



A STUDY ON PUBLIC HEALTH EXPENDITURE AND SELECT HEALTH OUTCOMES IN INDIA USING STATE LEVEL DATA

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Abstract

Since the transition to Sustainable Development Goals from Millennium Development Goals, the literature on public spending on health and health outcomes is gaining a lot of attention from researchers and policy makers across the globe particularly, the developing nations. The present study focuses on the relation between public health expenditure and health outcomes in India by means of a panel data for 23 Indian states from 1990-91 to 2019-20. The dependent variable health outcomes were measured by two variables; infant mortality rate and crude birth rate. Per capita public health expenditure, female literacy rate and health service infrastructure were the independent variables. Data was extracted from secondary sources. Descriptive statistics, pair-wise correlation and panel data models were used for analysis. The findings state that per capita public health expenditure has an impact on reducing the infant mortality rate and crude birth rate. Given the health needs of the developing nation like India, the study recommends for the improvement in public healthcare spending, female literacy rate and also improvement in the healthcare infrastructure.

Keywords: *Public Health Expenditure, Female Literacy Rate, Infrastructure, Health Outcomes, India*

1. Introduction

In a global effort to achieve human development by the year 2015, 189 countries adopted the Millennium Development Goals (MDGs) in the year 2000. This included a total of 08 goals primarily focusing on health and other related areas, which acted as a universal yardstick for the countries, particularly the developing countries (Declaration UN, 2000; Desa, 2007).

As per the MDGs Report 2015, the progress is shown to be uneven across nations, with some sizeable number of gaps. From the worldwide perspective of health goals between 1990 to 2015, MD goal no 4; child mortality rate has declined to 43 deaths from 90 per 1,000 live births, MD goal no 5; maternal mortality ratio has also declined by 45%, MDG-6; HIV infections have fallen by 40% approximately, malaria incidence rate and its mortality rate reduced by 37% and 58% respectively, tuberculosis prevalence rate and mortality rate came down by 41% and 45%.

As for India, the MDGs were adopted in September 2000, and to augment spending on public health care and achieve the set targets, it has implemented a series of initiatives. In 2005, it introduced the National Rural Health Mission (NRHM); in 2008, Rashtriya Swasthya Bima Yojana (RSBY) and insurance scheme; in 2013, National Urban Health Mission (NUHM). All these measures surely tell a story of how India has been doing over the years in healthcare. At the end of 15 years period, India has made considerable progress. Nonetheless, there has been sluggish paced progress in aspects of mortality and morbidity and also the environmental factors which lead to meagre health setting (Nath, 2011).

Sustainable Development Goals were adopted by 193 countries, including India, right after the end of MDGs on September 25, 2015. SDGs covered altogether 17 goals with 169 targets which were universally accepted, and countries have been working towards achieving them by the year 2030. One such goal is SD goal no 3 that seeks to ensure healthy lives and well-being at all ages. It not only focuses on reducing child mortality but also stresses morbidity, mental health, non-communicable diseases, strengthening the health systems and so on. For India, it is a daunting task ahead; it is marred by intra and inter-state disparities in terms of financing of health care, health infrastructure, human resources etc. Despite all these hurdles, India is marching towards improvements in health indicators. It has taken some drastic steps; established the NITI Aayog and rolled out the National Health Policy (NHP) 2017 which recommended increasing the public expenditure on health as a percentage of GDP to 2.5 % by 2025. It has also launched the National Health Mission (NHM) which is a centrally sponsored scheme which has subsumed National Urban Health Mission (NUHM) and National Rural Health Mission (NRHM)(Assembly, G. 2015; Gera et al., 2018).

With the change from MDGs to SDGs, the literature on public expenditure on health and health outcomes is gaining a lot of interest over the years from different researchers and policymakers across the globe, in particular the developing nations. Varied studies on the relation between public expenditure on health and health outcomes remain to be utmost importance for implementing different public health policies in developing nations. Literature focuses on studies conducted at cross-country level, regional level, and panel data framework in African countries, OECD countries, European countries, and Asian nations.

