Original Research Article

Public Health Expenditure and Gross State Domestic Product in India: A Regression Analysis

ABSTRACT:

Spending on health is essential to increase labour productivity and people's life expectancy. But, the individual ability to make necessary health expenditure is inadequate in low-income and developing nations like India. In this regard, the current study aims to investigate the causal relationship between public health spending and per capita GSDP (Gross State Domestic Product), as well as the GSDP (Gross State Domestic Product) ratio, with a focus on a few chosen states of India (such as Assam, Andhra Pradesh, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Nagaland, Odisha, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, and West Bengal). The states have been chosen to represent the nation, while secondary data on public health spending and GSDP has been gathered from the EPW Research Foundation. OLS (Ordinary Least Square) is used in conjunction with a linear regression model to analyse the data. To determine the increasing trend of public health expenditures, trend analysis also been conducted. The findings showed that there is an inverse association between the nation's health spending and both the per capita GSDP and ratio of GSDP. This suggests that public health spending is influenced by a variety of other factors as well. The paper's conclusion suggested placing greater focus on certain measures that assist low-income or impoverished families with regard to medical expenses.

Key words: Public health, GSDP, Productivity, Per Capita GSDP.

1. INTRODUCTION

Spending on health stimulate physical and mental well-being as well as increase productivity of the individuals. Good health not only allows people to work longer hours but also has an impact on income levels (Piabou et al., 2017). An increase in an individual's productivity also raises the productivity of the economy's entire production forces (Sayın, 2015). Due to the nuanced effect on worker productivity, health can thus be considered as a significant predictor of savings and investment rates. Thus, it can be argued that health care spending boosts GDP (Gross Domestic Product) by raising income (Güvenek, 2015; Hooda, 2013).

Investments in public health care enhance locals' health and foster regional economic expansion (Penghui et al., 2022). We also can point out that certain factors, such as the duration of one's employment, work efficiency, and average life expectancy are directly related to investments made in the field of health and the prevalence of quality of health services. Whereas, this investment on the other hand depends on GDP of a country. Hence, the primary determinant of health spending can be considered as income or GDP per capita (Hossain et al., 2017; Sriram, 2022). In this regard, Zhan

(2022) argued that "the GDP is the primary driver of the growth in health spending." The percentage of people's income that is allocated to health care rises along with the amount spent on medical care per capita GDP. Consequently, economic factors that positively impacted health spending included the gross state domestic product (GSDP), revenue and capital receipts, internal debt, and so forth (Khan, 2022; Brahim, 2022). According to Junhao (2023), the GDP is the primary predictor of rising health care costs. The percentage of people's health expenditures in per capita GDP rises in tandem with increases in medical spending. Additionally, it is observed that effect of per capita GDP on health expenditure is positive and significant.

People's health also affects their average life expectancy, productive age and output, employment, and general well-being. Economic factors such as employment, income, purchasing power, and poverty all have an impact on people's health. Therefore, it has been noted that healthcare spending and the economic indices of personal income, labor productivity, per capita GDP, and other spending are positively correlated (Raghupati & Raghupati, 2020). IMR (Infant Mortality Rate), the death rate, and the birth rate all decline in tandem with rising health spending (Sarmah and Goswami, 2022). Under these conditions, social welfare measures that provide public healthcare are crucial. Social welfare programs help to guarantee steady economic growth and enhance the quality of human capital. A robust social security system enhances citizens' health conditions, promotes the market participation of an effective labor force, and advances rapid economic and social development (Qi Hu, 2024).

In India, health expenditure is incurred by both the central and state governments. According to the Constitution, health expenditure depends on resources from the central, state, municipal corporation, non-government organization, and other sources for financial support of the healthcare sector. India's public health spending has been woefully low since the 1940s. The Bhore Committee Report (1946) states that per capita private health spending was Rs 2.50 whereas per capita public health spending was at Rs 0.36. India spent 83% and 88% of its GDP on private health care in the 1950s and 1980s, respectively. The Bhore committee suggested establishing Primary Health Centers (PHCs) with 75 beds for every 10,000–20,000 residents and integrating curative and preventive care across all administrative levels.

