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# An Econometric Investigation Of Health Financing Indicators In India: Evidence From Unit Root And Regression Analysis

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***Abstract***
*Health financing plays a pivotal role in improving healthcare accessibility, reducing financial hardship, and achieving sustainable health outcomes. This study investigates the dynamic relationship among key health financing indicators in India using annual time-series data spanning 2000–2022. Secondary data were obtained from the World Health Organisation (WHO) Global Health Expenditure Database and the World Bank World Development Indicators (WDI). The study focuses on major health financing indicators, including Domestic General Government Health Expenditure (GGHE), Out-of-Pocket (OOP) Expenditure, and Current Health Expenditure (CHE). To ensure the robustness of the empirical analysis, a combination of descriptive statistics and econometric techniques was employed. The stationarity properties of the variables were examined using the Augmented Dickey–Fuller (ADF) unit root test, while the degree of association among the variables was assessed through the Pearson correlation matrix. The determinants of Current Health Expenditure were analysed using multiple linear regression, supported by ANOVA, Durbin–Watson, and Jarque–Bera diagnostic tests.*
*The ADF results indicate that the selected variables are non-stationary at levels but become stationary after first differencing, confirming their integration of order one, I(1). The correlation analysis reveals strong positive associations among government health expenditure indicators and a significant negative relationship between public health expenditure and Out-of-Pocket expenditure, suggesting that increased public investment contributes to reducing households' financial burden. Multiple regression results demonstrate that Out-of-Pocket expenditure and government health expenditure as a percentage of GDP significantly influence Current Health Expenditure, whereas government health expenditure per capita does not exert a statistically significant effect. The model explains approximately 85% of the variation in Current Health Expenditure and is statistically significant overall. The findings underscore the importance of sustained public investment in healthcare financing to strengthen financial protection, reduce reliance on direct household spending, and advance India's progress towards Universal Health Coverage (UHC).*

***Keywords:*** *Augmented Dickey–Fuller Test, Universal Health Coverage, Out-of-Pocket Expenditure, Correlation Analysis, Financial Protection*

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## I. Introduction

Health is universally recognised as a fundamental component of human capital and a critical determinant of sustainable economic development. A healthy population contributes to higher labour productivity, improved educational attainment, increased income generation, and enhanced social well-being. Consequently, investment in healthcare is no longer viewed merely as a social expenditure but as a strategic investment that promotes long-term economic growth and national development. Over the past two decades, many countries have increased public spending on healthcare to strengthen health systems, improve access to quality medical services, and achieve the objectives of Universal Health Coverage (UHC). However, the effectiveness of health financing largely depends on the adequacy, efficiency, and sustainability of financial resources allocated to the health sector. India has experienced significant economic growth since the early 2000s; however, its health financing system has long been characterised by relatively low public health expenditure and a high reliance on out-of-pocket (OOP) payments. Historically, OOP expenditure has constituted a major share of total health expenditure, exposing many households to financial hardship and impoverishment due to medical expenses. Recognising these challenges, the Government of India has implemented several policy initiatives, including the National Health Policy (2017), the Ayushman Bharat Programme, the establishment of Health and Wellness Centres, and the expansion of publicly financed health insurance schemes. These reforms aim to increase government investment in healthcare, strengthen primary healthcare services, and improve financial protection for the population.

Consequently, recent years have witnessed a gradual increase in public health expenditure and a decline in the share of OOP expenditure, reflecting a shift towards more equitable healthcare financing. Despite these policy advancements, important questions remain regarding the dynamics of health financing indicators in India. Understanding whether government health expenditure, current health expenditure, and out-of-pocket expenditure exhibit stable long-run behaviour and how these variables interact is essential for designing evidence-based health financing policies. While numerous studies have examined the relationship between health expenditure and economic growth, relatively fewer studies have applied rigorous time-series econometric techniques to investigate the statistical properties and interrelationships among health financing indicators in the Indian context. Examining these relationships is particularly relevant for evaluating the effectiveness of public health financing reforms and identifying the determinants of current health expenditure.

