

# Impact of Health Infrastructure and Manpower on Health Outcome and Economic Growth in India

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## Abstract

Health has a significant influence on the quality of people's lives, which is closely linked to the notion that a healthy population has the ability to actively engage in the country's economic activities, which is critical to the nation's economic growth. Based on this, the current paper seeks to analyze the trend of health infrastructure, health personnel, and a few critical health indicators during 2005 to 2020. To empirically study the growth pattern of health inputs and outputs, trend analysis and acceleration model were used. The effects of health inputs on health output and economic growth were investigated using a simple regression technique. The findings indicate that it is vital to boost the health manpower engaged in public healthcare delivery facilities as they favourably influence the nation's health indices.

**Keywords:** Health Infrastructure; Manpower; Indices; Economic Growth

## Introduction

Health care services are critical to enhancing people's quality of life and productivity. However, a number of factors impact health, including inherited characteristics, environmental factors, lifestyle choices, and, most significantly, the quality of public health infrastructure [1]. An easy access to health infrastructure leads to better health of the beneficiary. Good health contributes to increased labour productivity, which improves overall well-being and economic progress [2]. Infection and malnutrition, for example, have a long-term impact on the well-being of children and future productivity, which is directly associated with lower economic growth in the future. Simply defined, poor health leads to a production loss for an economy by reducing labour productivity [3].

The National Commission on Macro-economics and Health states that "Assuring a minimal level of physical and mental well-being is a critical constituent of the development

process. Furthermore, inequitable access to basic services results in welfare loss of the poor" [4]. Post -Independence India has shown a significant improvement in terms of developing physical healthcare services alongside improving the health indices. Despite attaining economic growth over the previous two decades, India has performed poorly in terms of health-care development, for instance India lags behind many developing countries in terms of crucial health indicators like Maternal Mortality Ratio (MMR), Infant Mortality Rate (IMR), Crude Death Rate (CDR), Crude Birth Rate (CBR) etc. Even though India has been witnessing a progressive reduction in MMR, where it declined from 128 in 2015 to 103 in 2020 still it lags behind countries like Sri Lanka and Thailand which have an MMR of 29 and 30 respectively. In terms of Infant Mortality Rate as well India lags behind countries like Bangladesh and Thailand, which register an IMR of 23 and 7 respectively as compared to that of IMR as high as 26 in India during 2021.

The state of health infrastructure is not deemed to be sufficient in India, particularly in comparison to growing countries like China, Sri Lanka, and Mexico [2]. If we simply look at the number of physicians in India then, there are merely 0.7 physicians per thousand population in India as compared to 1.2 physicians per 1000 population in Sri Lanka and 2.4 physicians per 1000 population in China in the year 2020. In other words, India does not have even one physician to cater to 1000 population. Infact, as per the World Health Organization estimates 68% Indians face challenges in accessing basic medicines in the public health structure, owing to which the household OOP spending on medications have risen [5]. This may be one of the reasons behind India performing not so well in terms of demographic indicators.

Given this context, the current paper seeks to assess the trajectory of health outcomes as well as the impact of health infrastructure and health personnel on the health outcomes under consideration. The paper is divided into four sections: the second section provides an overview of several demographic variables, health infrastructure, and health manpower, followed by the third section, which conducts a trend analysis of health inputs and outputs. In the same section we have also applied acceleration model to explore the direction of change. The fourth section would give empirical data as to what are the significant factors out of health outcomes and infrastructure that is contributing to

the country's economic growth, followed by a summary and conclusion in the fifth section.

### Data and Methodology

The paper is based upon the secondary data with the data being mainly extracted from various issues of Sample Registration System and Rural Health Statistics. The time period considered for the analysis ranges from 2005-2020.

Furthermore the Acceleration model and the trend growth rate have been used to study the pattern of health infrastructure, manpower and indices over time. The following regression equations are used for this purpose:

- Exponential Trend:  $\text{Ln}(Y) = a + bt$
- Quadratic (in semi-log):  $Y = a + bt + ct^2$

In the above equation  $t$  represents time which takes value as 1 for each year used for the analysis. Further  $\text{Ln}(Y)$  represents the natural log of public health infrastructure, manpower and health indices in year  $t$ . Coefficient  $b$  and  $c$  is interpreted as growth rate and magnitude of shift in growth rate respectively. The magnitude of shift is defined as the rate of acceleration or deceleration in the average growth of health inputs and outputs as the case may be.