Over the years, the Indian government has implemented various policies and periodically formed committees to increase public health expenditure. Expanding PHC, sub-centres, and community health centres throughout states was India's plan to attain health for all by the year 2000, as well as the country's community development program (1951–1955) and first National Health Policy (1983). Similarly, the ambitious target of raising government health spending to 2-3% of GDP was established by the National Health Policy 2002, the National Rural Health Mission (NRHM-2005), and the Universal Health Coverage Report (2012). In addition, the National Health Policy of 2017 placed focus on raising government health spending as a share of GDP from 1.15% to 2.5% by 2025.

In light of this, the current study aims to examine the trends in public health spending in India and examine the relationships between public health spending and the ratio of gross state product to per

capita GDP. We also wish to investigate the hypothesis that there is no correlation between the ratio of gross state product and public health expenditures and per capita GDP.

There are five sections in this paper. The study's history and problem were covered in the introduction section. The second section covered the theoretical framework as well as the review of earlier works. The methodology was covered in the third portion, and the fourth section contains the results and discussions. The conclusion was covered in the last section.

2. LITERATURE REVIEW

Under the theoretical insights we can consider the empirical studies conducted in various countries of the world. Some of the researchers focused on the significant relationship between health expenditure and health indicators outcomes among countries with different healthcare system (Raeesi, et al., 2018; Edeme et al., 2017; Malhotra, 2016) and some others examined the effects of health expenditure on health indicator outcomes (Arthur and Oaikhenan, 2017) in some other countries (i.e. Sub-Saharan African countries). All the studies revealed that health expenditure reduces mortality rate and improves life expectancy at birth (Kulkarni, 2016). In these circumstances, focus should be given on the study of health expenditure and its determinants.

In India, numerous studies carried out to examine the state of health spending at various points of time. According to Mohammed, Ahamed, and Honakeri (2012), there was a 22% average growth rate in overall health expenditure from 2000–01 to 2010–11. However, from 2000–01 to 2010–11, the share of public spending to total public spending stayed mostly unchanged. Nonetheless, from 13.65% in 2000–01 to 14.465 in 2010–11, the share of health spending in total social service spending increased. Santhanalakshmi and Malathi (2017) found a consistent growth rate in plan allocations for family welfare and health in another analysis. Examining factors that influence government spending per person it has observed that number of hospitals positively influence government expenditure on health.

According to Dutta (2018), there was a notable rise in health expenditure from 1990–1991 to 2009–2010. Additionally, it is discovered that the coefficients for both GSDP and total spending are positive and significant at the 1% level, suggesting that rising GSDP and total expenditure in the state has resulted in rising health expenditures. Additionally, Singh and Singh (2021) discovered that India's overall public health spending as a percentage of GDP was 1.5% in 2018–19 and 1.45 in 2009–10, suggesting a stagnation in public health spending during this time. In India, per capita health spending climbed from Rs. 135.80 in 2009–10 to Rs. 1657 in 2017–18. Further, Sarmah and Goswami (2022) discovered that health spending increased across all of North Eastern States of India. Compared to Sikkim, states like Assam and Tripura have higher expenditures. For the states in the Northeast, there is a negative correlation between health indices and health spending. Whie, there is a positive correlation between health status and health spending. Even though public health spending has grown over time, it still represents a relatively small portion of GDP when compared to many other nations.

In contrast, Hooda S.K (2013) was found that the government spending has remained almost constant during the period and hovered around 1% of GDP. The level of health spending is lower than the

required level of resources to provide the basic health facilities and the health expenditure has increased after the implementation of NRHM. Bhutka and Patra (2020) contended that there was little variance in the rise of public health expenditure and its constituent parts in Odisha between 2001–2002 and 2014–2015. There was no discernible pattern of growth or decline in public spending on health and its constituent parts throughout the preceding year. Over this time, the amount spent on health care in a given year rose by 11.66 percent relative to the value of the year before. Sudhakara and Rajendra (2016) also noted that despite allocation of sufficient funding for the health sector to improve important health indicators, health issues persisted as an unresolved economic issue (such as high rate of mortality).

