

**Systemic Analysis of Medical Inflation Trends in the Context of Economic Variables
Using Quantitative Techniques**

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ABSTRACT

Medical inflation means a steady increase in the cost of medical treatment and healthcare services. This study has focused on analysing the impact of medical inflation on other economic indicators, inclusive of general inflation, macroeconomic variables, the stock market returns, and lastly, the Volatility Index, in India. It is a retrospective study where secondary data for the specific indicators is collected over a specific period i.e. from 2014-2023 and performed regression using SPSS software. The study shows a strong positive relationship does exist between medical and general inflation and explains about 57% of general inflation. The results turned out, insignificant and minor for medical inflation to the GDP, repo rate, foreign exchange rate, stock market returns, and the Volatility Index. These results therefore indicate that though medical inflation has a significant effect on general or overall inflation, it does not have a direct impact on other economic variables. It increases awareness that any healthcare policy has to consider the economic consequences of rising medical costs and, therefore, gives a boost for further research into indirect effects and regional variations.

Keywords: Medical Inflation, GDP, Repo, FOREX, Stock returns, Volatility Index

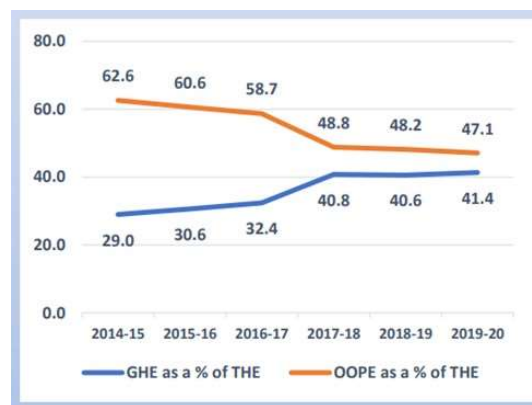
Background:

India's healthcare sector is a vital component of the country's economy and stands out for being dynamic and complicated. It offers a range of treatments, from complex surgery to preventative care, and is funded by both public and private institutions. The sector has expanded dramatically over the last few decades as a result of increased healthcare expenditures, technological advancements, and legislative changes. India, a country with a population of more than 1.44 billion, has the enormous challenge of providing healthcare services to a wide range of people. The robust healthcare industry contributes to reducing unemployment rates and fostering economic stability. The Indian healthcare sector accounts for about \$372 billion and is growing at a compounded annual growth rate (CAGR) of 22%. Moreover, the Indian healthcare system plays a crucial role in attracting medical tourists from around the world. India has emerged as a popular destination for medical tourism due to the high quality of medical care, state-of-the-art facilities, and cost-effective treatments. The revenue generated from medical tourism significantly contributes to the country's foreign exchange¹. The healthcare sector plays a vital role in ensuring the well-being of a nation's population. The medical inflation rate in India was about 14% in 2021, which was the highest among the South Asian nations. Thus, rising healthcare costs pose a significant challenge all around the world, especially in developing countries. Health care being a vital component of the economy, studies done in developed nations have shown that medical inflation also plays a significant role in economic development. So, there is a need to analyze the relationship between medical inflation and economic indicators such as Gross Domestic Product GDP, foreign exchange, repo rates, stock returns, volatility of the stocks, etc in developing nations like India.

¹ Investment opportunities in the healthcare sector by Niti Aayog Report 2024.

Problem Statement: The medical inflation in India is 14%, the highest in Asian countries. Medical inflation refers to the continued rise of medical care and treatment. Total health expenditure (THE) in India has been around 3.2 % of GDP including private and public expenditure. Out-of-pocket expenditure (OOPE), which refers to what is spent directly by households to access healthcare services, constitutes about 47.1% of THE. This high out-of-pocket expenditure is therefore a huge burden to the individuals and families, usually resulting in financial distress and pushing many below the poverty line.

Figure: 3.1 GHE as of % of THE vs. OOPE as of % of THE



Source: National Health Accounts 2021.

