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# Public health expenditure and economic growth in India: A causal analysis

**Geethu Rachel Stephen**[1]
**N. Savitha**[2+]

[1,2]*Department of Social Sciences, School of Social Sciences and Languages, Vellore Institute of Technology, Vellore, Tamil Nadu, India.*
[1]*Email: geethu.rachel@vit.ac.in*
[2]*Email: savitha.n@vit.ac.in*

*(+ Corresponding author)*

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## *ABSTRACT*

The causal relationship between public health spending and economic growth is investigated in this study. Data from a panel of 17 states in India is used for the period 2011 to 2022. The states are selected and categorized into three panels—most improved, moderately improved, and least improved—based on the incremental progress in the health index of the National Institution for Transforming India (NITI) Aayog to ensure homogeneity of the group. The Kao cointegration test and Granger causality tests are used for analysis. The cointegration test results showed a long-run equilibrium nexus between public healthcare expenditure and economic growth. In the panel of moderately improved states, the panel Granger-causality model found that there is a two-way causality between the variables. However, there is no causality in the most improved states. The least improved states exhibit a unidirectional causality from public health spending to economic expansion. This implies that the level of progress in the health index does not always correspond to the effectiveness of healthcare spending or its influence on economic growth.

**Contribution/Originality:** The current study focused on analyzing context-specific causality between government health spending and economic progress in India from 2011 to 2022. It significantly addresses the heterogeneity among Indian states by classifying them into three panels based on their progress in the NITI Aayog health index: most improved, moderately improved, and least improved. The identification of state-specific dynamics is made possible by this classification.

## 1. INTRODUCTION

"India's high and sustained economic growth in recent years is being accompanied by social and institutional progress, underpinned by transformational and effective implementation of government programmes" (Economic Survey 2023-24). The Ministry of Finance Government of India (2025) shows a gradual increase in public health expenditure in India from 1.4% in 2017-18 to 1.94% of gross domestic product (GDP) in 2023-24. But it is far below the National Health Policy target of 2.5%. Fiscal health outlays and economic growth have a complicated and situation-specific relationship. Some research suggests that health spending has a favorable influence on economic growth, while other studies imply that it has a negative effect, especially in the short term. Grossman (1972) asserts that health spending is anticipated to contribute to economic growth over the medium to long run, since it is considered a human capital investment." The endogenous growth theories, such as those of Romer (1986), Lucas Jr (1988) and Rebelo (1991) have also incorporated human capital in the aggregate production function" (Odhiambo, 2021). However, some research shows that government health expenditures may have a negative short-term impact

on economic growth. For example, in the case of Organization for Economic Co-operation and Development (OECD) countries, higher spending on health is associated with slower growth rates (Abas, Borhan, Muda, & Zakaria, 2024). In South Asia, economic progress has a favorable influence on health spending, but health spending may not always be an effective growth driver (Iftikar & Ali, 2024) and Wasim, Hanif, and Kanwal (2023). From another perspective, the quality of governance can modulate the efficacy of public health investment. This is seen in sub-Saharan Africa, where improved governance amplifies the benefits of health spending on economic output (Ikpe et al., 2024). Nenbee and Ismail (2024) provided similar outcomes in South Africa and Nigeria. Their effective governance enhances the benefits of state healthcare funding on economic growth. Thus, given the complex link between public health expenditure and economic growth, it is important to investigate the relationship between these two variables in Indian states.

The principal goal of the study is to verify the causality between economic growth and public health expenditure. It analyzes the variations in causality between public healthcare expenditure and gross state domestic product (GSDP), which is used as a measure of economic growth in different regions of India. Unlike cross-sectional studies, it provides a more nuanced understanding of the relationship between public healthcare investments and economic performance by using panel data from 17 Indian states over a broad period (2011–2022). By classifying Indian states into three panels (most improved, moderately improved, and least improved) based on their advancement in the NITI Aayog health index, it addresses heterogeneity among them. This categorization enables the identification of state-specific dynamics and helps policymakers tailor policies according to the needs and functionality of each region.

