THE ROLE OF EXPENDITURE MANAGEMENT IN MEDICAL AND PUBLIC HEALTH AND ITS IMPACT ON ECONOMIC GROWTH: AN INTER-STATE CAUSAL ANALYSIS

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ABSTRACT
This study explores the intricate and dynamic relationship between economic growth and medical and public health spending in the major Indian states.This paper offers a thorough econometric analysis covering the years 1980–81 to 2021–22, based on forty years of secondary data from the Reserve Bank of India's (RBI) annual publications, including State Finances: A study of Budgets and various RBI Bulletins.Time-series stationarity is checked using the Phillips-Perron and Augmented Dickey-Fuller tests to guarantee methodological rigor. As a dynamic measure of state-level economic performance, the Net State Domestic Product (NSDP) captures economic growth.The study uses advanced econometric methods, such as the Toda-Yamamoto causality test and the Johansen Cointegration Test, to clarify the direction and degree of causation between economic growth and medical and health spending.

Key findings show complex interrelationships between states: Assam and Jammu and Kashmir show a unidirectional causal relation between NSDP and health spending, indicating that economic growth is the primary driver of health expenditure in both states. Andhra Pradesh, Gujarat, Himachal Pradesh, Karnataka, Maharashtra, Manipur, Nagaland, Punjab, Rajasthan, Tamil Nadu, Tripura, and the entire country of India exhibit inverse **unidirectionality** (from health expenditure to NSDP), suggesting that strategic health spending can promote economic growth.Furthermore, only in Uttar Pradesh is **bidirectional causality** where each variable effects the othersfound, indicating a feedback loop between economic growth and health spending.In contrast, during the study period, **no significant causation** was found in Bihar, Kerala, Madhya Pradesh, and Odisha.

The study emphasizes the significance of approaching health spending management as a component of the states' larger political economy rather than as a separate sector. It ends with a strong policy recommendation: governments should give priority to the medical and public health sectors management through targeted investments, systemic changes, and public-private partnerships in situations where spending on these areas clearly increases NSDP. With this perspective, health should not only be seen as a welfare measure but also as a strategic pillar of human capital and long-term economic growth.

Keywords: NSDP, Medical & Public Health Expenditure, Unit Root, Cointegration, Toda-Yamamoto Granger Test.

Section-I: Introduction

This study examines the causal relationship between medical and public health expenditure and economic growth in major states of India. The relationship between economic growth and public expenditure has long been a subject of inquiry among scholars. The famous German political economist Adolph Wagner (1835–1917) provided one of the first theoretical underpinnings for this link when he postulated a functional "cause and effect" relationship between economic growth and the rise of the public sector. This idea, sometimes referred to as Wagner's Law or the "Law of Increasing State Activity," holds that as economies and societies develop, so does the demand for public services, which calls for higher public spending.

However, the Keynesian school of thought maintains that there is a reverse causal relationship, with public spending being a major factor in determining national revenue. Spending by the government can spur economic recovery and expansion, especially during recessions. Building on these fundamental concepts, contemporary endogenous growth theories emphasize the significance of human capital, which includes health, education, and skills, as a key factor in determining long-term economic growth (Romer, 1990). Since a healthy population is more productive, enjoys better income levels, and contributes to the economy more effectively, health is one of the most important aspects of human capital (WHO, 2005).

This viewpoint is supported by the health-led growth theory, which was first put forth by Mushkin in 1962 and holds that health should be seen as a type of capital. Similar to investments in human or physical capital, health care improves quality of life, increases labor productivity, and eventually promotes economic growth. Later academics have echoed this perspective, highlighting the importance of human capital in advancing economic progress (Lucas, 1988; Mankiw, Romer, & Weil, 1992; Riley, 2012). Notwithstanding these theoretical advancements, a crucial query still has to be addressed: which way does the causal relationship between public health spending and economic expansion run? Do higher health expenditures result from increased economic output, or do higher health investment levels stimulate economic growth? Answering this question is especially relevant for policymaking in developing economies like India, where choices about how to allocate resources are crucial.

Even while this causation has been the subject of much national and international study (e.g., Mohapatra, 2017; Odhiambo, 2021; Aluthge & Jibir, 2019), there are very few empirical studies that concentrate only on inter-state variations within India. The majority of existing study focuses on the macroeconomic relationship at the national level, paying little attention to the ways that state-by-state differences in public health spending may affect or be affected by economic performance. This gap highlights the necessity for a targeted investigation of the Indian context, where states differ greatly in terms of fiscal objectives, public health infrastructure, and economic growth. Therefore, the goal of the current study is to close this gap by examining the causal relationship between economic growth and medical and public health spending in the major Indian states. According to the Constitution's Seventh Schedule, healthcare in India is essentially a state matter. As a result, the federal government provides funding and policy direction to state governments, who are ultimately in charge of providing healthcare services.

At the federal and state levels, spending on medical and public health accounts for a sizeable portion of revenue expenditures. It is a budgetary issue, but it has a significant impact on the accessibility and quality of healthcare services in different regions. A thorough picture of healthcare spending patterns may be seen in India's 2020–21 and 2021–22 National Health Accounts (NHA). According to these figures, government spending on health care has been steadily rising, while out-of-pocket spending has decreased and social security expenditures has increased. These patterns point to a constructive change in the direction of a healthcare system that is more equal and inclusive.