The spending on health in India is likely to significantly increase shortly because of the aging population, a higher prevalence of chronic diseases, and rapidly escalating advanced medical technologies. The health expenditure as a percentage of GDP could rise to 5% by 2025 if the current trend continues. This rise in health expenditure is both an opportunity and a challenge for the nation. This is not only a reflection of the increased demand for quality healthcare services but also an avenue that puts forward efficient health management and policy reforms to ensure that this increased spending translates into a better quality of health.

Bayati et al (2014), investigated the effect of inflation rates in hospitalization, medication, and specialist consultation on Iran's overall health inflation rate and the relationship between the rates of health and general inflation from 1985 to 2013. It concludes that a 1% increase in these healthcare components' respective inflation rates increases the overall health inflation rate by 0.41888% in the long run which explains 88% of the fluctuation in the overall health inflation rate.

Moreover, for every 1% increase in health inflation, the change in the general inflation will be 0.3030%, which contributes to more than 11% of its variability. The conclusion from the study above is that the rates of inflation by these healthcare components are strong drivers of the overall rate of health inflation and are directly proportional to the general inflation rates. Nair-Reichert et al. (1999), discusses two issues: one is the pattern of increasing IRHC (Inflation Rate of Health care services), and the other one is the alleged inadequate access to healthcare services. The results of the analysis add to the current disclosure of healthcare, as it is inputting more empirical data on the causes of IRHC. This study concludes by saying that Medicare and technological changes both have a significant impact on the IRHC in the US and the overall inflation and suggests that this can be curbed by introducing stringent policies to promote healthy competition. A study by Poongavanam (2023), titled “Medical inflation - Issues and Impact” describes that one of the major threats to developing countries is inflation. It devalues the rupee, thus making goods and services costly. Normally 5-7% inflation rate is considered decent. The Medical inflation is therefore much higher than the overall inflation and is estimated at around 20%. Year on year, the money spent on the services rendered by the medical professionals goes on increasing and so medical inflation rises automatically. It concludes by saying that the government has to come forward to make policies to reduce the impact of medical inflation and individuals can be protected with sufficient medical coverage. Payne & Geppert (2013), research analyzes the relationship between healthcare costs (medical inflation) and stock returns in the US. One of the key findings is that the rising healthcare costs are a significant factor influencing stock market performance. That means medical inflation is having a specific hard-hit effect on stock returns, unlike other factors that may muddle in with the general price increases. The study suggests that the healthcare industry plays a crucial role in the US economy due to its influence on stock market behavior.

The relationship between medical inflation and economic development is tricky. High medical costs cut down disposable income reducing consumer spending, savings and investment thus lowering overall economic growth. For businesses, increasing healthcare costs may boost the cost of operation and thus lower their profitability, which will reduce investment in other sectors. The

ripple effect is controlled by the government by either increasing taxation or reducing expenditure in critical areas such as education and infrastructure.

There are numerous studies done over the decades about the effect of general inflation on economic variables like GDP, exchange rates, stock returns, government expenditure. However, there have been fewer studies on the effect of medical inflation on key variables like GDP, FOREX, Repo rates and Stock returns in developed countries where rising cost of medical care could eventually increase insurance premiums which may have far-reaching implications for the stability and growth of the economy. Given the immense contribution the healthcare sector makes to the economy most of the key indicators will be impacted in a big way by the medical inflation. This paper makes an attempt to investigate the relationship that medical inflation shares with GDP, foreign exchange rates, repo rates, return on the stock market and the VIX provide insights that might be useful to many stakeholders, including policymakers, investors, and healthcare professionals, who may wish to develop strategies for managing medical inflation sustainably and supporting economic growth.

Objectives of the Study:

To examine the relationship between medical inflation & macro-economic factors

To examine the relationship between medical inflation and stock market returns

To assess the relationship between medical inflation & Volatility Index

Hypotheses:

H₀₁ - There is no significant impact of medical inflation on general inflation.