## 2. LITERATURE REVIEW

Spending more on public health can result in a healthier population, which in turn spurs economic growth and productivity (World Economic Forum & GAVI the Vaccine Alliance, 2023). This can also lead to lower overall healthcare costs (British Medical Association, 2022). However, some economists argue that higher public health spending may displace other investments, such as infrastructure and education, which can also be significant engines of economic expansion (British Medical Association, 2022). Moreover, particular settings and different kinds of health interventions applied might influence the degree to which public health expenditure supports economic growth (Raghupathi & Raghupathi, 2020).

Wasim et al. (2023) claim that public health expenditure benefits economic development in South Asian countries. The strong interconnection between economic growth and health spending indicates that developing the health sector is essential for long-term economic expansion. Based on Hu and Wang (2024), public health expenditure enhances human capital quality, which is necessary for consistent economic development. The study also revealed that public health spending in the Organization for Economic Cooperation and Development increases when "household consumption, employee wages, and physical capital investment" surpass certain thresholds. Wu (2023) conducted similar research on government health care expenditure in China, which shows that, particularly in more developed areas, government spending on health care significantly accelerates economic growth by increasing household consumption. Bol (2024) clarified that, based on GDP per capita, there is a direct interdependence between public healthcare expenditure and economic growth. As economic development increases public expenditure on health services, macroeconomic stability becomes even more important for long-term health funding in Turkey. Growth in the economy Granger-causes health expenditure in the short term, according to Kamanda, Lanpin, and Sesay (2022), implying that as economies develop, they generally spend more on health care. This link underlines the essential role economic development plays in increasing public health expenditure in Sub-Saharan Africa. According to Tengilimoğlu (2023), economic development improves public health expenditure since an increase in economic resources might result in a better distribution of investment to health systems. Following this, the welfare and well-being of the population increase, creating a positive feedback loop between health and economic performance.

Yusuf and Setiawan (2022) assert that healthcare expenditure and economic development have a two-way causal relationship. This implies that although public health expenditure can support economic development, economic growth can also increase healthcare spending. An analysis by Mosha, Aikaeli, and Osoro (2021) in Tanzania found a two-way link between public health expenditure and economic growth, underscoring the interdependence of health investment and economic development. Finding a similar bidirectional relationship between total health expenditure and real GDP, Awoyemi and Nwibe (2022) concluded that economic growth determines health expenditure in Nigeria. An analysis by Saha (2022) revealed only a unidirectional causal link between national health expenditure and economic growth, indicating that government health expenditures in India increased as the economy expanded over the years 1999–2018. Conversely, Nwani and Kelikume (2019) found that public health expenditure and economic growth are not explicitly correlated. Rather, public health spending has an indirect impact on economic growth through health outcomes. This supports the argument that initiatives to increase growth by emphasizing health innovations might not be long-lasting.

This study attempts to determine the relationship between public health spending and India's economic growth using information from the NITI Aayog health index, as there are not many studies on the topic based on the country's state classification. Furthermore, the complex interplay of the relationship between the two in different contexts warrants further investigation.

## 3. RESEARCH METHODOLOGY

### *3.1. Data Repository*

The study analyzed economic variables such as public health expenditure and gross state domestic product (GSDP) in India from 2011 to 2022 to determine the causality between public health expenditure and economic growth. The Directorate of Economics and Statistics of the respective state governments provides secondary data for GSDP at constant prices, which includes private consumption, government spending, investment, and net exports. Public health expenditure data, which comprises medical and public health components as well as family welfare components, is obtained from the official website of the Reserve Bank of India. Table 1 shows the variables used in the study, its constituents and the source of data.

**Table 1.** Description of variables.

| Variable | Notation | Constituents | Data source |
|---|---|---|---|
| Public health expenditure | PubHealth | medical and public health + family welfare | Reserve Bank of India |
| Gross State Domestic Product | GSDP | private consumption + government spending + investment + net exports | Directorate of economics and statistics |

The present study used the health index of Aayog (2021) to categorize the states based on their incremental progress shown in the index, such as most improved, moderately improved, and least improved states. Most improved states are those that showed an index score greater than 4.0.