Interesting to note is the number of studies undertaken in developed, developing and underdeveloped nations with inconclusive results. Most of the studies also focus on infant mortality, under-five child mortality, maternal mortality rate and life expectancy, which are considered to be ultimate goals, but the proximate targets are neglected. For a country to achieve full improvements in the health sector and other related areas by 2030, it must take into consideration both these targets. India is an emerging and developing nation which has undertaken measures to improvise the health scenario of the nation, there persists inequality in the development goals and targets due to inefficiency in health spending as a result low priority on health spending amongst the Indian states (Durairaj & Evans, 2010; Tandon & Cashin, 2010).

With this information, the current study explores the relation between public health expenditure and health outcomes for India taking state level dataset from 1990-91 to 2019-20.

2. Literature review:

This section covers some of the previous studies undertaken by researchers over the globe pertaining to the current study.

Wolfe & Gabay (1987) studied the linkage between health status and medical expenditures for twenty-two nations over 20 years. It was concluded that the ageing population, lifestyle changes and medical expenditures positively influence health status. Hojman (1996), in his study, stated that non-economic factors transformed the relation from diminishing returns to increasing returns and relative investment in health expenditure could improve the infant and child mortality. Young (2001) conducted a similar study for Japan, USA and 29 European countries. The result stated socio and economic factors to impact the mortality than the availability of medical specialists as they had a minor impact on mortality rates. Gupta et al. (2002) explored the effects of public spending on health on to infant and child mortality in fifty developing countries. It was concluded that increased spending on healthcare reduced child mortality in those selected countries.

Kaur & Misra (2003) analysed the level and effectiveness of expenditure made on the social sectors primarily health and education for Indian states. The results established a weaker link with public health expenditure on to health outcome, which is more of inadequacy than ineffective public health spending. It was also highlighted in the study that proper availability of the infrastructure is necessary to decrease the infant mortality rate. Self & Grabowski (2003) highlighted in their study the ineffectiveness of spending on public health in improving overall health of the developed nations, whereas spending on public health was found to be effective in improving health of middle-income and less-developed nations. Nixon & Ulmann (2006) empirically tested the causal link of health spending and health outcomes for European Union. It highlighted the importance of increasing the spending on healthcare in improving the health outcomes. Bhalotra (2007) undertook a study on similar lines in India for fifteen major states from 1970 to 1998. Study presented little evidence of the impact of public health expenditure on infant mortality rate, which basically means that state health spending saves no lives. Martin et al. (2007) explored whether healthcare spending improves health outcomes or not. Results stated a positive strong effect of healthcare expenditure on outcomes of health. Akinkugbe & Mohanoe (2009) examined a similar study in Lesotho. Study results concluded along with public health spending, physician availability, female literacy and child immunisation influenced the outcomes of health in the nation.

Farahani et al. (2009) in a similar study analysed the short run and long run effects of healthcare inputs on infant mortality. It was derived to rising physicians would reduce the infant mortality rate, and the health system resources have a substantially larger effect in the long run. Weitzman (2011) analysed women's education and its effect on maternal health for Peru. The results indicate that increasing the schooling years for women reduced the probability of maternal health complications resulting in an overall reduction in maternal morbidity. Prachitha & Shanmugam (2012) measured the Indian states' efficiency in increasing health outcomes for seventeen states from 2000 till 2009. It was found out that out of the seventeen states, 07 states' efficiency was below average, and it was suggested that

these states could improve their performances by increasing their health expenditure, creating health awareness, educating people, and lastly increasing the number of medical specialists. Kim & Lane (2013) undertook a similar for developed nations, which stated the relationship between public health expenditure and health outcomes to be significant. Kumar et al. (2013) conducted a similar study in India using datasets from NFHS-I, II, and III, i.e., 1980-2006. The results indicated a marginal negative effect of public health expenditure on infant mortality and under-five mortality rates. Mothers' education and age during the child's birth also had a significant improvement in health outcomes. Saurabh et. al, (2013) investigated the association between literacy rates, infant mortality rates and birth rates for India using panel data from the 2011 census. Results obtained indicated female literacy is a key factor in stabilising the population and reducing the infant mortality rate. Shetty & Shetty (2014) in a similar study concluded that per capita health spending is a vital determinant for improving infant mortality rate.