H₀₂ - There is no significant impact of medical inflation on GDP

H₀₃ - There is no significant impact of medical inflation on Repo

H₀₄ - There is no significant impact of medical inflation on FOREX

H₀₅ - There is no significant impact of medical inflation on stock market return.

H₀₆ - There is no significant impact of medical inflation on the volatility index.

Methodology: The retrospective study is carried out for ten years from 1st April 2014 to 31st March 2024 during which the historical data on specific economic indicators and medical inflation are

gathered to analyze the relationship between medical inflation and economic indicators. The historical medical inflation data is obtained from Statista, general inflation, Repo & FOREX rates from RBI website, GDP data from mopsi.gov.in. Nifty 50 index returns are used as a proxy for stock market returns and volatility index returns are obtained from nseindia.com. Analysis of the study was done with the use of IBM SPSS version 27.

Results:

H₀₁- There is no significant impact of medical inflation on general inflation.

Table 1: Medical Inflation & General Inflation

Model Summary						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	.755 ^a	.570	.516	.87918		
ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.188	1	8.188	10.593	.012 ^b
	Residual	6.184	8	.773		
	Total	14.372	9			
Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.897	1.340		.669	.522
	Medical inflation	.442	.136	.755	3.255	.012

The output of linear regression analysis shows a strong positive relationship ($R = 0.775a$) between the general inflation which is the dependent variable and medical inflation which is the independent variable. The coefficient of determination (R square = 0.570) suggests that approximately 57% of the variance in general inflation is explained by medical inflation. The

adjusted R square value (0.516) suggests that the inclusion of the independent variable improves the model fit. The coefficient for the constant term (intercept) is 0.897, indicating the expected value of the dependent variable when all independent variables are 0.522. The coefficient for the independent variable is 0.012, suggesting a strong and statistically significant impact on the dependent variable. The p-value is less than 0.05, so we reject the null hypothesis, suggesting that the medical indicator is a significant predictor of general inflation.

H₀₂ - There is no significant impact of medical inflation on GDP

Table 2: Medical Inflation & GDP

Model Summary						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	.064 ^a	.004	-.120	4.62598		
ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.706	1	.706	.033	.860 ^b
	Residual	171.198	8	21.400		
	Total	171.904	9			
Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.186	7.053		.594	.569
	Medical inflation	.130	.714	.064	.182	.860

The regression equation is $Y = 4.186 + 0.130 * 1$. Linear regression analysis shows a very weak positive relationship ($R = 0.064a$) between the dependent variable (GDP) and the independent variable (medical inflation). The coefficient of determination (R square = 0.004) suggests a negligible amount of the variance in GDP is explained by medical inflation. The adjusted R square value (-0.120) suggests that the inclusion of the independent variable does not improve the model

fit. The coefficient for the constant term (intercept) is 4.186, indicating the expected value of the dependent variable when all independent variables are 0.569. The coefficient for the independent variable is 0.860, suggesting a weak and no statistically significant impact on the dependent variable. The p-value is more than 0.05, so we fail to reject the null hypothesis suggesting that medical inflation has no impact on GDP.

H₀₃ - There is no significant impact of medical inflation on the Repo rate.

Table 3: Medical Inflation & Repo

Model Summary						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	.072 ^a	.005	-.119	1.33508		
ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.075	1	.075	.042	.842 ^b
	Residual	14.259	8	1.782		
	Total	14.335	9			
Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.509	2.035		2.706	.027
	Medical inflation	.042	.206	.072	.206	.842

The regression equation is $Y = 5.509 + 0.042 * X$. Linear regression analysis shows a very weak positive relationship ($R = 0.072a$) between the dependent variable (Repo rate) and the independent variable (medical inflation). The coefficient of determination (R square = 0.005) suggests a negligible amount of the variance in repo rate is explained by medical inflation. The adjusted R square value (-0.119) suggests that the inclusion of the independent variable does not improve the

model fit. The coefficient for the constant term (intercept) is 5.509, indicating the expected value of the dependent variable when all independent variables are 0.042. The coefficient for the independent variable is 0.842, suggesting a weak and no statistically significant impact on the dependent variable. The p-value is more than 0.05 failing to reject the null hypothesis suggesting that medical inflation has no impact on Repo rates.