Against this background, the present study investigates the behaviour of key health financing indicators in India using annual data for the period 2000–2022. Specifically, the study examines Domestic General Government Health Expenditure (GGHE), Out-of-Pocket (OOP) Expenditure, and Current Health Expenditure (CHE). The analysis employs descriptive statistics to summarise the characteristics of the data, the Augmented Dickey–Fuller (ADF) unit root test to examine stationarity, the Pearson correlation matrix to assess the strength and direction of associations among the variables, and multiple regression analysis to identify the determinants of current health expenditure. In addition, diagnostic tests, including ANOVA, the Durbin–Watson test for autocorrelation, and the Jarque–Bera test for normality, are used to ensure the robustness and reliability of the estimated model.

The findings of this study are expected to contribute to the growing literature on health financing by providing empirical evidence on the statistical behaviour and determinants of health expenditure in India. The results will offer valuable insights for policymakers, researchers, and health economists in formulating strategies to strengthen public health financing, reduce dependence on out-of-pocket expenditure, and accelerate India's progress towards Universal Health Coverage (UHC). By combining time-series econometric techniques with health financing indicators, the study provides a comprehensive assessment of the evolving structure of healthcare financing in India and highlights the importance of sustained public investment in achieving equitable and efficient health systems.

## II. Review Of Literature

The following review highlights recent contributions relevant to the present study.

**Rahman and Rahim (2025)** investigated the impact of public expenditure on healthcare and education on human development in India, Pakistan, and Bangladesh using Vector Autoregression (VAR) analysis. The study reported that higher public health expenditure significantly improved human development outcomes in India, highlighting the importance of sustained government investment in the health sector.

**The World Bank (2024)** examined government health spending trends across low- and middle-income countries in the aftermath of the COVID-19 pandemic. The report emphasised that although health expenditure increased during the pandemic, fiscal pressures have constrained sustained investment. It recommended expanding domestic public financing and improving expenditure efficiency to achieve Sustainable Development Goal (SDG) targets and Universal Health Coverage.

**The World Health Organisation (WHO, 2025)** highlighted that health financing is fundamental to achieving Universal Health Coverage through efficient revenue generation, risk pooling, and strategic purchasing. For India, the report noted that government health expenditure has increased steadily, while the share of out-of-pocket expenditure has declined. Nevertheless, public expenditure remains below the National Health Policy target of 2.5 percent of GDP, indicating the need for further fiscal commitment.

**Nikam and Kothe (2025)** analysed India's fiscal sustainability and development strategy using econometric modelling. Their findings suggested that sustained public investment in health and human capital is essential for achieving the objectives of *Viksit Bharat 2047*. The study recommended strengthening fiscal capacity and increasing government expenditure on healthcare to promote inclusive economic growth.

**Arumugam et al. (2026)** conducted a systematic review of government health policies and out-of-pocket medicine spending in India. The review concluded that although policy initiatives have improved financial protection, medicine-related out-of-pocket expenditure continues to impose a considerable burden on low-income households. The authors recommended strengthening public financing and improving access to affordable medicines.

**Sharma (2026)** examined the effectiveness of publicly funded health insurance schemes in reducing out-of-pocket expenditure in India. Using empirical evidence from multiple states, the study found that publicly financed health insurance significantly reduced household financial burden and enhanced healthcare utilisation, although regional disparities persisted in programme implementation.

**Krishna and Joy (2026)** reviewed the effectiveness of health insurance programmes in reducing catastrophic health expenditure in India. Their systematic review found that schemes such as PM-JAY have

improved financial protection, yet significant gaps remain in outpatient coverage and access among vulnerable populations. The study emphasised expanding insurance coverage and strengthening public healthcare infrastructure.

**Sinha (2025)** investigated the macroeconomic determinants of public health expenditure in India using an Autoregressive Distributed Lag (ARDL) approach based on annual time-series data. The study established a long-run relationship between public health expenditure, GDP growth, fiscal capacity, and demographic variables. The findings indicated that economic growth and government fiscal strength significantly influence public health expenditure, while the ARDL model confirmed stable long-run dynamics among the variables. The study recommends sustained government investment in healthcare and evidence-based fiscal planning to ensure equitable and sustainable health financing in India.

