The Impact of Public Health Expenditure on Health and Demographic Indices in India

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Abstract: Since gaining independence, India has made continuous efforts to improve its health and demographic indicators. To this end—ranging from the first population policy of 1948 to the health policy of 2017— sustained efforts have been made to ensure universal access to quality healthcare facilities through the development of basic health infrastructure. For this purpose, various committees constituted periodically, as well as international reports, have consistently recommended increasing public health expenditure; likewise, the government has strived to raise health spending in every annual budget, despite limited resources. However, statistics reveal that the actual amount expended falls significantly short of the figures recommended by these policies. Due to this shortfall in public health expenditure, India's public health system has had to grapple with numerous challenges—most notably, a shortage of adequate facilities in rural and remote areas, alongside a lack of basic medical amenities within existing health centres. This research paper examines the evolving trends and interdependencies between per capita government health expenditure and various demographic indicators by establishing statistical relationships over the period of 2000 to 2022.

Keywords: Public Health Expenditure, Health Infrastructure, Demographic Indicators, Healthcare Financing, Health Policy, Population Health, Rural Healthcare, India.

INTRODUCTION

Over the past two decades, India's health indicators have shown significant improvements, reflecting the government's efforts in health and demographic reforms. Increased investment in healthcare infrastructure has contributed substantially to these improvements. In India—where poverty and access to healthcare services remain persistent challenges—the role of public health facilities and public health expenditure is of paramount importance. Therefore, it is imperative to examine the nexus between health and demographic parameters on the one hand, and public health expenditure on the other.

Among key health indicators, the Maternal Mortality Rate and Infant Mortality Rate are directly influenced by factors related to the health and nutrition of women and infants. Primary Health Centres—and in particular healthcare facilities in rural areas —play a pivotal role in this regard. Government-sponsored health and family welfare programs collectively impact these mortality rates, as well as the Total Fertility Rate. Furthermore, better health during early childhood contributes significantly to increased life expectancy and a reduction in the Crude Death Rate. More specifically, adequate nutrition, healthcare, and proper nurturing from the beginning of life are crucial for a long, disease-free life; thus, public health expenditure serves as an essential support system, particularly for families unable to afford these services.

OBJECTIVE AND METHODOLOGY

The main objective of the study is to examine trends in per capita government health expenditure from 2000 to 2022 and their impact on health and demographic indices. For this, the Lenier trendline has been drawn for per capita government health expenditure and health and demographic variables. Correlation and regression analyses to establish an interrelationship between health expenditure and demographic variables.

The data for the analysis have been drawn from the World Bank's country data and Macrotrends' reports on Indian vital statistics.

TREND ANALYSIS OF PUBLIC HEALTH EXPENDITURE AND HEALTH AND DEMOGRAPHIC INDICATORS

Table 1 presents data regarding per capita government expenditure on health, as well as key health and demographic indicators—such as Maternal Mortality Rate, Infant Mortality Rate, Life Expectancy at Birth, Total Fertility Rate, Crude Birth Rate, and Crude Death Rate—spanning the years 2000 to 2022. These data reveal an overall positive trend, although significant fluctuations were observed during the COVID-19 period. A statistical representation of these data is provided below.

Government Health Expenditure

The data in Table 1 show that per capita domestic general government health expenditure in India increased from $3.82 in 2000 to $32.93 in 2022. Although the R^2 value of 0.9043 for the linear trend line analysis indicates a steady upward trend in health expenditure, the annual growth rate of per capita government health expenditure during this period has been quite

volatile. After experiencing negative annual growth rates in 2001 and 2002, the growth rate remained positive and high until 2011. Per capita government health expenditure declined slightly in 2012 and 2013, but thereafter, its growth rate became positive and large, and during the COVID-19 pandemic, the annual growth rate was the highest in 2021 (Table 2).

Maternal Mortality Rate

Maternal mortality rate refers to the number of maternal deaths per 100,000 live births. Besides being an important indicator of women's health and primary healthcare facilities, maternal care is a multidimensional approach to caring for women during pregnancy. This rate also reflects the combined impact of counselling, nutritional care, vaccinations, and periodic preventive checkups during pregnancy. It is significantly influenced by institutional delivery facilities and emergency services during birth.