This development is in line with India's overarching policy objectives of attaining universal health coverage and lowering the cost of healthcare. Recent major changes, including the Ayushman Bharat initiative and more financing for public health infrastructure, show that the government has made a determined effort to make health a top priority and a pillar of national development. The significance of investigating the relationship between sub-national economic outcomes and public health spending is emphasized by these developments. Furthermore, foreign encounters provide insightful information. Increased public health investment, for example, is frequently associated with improved economic performance, according to studies conducted in OECD nations (Akca, 2017). The idea that health spending can spur economic expansion is further supported by these findings.

In this study, the main measure of economic growth is the Net State Domestic Product (NSDP) at constant prices. The stationarity of the data provides more dependable econometric analysis, which is why constant prices are preferred than current prices. In order to examine its possible impact on NSDP, medical and public health spending as reported in state budgets and national health accounts is used as the independent variable. The main goal of this study is to ascertain which way economic growth and public health spending in Indian states are causally related. Specifically, it aims to answer the following question: does health investment promote economic growth, or does economic growth promote health investment?

To structure this investigation, the paper is organized into five sections. **Section Two** presents the theoretical framework and a review of relevant empirical literature. **Section Three** outlines the data sources, variable definitions, and econometric methodologies employed. **Section Four** discusses the empirical findings, interpreting the statistical results within the context of existing theories. Finally, **Section Five** concludes the study by summarizing the key insights and offering policy recommendations based on the evidence. Through this inquiry, the study aspires to contribute to a more nuanced understanding of the dynamics between public health expenditure and economic growth in India, thereby informing future policy directions at both state and national levels.

Section-II: Literature Review

This section presents an extensive review of the existing literature, drawing from both **theoretical frameworks and empirical investigations**, to explore the complex relationship between medical and public health expenditures and economic growth (commonly measured by Net State Domestic Product-NSDP). Despite numerous studies on this topic, significant ambiguity persists regarding the nature and direction of this association. Historically, the role of health expenditure in fostering economic development received limited attention in mainstream economic theory. However, with the emergence of endogenous growth models and increasing acknowledgment of human capital's role in productivity, this relationship has garnered greater scholarly focus. Foundational contributions by Solow (1956), who introduced the exogenous growth model, laid the groundwork for later theories that incorporated human capital more explicitly. Mushkin (1962) was among the first to conceptualize health as a form of human capital, asserting that investments in health improve productivity and thus contribute to economic development. Subsequent theorists such as Romer (1986), Mankiw, Romer, and Weil (1992), and Barro and Sala-i-Martin (1995) expanded on this premise by integrating health and education into their models of economic growth. Other scholarsincluding Stanley (1993), Fuchs (1996), Fogal (1997), Harberger (1998), Bloom and

Canning (2000), Cole and Neumayer (2006), David and David (2004), Xiangjie (2013), and Jin and Zhang (2022)have examined the multifaceted links between health outcomes, human capital, and macroeconomic performance.

On the empirical front, numerous studies have employed a variety of econometric techniques to explore the dynamic relationship between public health and medical expenditures and economic growth, often producing divergent findings. Some scholars, such as Mohapatra (2017), Ifa and Guetat (2019), Gaies (2022), Raghupathi and Raghupathi (2020), Amiri and Ventelou (2012), Elmi and Sadeghi (2012), and Balani et al. (2022), find a long-run equilibrium relationship and evidence of bidirectional causality between health spending and economic growth. These results suggest a reinforcing cycle in which improved health infrastructure contributes to economic growth, which in turn enables greater public investment in health services. Conversely, other studies report unidirectional causality. For instance, Balaji (2011), Zhang et al. (2020), Somé et al. (2019), Sahnoun (2018), Modibbo and Saidu (2020), Odhiambo (2021), Penghui et al. (2022), Mojahid et al. (2020), Newhouse (1977), Deno (1988), Boachie et al. (2014), Atems (2019), Agénor (2010), Piras and Marica (2018), Şen et al. (2015), and Rizvi (2019) find a one-way causal relationship from either health spending to economic growth or vice versa. These discrepancies are often attributed to methodological differences, time periods under study, and regional heterogeneity.

While a considerable body of literature has focused on national-level analyses or cross-country comparisons, relatively few studies have examined the threshold-level or state-specific dynamics of health spending and economic growth within the Indian context. Balaji (2011) is among the few to address this gap, using data from four Southern Indian states—Andhra Pradesh, Karnataka, Kerala, and Tamil Nadufor the period 1960–2009. The study employs Granger causality and Johansen-Juselius cointegration techniques to investigate the dynamic interplay between healthcare expenditure and economic growth. While the findings suggest a meaningful relationship, the analysis remains limited in geographical scope. Mohapatra (2017) explores the interaction among economic growth, public health spending, and the infant mortality rate (IMR) in India through time-series analysis. Although, the study establishes causality among these variables, it fails to adequately capture the decentralized and multidimensional nature of public health service delivery, thus limiting its policy relevance.Zhang et al. (2020) argue that government healthcare spending in China has a strong positive impact on economic growth, with direct effects being more significant than indirect ones. The authors advocate for sustained increases in public health investment to support high-quality economic development. In a similar vein, Penghui et al. (2022) find that both health-related financial inputs and health insurance expenditures significantly promote economic growth, both within individual provinces and across provincial borders. The study underscores the importance of coordinated development strategies and comprehensive planning to enhance the dual objectives of economic and health system development.