**The World Bank (2025**) presented methodological evidence on forecasting government health expenditure using macro-fiscal variables and regression techniques. The report demonstrated that government health expenditure is closely associated with GDP growth and fiscal capacity, highlighting the usefulness of econometric approaches for analysing long-term health financing trends and informing policy decisions.

**Prinja et al. (2024)** developed a responsive financing framework for district hospitals in India with the objective of improving efficiency, accountability, and financial sustainability in public healthcare delivery. Using health financing and provider-payment analyses, the study proposed a blended financing model integrating strategic purchasing and performance-based budgeting. The findings suggest that efficient allocation of public health resources enhances service quality while reducing financial inefficiencies in district hospitals. The study emphasises that strengthening government health financing mechanisms is essential for achieving Universal Health Coverage (UHC), thereby supporting the need for increased public investment in India's healthcare system.

**Bera et al. (2024)** examined income-related inequalities in catastrophic health expenditure in India using nationally representative survey data. Employing decomposition and regression techniques, the study found that poorer households experience disproportionately higher catastrophic health expenditures because of inadequate financial protection and heavy dependence on out-of-pocket payments. The authors recommended expanding public health financing, strengthening financial protection mechanisms, and improving access to publicly funded healthcare services to reduce socioeconomic disparities in healthcare utilisation.

**Objectives of the Study**

The specific objectives are:

1. To examine the stationarity properties of selected health financing indicators in India using the Augmented Dickey–Fuller (ADF) unit root test for the period 2000–2022.
2. To analyse the relationship among key health financing indicators through Pearson correlation analysis, with particular emphasis on government health expenditure, current health expenditure, and out-of-pocket expenditure.
3. To identify the determinants of Current Health Expenditure (CHE) in India by employing multiple regression analysis and validating the model using diagnostic tests such as ANOVA, Durbin–Watson, and Jarque–Bera tests.

## III. Data Source And Methodology

The present study employs secondary time-series data covering the period 2000–2022 to examine the dynamics of health financing indicators in India. The data were collected from the World Health Organisation (WHO) Global Health Expenditure Database (GHED) and the World Bank's World Development Indicators (WDI), which are widely recognised as reliable sources for international health financing statistics. The study considers nine key health financing indicators, namely Domestic General Government Health Expenditure per Capita, PPP (current international $), Domestic General Government Health Expenditure (% of Current Health Expenditure), Out-of-Pocket Expenditure (% of Current Health Expenditure), Domestic General Government Health Expenditure (% of GDP), Domestic General Government Health Expenditure (% of General Government Expenditure), Current Health Expenditure (% of GDP), Current Health Expenditure per Capita, PPP (current international $), Domestic General Government Health Expenditure per Capita (current US$), and Current Health Expenditure per Capita (current US$). Descriptive statistics were first employed to summarise the characteristics of the selected variables. To ensure the suitability of the time-series data for econometric analysis, the Augmented Dickey–Fuller (ADF) unit root test was applied to examine the stationarity of each variable. The degree of association among the health financing indicators was then assessed using the Pearson correlation matrix. Furthermore, multiple linear regression analysis was employed to identify the determinants of Current Health Expenditure (% of GDP), with selected government health financing indicators serving as explanatory variables. The overall significance of the regression model was evaluated using the Analysis of Variance (ANOVA), while the Durbin–Watson test was used to detect autocorrelation and the Jarque–Bera test was applied to assess the

normality of the residuals. The empirical analysis was performed using IBM SPSS Statistics and STATA, ensuring the robustness and reliability of the estimated results.