Maternal mortality rates in India have steadily declined since 2000. The MMR was 336 in 2000, which declined to 90 in 2022. From 2000 to 2010, maternal mortality rates declined more rapidly than in subsequent years. With the onset of COVID-19 in 2020, the MMR stabilised at 101 and increased to 151 in 2021 due to the COVID-19 impact. But after COVID, MMR decreased significantly again and reached 90 (Table 1).

If the annual rate of decline in MMR is measured (Table 2), it was -3.59 percent for the year 2001, which further declined to -8.07 percent in the year 2010, which is a good sign from the point of view of maternal health. From 2011 to 2019, the rate of decline in the maternal mortality rate declined, and it further declined from -7.98 in 2011 to -5.61 percent in 2019.

Infant Mortality Rate

Infant mortality rate, the number of deaths of infants (0–1 year) per year as a proportion of live births, is another important demographic indicator of health facilities. Within infant mortality, neonatal mortality is primarily caused by foetal anatomy and complications during delivery, while post-neonatal mortality is associated with malnutrition, inadequate postnatal care, infections, illness, and lack of medical attention.

In India, IMR declined from 66.3 in 2000 to 25.6 in 2022 (Table 1). The R^2 value for the linear trendline of IMR in this table is 0.8892, indicating a steady decline. This is very close to India's SDG-3 targets. The annual growth rate during this period was negative, and declined more

rapidly from 2011 to 2020 than in the initial years. The rate of decline was affected by the Covid impact in 2021-22.

Life Expectancy at the Time of Birth

Being born without complications or illnesses reduces the risk of early death and increases the likelihood of longevity. However, proper health and medical care in later life play a crucial role in life expectancy. Life expectancy at birth was 62.75 years in 2000, increasing to 71.7 years in 2022. The R^2 value of 0.9981 for the linear trendline based on life expectancy data in Table 1 indicates a pattern of consistent increase in life expectancy. The data shows that the growth rate of life expectancy has been positive, with a slight decrease each year until the COVID-19 pandemic in 2020-21. Table 2 clearly shows that; life expectancy increased more rapidly from 2000 to 2012 than in the subsequent decade.

Table 1: Trends of Government Health Expenditure and Health - Demographic Indicators

Year	Domestic general government health expenditure per capita (current US$)	MMR	IMR	Life Expectancy at the time of birth	TFR	CBR	CDR
2000	3.82	362	66.3	62.75	3.35	27.52	8.63
2001	3.73	349	64.3	63.16	3.3	27.21	8.48
2002	3.66	330	62.4	63.65	3.22	26.54	8.29
2003	4.10	313	60.5	64.09	3.12	25.78	8.13
2004	4.48	296	58.6	64.48	3.05	25.12	7.98
2005	5.53	277	56.7	64.94	2.96	24.3	7.82
2006	6.02	258	54.8	65.37	2.87	23.56	7.67
2007	7.45	240	52.8	65.8	2.78	22.93	7.54
2008	8.52	223	50.8	66.25	2.71	22.51	7.41
2009	9.75	205	48.7	66.7	2.67	22.21	7.29
2010	11.74	188	46.7	67.16	2.6	21.63	7.16
2011	13.91	173	44.6	67.62	2.53	21.16	7.05

2012	13.56	160	42.5	68.08	2.47	20.67	6.95
2013	12.80	148	40.5	68.5	2.4	20.06	6.86
2014	13.33	137	38.5	68.93	2.29	19.09	6.77
2015	14.90	129	36.6	69.33	2.29	18.94	6.73
2016	16.03	121	34.7	69.71	2.28	18.76	6.7
2017	18.67	113	33	70.07	2.19	18	6.67
2018	19.71	107	31.3	70.42	2.18	17.91	6.67
2019	21.28	101	29.7	70.75	2.12	17.37	6.67
2020	23.14	101	28.2	70.16	2.05	16.74	7.21
2021	30.52	155	26.8	67.28	2.01	16.49	9.26
2022	32.93	90	25.6	71.7	1.99	16.34	6.58
Trend Line Value (R^2)	0.9043	0.9166	0.8892	0.9981	0.983	0.9888	0.3195*
Trend line Equation	y = 1.1744x - 1.0674	y = -12.376x + 347.47	y = 0.3678x + 62.842	y = -1.9101x + 67.904	y = -0.0632x + 3.3421	y = -0.5231x + 27.618	y = -0.0625x + 8.1645
2020 and 2021were the COVID Year							
Source: World Bank Data Reports							

Total Fertility Rate

In a populous country like India, the total fertility rate (TFR) plays a prominent role in shaping demographic trends. The total fertility rate is the number of live births a woman has during her fertile years. If in a country, TFR rises the population will rise too. In India, the TFR was 3.35 per woman in 2000, which reduced to 1.99 per woman in 2022 (Table 1). The R^2 value of TFR's linear trendline is 0.9888, indicating a stable decline in the number of children a woman gives birth to in her fertile lifespan. The decline rate of TFR is very fluctuated and varies from 0 to -4.58 percent during the period (table 2).