Balani et al. (2022), examining data from 1981 to 2017 across multiple Indian states, identify a bidirectional and nonlinear relationship between public health spending and GDP. The study highlights pronounced inter-state differences in income elasticity of health spending, attributing these variations to divergent institutional structures and colonial-era policy legacies. Mohanty and Behera (2023) further reinforce the connection between public health investment and improved outcomes. Analyzing data from 2000 to 2016, they find that increases in per capita publicly financed health expenditure (PCPHE) are associated with enhanced life expectancy, broader immunization coverage, and reductions in IMR, child mortality rate (CMR), and malaria incidence. Interestingly, the elasticity of health outcomes relative to per capita income exceeds that of public health spending, suggesting that while investments in health services are vital, income remains a stronger determinant of health improvements.Collectively, these studies underscore that the relationship between economic growth and health expenditure is often bidirectional and context-specific, shaped by mediating factors such as institutional quality, demographic transitions, and the efficiency of health systems. Nevertheless, a significant research gap persists in understanding how India's federal structure influences this relationship. Health is constitutionally a state subject under the Seventh Schedule of the Indian Constitution, assigning the majority of health policy responsibilities to state governments. Consequently, stark disparities exist in health spending and developmental outcomes across states.

Despite this, there is a surprising paucity of robust, state-level causal analyses that account for these differences.
This gap is particularly critical given India's vast socio-economic diversity and decentralized governance model. A nuanced understanding of how individual states' health expenditures influence their economic trajectories is essential for crafting effective and equitable fiscal and health policies. In light of this, the present study seeks to address this deficiency by examining the causal relationship between economic growth and public health expenditure across twenty major Indian states. The study employs the Toda-Yamamoto (T-Y) Causality Test, a robust econometric technique capable of analyzing non-stationary time series data, to uncover directional linkages and offer evidence-based insights for policy formulation.

Section-III: Data Sources and Econometric Methods
This study utilizes secondary data spanning the period from 1980–1981 to 2021–2022, covering a comprehensive 42-year timeframe. The data set encompasses twenty major Indian states, namely: Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Nagaland, Odisha, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh, and West Bengal. A forty-two-year period of study has been takento ensuring statistical robustness and reliability, while also facilitating the identification of long-term trends, structural transformations, economic cycles, and environmental shifts that may not be discernible over shorter periods.The primary sources of secondary data include the Reserve Bank of India's annual publication State Finances: A Study of Budgets and various issues of the RBI Bulletin. The selection of these data sources is grounded in their credibility, consistency, and comprehensive coverage of fiscal and macroeconomic variables relevant to the states under study.

To ensure methodological rigor, the data structure has been analyzed using statistical and econometric software such as EViews. A series of advanced econometric tests have been employed to validate the data and explore the dynamic relationships among variables. Specifically, Unit Root Testsnamely the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) testshave been applied to examine the stationarity properties of the time series data. These tests are critical for avoiding spurious regression results and ensuring the validity of time series analyses (Dickey & Fuller, 1979; Phillips & Perron, 1988; Kwiatkowski et al., 1992; McCoskey & Selden, 1998).

To assess the existence of long-run equilibrium relationships among the variables, the Johansen Cointegration Test has been utilized. This test is particularly suitable for multivariate systems, offering insights into the number of cointegrating vectors and the nature of long-term interactions (Johansen, 1988, 1995; Bédia & Dumont, 2008).Additionally, the Toda–Yamamoto (T-Y) causality test has been implemented to determine the direction of causality without the need for pre-testing for cointegration or stationarity. This approach enhances robustness and reduces the risk of model misspecification (Toda & Yamamoto, 1995; Oz Yilmaz et al., 2022).In sum, the methodological frameworkrooted in a robust dataset and advanced econometric techniquesensures the credibility and depth of the empirical findings, supporting a nuanced understanding of the temporal and spatial dynamics across Indian states.

III.a: Augmented Dickey-Fuller Test (ADF)

The unit root of the time series is tested using the ADF test. The present study uses this test under the assumption that there may be a relationship between the error terms. The ADF model shows that the DF test has undergone a small adjustment.

$$\Delta Y_t = \beta_1+\beta_2 t+\delta Y_{t-1}+\sum \alpha_i \Delta Y_{t-i}+u_t \quad \text{...(1.1)}$$

Where;

- ΔY_t: First difference of the dependent variable Y_t,
- β_1: Constant (intercept)
- $\beta_2 t$: Time trend component,
- δY_{t-1}: Lagged level of Y (tests for stationarity)
- $\sum \alpha_i \Delta Y_{t-i}$: Sum of lagged differences to control for autocorrelation,
- ut : Error term

In this equation lagged values of the dependent variable are added to the explanatory variable, which is different from its previous form (Dickey-Fuller). The intercept term in this case is β_1, and the coefficient terms are β_2, δ, and α_i.