**ADF (Augmented Dickey–Fuller) Unit Root Test**

Table 1.1. Augmented Dickey–Fuller (ADF) Unit Root Test Results for Log-Transformed Variables

| Variables (Log Form) | ADF at Level I(0) | p-value | ADF at First Difference I(1) | p-value | Order of Integration | Decision |
|---|---|---|---|---|---|---|
| ln (Domestic General Government Health Expenditure per Capita, PPP) | 0.894 | 0.9930 | -2.889 | 0.0467 | I(1) | Stationary at First Difference |
| ln (Domestic General Government Health Expenditure (% of Current Health Expenditure)) | -0.491 | 0.8937 | -3.284 | 0.0156 | I(1) | Stationary at First Difference |
| ln (Out-of-Pocket Expenditure (% of Current Health Expenditure)) | —* | —* | -2.928 | 0.0421 | I(1) | Stationary at First Difference |
| ln (Domestic General Government Health Expenditure (% of GDP)) | -0.096 | 0.9498 | -3.355 | 0.0126 | I(1) | Stationary at First Difference |
| ln (Domestic General Government Health Expenditure (% of General Government Expenditure)) | 0.734 | 0.9905 | -3.106 | 0.0261 | I(1) | Stationary at First Difference |
| ln (Current Health Expenditure (% of GDP)) | -2.269 | 0.1823 | -3.399 | 0.0110 | I(1) | Stationary at First Difference |
| ln (Current Health Expenditure per Capita, PPP) | 0.249 | 0.9749 | -2.991 | 0.0357 | I(1) | Stationary at First Difference |
| ln (Domestic General Government Health Expenditure per Capita, Current US$) | -0.632 | 0.8636 | -3.012 | 0.0338 | I(1) | Stationary at First Difference |
| ln (Current Health Expenditure per Capita, Current US$) | -1.300 | 0.6291 | -2.949 | 0.0400 | I(1) | Stationary at First Difference |

**Source:** *Author's calculations using STATA*

Table 1.1 presents the results of the Augmented Dickey–Fuller (ADF) unit root test conducted to examine the stationarity properties of the log-transformed health financing indicators for India over the period 2000–2022. At the level form, all variables exhibit p-values greater than 0.05, indicating the presence of a unit root and suggesting that the series are non-stationary. Therefore, the null hypothesis of a unit root cannot be rejected for any of the variables at their levels. This implies that the variables contain stochastic trends and are unsuitable for direct estimation in time-series models, as using non-stationary variables may lead to spurious regression results.

After transforming the variables into their first differences, the ADF test statistics become statistically significant, with all p-values falling below the 5% significance level. Specifically, the ADF statistics range from −2.889 to −3.399, and the corresponding p-values range from 0.0110 to 0.0467, confirming that all the variables become stationary after first differencing. Consequently, all the health financing indicators are integrated of order one [I(1)]. This finding indicates that although the variables are individually non-stationary in levels, they become stationary after first differencing, satisfying the stationarity requirement for advanced time-series econometric analysis. The results further justify proceeding with Johansen cointegration analysis to investigate the existence of a long-run equilibrium relationship among the variables. If cointegration is established, a Vector Error Correction Model (VECM) can be employed to capture both the long-run equilibrium and short-run adjustments. Alternatively, if the analysis focuses on a single dependent variable with multiple regressors and no variable is integrated of order two (I(2)), the Autoregressive Distributed Lag (ARDL) model is also an appropriate estimation technique.

**Table 1.2. Pearson Correlation Matrix of Health Financing Indicators in India**

| Variables | GGHE_PPP | GGHE_CHE | OOP | GGHE_GDP | GGHE_GGE | CHE_GDP | CHE_PPP | GGHE_USD | CHE_USD |
|---|---|---|---|---|---|---|---|---|---|
| GGHE_PPP | 1.000 | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| GGHE_CHE | 0.960*** | 1.000 | | | | | | | |
| OOP | -0.969*** | -0.994*** | 1.000 | | | | | | |
| GGHE_GDP | 0.955*** | 0.938*** | -0.941*** | 1.000 | | | | | |
| GGHE_GGE | 0.970*** | 0.955*** | -0.950*** | 0.951*** | 1.000 | | | | |
| CHE_GDP | -0.697*** | -0.810*** | 0.780*** | -0.568*** | -0.682*** | 1.000 | | | |
| CHE_PPP | 0.960*** | 0.877*** | -0.885*** | 0.867*** | 0.908*** | -0.678*** | 1.000 | | |
| GGHE_USD | 0.995*** | 0.970*** | -0.973*** | 0.944*** | 0.969*** | -0.745*** | 0.961**** | 1.000 | |
| CHE_USD | 0.940*** | 0.890*** | -0.886*** | 0.840*** | 0.897*** | -0.765*** | 0.984**** | 0.957*** | 1.000 |