Various states are facing trouble in providing health services due to the growing population, which necessitates significant budgetary commitments. Hooda (2020) looked at the trend in health expenditure indicators in India from 2000–01 to 2016–17 in a different study. It also attempted to identify the state-by-state distribution of these indicators. They discovered that there were falling trends in the ratio of government health spending to overall health spending based on secondary data from the World Bank and National Health Profile. Most developed states dedicate very little funding to the healthcare industry.

In their study, Das, Ray, and Das (2018), investigated whether the major Indian states are approaching a single level of per capita health spending based on state-level capital expenditures allocated by the federal government to public and medical health from 1990–1991 to 2009–2010. The Reserve Bank of India's capital expenditure statistics from various states as well as the Barro and Sala-i-Martin (1992) method of convergence were used. According to the study, there is absolute beta convergence, and the states' inclination toward divergence is shown by the alpha results. The concentration of health expenditures and inequality have been measured using the Gini Coefficient and Theil Index, which indicate increasing inequality until 2003–2004, at which point a trend towards equality begins.

In all the studies discussed above it has observed that they tried to focus on public health expenditure from different angle. They also examined the trends of health expenditure as well as the disbursement of health services within the country. Few studies also tried to examine the causes and effects of health expenditure using scientific tools. But, we have observed little gap in the context of the causal relationship between public health expenditure and per capita GSDP as well as the GSDP ratio. Therefore, our study trying to highlight the effect of GSDP and GSDP ratio on public health expenditure. Except the GSDP and GSDP ratio, there have lot of other factors that influence health expenditure.

3. METHODOLOGY

3.1. Study Area and Data Sources: The study looks at the spending on public health in a few chosen Indian states such as Assam, Andhra Pradesh, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Nagaland, Odisha, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, and West Bengal Additionally, the gross state domestic product (GSDP) ratio and per capita GDP of the chosen states have been taken into

consideration. Although various factors influence health expenditure, we have taken only two factors due to non-availability of data on other factors as per our requirement.

Data used in this paper came from secondary sources. The EPW Research Foundation Time Series Data contains the information needed for analysis. The data was averaged over a period of five years, from 2015–16 to 2019–2020. The trend of India's public health spending for a few chosen states, using data from 1991–1992 to 2019–2020, is displayed using a line graph. Since the focus of the research is public health spending, information about private health spending is not well documented. To examine the study's aims, data is analyzed using statistical tools as discussed in the sub-sections. An effort was made to gather information for as many states as feasible.

3.2. Statistical tools

Various statistical tools have been used to analyse the data collected from EPW research foundation. First of all, we have applied the data normality test, i.e. Shapiro Wilk test. Then, we have applied the Pair-wise Correlation coefficient and Variance Inflation Factor to check multicollinearity. The values of those tests are given in table 1 and table 2:

Table 1: Correlation Value

		Ratio of GSDP	Per Capita GSDP
Ratio of GSDP	Pearson Correlation	1	-.395
Per Capita GSDP	Pearson Correlation	-.395	1

Source: Author's own calculation

Given that the ratio of gross state product to per capita gross state product is -0.395, which means that there is no positive link between the two. A Pearson Correlation value of more than 0.5 indicates the presence of correlation between two independent variables.

To examine the multicollinearity between the independent variables, a second analysis i.e. VIF was employed and the results presented in table 2.

Table 2: Variance Inflation Factor (VIF) Value

Model	Collinearity Statistics	
	Tolerance	VIF
Per Capita GSDP	0.844	1.185
Ratio of GSDP	0.844	1.185

Source: Author's own calculation

The VIF value of 1.185 implies that there is no multicollinearity among the independent variables, i.e., per capita GSDP and ratio of GSDP. If the VIF value is between 5 and 10, There is a then it will indicate that there is strong correlation between independent variables, i.e. the problem of multicollinearity.