Moderately improved and least improved states are those having an index score (>2.01 and <4.0) and (>0.01 and <2), respectively. The states that are not showing any improvement in the index are excluded from the study. Therefore, the study selects 17 states. Table 2 below shows the states selected based on their categorization in the Aayog (2021).

**Table 2.** States selected with health index score.

| State | Health index score | Category |
|---|---|---|
| Uttar Pradesh | 5.51 | Most improved (Index score>4.0) |
| Assam | 4.35 | |
| Mizoram | 18.45 | |
| Meghalaya | 17.70 | |
| Maharashtra | 3.60 | Moderately improved (Index score >2.01 and <4.0) |
| Jharkhand | 3.39 | |
| Madhya Pradesh | 3.35 | |
| Nagaland | 3.43 | |
| Punjab | 1.75 | Least improved (Index score >0.01 and <2) |
| Tamil Nadu | 1.63 | |
| Gujarat | 1.13 | |
| Andhra Pradesh | 1.07 | |
| Bihar | 0.76 | |
| Kerala | 0.60 | |
| Uttarakhand | 0.59 | |
| Odisha | 0.13 | |
| Tripura | 0.20 | |

**Source:** Aayog (2021).

### *3.2. Empirical Analysis*

The study categorizes 17 Indian states into three panels: Panel A1, Panel A2, and Panel A3. Panel A1 consists of panel data from four states that belong to the category of most improved states in incremental progress in the health index of NITI Aayog. They are *Uttar Pradesh*, *Assam*, *Mizoram*, *and Meghalaya*. Panel A2 consists of data from moderately improved states in the health index, which are *Maharashtra*, *Jharkhand*, *Madhya Pradesh*, *and Nagaland*. Panel A3 includes the states with the least improvement. They are *Punjab*, *Tamil Nadu*, *Gujarat*, *Andhra Pradesh*, *Bihar*, *Kerala*, *Uttarakhand*, *Odisha*, *and Tripura*. After the categorization, tests for stationarity, cointegration, and panel-based Granger causality are applied for analysis. The Granger causality models for economic growth and public health spending used can be stated as

$$Model\ 1: \Delta GSDP_{it} = \alpha_{1j} + {}^{P}\sum_{k=1} \varphi_{11ik}\, \Delta GSDP_{it-k} + {}^{P}\sum_{k=1} \varphi_{12ik}\, \Delta PubHealth_{it-k} + \varepsilon_{1it} \quad (1)$$

$$Model\ 2: \Delta PubHealth_{it} = \alpha_{2j} + {}^{P}\sum_{k=1} \varphi_{21ik}\, \Delta GSDP_{it-k} + {}^{P}\sum_{k=1} \varphi_{22ik}\, \Delta PubHealth_{it-k} + \varepsilon_{2it} \quad (2)$$

Where $\alpha_{1j}$ and $\alpha_{2j}$ are the respective intercepts for models 1 and 2. $\varphi_{11ik}$ and $\varphi_{12ik}$ are the coefficients for model 1. $\varphi_{21ik}$ and $\varphi_{22ik}$ are the coefficients for model 2. GSDP is Gross State Domestic Product, PubHealth is public health expenditure, $\varepsilon$ is the white noise error term, i is the individual state belonging to the panels, t is the time period, and p is the lag length. The first equation shows GSDP as the dependent variable, and the second equation demonstrates public health expenditure as the dependent variable.

### *3.3. Panel Cointegration Test*

The Augmented Dickey-Fuller (ADF) Fischer test is used to check the stationarity of the data used in the study. The results reported in Table 3 include the variables employed in the study and the ADF unit root results. The results show that, in the first difference, the data are stationary for the variables, as both have low p-values at the 5% significance level. This indicates that the cointegration test can now be conducted to see if the variables of economic growth and public health expenditure are related.

**Table 3.** ADF-Fischer test results.

| Variables | ADF-Fischer test first difference (p-value) |
|---|---|
| GSDP | 0.0012 *** |
| PHE | 0.0022 *** |

**Note:** ***indicates high statistical significance at 5% level.

For panels A1, A2, and A3, the Kao panel cointegration test is used to determine whether there is a link between the quantity of funds allocated to public health and economic growth. The null hypothesis ($H_0$) assumes that there is no cointegration between economic growth and public health expenditure. The alternative hypothesis ($H_a$) assumes that there is cointegration between economic growth and public health expenditure. Table 4 below presents panel cointegration test results.