Barenberg et al. (2015) analysed a similar study for twenty nine Indian states and seven Union territories. The results showed that public health spending reduces infant mortality rate. It was also stated that other covariates, female literacy, political competition and urbanisation reduced the infant mortality rate in India. Sengupta (2015) studied the effect of per capita public and private health expenditure on child mortality and infant mortality for a similar dataset. It was concluded that health expenditure individually merely impacts the health outcomes, but together with the mother's education, per capita income improves the health parameters of child and infant mortality. Ssozi & Amlani (2015), in a similar kind of study, explored the effectiveness of health expenditure in forty-three nations of Sub-Saharan Africa. Findings stated health expenditure to have a lower effect on ultimate goals and higher effect on proximate targets. It was concluded that the service delivery in addition to healthcare systems and female education should improve in order for public health expenditure to be more effective.

Kulkarni (2016) studied the relation of health inputs on health outcomes via Grossman's health production function for BRICS. Findings showed a positive relation between per capita GDP, out-of-pocket expenditure, Literacy rate and health outcomes. David (2018) investigated the relationship between public health spending and the infant mortality rate for Nigeria by means of ARDL approach; it was determined to have a statistically significant relationship with each other. Mohanty & Behera (2020) empirically tested public healthcare expenditure and its importance in improving the health outcomes Indian states using a panel dataset. Results highlighted per capita public healthcare expenditure to have an adverse effect on the health outcomes under study. However, it had a positive result on immunisation coverage and life expectancy at birth.

It can be concluded from the above empirical research that there is no unified conclusion as to whether public health expenditure improves health outcomes or not. An interesting finding to note is lesser studies at a sub-national level covering ultimate goals and proximate targets about MDG's and SDG's in recent times. As health is a state subject, studying at a sub-national level will allow deeper insights. So, important questions that can be posed here is whether public health expenditure favourably or adversely affects health outcomes. Are they any other factors that significantly influence health outcomes? To answer these questions, it

becomes imperative to undertake a study on similar lines in a developing nation like India which can be a source of guideline for the policymakers in achieving the SDGs targets by 2030.

3. Data sources and Methodology:

a) Description of variables used for the study-

Variables under study were chosen based on the exiting literature suited in the Indian context (Barenberg et al., 2016; Behera & Dash, 2020; Mohanty & Behera, 2020; Taylor & Dessai, 2023). The independent variables were Public health expenditure, Female Literacy rate and Health Infrastructure and the dependent variables were Infant mortality rate and Crude Birth rate. All the data for these variables was sourced from the secondary sources which includes official websites of RBI, NFHS, EPWRF and SRS. The variables were further converted into natural logarithm. The study uses log-log model.

Public health expenditure is calculated by adding the sum of total revenue and capital expenditure on medical and public health and family welfare divided by the population to arrive at the per capita public health expenditure. It is symbolized as LnPCPHE. Female literacy rate is the females aged 15 and above who can write, read and carry out simple calculations symbolized as LnFEML. Health Infrastructure is the addition of total number of Sub-centres, Community centres and Primary health centres. It is symbolized as LnINFRA. Infant mortality rate is the infants dying rate before turning one year after their birth symbolized as LnIMR and lastly Crude Birth rate is the average number of live births occurring to 1000 individuals in a year, symbolized as LnCBR.

b) Period and selection of states-

Twenty-three Indian states were chosen due to the availability of the dataset for 30 years from 1990-1991 to 2019-2020 which were consistent and comparable. Following were the states chosen for the study. Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Goa, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Odisha, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Nagaland, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal.

c) Statistical procedure-

The study includes the trend analysis for the selected health outcomes variables at a national level Followed by descriptive statistics, pair-wise correlation, and panel data models of FEM and REM will be applied to the study due to the randomness in choosing the sample size for the study. An increase in public health expenditure is expected to have lower infant mortality and crude birth rate. Along with the public health expenditure, the study also includes two other independent variables, which are the female literacy rate and health service infrastructure. It is known to believe as the female literacy rate goes up, they become more educated and aware of health issues which can help in improving the health of them and their family members and the health infrastructure will provide easy accessibility to the healthcare facility. These are the null hypotheses developed accordingly:

H₀1: There is no statistically significant impact of (public health expenditure, female literacy rate, health infrastructure) on infant mortality rate.

H₀2: There is no statistically significant impact of (public health expenditure, female literacy rate, health infrastructure) on crude birth rate.

