for estimating separate models is to check the robustness of the results by adding another explanatory variable (INFRA) in the model.

We have estimated the stationarity properties of variables adopted in the model using Levin, Lin & Chu (LLC, 2002), and Im-Pesaran-Sin (IPS, 2003) panel unit root tests. The result of LLC and IPS unit root test has been reported in Table 3. The result shows that variables are not rejected the null hypothesis of no unit root which indicates that our series is stationary at level.

Table 3: Result of Panel Unit Root Tests

	Levin, Lin & Chu (LLC)		Im, Pesaran, and Shin (IPS)	
Variables	(level)	(1st Diff.)	(level)	(1st Diff.)
lnLEit	3.993***	-10.593***	-0.057	-3.602***
$lnIMR_{it}$	-7.424***	-7.942***	-2.021**	-1.829**
$lnCMR_{it}$	-8.150***	-14.161***	-3.532***	-5.455***
$lnMALARIA_{it}$	-7.432***	-11.399***	-2.637**	-3.669***
$lnIMMU_{it}$	-9.002***	-16.285***	-2.265**	-5.996***

[23] The variables are in log form which helps in measuring the elasticity.

$lnPCPHE_{it}$	-4.234***	-15.260***	0.174	-5.814***
$lnPCGSDP_{it}$	-7.595***	-13.438***	-2.475**	-5.265***
$lnINFRA_{it}$	-3.823***	-12.649***	1.258	-5.493***
$lnBCGI_{it}$	-7.478***	-14.664***	-1.414*	-5.504***
$lnPOLIO_{it}$	-10.379***	-20.609***	-3.332***	-6.588***
$lnTETA_{it}$	-14.348***	-18.624***	5.844***	-7.123***
$lnMEAS_{it}$	-7.386***	-15.252***	-2.264**	-6.302***

Note: ln: Natural logarithm; *** p<0.01, ** p<0.05, * p<0.1

4. The Empirical Results

This study estimates the impact of public health expenditure on the selected health outcome (i.e. LE, IMR, CMR, MALARIA, and IMMU)[24] by controlling PCGSDP and INFRA for all selected 28 States of India (See Table 4). Then, a similar kind of analysis has also been done for both HFS and NHFS of India (See Table 5 and 6). It is to be noted that the study has estimated two separate models for each health outcome. For result interpretation, it will use the estimates of the model which includes all the control variables (column 2, 4, 6, 8 and 10).[25]

Table 4 shows the result of FE regression models of all the selected 28 Indian States. It shows that PCPHE has a positive and significant impact on LE and IMMU. It implies that at a 10 per cent increase in PCPHE leads to an increase of 0.18 per cent rise in the LE and a 1.8 per cent increase in the IMMU among the Indian States. However, the rise in PCPHE has an adverse impact on IMR, CMR and Malaria cases. It implies that a 10 per cent increase in PCPHE, leads to -1.4, -0.7 and -5.9 per cent reduction in the rate of IMR, CMR, and MALARIA, respectively. Our results are similar to those of earlier studies who have argued that public health spending has a positive impact on life expectancy, reducing child-health related mortality, increase immunization coverage, and prevention of deadly diseases (Barenberg et al., 2017; Berger and Messer, 2002; Jaba et al., 2014; Martin et al., 2007).

On the contrary, some studies found that only per capita public health spending could not be achieved the potential health outcome rather it requires the availability health services infrastructure and potential level of per capita income (Akinkugbe and Mohanoe, 2009; Narayan et al., 2010; Behera et al. 2019). The results also find that PCGSDP has a positive and statistically significant impact on LE. It has an adverse impact on IMR, CMR, and MALARIA. It implies that an increase in income of a State helps in improving the health status. However, the higher availability of INFRA helps in reducing IMR and CMR in the Indian States. The impact of INFRA on reducing CMR is more than reducing IMR among all States.

[24] These are most widely accepted health indictors by the demographers, health economists, and policy makers.

[25] However, the coefficients of other models are almost similar to these models, which shows that the empirical estimations are robust.

Table 4: Results of Fixed-Effects Model in the Indian States (ALL)

Variables	$lnLE_{it}$		$lnIMR_{it}$		$lnCMR_{it}$		$lnMALARIA_{it}$		$lnIMMU_{it}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$lnPCPHE_{it}$	0.018***	0.018***	-0.154***	-0.139***	-0.122***	-0.071*	-0.558***	-0.587***	0.187***	0.181***
	(0.004)	(0.004)	(0.045)	(0.041)	(0.041)	(0.039)	(0.162)	(0.165)	(0.038)	(0.039)
$lnPCGSDP_{it}$	0.066***	0.066***	-0.4176***	-0.416***	-0.749***	-0.778***	-0.469**	-0.469**	-0.388***	-0.388***
	(0.007)	(0.007)	(0.059)	(0.059)	(0.067)	(0.063)	(0.237)	(0.238)	(0.056)	(0.056)
$lnINFRA_{it}$		0.002		-0.163*		-0.495***		0.331		0.071
		(0.009)		(0.091)		(0.091)		(0.364)		(0.086)
Constant	3.411***	3.388***	8.877***	10.099***	10.946***	15.372***	17.637***	15.150***	15.601***	15.069***
	(0.053)	(0.101)	(0.435)	(0.809)	(0.508)	(0.940)	(1.735)	(3.242)	(0.409)	(0.764)
R-squared	0.836	0.836	0.595	0.599	0.832	0.853	0.271	0.273	0.148	0.150
F-test	188.72***	186.99***	105.53***	104.07***	203.59***	226.94***	156.74***	153.72***	832.81***	83.42***
No. of obs.	204	204	336	336	228	228	336	336	336	336
No. of States	17	17	28	28	19	19	28	28	28	28