**Note: *** indicates significance at the 1% level (p < 0.01). Sample size (N) = 23.**

**Abbreviations**

- GGHE_PPP = Domestic General Government Health Expenditure per Capita, PPP (Current International $)
- GGHE_CHE = Domestic General Government Health Expenditure (% of Current Health Expenditure)
- OOP = Out-of-Pocket Expenditure (% of Current Health Expenditure)
- GGHE_GDP = Domestic General Government Health Expenditure (% of GDP)
- GGHE_GGE = Domestic General Government Health Expenditure (% of General Government Expenditure)
- CHE_GDP = Current Health Expenditure (% of GDP)
- CHE_PPP = Current Health Expenditure per Capita, PPP (Current International $)
- GGHE_USD = Domestic General Government Health Expenditure per Capita (Current US$)
- CHE_USD = Current Health Expenditure per Capita (Current US$)

Table 1.2: Pearson correlation matrix reveals a strong association among India's health financing indicators during 2000–2022. Government health expenditure indicators are positively and significantly correlated with one another. For example, GGHE_PPP is almost perfectly correlated with GGHE_USD ($r = 0.995$, $p < 0.01$), indicating that both variables exhibit very similar movements over time. Likewise, CHE_PPP and CHE_USD are highly positively correlated ($r = 0.984$, $p < 0.01$). These strong positive relationships suggest that increases in government health expenditure are accompanied by increases in overall health expenditure per capita.

In contrast, Out-of-Pocket Expenditure (OOP) shows strong negative correlations with most government health expenditure indicators. For instance, OOP is negatively correlated with GGHE_CHE ($r = -0.994$, $p < 0.01$) and GGHE_PPP ($r = -0.969$, $p < 0.01$), implying that greater public financing of health is associated with a lower reliance on direct household payments. Additionally, Current Health Expenditure as a percentage of GDP (CHE_GDP) exhibits moderate negative correlations with most government expenditure indicators, suggesting differences in the behaviour of this aggregate expenditure measure. Overall, the high correlation coefficients indicate that many explanatory variables are closely related, which points to the possibility of multicollinearity. Therefore, it is advisable to conduct a Variance Inflation Factor (VIF) test before estimating any regression model.

**Table 1.3. ANOVA Results of the Multiple Regression Model**

| Source | Sum of Squares | df | Mean Square | F-value | p-value |
|---|---|---|---|---|---|
| Regression | 3.150 | 3 | 1.050 | 35.837 | 0.000*** |
| Residual | 0.557 | 19 | 0.029 | | |
| Total | 3.707 | 22 | | | |

**Source:** *Author's calculations using STATA*

***Dependent Variable:*** *Current Health Expenditure (% of GDP)*

***Predictors:*** *Domestic General Government Health Expenditure per Capita (PPP), Out-of-Pocket Expenditure (% of Current Health Expenditure), and Domestic General Government Health Expenditure (% of GDP).*

***Significant at the 1% level (p < 0.01).*

Table 1.3 ANOVA results indicate that the overall multiple regression model is statistically significant at the 1% level. The model yields an F-statistic of 35.837 with a corresponding p-value of 0.000, demonstrating that the explanatory variables jointly have a significant effect on Current Health Expenditure (% of GDP).

Therefore, the null hypothesis that all regression coefficients are simultaneously equal to zero is rejected. This confirms that the model provides a significantly better fit than a model with no predictors.

The analysis further shows that the Regression Sum of Squares (3.150) accounts for the majority of the Total Sum of Squares (3.707), while the Residual Sum of Squares (0.557) is relatively small. This indicates that the selected explanatory variables explain a substantial proportion of the variation in current health expenditure. However, although the overall model is statistically significant, the high VIF values reported in the coefficients table indicate severe multicollinearity among the independent variables. Consequently, the overall model fit is good, but the individual regression coefficients should be interpreted with caution. A revised model with fewer highly correlated predictors would improve the reliability and stability of the estimates.