For the purpose of analysis following classification has been used:

Health Indices	Health Infrastructure	
	Health Facilities	Health Manpower
Infant Mortality Rate (IMR)	Sub - Centre	Doctors
Maternal Mortality Rate (MMR)	Primary Health Centre	Nurses
Crude Death Rate (CDR)	Community Health Centre	Auxiliary Nurse Midwives (ANMs)
Crude Birth Rate (CBR)		
Total Fertility Rate (TFR)		

**Table 1:** Classification of Health infrastructure and Health Indices.

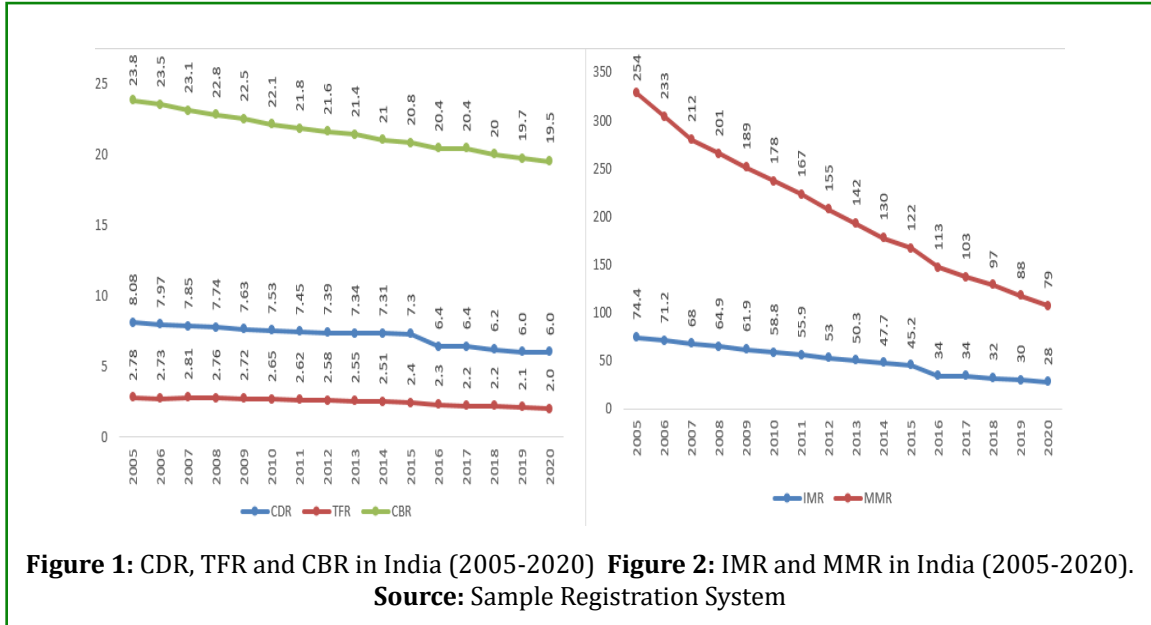
## Results

### Demographic Indicators and Health Infrastructure in India

This section attempts to provide an overview of the health inputs and outputs to be considered in the study. As per the latest reports of E&Y, in absolute numbers India will have 1.04 billion working age population by 2030, and on the contrary the dependency ratio will be the lowest by 2030 which is expected to be around 31.2%. However the potential contribution of the young age population to the country's

GDP would depend upon a number of factors, one of which is the efficient the population is, that is directly linked to the health of the population.

Figures 1 and 2 shown below depicts the pattern of various demographic indices over a period of 15 years. It is appreciable to note that almost all the demographic indices have declined over the last decade. Out of all the indices considered MMR and IMR have declined the most viz. IMR has declined from 74.4 in 2005 to 28 in 2020 and MMR has declined from 254 in 2005 to 79 in 2020.



**Trend Growth Rate and Acceleration Results of Health Infrastructure and Demographics in India**

In the present era major concern of India revolves around not only in providing an adequate level of health spending but also it aims at providing services that is accessible and acceptable by all, which consequently has an impact upon the health demographics. Owing to this background the government’s efficiency in this area is reflected in the country’s health status prompting us to examine both, the trajectory of health infrastructure, health manpower as well as status of some important health indices that are impacted through the services provides through the public health infrastructure.