In order to check the normality of the given data, Shapiro Wilk test has been run for the dependent variable health expenditure.

Table 3: Tests of Normality

	Shapiro-Wilk	
	df	Sig.
Health Expenditure	22	0.130

The dependent variable, health expenditure, is displayed in the above table as having a normal distribution, as indicated by the Shapiro-Wilk test's "p" value of 0.130. Data are normally distributed if the "p" value is higher than the alpha value of 0.05 that was previously set. If not, the data are not normally distributed.

After Conducting the tests, multiple linear regression model is used for the analysis which is expressed as:

$$Y = \beta_0 + \beta_1 PCGSDP + \beta_2 RGSDP + \mu \quad (1)$$

Where,

Y= Health Expenditure,

PCGSDP= Per Capita Gross State Domestic Product,

RGSDP= Ratio of Gross State Domestic Product

For the estimation of the above equation (1), we have transformed it into the regression equation as.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \mu \quad (2)$$

Where, X_1 indicates PCGSDP and X_2 indicates RGSDP.

4. RESULTS AND DISCUSSIONS

We have observed that public health spending in India has been rising since 1991 based on secondary data on health spending that we were able to collect from the EPW research foundation. Figure 1 illustrates the trend line in this context. The trend line also showed an upward trend in India as a result of the government of India's occasionally adopted policies and committees. However, after 2014, the

trend line has got much steeper. It demonstrated that the 2014-formed administration has made significant progress toward enhancing India's healthcare system.