Table 2: Annual Growth Rates of Government Health Expenditure and Health - Demographic Indicators

Year	Domestic general government health expenditure per capita (current US$)	MMR	IMR	Life Expectancy at the time of birth	TFR	CBR	CDR
2001	-2.36	-3.59	-3.02	0.65	-1.49	-1.13	-1.74
2002	-1.88	-5.44	-2.95	0.78	-2.42	-2.46	-2.24
2003	12.02	-5.15	-3.04	0.69	-3.11	-2.86	-1.93
2004	9.27	-5.43	-3.14	0.61	-2.24	-2.56	-1.85
2005	23.44	-6.42	-3.24	0.71	-2.95	-3.26	-2.01
2006	8.86	-6.86	-3.35	0.66	-3.04	-3.05	-1.92
2007	23.75	-6.98	-3.65	0.66	-3.14	-2.67	-1.69
2008	14.36	-7.08	-3.79	0.68	-2.52	-1.83	-1.72
2009	14.44	-8.07	-4.13	0.68	-1.48	-1.33	-1.62
2010	20.41	-8.29	-4.11	0.69	-2.62	-2.61	-1.78
2011	18.48	-7.98	-4.50	0.68	-2.69	-2.17	-1.54
2012	-2.52	-7.51	-4.71	0.68	-2.37	-2.32	-1.42
2013	-5.60	-7.50	-4.71	0.62	-2.83	-2.95	-1.29
2014	4.14	-7.43	-4.94	0.63	-4.58	-4.84	-1.31
2015	11.78	-5.84	-4.94	0.58	0.00	-0.79	-0.59
2016	7.58	-6.20	-5.19	0.55	-0.44	-0.95	-0.45
2017	16.47	-6.61	-4.90	0.52	-3.95	-4.05	-0.45
2018	5.57	-5.31	-5.15	0.50	-0.46	-0.50	0.00
2019	7.97	-5.61	-5.11	0.47	-2.75	-3.02	0.00
2020	8.74	0.00	-5.05	-0.83	-3.30	-3.63	8.10
2021	31.89	53.47	-4.96	-4.10	-1.95	-1.49	28.43
2022	7.90	-41.94	-4.48	6.57	-1.00	-0.91	-28.94

Crude Birth Rate

The Crude Birth Rate (CBR) represents the ratio of the total number of births to the population in a specific year. In the year 2000, the CBR stood at 27.52, which subsequently declined to 16.34 in 2022. The decline in the Crude Birth Rate between 2000 and 2014 was more pronounced than in the subsequent years. This pattern of decline in the CBR is a natural occurrence as the Total Fertility Rate approaches its lower limits. According to Table 1, the R^2 value of the linear trendline for the CBR stood at 0.9888, indicating the stability of the trendline in the CBR.

However, during this same period, the rate of decline in the CBR fluctuated widely; specifically, it decreased rapidly from 2000 to 2006. Subsequently, between 2007 and 2014, a sharp decline was observed in certain years, although the decline rate moderated in the years that followed (Table 2).