Note: ln: Natural logarithm; Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

The results of fixed-effect regression models for the HFS are shown in Table 5. It finds that PCPHE shows a positive and statistically significant relationship with the increase in the LE and IMMU. It implies that at a 10 per cent increase in PCPHE leads to an increase of LE by 0.34 per cent and a slightly higher than 1 per cent in the IMMU. It also finds that an increase in PCPHE helps in reducing the IMR, CMR, and MALARIA among HFS. Precisely, a 10 per cent increase in PCPHE leads to 0. 84, 0.62 and 5.7 per cent reduction in the rate of IMR, CMR, and MALARIA, respectively. As previously find, PCGSDP has a favourable effect on LE and an adverse impact on IMR, CMR, and MALARIA. However, the higher availability of INFRA helps in reducing IMR and CMR in the HFS. Health infrastructure also helps in detecting the total number of MALARIA in these States.

The similar type of empirical analysis is carried out for NHFS (Table 6). The empirical results show that PCPHE has a negative and significant impact on IMR and positive impact on IMMU. However, PCPHE does not have any significant impact on LE and CMR after taking the control variables. It's only PCGSDP, which have a positive impact on LE. High PCGSDP also helps in reducing IMR, CMR, and MALARIA in NHFS. However, higher availability of INFRA helps in reducing CMR, MALARIA and increasing the IMMU in NHFS.

Table 5: Results of Fixed-Effects Model in the High-focus Indian States

Variables	$lnLE_{it}$		$lnIMR_{it}$		$lnCMR_{it}$		$lnMALARIA_{it}$		$lnIMMU_{it}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$lnPCPHE_{it}$	0.034***	0.034***	-0.107**	-0.084*	-0.066	-0.062	-0.519**	-0.572***	0.145***	0.161***
	(0.005)	(0.005)	(0.049)	(0.049)	(0.048)	(0.045)	(0.183)	(0.185)	(0.469)	(0.047)
$lnPCGSDP_{it}$	0.064***	0.062***	-0.388***	-0.370***	-0.802***	-0.703***	-0.139	-0.180	-0.258***	-0.246***
	(0.009)	(0.009)	(0.072)	(0.071)	(0.082)	(0.080)	(0.270)	(0.270)	(0.069)	(0.069)

lnINFRA$_{it}$		0.008		-0.333***		-0.581***		0.755*		-0.219**
		(0.015)		(0.117)		(0.142)		(0.443)		(0.113)
Constant	3.339***	3.281***	8.349***	10.592***	11.248***	15.363***	13.723***	8.639**	13.989***	15.462***
	(0.064)	(0.121)	(0.523)	(0.938)	(0.619)	(1.162)	(1.963)	(3.568)	(0.502)	(0.911)
R-squared	0.890	0.890	0.486	0.507	0.820	0.844	0.158	0.171	0.067	0.084
F-test	202.51***	197.98***	69.26***	62.89***	56.95***	60.55***	202.97***	203.39***	735.43***	74.22***
No. of obs.	96	96	216	216	120	120	216	216	216	216
No. of States	8	8	18	18	10	10	18	18	18	18

Note: ln: Natural logarithm; Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Results of Fixed-Effects Model in the Non-high focus Indian States

	lnLE$_{it}$		**lnIMR$_{it}$**		**lnCMR$_{it}$**		**lnMALARIA$_{it}$**		**lnIMMU$_{it}$**	
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
ln PCPHE$_{it}$	-0.010*	0.006	-0.290**	-0.312***	-0.279***	-0.070	-0.398	-0.042	0.451***	0.345***
	(0.005)	(0.006)	(0.067)	(0.071)	(0.078)	(0.090)	(0.326)	(0.334)	(0.053)	(0.048)
lnPCGSDP$_{it}$	0.091***	0.086***	-0.412***	-0.387***	-0.549***	-0.858***	-1.492***	-1.891***	-0.914***	-0.795***
	(0.009)	(0.011)	(0.098)	(0.102)	(0.122)	(0.139)	(0.478)	(0.477)	(0.077)	(0.068)
lnINFRA$_{it}$		0.009		-0.110		-0.569***		-1.791***		0.533***
		(0.011)		(0.124)		(0.146)		(0.579)		(0.083)
Constant	3.308***	3.425***	9.547***	8.462***	9.607***	16.853***	28.264***	45.931**	20.697***	15.434***
	(0.065)	(0.155)	(0.717)	(1.415)	(0.911)	(2.044)	(3.490)	(6.624)	(0.563)	(0.947)
R-squared	0.878	0.879	0.827	0.829	0.820	0.873	0.556	0.593	0.632	0.735
F-test	251.74***	241.04***	149.91***	149.62***	241.44***	277.90***	95.66***	92.12***	1781.26***	89.28***
No. of obs.	108	108	120	120	108	108	120	120	120	120
No. of States	9	9	10	10	9	9	10	10	10	10