**Table 4.** Panel cointegration test results.

| **Coint p_Kao (GSDP.PHE,1,1,1) out (2×2)** | | |
|---|---|---|
| **Test applied** | **Test statistics** | **p-value** |
| Unadjusted DF test | -2.0216 *** | 0.0021 |
| Unadjusted mod DF test | -3.4277 *** | 0.0003 |

**Note:** ***indicates high statistical significance at 5% level.

The output indicates that in the unadjusted Dickey-Fuller (DF) test, the test statistic (-2.0216) and the corresponding p-value (0.0021) both suggest cointegration. The low p-value indicates that we can reject the null hypothesis of no cointegration at a 5% significance level. The test statistic (-3.4277) and its very low p-value (0.0003) in the unadjusted modified DF test strongly support the presence of cointegration. This implies rejecting the null hypothesis of no cointegration. Consequently, the test results show that the variables for the study panels are cointegrated, thereby rejecting the null hypothesis and accepting the alternative hypothesis. This suggests that a long-term equilibrium relationship exists between GSDP and public health expenditure.

### *3.4. Panel Granger-Causality Test*

In this research, a panel-based Granger test is performed in R Studio to verify the causality between public health expenditure and economic growth from 2011 to 2022. For this purpose, a panel Granger causality test is conducted separately for each panel to yield more efficient results for each homogeneous group. Two null hypotheses are used for the analysis. The first null hypothesis ($H_{0a}$) pertains to Case I, where PHE is the dependent variable and GSDP is the independent variable. It assumes that Gross State Domestic Product (GSDP) does not Granger cause public health expenditure (PHE). The second null hypothesis ($H_{0b}$) pertains to Case II, where GSDP is the explained variable and PHE is the independent variable. It assumes that PHE does not Granger cause GSDP. Conversely, the alternative hypotheses ($H_{1a}$) and ($H_{1b}$) assume Granger causality in at least one direction. That is, ($H_{1a}$) assumes that GSDP causes PHE, while ($H_{1b}$) assumes that PHE influences GSDP. Table 5 shows the panel Granger-causality results produced in R Studio.

**Table 5.** Panel granger-causality results.

| **Panel** | **CASE** | **D.V** | **I.V** | **Function** | **p-value** |
|---|---|---|---|---|---|
| A1 (Most improved states) | I | PHE | GSDP | Pgrangertest (PHE~GSDP, data = Pdata) | 0.127 |
| | II | GSDP | PHE | Pgrangertest (GSDP~PHE, data = Pdata) | 0.609 |
| A2 (Moderately improved states) | I | PHE | GSDP | Pgrangertest (PHE~GSDP, data = Pdata) | 0.031 |
| | II | GSDP | PHE | Pgrangertest (GSDP~PHE, data = Pdata) | 0.044 |
| A3 (Least improved states) | I | PHE | GSDP | Pgrangertest (PHE~GSDP, data = Pdata) | 0.139 |
| | II | GSDP | PHE | Pgrangertest (GSDP~PHE, data = Pdata) | 0.027 |

The results reported in Table 5 show that there is no causality between government health expenditure and GSDP at a 5% significance level for most improved states (Panel A1). The p-value for the panel in the first case, with PHE as the dependent variable (D.V.) and GSDP as the independent variable (I.V.), and in the second case, with GSDP as the D.V. and PHE as the I.V., were both greater than 0.05. These values, 0.127 and 0.609, indicate that null hypotheses ($H_{0a}$) and ($H_{0b}$) are not rejected. It implies that, in those states, neither public health expenditure causes

economic growth nor vice versa. Nonetheless, bidirectional causality is found between public health expenditure and GSDP in moderately improved states (Panel A2) in the health index, as the p-value is less than 0.05 in both cases, which makes it possible to reject both the null hypotheses ($H_{0a}$) and ($H_{0b}$). It implies that public health expenditure and economic growth influence one another in those regions. However, in Panel A3, for the least improved category of states in the health index, only a single-way causation from public healthcare expenditure to economic growth is observed, as the null hypothesis ($H_{0a}$) for case I is not rejected and the null hypothesis ($H_{0b}$) for case II is rejected.