The unit root or non-stationery status of the series is the null hypothesis for the ADF test. Additionally, τ (tau) statistics were used to test the null hypothesis, indicating that the series may be stationary.If the estimated τ value is higher than the tabulated τ value, the null hypothesis will be rejected. A series is referred to as integrated of order zero, or I (0), if it becomes stationary at particular levels. The series will be called integrated of order 1, or I (1), if it stays stationary after the first difference is calculated. Therefore, if d time differentiation is used to make a series stable, it can be said to be integrated of order d, or I(d), in general form.

III.b: The Philips Perron Test

An alternative (non-parametric) unit root test approach was provided by Phillips and Perron (1990) to control the serial correlation in uni-variate data. The PP technique adjusts the t-ratio of the α-coefficient and calculates the non-augmented DF test equation (1.2) to guarantee that the test statistic's asymptotic distribution is unaffected by serial correlation. On this statistic, the PP test is based:

$$\Delta Y_t = \alpha+\beta t+\gamma Y_{t-1}+\sum_{i=1}^{p} \delta_i \Delta Y_{t-i}+\varepsilon t \quad \text{...(1.2)}$$

Where:

- Y_t is the time series variable (e.g., medical and public health expenditure or NSDP) at time *t*.
- ΔY_t is the first difference of the variable Y at time t,
- α is a constant (intercept),
- β_t represents a deterministic time trend,
- γY_{t-1} is the lagged level of Y,
- $\sum_{i=1}^{p} \delta_i \Delta Y_{t-i}$ is the sum of lagged first differences up to lag p,
- ε_t is the error term (white noise)

The time series variable Yt has a unit root, which shows non-stationarity, according to the Phillips-Perron test's null hypothesis. The test statistic is calculated using the regression coefficients and then compared to crucial values from statistical tables to establish the relevance of the unit root.

To reject the null hypothesis that the time series variable is stationary after differencing, the test statistic must be greater than the critical values. The time series variable may not be stationary if the test statistic is within the critical values, which prevents the null hypothesis from being rejected.

III.c: Johansen Cointegration Test.

The Johansen cointegration test is used by statisticians to ascertain whether there is a long-term link or cointegration between several time series variables. This approach is frequently used by econometricians to ascertain whether non-stationary variables cointegrate. The following is the equation for the Johansen cointegration test:

$$\Delta Y_t = \Pi Y_{t-1} + \Gamma 1 \Delta Y_{t-1} + \Gamma 2 \Delta Y_{t-2} + ... + \Gamma p-1 \Delta Y_{t-(p-1)} + \varepsilon_t \ldots\ldots (1.3)$$

Where:

- Y_t is a vector of K non-stationary time series variables at time t.
- ΔY_t represents the first difference of Y_t, which is often used to transform non-stationary variables into stationary ones.
- Π is a matrix of cointegration coefficients to be estimated.
- $\Gamma_1, \Gamma_2, ..., ..., \Gamma_{p-1}$ are matrices of coefficients of lagged differences of Y_t.
- εt is a vector of error terms assumed to be white noise.
- According to standards like the Akaike Information Criterion (AIC), **p** is the lag length.

The Johansen cointegration test involves estimating the parameters of a given equation and comparing the alternative hypothesis of cointegration with the null hypothesis of no cointegration. The number of cointegrating vectors, or the rank of the cointegration matrix Π, is determined by the test using eigenvalues and likelihood ratio statistics.

An equation with the variables represented as Yt and the parameters predicted to determine a long-run relationship between them would be used to test for cointegration between economic growth and medical and public health spending.

III.d: Toda–Yamamoto (T-Y) Causality Test

The modified Wald statistics (MWALD) developed by Toda-Yamamoto (1995), commonly referred to as the augmented Granger causality test is applied in this work to fix in which way the variables are causally related. This causality test, which again relies on basic Granger causality, has the key advantage of being able to handle both I (0) and I (1) variables without being constrained by the need that variables be cointegrated. In another words, it is particularly useful when the variables are non-stationary or cointegrated. It is an improvement over the traditional Granger causality test, which doesn't consider these possibilities. It is also advantageous because it reduces the risk of misidentifying the integration order and improves Granger causality testing (Toda & Yamamoto,1995).

The present study starts by creating a VAR model with maximum order on integration (dmax) plus latency (k). One crucial need for T-Y causality is that extra lag factors be included in the test so that the null hypothesis of lagged variables is jointly different from zero (Zapata & Rambaldi 1997). The causality test T-Y variant is represented in the system that follows.

$$Y_t = \alpha_0 + \sum^{k} \alpha_{1i} Y_{t-1} + \sum^{k} \beta_{1i} X_{t-1} + u_{1t} \ldots\ldots (1.4)$$

$$X_t = \gamma_0 + \sum_{i=1}^{k} \gamma_{1i} X_{t-1} + \sum_{i=1}^{k} \tau_{1i} Y_{t-1} + u_{2t} \ldots\ldots(1.5)$$

It may be inferred from above equations that causality flows from X_t to Y_t when $\beta_{1i} \neq 0$, i= 1……k. Similar to this, causality flows from Y_t to X_t in equations (1.4 to 1.5) if ㄹ1i ≠ 0, i= 1…..k -Toda – Yamamoto (T-Y) Causality Test.