Note: ln: Natural Logarithm; Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

4.1: Discussion

There exists a wide range of core indicators, which measures the performance of health care spending by the government (Gupta et al., 2002). These are infant mortality rate, child mortality rate, maternity mortality ratio, births attended by skilled health personnel, contraceptive prevalence rate, HIV infection rate in 15 to 24-year-old pregnant women, and life expectancy at birth. This study has adopted some of those major indicators such as infant mortality, child mortality, life expectancy, immunization coverage, and malaria cases on the basis of its relevance in the Indian health policy. As per the latest National Family Health Survey (NFHS) report, the trends in infant mortality, child mortality, child immunization have seen an improvement from 2005-06 to 2015-16 (IIPS, 2017). The trends of infant death per 1000 live births have shown a reduction from 79 per cent in 2005-06 to 41per cent in 2015-16 in India, whereas the under-five mortality rate declined from 74 per cent to 50 per cent between 2005-06 and 2015-16. The information on infant and child mortality is relevant for the demographic assessment of the population and it is an important indicator of the country's socio-economic development. There is a huge difference in the performance on the reduction of child and infant mortality across the States of India. The under-five mortality rate is highest in Uttar Pradesh (78 deaths per 1000 live births), and lowest in Kerala (7

deaths per 1000 live births). It is argued that the under-five mortality rate declines with increasing household's wealth, which means lowest wealth quintile income groups shows a less percentage reduction in child mortality than the reduction in higher quintile income groups. Our results also find PCGSDP has shown an inverse relationship with IMR and CMR that means higher per capita income States could mobilize public spending on health care services, nutrition, better sanitation, etc., which eventually leads to a reduction in infant and child mortality rate.

Further, trends in full immunization rate (percentage of children 12-23 month received all vaccination of BCG, measles, polio, and DPT) has increased from 44 per cent in 2005-06 to 62 per cent in 2015-16. This increasing trend of vaccination coverage might be due to an increase in health spending among States. The estimated result shows that PCPHE has a positive and significant relationship with the immunization rate. It can be inferred that higher allocation of health expenditure in the terms of the higher distribution of health resource per person (per capita health expenditure) will have a direct positive impact on rising of immunization rate in India. This phenomenal performance can be linked to an enhancement of fund flow by the Central government under the NHM since its inception 2005-06. Under NHM, Central government contributes 60 per cent and 90 per cent of the total NHM funds among General category states and Special category states, respectively. Additional assistance by the Center helps the State governments for prioritizing the health care, which helps in an improvement of the overall health outcome such as a reduction in infant and child mortality, increase in immunization, reduction in malaria incidence due to fund flow in specific diseases specific programs. However, per capita income has a determinantal effect on the rate of immunization across States irrespective of their category. It is found that as income increases, people adopt birth control measures and prefers a maximum one or two children. As birth rate falls, immunization coverage will definitely decline among high-income people.

Further, it finds that LE shows a positive and statistically significant relationship with PCPHE and PCGSDP. LE of an economy rises rapidly due to improvements in the health of people, nutrition, sanitation, innovation in medical technology, medicine and better health infrastructure. These facilities can be achieved only with sufficient health spending and a high level of economic development. Lau et al. (2012) argue that an increase in ageing population has been a direct result of a demographic transition from high to low levels of mortality and fertility which eventually combined with an increase in life expectancy. Therefore, increase per capita health expenditure and per capita income has reduced the mortality rate in the first place and thereby it has improved the life expectancy over the year.[26]

The empirical result also finds that CMR and IMR have an inverse relationship with the level of health services infrastructure. In this study, we have taken the aggregate number

[26] The improvement in life expectancy is used to assess how a country's population is healthy or whether the population is suffering from increasing rates of communicable and non-communicable disease (Johnson, 2008). So overall performance in health outcome is useful in determining the allocation of resources for health promotion and in providing an improved understanding of the determinants of health (Johnson et al. 2005).

of CHC, PHC, and SC as a proxy for the availability of health services infrastructure. It implies that greater access to health care services leads to a reduction in child-health related mortality. Our finding is similar to Fay et al. (2005), who find that better access to basic infrastructure (i.e. sanitation and electricity, and piped water) has a large and statistically significant effect in reducing infant and child mortality and the incidence of stunting. They argued that there are complementary relationships between basic infrastructure and health services infrastructure (i.e. CHC, PHC, and SC) which leads to an opposite or inverse effect on child mortality (infant and under-five mortality). The impact of health services infrastructure has no direct impact on the incidence of malaria and immunization among all the States. The size of infrastructure is not the only solution to achieve better health outcome rather the quality of health services remains a challenge in the health system of India for advancing UHC (Lahariya et al., 2016). They argued that the quality of health services are sub-optimal level in both rural and urban health center which are partially due to uncoordinated and fragmented health service delivery, suboptimal financing, insufficient coordination amongst multiple agencies, shortage of human resources, high level of inequalities and inequities, etc.