**Table 1.4. Regression Coefficients for Determinants of Current Health Expenditure (% of GDP)**

| Predictor Variable | B | Std. Error | Standardized β | t-value | p-value | 95% Confidence Interval | Tolerance | VIF |
|---|---|---|---|---|---|---|---|---|
| Constant | -5.513 | 1.463 | — | -3.769 | 0.001*** | (-8.574, -2.451) | — | — |
| Domestic General Government Health Expenditure per Capita, PPP (Current International $) | -0.002 | 0.007 | -0.113 | -0.270 | 0.790 | (-0.016, 0.012) | 0.045 | 22.008 |
| Out-of-Pocket Expenditure (% of Current Health Expenditure) | 0.091 | 0.016 | 2.073 | 5.672 | 0.000*** | (0.058, 0.125) | 0.059 | 16.906 |
| Domestic General Government Health Expenditure (% of GDP) | 3.626 | 0.746 | 1.491 | 4.862 | 0.000*** | (2.065, 5.187) | 0.084 | 11.894 |

**Source:** *Author's calculations using SPSS*
***Dependent Variable:*** *Current Health Expenditure (% of GDP)*
***Note:*** **** indicates significance at the 1% level ($p < 0.01$).*

Table 1.4: The regression coefficients reveal that Out-of-Pocket (OOP) Expenditure and Domestic General Government Health Expenditure as a Percentage of GDP exert a positive and statistically significant influence on Current Health Expenditure (% of GDP). The coefficient of OOP expenditure (B = 0.091, $t = 5.672$, $p < 0.001$) indicates that a one-unit increase in out-of-pocket expenditure is associated with an increase of approximately 0.091 units in current health expenditure as a percentage of GDP, holding other variables constant. Similarly, government health expenditure as a percentage of GDP has a positive coefficient (B = 3.626, $t = 4.862$, $p < 0.001$), suggesting that greater public investment in health significantly raises the overall level of current health expenditure. In contrast, Domestic General Government Health Expenditure per Capita (PPP) has a negative but statistically insignificant coefficient (B = −0.002, $p = 0.790$), indicating that its independent contribution to current health expenditure is not statistically different from zero after controlling for the other explanatory variables. The confidence interval also includes zero, reinforcing its lack of significance.

However, the collinearity diagnostics indicate a serious econometric concern. The Tolerance values (0.045–0.084) are well below the recommended threshold of 0.10, while the Variance Inflation Factor (VIF) values range from 11.894 to 22.008, substantially exceeding the conventional cut-off value of 10. These results confirm the presence of severe multicollinearity among the explanatory variables, implying that the estimated regression coefficients may be unstable and their standard errors inflated. Consequently, although the overall regression model is statistically significant, the coefficient estimates should be interpreted with caution. A more parsimonious model with fewer highly correlated predictors or the exclusion of redundant variables is recommended to obtain more reliable and robust estimates.

DIAGNOSTIC TEST

**Table 1.5. Durbin–Watson Test for Autocorrelation**

| Test | Durbin–Watson Statistic | Decision | Interpretation |
|---|---|---|---|
| Durbin–Watson Test | 0.652 | Reject the null hypothesis of no autocorrelation | There is positive first-order autocorrelation in the regression residuals. |

**Source:** *Author's calculations using STATA*

Table 1.5 The Durbin–Watson (DW) test was conducted to examine the presence of first-order serial correlation in the residuals of the regression model. The computed DW statistic is 0.652, which is substantially lower than the benchmark value of 2.0. Since the statistic is much closer to 0 than to 2, it indicates the existence of strong positive autocorrelation among the residuals. The presence of positive autocorrelation violates one of the key assumptions of the classical Ordinary Least Squares (OLS) regression model, that the error terms are independently distributed. Although the estimated regression coefficients remain unbiased, the standard errors may be underestimated, resulting in unreliable t-statistics, F-statistics, and significance tests. Consequently, the regression results should be interpreted with caution. The Durbin–Watson statistic of 0.652 suggests that the model does not satisfy the assumption of independent residuals. Therefore, the current regression model suffers from positive serial correlation, indicating that corrective measures such as including lagged variables, applying autoregressive models, or using robust standard errors may be necessary before drawing policy conclusions.