Section-IV: Empirical Results and Discussion

Empirical Results: The empirical results are as follows:

Table-1: Descriptive Statistics of NSDP and Medical and Public Health Expenditure

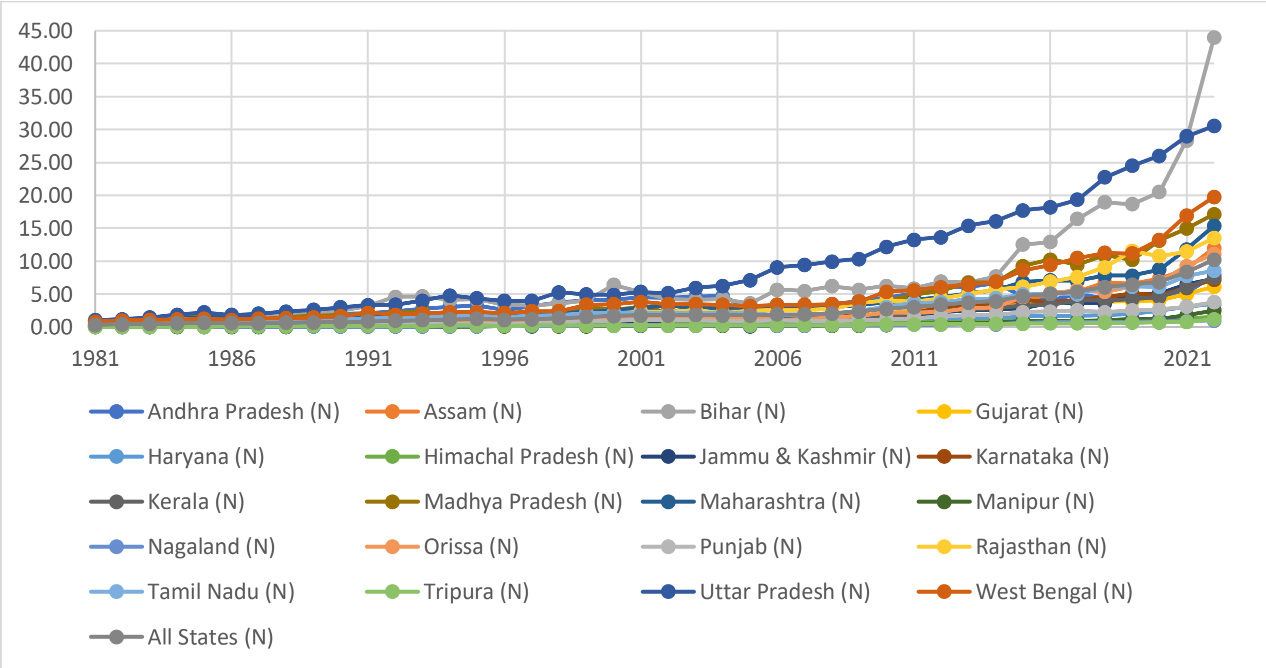
State	NSDP						Medical & Public Health Expenditure					
	Mean	**SD**	**Ku**	**Sk**	**Min.**	**Max.**	**Mean**	**SD**	**Ku**	**Sk**	**Min.**	**Max.**
Andhra Pradesh	43000.62	34727.83	-0.74	0.82	10216	117464	194000.93	44633411994	1.90	1.42	11198	924067
Assam	35467.10	11945.59	0.47	1.28	22764	65726	108576.21	29871881130	5.67	2.34	3563	790432
Bihar	15262.07	7020.49	-0.81	0.75	7430	29798	158419.17	62906159949	8.95	2.80	6659	1262471
Gujrat	63191.07	45745.60	-0.02	1.10	19961	170384	180132.10	60381403287	3.31	1.92	7364	1047562
Haryana	74460.05	46393.34	-0.46	0.95	27938	172657	95543.95	21331525256	3.93	2.08	3670	614306
Himachal P	62583.69	38428.09	-0.56	0.85	22526	143640	46986.45	3158016692	1.62	1.54	2406	222708
J&K	44283.83	12338.27	-0.48	0.87	29394	72574	88817.10	15885961270	3.77	2.03	2691	534164
Karnataka	67699.29	41728.65	-0.21	0.96	24169	164471	200590.43	78737899516	3.33	1.94	7043	1187307
Kerla	65366.48	41569.71	-0.78	0.78	23262	148810	177730.52	65493614426	4.01	2.04	6443	1121848
M.P.	28539.40	15413.34	-0.45	0.81	11690	61534	184384.05	67126743356	3.03	1.93	11751	1056261
Maharashtra	66667.07	39909.05	-0.95	0.70	23681	142211	353122.81	2.28076E+11	4.08	2.02	16155	2133371
Manipur	31992.67	9758.17	-1.01	0.51	19242	51211	16809.52	679705288.8	6.62	2.42	291	124554