4. Data Analysis and Findings:

4.1 National Level-

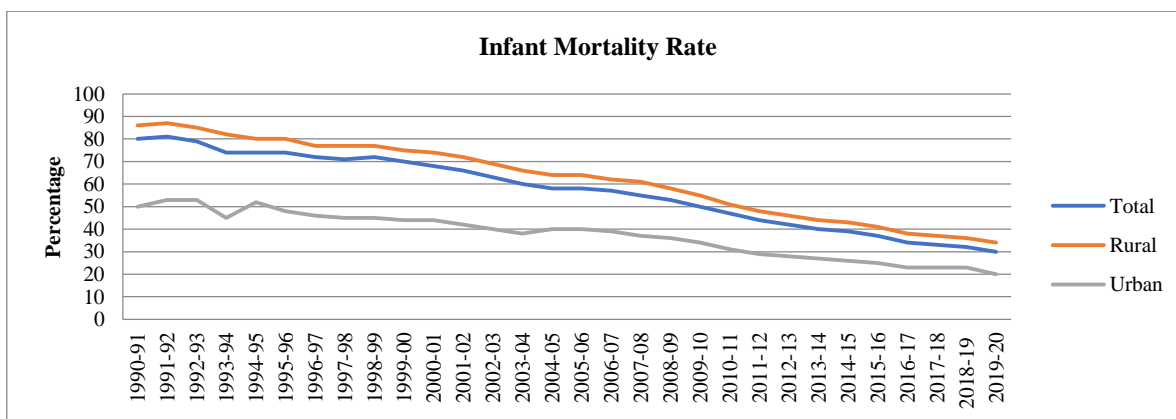


Fig 1: Infant mortality rate at a national level for a period of 30 years

Source: Author's compilation

Fig 1 shows the infant mortality rate trend for 30 years at a national level. At present, 2019-20 the infant mortality rate is thirty infant deaths per thousand live births, which are about two-thirds as compared to 1990-91 (80 infant deaths). For last 30 years, the Infant mortality rate has witnessed a reduction of about 34% and 20% in rural area and urban areas respectively. It also indicates that infant mortality rate at all India levels has declined from 47 to 30 in the last decade. In rural areas it declined from 51 to 34, and for urban areas, it reduced from 31 to 20. Even though there has been a decline in the infant mortality rate over the last decades, one in every thirty-three infants dies within the first year of their life at the National level (irrespective of rural-urban).

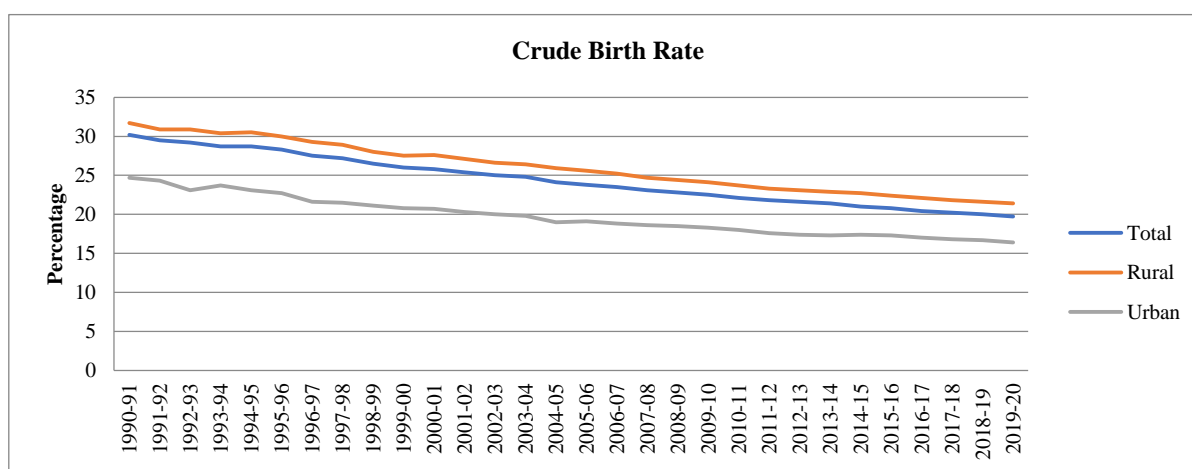


Fig 2: Crude Birth rate at a national level for a period of 30 years

Source: Author's compilation

The crude birth rate in India is represented in Fig 2, which has declined drastically over the last three decades from 30.2 to 19.7 i.e. 1990-91 to 2019-20. The rural and urban differential has also narrowed down over the last 30 years period. Nevertheless, in the last three decades the crude birth rate has remained to be higher in rural areas than urban areas. It shows its level of crude birth rate for India over the last 30 years. The crude birth rate has declined by about 35% in the last 30 years, and when it comes to the last decade, i.e., 2010 onwards, it has gone down from 22.1 to 19.7 in 2019-20, which is gone down about 11%. Correspondently, in rural areas it is 21.4, and for urban areas, it is 16.4.