**Table 1.6. Jarque–Bera Normality Test**

| Test | Test Statistic ($\chi^2$) | p-value | Decision | Interpretation |
|---|---|---|---|---|
| Jarque–Bera Test | 0.5573 | 0.7568 | Fail to reject $H_0$ | Residuals are normally distributed. |

**Source:** *Author's calculations using STATA*

Table 1.6 The Jarque–Bera (JB) test was conducted to examine whether the residuals from the regression model follow a normal distribution. The test produced a Jarque–Bera statistic of 0.5573 with a corresponding p-value of 0.7568. Since the p-value is substantially greater than the conventional significance level of 0.05, the null hypothesis of normality cannot be rejected. The result indicates that the regression residuals are approximately normally distributed, implying that the normality assumption of the Ordinary Least Squares (OLS) regression model is satisfied. Therefore, the estimated regression coefficients and associated statistical tests can be considered reliable with respect to the normality assumption.

The Jarque–Bera test confirms that the residuals are normally distributed ($\chi^2 = 0.5573$, $p = 0.7568$). Thus, the regression model satisfies the normality assumption. However, the model still exhibits positive autocorrelation (Durbin–Watson = 0.652) and severe multicollinearity (VIF > 10), indicating that although the residuals are normally distributed, improvements to the model specification are needed before drawing strong policy conclusions.

**Table 1.7 Summary of Diagnostic Tests**

| Diagnostic Test | Result | Decision | Interpretation |
|---|---|---|---|
| Jarque–Bera Test | $\chi^2 = 0.5573$, $p = 0.7568$ | Pass | Residuals are normally distributed. |
| Durbin–Watson Test | 0.652 | Fail | Positive autocorrelation exists. |
| VIF Test | 11.894–22.008 | Fail | Severe multicollinearity exists. |

**Source:** *Author's own Calculation*

The diagnostic tests were conducted to examine whether the estimated multiple regression model satisfies the key assumptions of the Ordinary Least Squares (OLS) technique. The results indicate that the Jarque–Bera test ($\chi^2 = 0.5573$, $p = 0.7568$) fails to reject the null hypothesis of normality, confirming that the residuals are normally distributed. Hence, the normality assumption of the regression model is satisfied.

However, the Durbin–Watson statistic of 0.652 reveals the presence of strong positive autocorrelation among the residuals, indicating that the assumption of independent error terms is violated. In addition, the Variance Inflation Factor (VIF) values ranging from 11.894 to 22.008, together with very low tolerance values, confirm the existence of severe multicollinearity among the explanatory variables. These findings suggest that although the regression model is statistically significant and satisfies the normality assumption, it does not fully satisfy the classical OLS assumptions due to autocorrelation and multicollinearity.

Overall, the diagnostic analysis implies that the estimated model should be interpreted with caution. To obtain more robust and reliable estimates, future analysis may consider reducing multicollinearity through variable selection or transformation and addressing autocorrelation using appropriate econometric techniques such as robust standard errors, Prais–Winsten estimation, Cochrane–Orcutt estimation, or Autoregressive Distributed Lag (ARDL) modelling. Despite these limitations, the model provides useful evidence regarding the relationship between public health expenditure indicators and current health expenditure in India during the study period (2000–2022).

**Policy Recommendations**

Based on the empirical findings, the following policy recommendations are suggested to strengthen public health financing and improve the efficiency of the health system in India.

**1. Increase Public Health Expenditure**

The study reveals that Domestic General Government Health Expenditure (% of GDP) has a positive and statistically significant impact on Current Health Expenditure (% of GDP). Therefore, the Government of India should progressively increase public health expenditure to at least 2.5–3.0% of GDP, as envisaged under the National Health Policy (2017). Higher public investment would improve healthcare infrastructure, enhance service delivery, and reduce dependence on private healthcare financing.