H₀4 - There is no significant impact of medical inflation on FOREX

Table 4: Medical Inflation & FOREX

Model Summary						
Model	R	R Square	Adjusted Square	R	Std. Error of the Estimate	
1	.344 ^a	.118	.008		\$6.71299	
ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	48.371	1	48.371	1.073	.330 ^b
	Residual	360.514	8	45.064		
	Total	408.885	9			

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	60.582	10.234		5.919	.000
	Medical inflation	1.073	1.036	.344	1.036	.330

The regression equation is $Y = 60.582 + 1.073 * X$. Linear regression analysis shows a very weak relationship ($R = 0.334$) between the dependent variable (foreign exchange) and the independent variable (medical inflation). The coefficient of determination (R square = 0.118) suggests a negligible amount of the variance in foreign exchange is explained by medical inflation. The adjusted R square value (0.008) suggests that the inclusion of the independent variable does not improve the model fit. The coefficient for the constant term (intercept) is 60.582, indicating the expected value of the dependent variable when all independent variables are 0.000. The coefficient for the independent variable is 0.330, suggesting a weak and no statistically significant impact on the dependent variable. With the p -value more than 0.05 we failed to reject the null hypothesis suggesting that medical inflation has no impact on Foreign exchange.

H_05 - There is no significant impact of medical inflation on Nifty 50 Stock Returns.

Table 5: Medical Inflation & Nifty 50

Model Summary						
Model		R	R Square	Adjusted R Square	Std. Error of the Estimate	
1		.161 ^a	.026	-.096	23.11213	
ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	114.320	1	114.320	.214	.656 ^b
	Residual	4273.366	8	534.171		
	Total	4387.686	9			

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-2.516	35.236		-.071	.945
	Medical inflation	1.650	3.567	.161	.463	.656

The regression equation is $Y = -2.516 + 1.650 * X$. Linear regression analysis shows a very weak relationship ($R = 0.161$) between the dependent variable (Nifty 50 stock returns) and the independent variable (medical inflation). The coefficient of determination ($R^2 = 0.026$) suggests a negligible amount of the variance in Nifty 50 is explained by medical inflation. The adjusted R^2 value (-0.096) suggests that the inclusion of the independent variable does not improve the model fit. The coefficient for the constant term (intercept) is -2.516 , indicating the expected value of the dependent variable when all independent variables are 0. The coefficient for the independent variable is 0.161 , suggesting a weak and no statistically significant impact on the dependent variable. The p-value is more than 0.05 failing to reject the null hypothesis suggesting that medical inflation has no impact on nifty 50 stock returns.

H₀6- There is no significant impact of medical inflation on the Nifty 50 Volatility Index.

Table 6: Medical Inflation & Nifty 50 Volatility Index

Model Summary						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	.027 ^a	.001	-.124	5.87926		
ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.202	1	.202	.006	.941 ^b
	Residual	276.526	8	34.566		
	Total	276.728	9			
Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	14.833	8.963		1.655	.137
	Medical inflation	.069	.907	.027	.076	.941

The regression equation is $Y = 14.833 + 0.069 * X$. Linear regression analysis shows a very weak relationship ($R = 0.027^a$) between the dependent variable (Nifty 50 volatility index) and the independent variable (medical inflation). The coefficient of determination (R square = 0.001) suggests a negligible amount of the variance in volatility index is explained by medical inflation. The adjusted R square value (-0.124) suggests that the inclusion of the independent variable does not improve the model fit. The coefficient for the constant term (intercept) is 14.833, indicating the expected value of the dependent variable when all independent variables are 0. The coefficient for the independent variable is 0.027, suggesting a weak and no statistically significant impact on the dependent variable. The p -value is more than 0.05 failing to reject the null hypothesis suggesting that medical inflation has no impact on the nifty 50 volatility index.