In order to analyse the trend of health infrastructure in India we have taken into account the date of the three-tier healthcare infrastructure data established to provide free of charge health services with a special focus upon the marginalised population. These three tier healthcare infrastructure include: Sub-centre, Primary Health Centre and Community Health Centre. Other than this we have also gauged into the health manpower viz. Doctors, Nurses and ANMs. These categories have been arrived at by combining .the concerned manpower from all the three tier infrastructures. Furthermore the trend of selected health indices has also been studied in this section. Table 2 depicts the results of trend growth rate and Acceleration model of health infrastructure and Indices.

		'b value'	'c' value	R <sup>2</sup>	TGR
Health Indices	IMR	-0.39 (-3.68)*	-0.61 (-5.70)*	0.99	-5.82
	MMR	-0.98 (-17.69)*	-0.02 (-0.38)	0.99	-7.44
	CDR	-0.18 (-0.88)	-0.81 (-3.99)*	0.98	-1.78
	CBR	-1.21 (-23.12)*	0.22 (4.15)*	0.99	-1.38
	TFR	-0.48 (-1.93)**	-0.49 (-1.97)	0.96	-2.05
Health Infrastructure	SC	0.28 (0.89)	0.68 (2.17)**	0.95	0.92
	PHC	-1.30 (-2.29)**	2.02 (3.55)*	0.82	1.75
	CHC	1.70 (12.08)*	-0.75 (-5.32)*	0.99	3.78
	HII	-0.09 (0.23)	1.01 (2.59)*	0.92	1.13

Health Manpower	Doctors	1.44 (3.62)*	-0.55 (-1.39)	0.92	2.82
	Nurses	0.60 (3.62)*	0.38 (2.30)*	0.98	6.04
	ANMs	0.85 (4.98)*	0.14 (0.81)	0.99	4.17
	HMI	0.66 (4.17)*	0.33 (0.09)**	0.98	5.39

**Table 2:** Estimates of Trend Growth rate and Acceleration Model (2005-2020).

Source: Estimated from data given in various issues of SRS and RHS

Note: #: Exponential Trend  $Ln(Y) = a + bt$

\*\* , \* denotes significance at 5% level and 1% level respectively

Figures in parenthesis show 's' values

If we look at the results of trend growth rate then overall under the Health Infrastructure and Manpower category all the components have shown a positive trend indicating the growth in these components during 2005-2020. Looking at individual components under these categories we have found that Community Health Centres under the infrastructure category and Nurses under the Health Manpower category have shown the highest annual growth rate of 3.78 percent and 6.04 percent respectively. Talking about the acceleration results then, even though CHC has registered to be growing annually over the years it has shown a decelerating trend (-0.75), indicating that there is a need to pace up the setting up of CHC over the years. However, if we see the acceleration results of number of nurses then it has shown an accelerating trend with 0.38 percent magnitude which is statistically significant.

(HMI) simply by taking the average of components considered under each of them. Furthermore, a trend analysis has also been done in respect of HII and HMI to have an overall idea about the growth pattern of health infrastructure and Health manpower during 2005-2020. The results of trend growth rate shows that HII has registered an annual trend growth rate of 1.13 percent showing an accelerating trend of 1.01 percent magnitude whereas HMI has shown an annual trend of 5.39 percent with an accelerating trend of 0.33 percent magnitude.

Empirical results pertaining to health input and outputs. This section examines the impact of health inputs (health infrastructure and health manpower) and health outputs (chosen health indicators in our instance). We attempted to regress the health infrastructure and workforce on the indices in order to identify relevant variables that are likely to have an impact on improving the health indicators.

In the same table we have also developed Health Infrastructure Index (HII) and Health Manpower Index

Health Infrastructure and Health Outcome					
Dependent Variables	IMR	MMR	CDR	CBR	TFR
Independent Variables					
Sub-Centre	-3.92**	-4.06*	-1.60*	-0.67	-2.15**
Primary Health Centre	0.13	0.22	0.09	0.51	0.16
Community Health Centre	-0.66**	-1.16*	-0.12	-0.23	-0.09
R <sup>2</sup>	0.939	0.989	0.902	0.988	0.926
Adjusted R <sup>2</sup>	0.927	0.987	0.885	0.987	0.913
Health Manpower and Health Outcome					
Dependent Variables	IMR	MMR	CDR	CBR	TFR
Independent Variables					
Doctors	-0.06	-0.58*	-0.03	-0.12*	-0.07
Nurses	-0.50*	-0.81	-0.11	-0.12	0.12
Auxiliary Nurse Midwife	-0.69*	-1.21**	-0.26**	-0.23*	-0.63*
R <sup>2</sup>	0.948	0.978	0.893	0.976	0.914
Adjusted R <sup>2</sup>	0.938	0.974	0.874	0.971	0.899