Nagaland	35863.62	18973.13	-1.03	0.73	14380	73361	16028.43	414913789	1.19	1.55	1067	72225
Odisha	37511.00	18647.47	-0.18	1.02	18317	81178	124979.74	40775076540	5.56	2.36	5491	903916
Punjab	63534.79	27514.03	-0.70	0.78	30266	118487	94735.62	12508628311	1.65	1.55	4891	448936
Rajasthan	39911.93	19824.94	-0.84	0.70	16569	80545	201212.33	78088937488	2.41	1.82	7965	1091190
T.N.	62669.64	41715.89	-0.56	0.87	19415	154557	249558.24	1.08981E+11	2.52	1.78	10481	1328197
Tripura	32742.38	24286.90	-0.35	0.97	10017	85210	16120.48	499960444.9	5.03	2.16	408	103627
U.P.	24990.52	9099.81	-0.63	0.81	14418	43420	303484.36	1.30992E+11	1.20	1.50	14931	1326128
West B	36272.36	17596.88	-1.09	0.52	15471	69890	240801.02	1.02961E+11	3.71	1.99	13441	1383101
All India	932009.57	520010.16	-0.58	0.86	391793	2037078	3476881.86	2.39992E+13	3.59	1.99	139045	20923014

Note: *Author's own calculation, SD – standard deviation, Ku- Kurtosis, Sk- Skewness*

The descriptive statistics for NSDP and medical and public health spending are displayed in **Table 1** together with the results of central tendency. The mean NSDP for all of India is 932,009.57, which is the average economic output that state-specific NSDPs are centered around. The substantial variation in NSDP between states is reflected in the high standard deviation of ₹520,100.16. While the majority of states have NSDPs below the national average, a few economically powerful states, including Maharashtra, Tamil Nadu, and Karnataka, have much higher NSDP values, which raises the average, according to a positive skewness value of 0.86. The NSDP's maximum and minimum ranges, which further emphasize the stark differences in state-to-state economic performance, are 2037078 and 391793. Furthermore, compared to a normal distribution, a fairly flat distribution is indicated by a kurtosis score of -0.58, which shows less clustering around the mean. The national average for medical and public health spending is ₹3,476,881.86, with a significant standard deviation of ₹2.40×10^{13}, highlighting the stark variations in state-by-state spending patterns. A skewness of 1.99 indicates considerable positive skewness, meaning that while most states spend less than the average, a small number of outliers with disproportionately high spending raise the mean. The leptokurtic distribution, shown by a kurtosis of 3.59, suggests that the data are more peaked than the normal distribution, with the majority of the values concentrated around the mean and a small number of extreme values. However, the lower and upper limits for medical and public health spending fall between 20923014 and 139045, which reflects the many states' varying financial capacity and priorities. A noteworthy trend is also seen in **figure 1**, which shows a sharp rise in the proportion of medical and public health spending to NSDP in 20 major Indian states and the country overall, especially after 2001. States with the greatest notable increase are Andhra Pradesh and Bihar. Many factors contributed to this increase, such as increased political commitment, policy changes, growing healthcare demands, and initiatives to improve historically poor health systems. Fiscal changes after 2001 had a greater visible impact in states with low baseline spending because even modest increases resulted in significant percentage rises

Figure-1: Percentage of Medical and Public Health Expenditure to NSDP for 20 major states and all-states of India



Note:*Based on Author's calculation*

Long-Run Cointegration of the Medical & Public Health Expenditure and Net State Domestic Product among twenty Indian States

After the initial regression models, the present study used the Johansen-Cointegration test to analyze the long-term cointegration between medical and public health spending and Net State Domestic Product (NSDP) in these states. According to the computed trace statistics and eigenvalues, Odisha and Tamil Nadu have 1-1 cointegrating vectors during the 1980–81 to 2021–22 timeframe, indicating the possibility of long-term cointegration.

Toda-Yamamoto CausalityTest Results

In order to establish the path of causality between economic growth (NSDP) and medical and public health expenditure across twenty major Indian states from 1980–1981 to 2021–2022, the current study additionally employed the Toda–Yamamoto (1995) causality test.From 1980–81 to 2021–22, the stationary of NSDP and medical and public health expenditures in 20 Indian states have been analyzed.At the first difference level, the NSDP and medical and public health spending in each of the 20 Indian states have also been found to be stationary, indicating an integrated order of 1, or I (1). The process by which a t-statistic is deemed negative at a 5% significance level.

Prior to conducting the causality test, the lag structure of the VAR models is determined using the AIC criterion proposed by Akaike in 1974. The empirical findings show that during the period 1980-81 to 2021-22,the presence of bi-directional causality has been noticed (NSDP is the driver of medical and public health expenditure and medical and public health expenditure is the driver of NSDP) in the case of Uttar Pradesh. While, unidirectional causalities (NSDP is the driver of medical and public health expenditure) have been observed for the Assam and Jammu & Kashmir. Converseuni-directional causation (medical and public health expenditure is the driver of NSDP) exist in the cases of Andhra Pradesh, Gujarat, Himachal Pradesh, Karnataka, Maharashtra, Manipur, Nagaland, Punjab, Rajasthan, Tamil Nadu and Tripura and all-states as well.