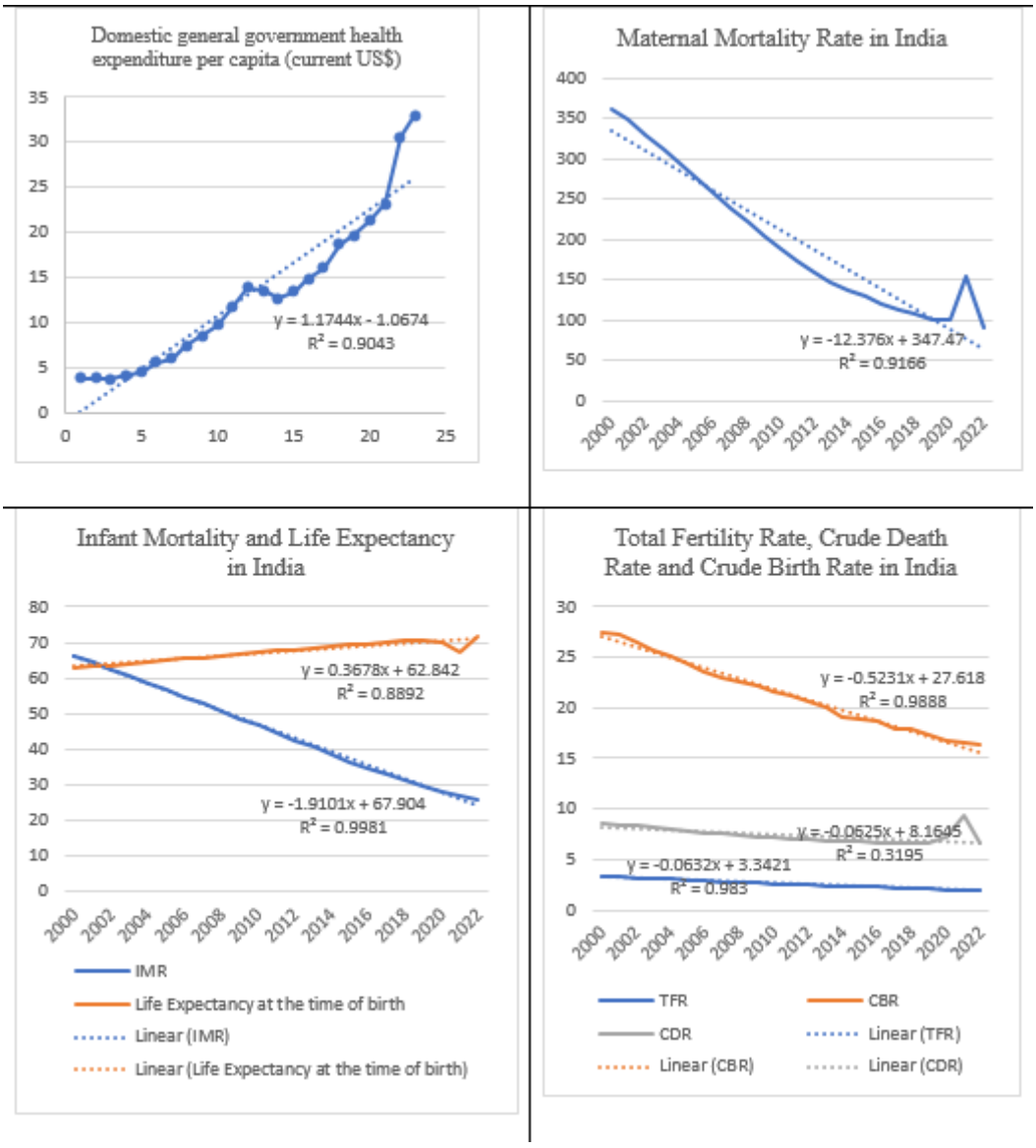

Figure 1: Trendline for Government Health Expenditure and Health - Demographic Indicators

Crude Death Rate

The Crude Death Rate (CDR) represents the number of deaths per 100,000 people occurring in a year. Although it is not a standardised rate, it nevertheless provides a rough estimate of various types of mortality rates. In the year 2000, the CDR stood at 8.63, which subsequently

declined to 6.85 in 2022. For the period spanning 2002 to 2019, the linear trendline R^2 value for the CDR—at 0.9478—indicated a steady decline; however, following the inclusion of data from the COVID years (2019–2020), the R^2 value dropped to 0.3195 due to the high number of deaths caused by the pandemic. The rate of decline in the CDR exhibited fluctuations during the 2000–2010 period; however, from 2011 through 2019, the rate of decline became more moderate yet stable (Table 2). The stabilisation of the CDR at a lower level during this period is a positive sign. In 2020—the year of the pandemic—the growth rate of the CDR was 8 percent; the following year it surged to 28.43 percent, underscoring the severe impact of the pandemic on mortality rates. In the post-pandemic period, the CDR declined by 28.94 percent, signalling a return to the previously established pattern.