Discussion:

This study looked into the connection between different economic variables and medical inflation in the Indian context. The results show a complicated link, with some variables being more affected than others by medical inflation. On the positive side, the research did establish a strong positive relation between medical inflation and general inflation, indicating that spiral increases in medical costs do add significantly to a general price rise of goods and services within the economy. This surge in general inflation may have profound implications on the budgets of households and the stability of the economy since families find it hard to adjust to the rise in their living expenses. At the same time, on the other hand, this study finds no statistically significant relationships between medical inflation and major economic indicators as GDP, repo rate, FOREX rate. This means that, within the range of data used, medical inflation does not have a direct significant impact either on GDP growth, interest rates, or currency exchange rates. On the other hand, no strong evidence turned out in the analysis to establish the impact of medical inflation on stock market return and the Volatility Index, so it would mean that medical inflation will not affect investor sentiment or market volatility directly. The important limitations of this study include its dependence upon data from a narrow period that perhaps may not encompass long-term trends or variations. Other factors that have not been taken up for the present study also might influence the economic indicators under consideration. Another limitation of this research is that it analyzes the issues only at the national level, overlooking the possible regional differences within the impact of medical inflation in different parts of India. An important finding is the strong relationship between medical and general inflation; this would mean that an increase in medical spending characterizes conventions that may worsen rather than mitigate economic problems in times of household budget strain. Most basically, this points to one clear implication: Healthcare policy has to suffer much more sensitivity to the broader economic consequences that emanate from medical inflation. Entailing policies for regaining control over the growth of medical expenditure could thus serve two purposes: health and economics. The study also calls for more impetus on the indirect effects that medical inflation has on GDP, interest rates, and financial markets. That might bring subtle elements of difference beneficial for policymakers in their decision-making.

Conclusion:

This study has attempted to examine the relationship of medical inflation with other economic indicators in India. It has been found that medical inflation shares a positive strong impact with general inflation, thus proving that escalation in medical costs is one of the prime factors for a rise in prices of goods and services in the economy. This relationship indicates that rising medical costs can put pressure on household finances and generally on economic stability. Consequently, the impact of medical inflation on key macroeconomic indicators such as GDP repo rate and foreign exchange rate was not statistically significant. It thereby suggests that medical inflation does not directly influence economic growth, central bank interest rates, or the state of currency exchange rates in India during the considered period. The study on the impact of medical inflation on stock market returns and the volatility Index also did not come up with any significant relation, thereby establishing that medical inflation does not directly influence investor sentiment or market volatility. The results clearly show the complexity of the economic effects of medical inflation, while it works as a general inflationary influence, the effects on other economic variables seem to remain rather limited.

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ANNEXURE

YEAR												
INDICATOR	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	SOURCE	
MEDICAL INFLATION	12.49	9	6.8	7.14	10	8.4	10.25	8.65	13.6	10.3	Statista	
INFLATION	6.7	4.91	4.95	3.3	3.94	3.7	6.63	5.13	6.7	5.69	www.rbi.org	
GDP	7.4	8	3.3	6.8	6.5	3.9	-5.8	9.7	7	7.6	www.mospi.gov	
REPO	8	7.31	6.3	6	6.25	5.6	4.25	4	4.97	6.5	www.rbi.org	
FOREX	61.14	65.46	67.07	64.45	69.92	70.89	74.22	74.5	80.3	81.6	www.rbi.org	
STOCK MARKET	24.64	-7.94	17.57	10.52	15.04	-26.38	56.37	18.14	0.4	25.94	www.nseindia.com	
VOLATILITY INDEX	16	15.9	12.28	9.86	12.3	27.5	21.9	15.7	14.2	9.4	www.nseindia.com	