Meanwhile, empirical results suggest that independent causal or non-causal relationship exists between NSDP and medical & public health expenditure in cases of Bihar, Kerala, Madhya Pradesh and Odisha during the study period (1980-81 to 2021-22).It is because the probability value is insignificant at 1%, 5% & 10% level. Hence, NSDP does not Granger cause to medical & public health expenditure and medical & public health expendituredoes not Granger cause to NSDP.
The results indicate that in Andhra Pradesh, Gujarat, Himachal Pradesh, Karnataka, Maharashtra, Manipur, Nagaland, Punjab, Rajasthan, Tamil Nadu, and Tripura, as well as throughout India, the NSDP increases in tandem with increases in medical and public health spending. Additionally, as medical and public health spending rises in these states, human development, social welfare, and other indicators of economic growth also rise.

Table-2: Toda-Yamamoto CausalityTestSummary for the period from 1980-81 to 2021-22.

Uni-Directional Causality NSDP Cause to MPHEx	**Conversely Uni-Directional Causality that means MPHEx Cause to NSDP**	**Bi-directional Causality NSDP cause to MPHEx &MPHEx cause to NSDP**	**No Causality between NSDP & MPHEx**
Assam***, Jammu and Kashmir***.	Andhra Pradesh***, Gujrat**, Himachal Pradesh*, Haryana*, Karnataka***, Maharashtra*,Manipur***, Nagaland***, Punjab**, Rajasthan*, Tamil Nadu*, Tripura*and All India*.	Uttar Pradesh**.	Bihar, Kerala, Madhya Pradesh and Odisha

Note:*1%, **5%and ***10%level of significance.

Table-3: Toda-Yamamoto Causality Test Summary for the period from 1980-81 to 2021-22

State	**H0**	**Lag**	**χ2 (CHAI^2)**	**PValue**	**Decision**
Andhra P	NSDP→MPHEx	3.374083	2	0.1851	Accept
	MPHEx→NSDP	5.792003	2	0.0552	Reject***
Assam	NSDP→MPHEx	5.518182	2	0.0633	Reject***
	MPHEx→NSDP	2.812716	2	0.2450	Accept
Bihar	NSDP→MPHEx	1.217464	2	0.5440	Accept
	MPHEx→NSDP	2.441163	2	0.2951	Accept
Gujrat	NSDP→MPHEx	1.154292	2	0.5615	Accept
	MPHEx→NSDP	7.279144	2	0.0263	Reject**
Himachal P	NSDP→MPHEx	11.35545	2	0.0034	Reject*
	MPHEx→NSDP	0.606611	2	0.7384	Accept

Haryana	NSDP→MPHEx	1.849513	2	0.3966	Accept
	MPHEx→NSDP	10.90887	2	0.0043	Reject*
J & K	NSDP→MPHEx	8.184960	2	0.0167	Reject***
	MPHEx→NSDP	1.229968	2	0.5406	Accept
Kerala	NSDP→MPHEx	1.839035	2	0.3987	Accept
	MPHEx→NSDP	2.485375	2	0.2886	Accept
Karnataka	NSDP→MPHEx	2.246708	2	0.3252	Accept
	MPHEx→NSDP	5.635764	2	0.0597	Reject***
Maharashtra	NSDP→MPHEx	0.607684	2	0.7380	Accept
	MPHEx→NSDP	14.31692	2	0.0008	Reject*
Manipur	NSDP→MPHEx	0.563335	2	0.7545	Accept
	MPHEx→NSDP	5.249040	2	0.0725	Reject***
M.P.	NSDP→MPHEx	4.204410	2	0.1222	Accept
	MPHEx→NSDP	1.917624	2	0.3833	Accept
Nagaland	NSDP→MPHEx	2.509121	2	0.2852	Accept
	MPHEx→NSDP	5.523342	2	0.0632	Reject***
Odisha	NSDP→MPHEx	3.301063	2	0.1919	Accept
	MPHEx→NSDP	4.180569	2	0.1237	Accept
Punjab	NSDP→MPHEx	0.632173	2	0.7290	Accept
	MPHEx→NSDP	8.719611	2	0.0128	Reject**
Rajasthan	NSDP→MPHEx	2.225133	2	0.3287	Accept
	MPHEx→NSDP	10.54309	2	0.0051	Reject*
Tamil Nadu	NSDP→MPHEx	0.440565	2	0.8023	Accept
	MPHEx→NSDP	16.31645	2	0.0003	Reject*
Tripura	NSDP→MPHEx	3.867836	3	0.2761	Accept
	MPHEx→NSDP	16.90144	3	0.0007	Reject*
U.P.	NSDP→MPHEx	3.619603	1	0.0571	Reject**
	MPHEx→NSDP	5.007064	1	0.0252	Reject**
West Bengal	NSDP→MPHEx	1.309626	1	0.2525	Accept
	MPHEx→NSDP	1.295983	1	0.2549	Accept
All India	NSDP→MPHEx	1.971514	2	0.3732	Accept
	MPHEx→NSDP	9.570277	2	0.0084	Reject*

Note:*1%, **5%and ***10%level of significance.
NSDP = Net State Domestic Product and MPHEx = Medical & Public Health Expenditure

Discussion
The empirical analysis for the years 1980–81 to 2021–22, based on unit root testing, demonstrates that, for all 20 Indian states, Medical and Public Health Expenditure and Net State Domestic Product (NSDP) are integrated of order one, I (1). Furthermore, NSDP and health spending have a long-term equilibrium relationship, according to Johansen cointegration tests. This is in line with previous research that indicates health spending has a significant role in economic growth (Bloom et al., 2004; Barro, 1996).