CORRELATION ANALYSIS

By utilizing a correlation matrix, a deep understanding of the interrelationships among key public health indicators in India between the years 2000 and 2022 can be attained. The direction and intensity of the correlation among various factors—such as health expenditure, mortality rate, life expectancy, fertility rate, and birth rate—can be measured with the aid of Pearson correlation coefficients, the values of which range from -1 to +1. These results illustrate the mutual influence, direction, and limitations of public health expenditure and the indicators associated with it.

Table 3: Correlation matrix for Government Health Expenditure and Health - Demographic Indicators

	GHE	***MMR***	***IMR***	**Life Exp.**	***TFR***	***CBR***	***CDR***
GHE	1						
MMR	-0.83959	1					
IMR	-0.93855	0.96635	1				
Life Exp.	0.83450	-0.98377	-0.94996	1			
TFR	-0.91477	0.97888	0.99434	-0.95175	1		

CBR	-0.92137	0.97420	0.99632	-0.95023	0.99917	1	
CDR	-0.36925	0.75812	0.58582	-0.80358	0.61655	0.604129	1
***Researcher's Calculation**							

Table-3 presents the mutual correlations among government health expenditure, health indicators, and demographic parameters. These correlations have been calculated based on the index values presented in Table 1. Based on the values in the correlation matrix, it is evident that per capita public health expenditure shows strong correlations with all demographic parameters, except the Crude Death Rate (CDR). Specifically, per capita public health expenditure demonstrates a strong negative correlation with the Maternal Mortality Rate (MMR) (-0.83959) and the Neonatal Mortality Rate (-0.93855). Conversely, there exists a strong positive correlation (0.96635) between the MMR and the Infant Mortality Rate (IMR). The strong correlation between maternal mortality rates and infant mortality rates is natural, as the care, nutrition, and health-related facilities received during pregnancy and delivery affect both rates equally. Consequently, a strong negative correlation is observed between these rates and per capita government health expenditure.

Life expectancy is positively and strongly correlated (0.83450) with per capita public health expenditure. Healthcare services exert a negative influence on mortality rates—particularly deaths caused by diseases—across all stages of life. The high negative correlation of MMR (-0.98377) and IMR (-0.94996) with life expectancy further confirms that at birth—when an infant is in greatest need of health-related care—an expansion of public health services leads to a reduction in mortality rates, thereby resulting in an increase in life expectancy at birth.

The Total Fertility Rate (TFR) exhibits a strong negative correlation (-0.91477) with per capita public health expenditure. The strong positive correlation of TFR with the Maternal Mortality Rate (MMR) (0.97888) and the Infant Mortality Rate (IMR) (0.99434) indicates that if infant and maternal mortality rates rise, the likelihood of children surviving decreases; consequently, an increase in TFR emerges as a significant trend serving as a compensatory measure. This fact is further corroborated by the strong negative correlation value (-0.95175) observed between TFR and life expectancy.

The Crude Birth Rate (CBR) exhibits a strong positive correlation (0.99916) with the Total Fertility Rate (TFR), as the TFR is an inherent component of the CBR. Furthermore, the CBR demonstrates a strong negative correlation (-0.92137) with per capita government health expenditure—an association whose analysis mirrors that previously conducted for the TFR.

The Crude Death Rate (CDR) encompasses both the Infant Mortality Rate (IMR) and the Maternal Mortality Rate (MMR); consequently, it shows a strong positive correlation with both. Similarly, a strong negative correlation (-0.80358) is confirmed between mortality rates and life expectancy—a relationship that is entirely natural, as a decline in mortality rates invariably increases life expectancy.

The negative correlation coefficient (-0.36925) between the CDR and per capita public health expenditure is not particularly strong, primarily because the CDR accounts for deaths resulting from all causes, including those that cannot be prevented even with access to healthcare facilities.

REGRESSION ANALYSIS

A linear regression model has been employed to analyse the impact of per capita public health expenditure on various health and demographic indicators. In this regression analysis, per capita public health expenditure was the independent variable, and health and demographic indicators were the dependent variables. The regression results are presented in Table 4.