Overall, it finds that both per capita public health expenditure and per capita income have played a major role in the improvement of the selected health outcome of Indian States. But the elasticity of health outcome (LE, IMR, and CMR) with respect to per capita income is much stronger than the elasticity of public health expenditure. But in the case of Malaria reduction and increasing immunization coverage, public health expenditure has favourably impacted the health outcome than the per capita income. Because prevention of communicable and non-communicable diseases i.e. malaria and vaccination of children, the direct intervention of public health policies are required while other indicators like life expectancy and child-health related mortality are the optimum health goals and are influenced by other non-medical factors particularly standard of living and lifestyle factors. PCPHE has a greater impact on reducing infant and child mortality in HFS than NHFS. Life expectancy is significantly affected by both public health spending and income in HFS, while it is only influenced by income among NHFS. Health infrastructure plays a more crucial role in improving health outcome in HFS than NHFS.

5. Conclusion and Policy Implication

Healthy people can serve as a major driver for economic activities and development of a nation. In a developing economy, the Government plays a significant role in providing affordable and accessible health services to its poor and needy people. The linkage between public health care expenditure and health outcomes is of interest to policymakers due to a steady rise of per capita public health care spending in India. State governments are trying to provide hospitals with all necessary infrastructures, safe drinking water, proper sanitation, immunizations, antibiotics, rehydration therapy, malaria prevention and treatment, nutrition etc. through their health policies, which helps in improving the health status like a reduction of mortality among infants, children, and adults. In general, public health practices is very necessary to implement wide-scale reductions in mortality indicators of an economy. Thus, the objective of this study is to investigate the effects of public health expenditure on selected

health outcomes such as life expectancy, infant and child mortality rate, malaria and immunization, using panel fixed effects models across 28 Indian States for the period of 2005 to 2016. The empirical result is being carried out in different ways. First, this study estimates the impact of public health expenditure on ultimate health goals like life expectancy at birth, infant mortality rate, and child mortality rate. Second, it also examines the impact on two selected proximate health goals based on data availability like immunization and Malaria. Third, to verify the differential impact of public health spending, the study has also examined the issue for both High focus states and Non-high focus states of India.

The empirical results show that per capita health care expenditure has a positive and statistically significant effect on life expectancy and immunisation, while it has a negative impact on infant mortality rate, child mortality rate and malaria cases. Like public health spending, per capita income has an adverse impact on infant and child mortality, malaria, while it has a favourable impact on improving life expectancy across States. It also finds that total health services infrastructure has potential effect for reducing the inequality in health outcome among States irrespective of the level of development. The study is very much relevant from the perspective of achieving universal health coverage at the State level. Public health per capita spending has a greater impact on reducing infant and child mortality in high focus states than non-high focus states. Life expectancy is significantly affected by both public health spending and income in high focus states, while it is only influenced by income among non-high focus states. Health infrastructure plays a more crucial role in improving health outcome in high focus states than non-high focus states. The results of this study have important policy implications with respect to public health spending for the Indian States. The Indian States could rapidly achieve better health goals by spending more on their health sector. Given the health needs of Indian States, the study suggests for enhancement of public health spending, and improvement of health infrastructure among the Indian States. Based on the data availability in future, this study can be expanded by including other type's disease as well as other categories of health expenditure.

Reference

Akinkugbe, O., & Mohanoe, M. (2009). Public health expenditure as a determinant of health status in Lesotho. *Social Work in Public Health*, *24*(1-2), 131-147.

Anand, S., & Ravallion, M. (1993). Human development in poor countries: on the role of private incomes and public services. *Journal of Economic Perspectives*, 7(1), 133-150.

Anyanwu, J. C., & Erhijakpor, A. E. (2009). Health expenditures and health outcomes in Africa. *African Development Review*, *21*(2), 400-433.

Asfaw, A., Frohberg, K., James, K. S., & Jütting, J. (2007). Fiscal decentralization and infant mortality: empirical evidence from rural India. *The Journal of Developing Areas*, 41(1) 17-35.

Barenberg, A. J., Basu, D., & Soylu, C. (2017). The effect of public health expenditure on infant mortality: evidence from a panel of Indian states, 1983–1984 to 2011–2012. *The Journal of Development Studies*, *53*(10), 1765-1784.

Becchetti, L., Conzo, P., & Salustri, F. (2017). The impact of health expenditure on the number of chronic diseases. *Health Policy*, *121*(9), 955-962.

Behera, D. K., Mohanty, R. K., & Dash, U. (2019). Cyclicality of public health expenditure in India: role of fiscal transfer and domestic revenue mobilization. International Review of Economics, 1-24. Doi: https://doi.org/10.1007/s12232-019-00333-w.

Behera, D. K., & Dash, U. (2019). Effects of economic growth towards government health financing of Indian states: an assessment from a fiscal space perspective. *Journal of Asian Public Policy*, 12(2), 206-227.

Berger, M. C., & Messer, J. (2002). Public financing of health expenditures, insurance, and health outcomes. *Applied Economics*, *34*(17), 2105-2113.