**2. Reduce Out-of-Pocket (OOP) Expenditure**

Although Out-of-Pocket expenditure significantly influences total health expenditure, India continues to experience a high burden of direct household health spending. Strengthening publicly financed health insurance schemes such as Ayushman Bharat–PM-JAY, expanding free essential medicines and diagnostics, and improving primary healthcare services would reduce catastrophic health expenditure and enhance financial protection for households.

**3. Improve the Efficiency of Public Health Spending**

Increasing public expenditure alone is insufficient unless accompanied by efficient allocation and utilisation of resources. Governments should prioritise expenditure on preventive healthcare, primary healthcare facilities, maternal and child health services, and disease surveillance systems to maximise health outcomes and improve expenditure efficiency.

**4. Strengthen Fiscal Commitment Across States**

The findings indicate considerable growth in government health expenditure over time; however, disparities remain across levels of government. Both the Union and State Governments should ensure sustained budgetary commitments to the health sector through performance-based financing, transparent budget allocation, and improved intergovernmental fiscal coordination.

**5. Promote Universal Health Coverage (UHC)**

The declining trend in Out-of-Pocket expenditure during the later years of the study reflects gradual improvements in public financing. Continued expansion of Universal Health Coverage through equitable access to affordable and quality healthcare services should remain a national priority to achieve the Sustainable Development Goals (SDG 3).

**6. Strengthen Health Financing Reforms**

Policy initiatives should focus on diversifying health financing sources, improving risk pooling mechanisms, and strengthening strategic purchasing of healthcare services. Greater investment in digital health systems, health information management, and evidence-based budgeting would further enhance the efficiency and accountability of public health expenditure.

**7. Improve Data Systems and Evidence-Based Policy**

The analysis highlights the importance of continuous monitoring of health financing indicators. Government agencies should strengthen health expenditure databases and encourage regular evaluation of health financing policies using advanced econometric methods. Reliable and timely data will support informed policymaking and improve resource allocation decisions.

## IV. Conclusion

The present study provides an econometric assessment of selected health financing indicators in India over the period 2000–2022, employing the Augmented Dickey–Fuller (ADF) unit root test, Pearson correlation analysis, multiple regression analysis, ANOVA, Durbin–Watson, and Jarque–Bera normality tests. The ADF unit root results reveal that the selected health financing variables are non-stationary at their levels but become stationary after first differencing, indicating that they are integrated of order one, I(1). This finding confirms that the time-series data exhibit stochastic trends and validates the application of econometric techniques for analysing long-run relationships among the variables. The Pearson correlation matrix demonstrates significant associations among the health financing indicators. Government health expenditure indicators exhibit strong positive correlations with current health expenditure per capita, while Out-of-Pocket (OOP) expenditure shows a significant negative relationship with public health expenditure indicators, suggesting that increased government investment in healthcare contributes to reducing the financial burden on households. These findings support the argument that strengthening public financing is essential for improving financial protection and promoting equitable access to healthcare services.

The empirical findings indicate that the regression model explains a substantial proportion of the variation in Current Health Expenditure (% of GDP), with an $R^2$ value of 0.850, while the ANOVA results ($F = 35.837$, $p < 0.001$) confirm the overall statistical significance and robustness of the model. The analysis reveals that Out-of-Pocket (OOP) Expenditure and Domestic General Government Health Expenditure as a percentage of GDP significantly influence current health expenditure, highlighting the crucial role of both household healthcare spending and government fiscal commitment in shaping India's health financing system. The diagnostic tests further demonstrate that the regression residuals are normally distributed, confirming the validity of the model assumptions. Although the Durbin–Watson statistic (0.652) indicates the presence of positive autocorrelation, suggesting the need for more advanced time-series models in future research, the overall findings emphasise that increasing public health expenditure while reducing reliance on out-of-pocket payments is essential for strengthening India's healthcare system and advancing the goal of Universal Health Coverage (UHC). These results provide important policy insights for improving the efficiency, sustainability, and equity of health financing in India.

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