**Table 3:** Regression Results for health inputs and outputs.

Source: Authors Calculation

Note: \*\* , \* denotes significance at 5% level and 1% level respectively

Table 3 shows that Sub-Centres have a significant impact on health indicators such as IMR, MMR, and TFR. This is because, as the first point of access to public health care delivery services, these centres play an important role in bringing about behavioural change by establishing interpersonal communication skills with community members where they are established [6]. These include educating people on the benefits of having a small family, as well as encouraging mothers to adopt healthy practices during the pregnancy period. As a result empirically it is proven that a percent increase in the number of sub-centres may lead to a decrease in TFR by 2.15, MMR by 4.06 and IMR by 3.92 annually. Furthermore, CHCs have been found to have a considerable influence on IMR and MMR as they play an important role in encouraging institutional delivery, which is largely associated with safe delivery and improved postnatal care. Results suggest that a percent increase in CHC annually may lead to a decrease in IMR and MMR by 0.66 and 1.16 percent respectively.

When it comes to the influence of personnel on health indices, the findings indicate that the involvement of doctors and ANMs is critical in improving health indices. While ANMs play a significant part in bringing the people into line with

the public health care system, doctors play an important role in delivering the appropriate medical treatments that the community need. The regression results show that a percent increase in the number of doctors in the public health institutions can bring down the health indices like MMR and CBR by 0.58 percent and 0.12 percent annually whereas an increase in the number of ANMs can influence MMR by 1.21 percent, IMR by 0.69 percent, TFR by 0.63 percent and CDR by 0.26 percent annually.

### Health Index and Economic Growth

As previously discussed, the impact of health infrastructure and manpower is also linked to the country's economic growth as accessible public healthcare delivery systems and approachable manpower in these systems contribute to favourable indices, and favourable indices depict a healthy population, which is further linked to having the capacity to actively contribute to the country's GDP, which leads to economic growth. Owing to this we have attempted to regress the Health Infrastructural Index and Health Manpower Index upon the GDP at Current Prices which is a representative of Economic Growth in a country. Table 4 depicts the regression results for health Index and economic growth.

	Dependent variable: Economic Growth (GDP at Current Price)		
	Odds ratio	p-Value	95% Confidence Interval
Health Infrastructure Index	0.26	0.76	(-1.545,2.076)
Health Manpower Index	2.23*	0.00	(1.784,2.666)
R <sup>2</sup>	0.962		
Adjusted R <sup>2</sup>	0.958		
F Value	229.06 (0.00)		

**Table 4:** Regression Results between Health Index and Economic Growth.

Source: Authors Calculation

Note: \* denotes significance at 1% level.

The regression results suggest that as compared to the Health Infrastructure the Health Manpower has a much more crucial role to play in impacting the economic growth of the country as an increase in the overall manpower in the public healthcare service delivery network may favourably impact the GDP by 2.23 percent annually.

### Discussion

The paper tries to explore the pattern of health indices and health infrastructure during 2005-2020. Alongside it also attempts to study the impact of health inputs (infrastructure and manpower) upon the health outputs (health indices). The health infrastructure has shown an upward trend alongside the health indices have fallen over the period of time [7]. Even though, India has made significant progress in

terms of health infrastructure and access to healthcare, the scarcity of resources hampering the efficient functioning of public health infrastructure becomes very important in the current realm of public health [8-10].

### Conclusion

Our study seeks to analyze the pattern of health infrastructure, health personnel, and health indices while also investigating the influence of health inputs on health outputs and economic growth. According to the findings, nearly all components of health infrastructure (SC, PHC, and CHC) and health personnel (Doctors, Nurses, and ANM) have showed a favourable trend between 2005-2020, and health indicators (IMR, MMR, CDR, CBR, and TFR) have declined significantly throughout the years. Furthermore,

simple regression analysis reveals that health infrastructure, namely CHCs and Sub-Centres, as well as health manpower, particularly doctors and ANMs, have a significant influence on health outcomes such as IMR, MMR, and TFR. The paper finally suggests that the health manpower should be geared up properly to favourably affect the health indices in the country which will have a direct impact on the nation's long-term economic growth.

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