## 4. DISCUSSION

Studies show that, since a wealthier society can afford to invest more in healthcare, economic growth often precedes increased public health spending in developed economies. According to this "growth-driven health" model, improved healthcare systems are made feasible by economic prosperity (Iuga, Nerişanu, & Iuga, 2024; Jaoude et al., 2023; Martin, Grant, & D'Agostino, 2012; Zhao, Wu, Du, & Liu, 2024). Nonetheless, higher public health spending may promote economic growth in developing nations, especially those with severe health problems. By reducing disease burdens, improving population health, and enhancing human capital, healthcare can boost economic growth and productivity. This "health-led growth" paradigm emphasizes how important healthy populations are in promoting economic advancement (Atilgan, Ertuğrul, Baycan, & Ulucan, 2024; Chakroun, 2024; Jayadevan, 2021; Raj et al., 2024). Because of this, the precise causal relationship varies depending on a number of factors, including the degree of development of a nation, the quality of its healthcare system, and the specific health problems that it faces.

The findings of our study suggest that, despite a long-term equilibrium relationship between the variables of economic growth and public health spending, the causal relationship between the two depends on the context. Additionally, it highlights the reality that increased efficiency in the healthcare system may not always be indicated by improvements in the health index. The study shows that the states with the most incremental progress in the NITI Aayog health index are not always the ones that spend the most on public health. They may also not have health-led growth because there is no dependence between public health spending and economic growth in these states. On the other hand, there is a single-directional causation running from public health expenditure to GSDP in states that belong to the category of least improved states in the index.

## 5. CONCLUSION

The research investigates the connection between government investment in healthcare and the economic expansion of the Indian economy in 17 states using panel data from 2011 to 2022. As states in India possess different characteristics, the states are clustered into three panels of most improved, moderately improved, and least improved states based on the health index of NITI Aayog. Applying Granger causality and panel cointegration tests, the study revealed that, although there exists a long-run equilibrium relationship between the variables, the causality varies depending on contexts and regions. Least improved states in the health index show unidirectional causality, while moderately improved states show bidirectional causality. In contrast, most improved states do not show any causality at all. In the least improved states, targeted public health interventions that will lower the burden of disease and improve population health have a positive impact on economic activity and productivity. The results in moderately improved states point to a dynamic interaction whereby healthcare investments stimulate economic growth, which in turn permits further improvements to the healthcare system, resulting in a positive feedback loop that promotes long-term growth. The analysis of most improved states challenges the general consensus that there is a direct correlation between healthcare spending and economic outcomes when health index scores are higher. It implies that the position in the health index neither reflects the efficiency of the health system nor its impact on economic growth. This underscores the importance of considering other factors, such as the efficiency of healthcare delivery, the quality of healthcare services, and the broader socioeconomic context. In conclusion, this study emphasizes the necessity of investing in public healthcare in India in a varied and context-sensitive manner. It goes beyond simplistic notions

and offers insightful information to governing bodies looking to maximize healthcare spending for equitable and sustainable economic growth.

## 6. POLICY SUGGESTIONS

The results of this study, which show that public health spending and economic growth vary by Indian state, have important policy implications. A uniform approach to health spending is ineffective, as evidenced by the varying causal relationships. Specifically, the NITI Aayog health index's one-way causality in the least improved states indicates that since increased health spending may promote economic growth, health investments should be prioritized in these areas. Because of the bidirectional causality in states with moderate improvements, a more sophisticated approach that optimizes health spending for both improved health outcomes and economic growth is needed. It implies that raising health spending alone might not result in greater economic gains because there is no proof of a causal relationship in the states with the greatest improvement. Thus, these states need to focus on improving and streamlining healthcare delivery. It is crucial that the health index's degree of advancement does not always reflect how well healthcare spending performs or how it influences economic expansion. This demonstrates that in order to direct health policy and resource allocation, we require a more comprehensive evaluation system.

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