Bhalotra, S. (2007). Spending to save? State health expenditure and infant mortality in India. *Health Economics*, 16(9), 911-928.

Bhargava, A., Jamison, D. T., Lau, L. J., & Murray, C. J. (2001). Modelling the effects of health on economic growth. *Journal of Health Economics*, *20*(3), 423-440.

Carrin G, Politi C. 1995. Exploring the health impact of economic growth, poverty reduction, and public health expenditure. *Tijdschrift Voor Economie en Management*, 40: 227–246.

Cremieux, P. Y., Ouellette, P., & Pilon, C. (1999). Health care spending as determinants of health outcomes. *Health Economics*, *8*(7), 627-639.

Demery, L., & Walton, M. (1998). Are poverty reduction and other 21st century social goals attainable?. The World Bank. Washington, DC.

Deolalikar, A. B. (2005). Attaining the millennium development goals in India: reducing infant mortality, child malnutrition, gender disparities and hunger-poverty and increasing school enrollment and completion. Oxford University Press.

Durairaj, V., & Evans, D. B. (2010). Fiscal space for health in resource-poor countries. *World Health Report.* Background Paper, No 41.

Farag, M., Nandakumar, A. K., Wallack, S., Hodgkin, D., Gaumer, G., & Erbil, C. (2013). Health expenditures, health outcomes and the role of good governance. *International Journal of Health Care Finance and Economics*, *13*(1), 33-52.

Farahani, M., Subramanian, S. V., & Canning, D. (2009). The effect of changes in health sector resources on infant mortality in the short-run and the long-run: a longitudinal econometric analysis. *Social Science & Medicine*, 68(11), 1918-1925.

Farahani, M., Subramanian, S. V., & Canning, D. (2010). Effects of state-level public spending on health on the mortality probability in India. *Health Economics*, *19*(11), 1361-1376.

Fay, M., Leipziger, D., Wodon, Q., & Yepes, T. (2005). Achieving the child-health-related millennium development goals: the role of infrastructure. *World Development*, 33(8), 1267–1284.

Filmer, D., & Pritchett, L. (1999). The impact of public spending on health: does money matter?. *Social science & medicine*, 49(10), 1309-1323.

Gupta, S., Verhoeven, M., & Tiongson, E. R. (2002). The effectiveness of government spending on education and health care in developing and transition economies. *European Journal of Political Economy*, 18(4), 717-737.

Heijink, R., Koolman, X., & Westert, G. P. (2013). Spending more money, saving more lives? The relationship between avoidable mortality and healthcare spending in 14 countries. *The European Journal of Health Economics*, *14*(3), 527-538.

Hitiris, T., & Posnett, J. (1992). The determinants and effects of health expenditure in developed countries. *Journal of health economics*, 11(2), 173-181.

Hojman, D. E. (1996). Economic and other determinants of infant and child mortality in small developing countries: the case of Central America and the Caribbean. *Applied Economics*, 28(3), 281-290.

Hughes, G., & Dunleavy, M. (2000). Why do babies and young children die in India? The role of the household environment. The World Bank.

Im, K.S, Pesaran, M.H., & Shin, Y.C., (2003). Testing for Units Roots in Heterogeneous Panels. *Journal of Econometrics*, 115(1), 53–74.

International Institute for Population Sciences (IIPS) and ICF. 2017. National Family Health Survey (NFHS-4), 2015-16: India. Mumbai: IIPS.

Jaba, E., Balan, C. B., & Robu, I. B. (2014). The relationship between life expectancy at birth and health expenditures estimated by a cross-country and time-series analysis. *Procedia Economics and Finance*, *15*, 108-114.

Johnson, C. S. (2008). Ageing and healthy life expectancy: Will the extended years be spent in good or poor health. J Indian Academy Geriatr, 4(1), 64-67.

Johnson, C. S., Stevens, A., & Rajan, I. (2005). Promotion of healthy aging in the context of population aging phenomenon: a look at the aging state in India. *Indian J Gerontol*, 19(2-4), 181-192.

Judge, K., Mulligan, J. A., & Benzeval, M. (1998). Income inequality and population health. *Social Science & Medicine*, 46(4-5), 567-579.

Kaur, B., & Misra, S. (2003). Social sector expenditure and attainments: An analysis of Indian states. *Reserve Bank of India Occasional Papers*, 24(1), 105-143.

Kim, K., & Moody, P. M. (1992). More resources better health? A cross-national perspective. *Social science & medicine*, 34(8), 837-842.

Kishor, S. (1993). May God Give Sons to All: Gender and Child Mortality in India. *American Sociological Review, 5*8, 247-265.

Kulkarni, L. (2016). Health inputs, health outcomes and public health expenditure: evidence from the BRICS countries. *Int J Appl Econ*, *31*(1), 72-84.

Lahariya, Chandrakant, et al. Strengthening urban health for advancing universal health coverage in India. *Journal of Health Management,* 18 (3), 361-366.

Lau, Robin S., Shanthi Johnson, and T. J. Kamalanabhan. Healthy life expectancy in the context of population health and ageing in India. *Asia Pacific Journal of Public Health* 24.1 (2012): 195-207.