4.2 Descriptive Statistics and Pair-wise Correlation

Table 1: Results of descriptive statistics & pair-wise correlation

	Mean	Std. Dev	Kurtosis	Skewness	LnPCPHE	LnFEML	LnINFRA	LnIMR	LnCBR
LnPCPHE	763.095	1180.295	23.601	4.185	1	0.464	-0.307	-0.449	-0.418
LnFEML	56.444	16.6369	-0.334	-0.135		1	-0.330	-0.778	-0.807
LnINFRA	6878.855	6180.978	0.544	0.887			1	0.441	0.456
LnIMR	45.406	23.515	-0.212	0.385				1	0.845
LnCBR	21.922	5.679	-0.735	0.401					1

Source: Author's compilation

Table 1 explains the following results; the mean values indicate the average value for the last 30 years for LnPCPHE, LnFEML, LnINFRA, LnIMR, and LnCBR. The average is higher for LnPCPHE and LnINFRA in comparison to LnFEML. Even though the average mean values are less for LnIMR and LnCBR, it is good as it shows that there is some progress happening in terms of health outcomes. Standard deviation explains the dispersion of the data. In the case of LnFEML, the deviation is lesser than LnPCPHE and LnINFRA.

LnPCPHE, LnINFRA, LnIMR and LnCBR are positively skewed except for which is negatively skewed. In kurtosis, LnFEML, LnINFRA, LnIMR and LnCBR lie below three, which indicates the platykurtic behaviour of the data series. LnPCPHE data points lie above three, indicating leptokurtic behaviour of the data set. The results of pair-wise correlation indicate a moderate degree of negative correlation with LnIMR and LnCBR. It also shares a moderate degree of positive and negative relation with LnFEML and LnINFRA, respectively. LnFEML shares a moderate negative correlation with LnINFRA. However, it has a high degree of correlation with LnIMR and LnCBR. LnINFRA shows an average positive relation with LnIMR and LnCBR.

4.3. Panel data analysis:

Panel data analysis for India with state level data was conducted using FEM and REM models to see the impact of the independent variables (public health expenditure, female literacy rate, health infrastructure) on the dependent variables (infant mortality rate and crude birth rate) under study.

Table 2: Panel Data Analysis

DV's	Dependent variable: LnIMR		Dependent variable: LnCBR	
	FEM	REM	FEM	REM

CONSTANT	2.568802 (1.88519) [0.187]	4.144578*** (1.031093) [0.000]	4.656972*** (0.3242106) [0.000]	4.378409*** (0.1941282) [0.000]
PCPHE	-0.2860938*** (0.0344719) [0.000]	-0.268623*** (0.0300402) [0.000]	-0.1033077*** (0.0100668) [0.000]	-0.1043811*** (0.0097736) [0.000]
FEML	-0.2133252** (0.0806595) [0.015]	-0.2277502*** (0.0771159) [0.003]	-0.1410512*** (0.0333121) [0.000]	-0.1494137*** (0.0342515) [0.000]
INFRA	0.4493906* (0.245869) [0.081]	0.248386** (0.1231646) [0.044]	-0.0526939 (0.0394652) [0.195]	-0.0132664 (0.0218284) [0.543]
R²	0.4121	0.4719	0.3506	0.5429
Hausman test	P = 0.0081***			P = 3.02

Source: Author's compilation

*Note: Coefficient values, Parenthesis reflects the robust errors, and square brackets refer to the p-values. * 10% level of significance, ** 5% level of significance and *** 1% level of significance.*

Table 2 shows the panel data results for all twenty-three selected states. In the case where LnIMR is the dependent variable, FEM and REM models, LnPCPHE is statistically significant at 1% on LnIMR. This implies that as the states increase their spending on the health sector, the infant mortality rate tends to improve as they have an inverse relation with per capita public health expenditure. As a 1% increase in the LnPCPHE, it decreases LnIMR by 0.286%, across FEM model. Comparable results are found for REM also. Therefore, we accept the alternative hypothesis, which is there is a statistically significant impact of LnPCPHE on LnIMR.