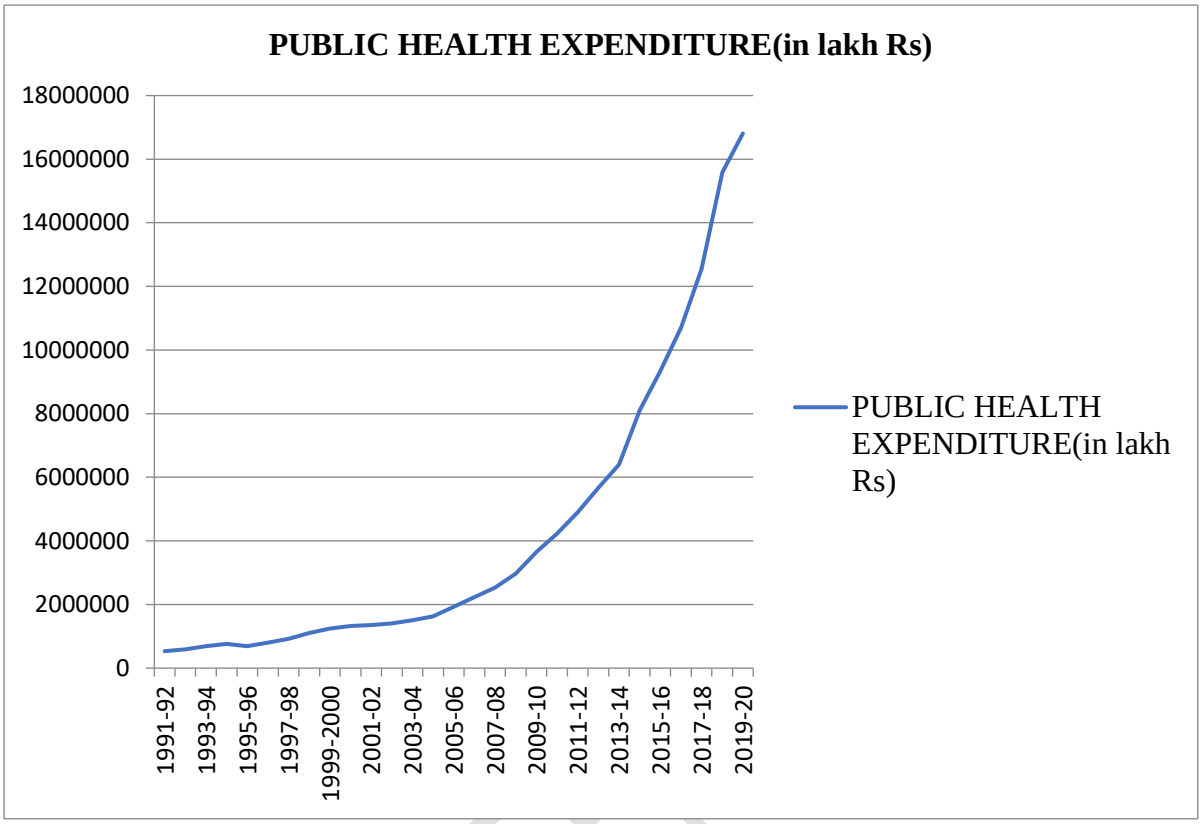

Figure 1: Trends in public health expenditure

Source: EPW Research Foundation, Time Series Data

The test that follows demonstrates the validity and reliability of the data, allowing for the application of further statistical methods. Therefore, we have applied the OLS method after the test of normality and test of multicollinearity. The results obtained are presented in the table 4. Since we have used only two explanatory variables and the calculation done on the basis of that two explanatory variables only.

Table 4: Coefficients and Summary

Variables	**R Square**	**B**	**Sig.**
Constant	0.516	1.192E6	0.000***
Ratio of GSDP		-2.583E7	0.000***
Per Capita GSDP		-249718.225	0.037**

Source: Author's own calculation

N.B.: *** Indicate highly significant, **Moderately significant, *Indicate significant

Dependent Variable: Health Expenditure
Independent Variable: Ratio of GSDP, Per Capita GSDP

Since there is a relationship between health spending and both the ratio of GSDP and per capita GSDP, the null hypothesis has been rejected. The model is moderately fitted, meaning that only 51.6% of the variation in a dependent variable can be explained by the independent variables, according to the R square value of 0.516. Health expenditure and the GSDP ratio have a negative relationship that is significant at the 5% level of significance. A 1% increase in the GSDP ratio will result in a 2.58 reduction in health. Additionally, there is a significant negative relationship, at the 1% level of significance, between health expenditure and per capita GSDP. It means that a 1% increase in the per capita GSDP will result in a 249718.225 drop in health expenditures.

As a result, the findings show that the link between health spending and per capita GSDP is inverse. It suggests that there are additional factors influencing health expenditures in addition to GSDP. However, the current investigation is unable to identify those aspects because of non-availability of secondary data as per our requirement. However, further study will be conducted to examined the effect of other factors on public health expenditure.

5. CONCLUSION

According to Serif Canbay and Mustafa Kirca (2022), there is no causal association between health expenditures and per capita income in the BRICS+T countries, despite the study's findings that there is a negative relationship between health expenditures and per capita GSDP and the ratio of GSDP. The report also shows that, for a few chosen states, public health spending in India is trending upward. Even though public health spending is rising annually, there are still issues with India's healthcare system, including poor care quality, low cost, low accountability, unethical treatment, overcrowding in clinics, a lack of coordination between the public and private sectors, obstacles to accessing services and medications, and a lack of public health knowledge (Rana et al., 2020). Due to these disadvantages, wealthier Indians are more likely to use the private healthcare system, which is more out of reach for low-income families and results in unequal access to healthcare for all.

The Indian government should periodically establish committees to provide recommendations for raising health spending and to take necessary action to ensure that public health is in good shape. Nonetheless, the central government's Ayushman Bharat Scheme is an essential step in helping low-income families with their medical expenses. Therefore, the government ought to place more focus on programs like this one that can help impoverished families with their medical expenses. Moreover, we would like to suggest to conduct further studies to examine the health care sector in India.

Disclaimer (Artificial intelligence)

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc have been used during writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1.QuillBot paraphrasing tool (https://quillbot.com/paraphrasing-tool)

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