Le Grand, J. (1987). Inequalities in health: some international comparisons. *European economic review,* 31(1-2), 182-191.

Levin, A., Lin, C. F., & Chu, C. S. J. (2002). Unit root tests in panel data: asymptotic and finite-sample properties. *Journal of Econometrics*, *108*(1), 1-24.

Linden, M., & Ray, D. (2017). Life expectancy effects of public and private health expenditures in OECD countries 1970–2012: Panel time series approach. *Economic Analysis and Policy*, *56*, 101-113.

Lippi, G., Mattiuzzi, C., & Cervellin, G. (2016). No correlation between health care expenditure and mortality in the European Union. *European Journal of Internal Medicine*, *32*, e13-e14.

Martin, S., Rice, N., & Smith, P. C. (2008). Does health care spending improve health outcomes? Evidence from English programme budgeting data. *Journal of Health Economics*, *27*(4), 826-842.

Mcguire, A., Parkin, D., Hughes, D., & Gerard, K. (1993). Econometric analyses of national health expenditures: can positive economics help to answer normative questions?. *Health Economics*, 2(2), 113-126.

Murthy, V. N., & Okunade, A. A. (2016). Determinants of US health expenditure: evidence from autoregressive distributed lag (ARDL) approach to cointegration. *Economic Modelling*, 59, 67-73.

Narayan, S., Narayan, P. K., & Mishra, S. (2010). Investigating the relationship between health and economic growth: Empirical evidence from a panel of 5 Asian countries. *Journal of Asian Economics*, *21*(4), 404-411.

Nixon, J., & Ulmann, P. (2006). The relationship between health care expenditure and health outcomes. *The European Journal of Health Economics*, *7*(1), 7-18.

Novignon, J., Olakojo, S. A., & Nonvignon, J. (2012). The effects of public and private health care expenditure on health status in sub-Saharan Africa: new evidence from panel data analysis. *Health Economics Review*, *2*(1), 22.

Rajeshkumar, N., & Nalraj, P. (2014). Public Expenditure on Health and Economic Growth in Selected Indian States. *International Journal of Science and Research*, *3*(3), 468-472.

Rajkumar, A. S., & Swaroop, V. (2008). Public spending and outcomes: Does governance matter?. *Journal of Development Economics*, *86*(1), 96-111.

Rao, M. G., & Choudhury, M. (2012). Health care financing reforms in India. National Institute of Public Finance and Policy working Paper No:100.

Schultz, T. P. (1993). Mortality decline in the low-income world: causes and consequences. *The American Economic Review*, 83(2), 337-342.

Self, S., & Grabowski, R. (2003). How effective is public health expenditure in improving overall health? A cross–country analysis. *Applied Economics*, *35*(7), 835-845.

Ssozi, J., & Amlani, S. (2015). The effectiveness of health expenditure on the proximate and ultimate goals of healthcare in Sub-Saharan Africa. *World Development*, *76*, 165-179.

St Leger, S (2001). The anomaly that finally went away. *Journal of Epidemiology and Community Health*, 55, 79.

Pritchett, L., and Summers, L. H., (1996). Wealthier is healthier. *Journal of Human Resources*, 31(4), 841-868.

Tandon, A., & Cashin, C. (2010). Assessing public expenditure on health from a fiscal space perspective. Health, Nutrition and Population Discussion Paper, (Washington: The World Bank).

Van den Heuvel, W. J., & Olaroiu, M. (2017). How important are health care expenditures for life expectancy? A comparative, European analysis. *Journal of the American Medical Directors Association*, *18*(3), 276-e9.

Weitzman, A. (2017). The effects of women's education on maternal health: Evidence from Peru. *Social Science & Medicine*, *180*, 1-9.

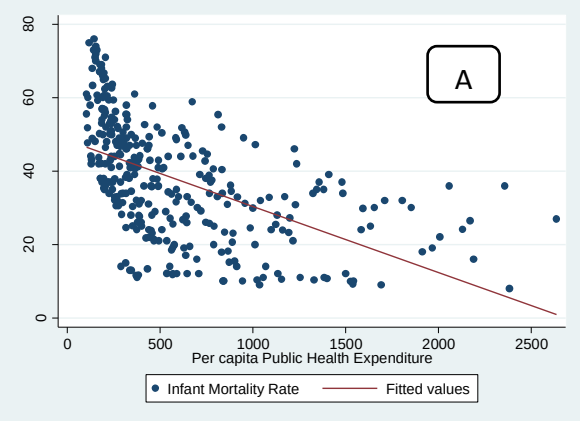
Wilson, S. E. (2011). Chasing success: health sector aid and mortality. *World Development*, *39*(11), 2032-2043.

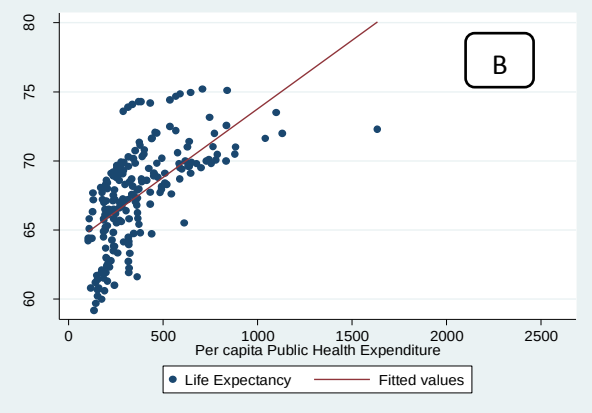
Wolfe, B. L. (1986). Health status and medical expenditures: is there a link? *Social Science & Medicine,* 22(10), 993-999.