LnFEML is also statistically significant at a 5% level in FEM model and 1% level in REM model. Nevertheless, it is negatively influencing the LnIMR. It can be stated that as the female literacy rate improves, they will take informed reproductive and healthcare decisions, which will play an important role in progressing health outcomes as they can make informed decisions about the health needs of the family. The results show that a 1% change in the LnFEML results in population stabilisation and better infant care, reflected by a lower infant mortality rate. Hence, we accept the alternative hypothesis. Therefore, we accept that there is a statistically significant impact of LnFEML on LnIMR.

Interestingly, LnINFRA has a positive and statistically significant relationship with the LnIMR. It is expected for LnIMR will improve when investment is made in the health infrastructure. But despondently, the results contradict the general perception. There can be reasons; Health care institutions are there, but accessibility can be an issue for people residing in rural areas. Then, in that case, the alternative hypothesis will be accepted, which is there is a statistically significant positive impact of LnINFRA on LnIMR.

The study shows the r-squared values. Generally, a higher r-squared value will indicate more variability. For the twenty-three Indian states, both FEM and REM show r-squared values of

41% and 47%, respectively, and as per the Hausman test, we can select the FEM model to be a better one. With this, we can infer that only 41% of the changes in the LnIMR are explained by LnPCPHE, LnFEML, and LnINFRA. 59% of it is explained by the factors which are not considered in the study.

Where LnCBR is the dependent variable for overall twenty-three Indian states, it can be inferred that across FEM and REM models, LnPCPHE is statistically significant at a 1% level to LnCBR. As public health expenditure increases, the crude birth rate will decrease. In simple words, as the government increases the expenditure on the health sector, the health outcome is improving, keeping LnCBR in mind.

It can also be seen that LnFEML is statistically significant at 1% level. It negatively influences LnCBR. This implies as the female literacy rate increases, the crude birth rate reduces; the reason for this is when women are literate, they become aware or are educated of the basic health concerns. Then the same will be imparted to the family members. This will improve the health outcomes, in this case, LnCBR. Therefore, we accept that there is a statistically significant impact of LnFEML on LnCBR.

Although LnINFRA showed a positive impact yet again but is not statistically significant, in this case, we fail to reject null hypothesis and state there is no statistically significant impact of LnINFRA on the LnCBR.

Lastly, the r-squared figures state the variations caused in the LnCBR by the LnPCPHE, LnFEML, and LnINFRA. For the overall twenty-three states, the Hausman test proves REM to be better than FEM, so it can be inferred that 54% of the changes in LnCBR are owing to LnPCPHE, LnFEML, and LnINFRA together.

5. Findings and conclusion

To sum up the panel data analysis for both the dependent variables, infant mortality rate and crude birth, the results suggest that an increase in the per capita public health expenditure and female literacy rate will allow for better facilities for the people, which will help them in improving the health outcomes. In this sense, the government should increase the per capita public health expenditure, increase the female literacy rates, and also increase the accessibility of health infrastructure for people. The results of the study are consistent with some studies in the literature (Barenberg, Basu & Soylu, 2017; Rana, Alam & Gow, 2018, Mohanty & Behera, 2020).

The presence of healthy people is said to be the major driver for economic activities and the development of a nation. In an economy which is developing like India, a pivotal role is played by the government in providing affordable healthcare services and easy accessibility to poor and needy citizens of the nation. The relation between public health expenditure and outcomes of health is of prime interest to policymakers because of the steady rise in per capita public health expenditure in India. State governments are doing their best in terms of providing hospitals with all necessary infrastructure, proper sanitation, safe drinking water, immunisation, malaria prevention and treatment, nutrition etc. Through their healthcare policies, there is an improvement in the health outcomes, like a reduction in the infant mortality rate and crude birth rate, as in the current study. In general, public health practices are particularly important to implement a wide reduction in the mortality indicators, fertility

rates and morbidity of an economy. India as a nation can rapidly achieve better health goals by increasing its spending on the health sector. Given the health needs of a developing nation like India, the study recommends an improvement in public healthcare spending, female literacy rate and also improvement in the healthcare infrastructure among the Indian states.

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