Toda-Yamamoto causality tests provide a deeper understanding of the directionality of this relation. NSDP and medical and public health spending in Assam and Jammu & Kashmir have been shown to be unidirectional relation. This suggests that economic prosperity may be the primary driver of increased spending on public and medical health in some jurisdictions. This result supports the idea that public spending increases in proportion to economic growth, as proposed by Wagner's Law. Importantly, the National Health Accounts Estimates (2015–16) reinforce this notion by demonstrating how increased economic capacity in these regions has led to better healthcare facilities and services, which are crucial components of the movement toward Universal Health Coverage (UHC).

Additionally, focused central government funding in economically disadvantaged states like Assam and J&K may have reinforced this growth-expenditure link, reflecting a coordinated policy commitment on equity and infrastructure development (La Forgia & Nagpal, 2012). The expenditures in these states are not just the outcome of NSDP expansion, but are part of a broader developmental strategy aimed at reducing regional health disparities. But in twelve states: Andhra Pradesh, Gujarat, Himachal Pradesh, Karnataka, Maharashtra, Manipur, Nagaland, Punjab, Rajasthan, Tamil Nadu, and Tripura—as well as all-India, the causality pattern is reversed, indicating that public health spending drives economic expansion. This result is supported by endogenous growth theories (e.g., Lucas, 1988; Romer, 1990), which contend that investments in human capital, including health, increase productivity, inducement in private capital, and foster long-term economic growth. These states' ongoing focus on health in public policy is evidenced by improvements in infrastructure and health outcomes (NITI Aayog, Health Index, Round III, 2018–19).

Interestingly, Uttar Pradesh exhibits bi-directional causality, suggesting that health spending and economic growth interact dynamically. The World Health Organization's (WHO, 2001) "virtuous cycle" idea, which holds that improvements in health lead to financial advantages that subsequently finance further health investments, is best illustrated by this mutually beneficial relationship. This finding highlights the importance of striking a balance between economic and health sector investments to support sustained growth.Lastly, diverse governance goals, external financial dependencies, and distinct socioeconomic circumstances that separate health spending from direct economic performance measures may be the cause of the absence of causality in states like Bihar, Kerala, Madhya Pradesh, and Odisha. Prior research has also shown that the relationship between the health and the economy is frequently weak or nonlinear in areas with long-standing structural issues or policy priorities that are not aligned (Drèze & Sen, 2013).

Overall, this study supports the complex, context-specific relations between health spending and economic development. Future research could gain a better understanding of the mechanisms at play by delving deeper into sub-national data on demographic changes, governance quality, and policy interventions.

Section-V: Conclusion and Policy Suggestion

In view of the analysis and discussion of the study, the present study concludes that in the study period there is uni-directional causality (NSDP is the driver of medical and public health expenditure) for Assam and Jammu & Kashmir. On the contrary, uni-directional causation (medical and public health expenditure is the driver of NSDP) exists in the case of Andhra Pradesh, Gujarat, Himachal Pradesh, Karnataka, Maharashtra, Manipur, Nagaland, Punjab, Rajasthan, Tamil Nadu, and Tripura, as well as at the all-India level. Moreover, there is bi-directional causality only in the case of Uttar Pradesh. Lastly, no causality was noted in the cases of Bihar, Kerala, Madhya Pradesh, and Odisha.

Thus, from the above, the present study argues that health expenditure should be included in the management of political economy of the state rather than occurring in a vacuum. While increasing it alone will not improve health outcomes or increase income/NSDP, Indian states must ensure to act with positive determination on a large scale. Apart from this, each state has its own unique challenges; most health policies are increasingly focusing on universal healthcare, improving access to services, strengthening primary healthcare, and addressing public health emergencies. However, disparities still exist, especially in rural areas, and states continue to work toward greater healthcare inclusivity. Because of this, if NSDP results in higher healthcare expenditures, the policy's focus would likely be on improving health outcomes through preventive measures, equitable access to services, efficient use of resources, and long-term financial sustainability to ensure that health-related costs do not undermine the broader sustainability goals.

Alternatively, if spending on medical and public health raises NSDP, the policy response will probably concentrate on increasing these sectors' economic contribution through reform, investment, public-private partnerships, and a focus on health as a component of human capital development. The ultimate objective would be to make sure that healthcare spending contributes significantly to economic growth in addition to improving health outcomes.

Limitation and Future Scope of the Study: Firstly, it relies on secondary data which may be subject to inconsistencies across states in terms of reporting standards and time lags. Secondly, the study does not account for informal healthcare expenditure or out-of-pocket expenses, which are substantial in many states and may significantly influence causality dynamics. Additionally, the analysis does not consider the qualitative aspects of healthcare such as service quality or health outcomes beyond expenditure levels and economic output.

For future research, it would be valuable to explore state-level panel data models incorporating variables such as education, infrastructure, and demographic factors to better understand the multifaceted relationship between health expenditure and economic growth. Further studies could also assess the impact of specific health programs or interventions and analyze causality over a longer or more recent time frame, considering the post-pandemic scenario and its implications on health and economy. Moreover, integrating spatial analysis could reveal regional spillover effects and interdependencies between states, offering more nuanced policy insights.

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