Yaqub, J. O., Ojapinwa, T. V., & Yussuff, R. O. (2012). Public health expenditure and health outcome in Nigeria: the impact of governance. *European Scientific Journal*, 8 (13), 189-201.

Young, F. W. (2001). An explanation of the persistent doctor-mortality association. *Journal of Epidemiology & Community Health*, 55(2), 80-84.

Appendix





Source: Authors' calculations

Figure 4: Scatter Plot of Per Capita Public Health Expenditure, Infant Mortality Rate, Life Expectancy across the Indian States Using Data From 2005-2016.

Table 1: Summary of Selected Studies on Health Expenditure and Health Output.

Author(s)	Country/study period	Findings
Ssozi and Amlani (2015)	43 Sub-Saharan African Countries for 1995-2011	Found a higher effect of health expenditure on the proximate targets and a lower effect on the ultimate goals.
Barenberg, Basu and Soylu (2017)	31 Indian states and union territories from 1983–84 to 2011–12	Public health expenditure helps in reducing IMR among Indian states.
Becchetti et al. (2017)	19 European Countries from 2004 to 2012	Found that lagged health expenditure had a significant and negative effect on chronic diseases, which varies according to age, health behaviour, gender, income and education.

Rajkumar and Swaroop (2008)	91 developed and developing countries using annual data for 1990, 1997 and 2003.	Public spending becomes more effective in achieving health outcomes in countries with good governance, while it has virtually no impact on health outcomes in poorly governed countries.
Berger and Messer (2002)	20 OECD countries from 1960 to 1992	Increase in health care expenditures are associated with lower mortality in developed countries, but if the share of publicly financed health expenditures increases, it will increase mortality rates.
Jaba et al. (2014)	175 world countries over 1995-2010	Health expenditure has a positive impact on life expectancy.
Bhargava et al. (2001)	92 countries during 1965-90	Their results showed positive effects of adult survival rates on GDP growth rates in low-income countries.
Rajeshkumar and Nalraj (2014)	Four Indian states from 1991 to 2010	found a unidirectional causality from health expenditure to economic growth
Martin et al., (2007)	295 English Primary Care Trusts.	Health care expenditure has a strong positive effect on health outcomes.
Narayan et al. (2010)	5 South Asian countries for the period from 1974 to 2007	Found that health, investment, exports, R&D, and the interaction term between education and R&D had a positive effect on economic growth.
Kulkarni (2016)	Five BRICS nations form 1995 to 2010	Found a positive relationship between health outcome and GDP Per capita, Adult literacy rate, and Out of Pocket expenditure, while environmental pollution, age dependency ratio and female workforce participation rate had a negative relation with health outcome.
Self and Grabowski (2003)	developed, middle-income and LDCs	Found that public health expenditures were quite ineffective in improving health in developed countries but effective in the middle-income countries and LDCs.
Farahani et al. (2010)	Indian states using the National Family Health Survey (NFHS II) data conducted in 1998–1999	Showed that a 10% increase in public spending on health decreases mortality by about 2%, with effects mainly concentrated on women, the young, and the elderly.
Cremieux et al. (1999)	Canadian provinces over the period 1978-1992	Lower health care spending was associated with an increase in infant mortality and a decrease in life expectancy in Canada.
Novignon (2012)	Panel data from 1995 to 2010 for 44 countries in sub-Saharan Africa.	Both private and public health care expenditure was significantly associated with improved health outcomes, like improving life expectancy at birth, reducing death and infant mortality rates, public health care expenditure had a relatively larger impact.
Akinkugbe and Mohanoe (2009)	Lesotho	Found that in addition to public health care expenditure, the availability of physicians, female literacy and child immunization significantly influenced health outcomes in Lesotho.
Nixon and Ulmann (2006)	15 members of the European Union over the period 1980–1995	An increase in health care expenditure was significantly associated with large improvements in infant mortality but only marginally in relation to life expectancy.

Anyanwu and Erhijakpor (2009)	47 African countries between 1999 and 2004	They found that health expenditures had an adverse effect on infant mortality and under-five mortality.
Yaqub et al. (2012)	Nigeria from 1980 to 2008	With governance, public health expenditure had a negative effect on infant mortality and under-5 mortalities.
van den Heuvel and Olaroiu (2017)	31 European countries	Expenditure on social protection played a more important role than health care expenditures for improving life expectancy at birth.
Akinci et al. (2014)	19 Middle East and North Africa (MENA) region for 1990-2010	Both government and private spending on health care had improved infant, under-five, and maternal mortality in the MENA region.
Lippi et al. (2016)	28 European countries from 2000 to 2013	Found no apparent association between health care expenditure and reduction in total mortality.
Weitzman (2017)	Peru between 2003 and 2009	Increasing women's years of schooling reduced the probability of several maternal health complications at last pregnancy/birth, decrease the probability of short birth intervals and unwanted pregnancies, and to increase antenatal healthcare use, which resulted in an overall reduction in maternal morbidity.
Gupta et al. (2002)	Cross-sectional data for 50 countries	Increased health care spending had reduced child and infant mortality rates.
Wilson (2011)	96 high mortality countries	Development assistant for health and aid on water development had no effect on mortality, whereas, economic growth had a negative effect on mortality.
Farag et al. (2013)	133 low and middle-income countries for the years 1995-2006.	Public health spending had a significant effect on reducing infant and child mortality.
Heijink et al. (2013)	14 western high-income countries over 1996-2006.	Both contemporaneous and lagged health- care spending had a negative impact on avoidable mortality.
Linden and Ray (2017)	34 OECD Countries from 1970 to 2012	Found the positive relationship between public health expenditures and life expectancy.

Table 2: Descriptive Statistics and Pair-wise Correlation

All States		Descriptive Statistics					Correlation			
Variables	Mean	Max.	Min.	Std. Dev.	Obs.	IMR	CMR	LE	IMM	MALARIA
PCPHE	584.3	2635.9	103.1	474.4	336	-0.5	-0.5	0.6	-0.7	-0.7
PCGDP	47030.8	250809.7	8481.0	28898.4	336	-0.7	-0.7	0.7	-0.4	-0.2
INFRA	8.0	10.1	5.1	1.4	336	0.2	0.2	-0.4	0.9	0.7
IMR	37.8	76.0	8.0	16.0	336	1.0	...	...	...	...
CMR	11.9	24.7	2.3	5.2	228		1.0	...	...	...
LE	67.5	75.2	59.2	3.5	204			1.0	...	...
IMM	12.6	15.7	8.9	1.8	336				1.0	...
MALARIA	9.3	13.0	2.6	2.3	336					1.0
High Focus States										

Variables	Mean	Max.	Min.	Std. Dev.	Obs.	IMR	CMR	LE	IMM	MALARIA
PCPHE	655.3	2635.9	103.1	517.0	216	-0.8	-0.8	0.8	-0.8	-0.7
PCGDP	38265.4	117756.8	8481.0	18557.7	216	-0.7	-0.7	0.7	-0.7	-0.5
INFRA	7.7	10.1	5.1	1.4	216	0.4	0.6	-0.6	1.0	0.7
IMR	41.4	76.0	9.0	16.1	216	1.0	...	...	...	...
CMR	14.9	24.7	4.9	4.4	120		1.0	...	...	...
LE	65.7	73.5	59.2	3.6	96			1.0	...	...
IMM	12.2	15.7	8.9	1.9	216				1.0	...
MALARIA	9.1	13.0	2.6	2.6	216					1.0
Non-High Focus States										
Variables	Mean	Max.	Min.	Std. Dev.	Obs.	IMR	CMR	LE	IMM	MALARIA
PCPHE	456.5	2383.7	178.8	353.5	120	-0.7	-0.6	0.6	-0.3	-0.5
PCGDP	62808.4	250809.7	17665.6	36582.2	120	-0.4	-0.4	0.4	-0.2	-0.2
INFRA	8.6	9.6	5.3	1.2	120	0.0	-0.1	-0.2	0.9	0.6
IMR	31.4	60.0	8.0	13.7	120	1.0	...	...	...	...
CMR	8.6	17.8	2.3	3.7	108		1.0	...	...	...
LE	69.2	75.2	65.0	2.5	108			1.0	...	...
IMM	13.4	14.5	9.7	1.2	120				1.0	...
MALARIA	9.6	12.1	6.4	1.5	120					1.0

Note: PCPHE = Per capita public health expenditure, PCGSDP = Per capita Gross State Domestic Product, PCGRANTS = Per capita central government grants, INFRA = Total health services infrastructure, IMR = Infant Mortality Rate, CMR = Child Mortality Rate, LE = Life Expectancy, IMM = Average Immunization, MALARIA = Incidence of malaria; IMMU= average immunization. The variables INFRA, IMMU, MALARIA are in log form.

Source: Author's calculation

MORE IN THE SERIES

- Chakraborty, L., (2020). Fiscal Consolidation Ex-post the Escape Clause: A Call for "Excessive Deficit Procedure", WP No. 299 (March).
- Kaur, A., and Chakraborty, L., (2020). The Climate Change-responsive Public Expenditure in India: An Empirical Analysis, WP No. 298 (February).
- Rangarajan, C., (2020). The New Monetary Policy Framework – What it Means, WP No. 297 (February).

Ranjan Kumar Mohanty, is Assistant Professor, NIPFP
Email: ranjan.mohanty@nipfp.org.in

Deepak Kumar Behera, is Assistant Professor, Asian Institute of Public Health University, Bhubaneswar
Email: deepakkumar.behera59@gmail.com

National Institute of Public Finance and Policy,
18/2, Satsang Vihar Marg,
Special Institutional Area (Near JNU),
New Delhi 110067
Tel. No. 26569303, 26569780, 26569784
Fax: 91-11-26852548
www.nipfp.org.in