Table 4: Regression Analysis Results

	MMR	IMR	Life Expectancy at the time of birth	TFR	CBR	CDR
R^2	0.705	0.8809	0.834504	0.836801	0.848932	0.136349
Adj. R^2	0.691	0.8752	0.696397	0.82903	0.841738	0.095223
Std. Error	48.750	4.5808	0.68194	0.178713	1.419448	0.71395
Sig. F (P-value)	5.48E-07	3.62E-11	7.42E-07	1.01E-09	4.46E-10	0.082915

Coefficient (Slope)	-8.789	-1.45302	0.26359	-0.0472	-0.39249	-0.03309
P-value (intercept)	1.87E-13	2.89E-20	2.03E-30	1.65E-22	7.12E-23	3.95E-18
Relationship	Negative	Negative	Positive	Negative	Negative	Negative
Model Strength	Highly Significant	Highly Significant	Highly Significant	Highly Significant	Highly Significant	Significant
***Researcher's Calculation**						

The regression analysis results presented in Table 4 confirm a causal relationship between public health expenditure and various health and demographic indicators. In accordance with general intuition, public health economics, and human capital theory, increased public spending on health should—in principle—lead to improved health outcomes, as such expenditure facilitates better access to healthcare, disease prevention, and enhanced preventive services.

In the context of MMR, the R^2 value indicates that per capita government health expenditure explained approximately 85 percent of the variation in the maternal mortality rate. Regarding MMR, the coefficient slope value suggests that a one-unit increase in per capita government health expenditure leads to a decrease of 8.789 units in the maternal mortality rate. $F < 0.05$ indicates that the model is significant and supports the hypothesis that an increase in per capita public health expenditure significantly reduces the maternal mortality rate.

In the case of IMR the value of R^2 indicates that approximately 88 percent variation in IMR is explained by per capita government health expenditure. The Coefficient slope value indicates that an increase of 1 unit in per capita public health expenditure leads to a decrease of 1.45302 units in IMR. The F value < 0.05 indicates that an increase in per capita government health expenditure significantly reduces infant mortality rate.

Life expectancy is a combined result of several health indicators and exogenous variables. But here, life expectancy is a dependent variable of per capita government health expenditure

(which itself a deciding factor for other health indicators too) for which the value of R^2 is 0.696397, which means approximately 69.64 percent variation in life expectancy is explained by per capita public health expenditure. Moreover, the slope coefficient indicates that a one-unit increase in per capita public health expenditure increases life expectancy by 0.2636 units. The F<0.05 signifies the regression model and proves that public expenditure on health increases life expectancy.

The total fertility rate is another combined result of medical facilities and mortality rates in early ages. which is already shown in the correlation analysis. The regression results show that per capita public health expenditure plays an important role in the decline of TFR. the R^2 value explained approximately 84 percent variation in TFR, which occurs due to a change in per capita government health expenditure. Therefore, the coefficient (slope) indicates that 1 unit increase in government health expenditure will reduce TFR by approximately 0.05 units. F < .05 makes this relationship significant.

Due to differences in the criteria and measurement methods for TFR and CBR, the regression results also differ accordingly. R^2 value explains approximately 85 percent of the deviation in CBR, which is due to per capita government health expenditure. The coefficient (slope) indicates that a one-unit increase in per capita government health expenditure reduces CBR by 0.39 units. The F < 0.05 indicates the relationship is significant. Notably, in the case of per capita government health expenditure and CBR, the regression analysis provides a higher impact value than the TFR and per capita government health expenditure regression analyses.

As mentioned above in correlation analysis, CBR is not highly correlated to per capita health expenditure. The regression analysis also shows a lower impact than IMR and MMR, and the results are less significant.

DISCUSSION

Musgrove (1996), highlighted the significance of public finance. They concluded that, if general health facilities were left entirely to the private sector, a large segment of the population could be deprived of preventive and obstetric care, as well as basic health services. Therefore, government participation in the health sector is essential to ensure universal access to healthcare and improve health outcomes. The paper's statistical findings also validate this approach.

Maternal Mortality Rate

Health-related facilities play a crucial role, alongside economic, social, familial, and demographic factors, in reducing the maternal mortality rate. Correlation and regression results further confirm that even a marginal increase in government health expenditure can reduce the maternal mortality rate significantly. This perspective is supported by global research findings; for instance, Campbell and Graham (2006) and Hogan et al. (2010) have demonstrated that the MMR can be reduced through skilled birth assistance, antenatal care, and emergency obstetric services. In India, a significant portion of the total population resides in rural areas; furthermore, due to widespread poverty prevalent in both rural and urban communities, accessing private maternal healthcare services becomes challenging. Consequently, government investment in quality public health services plays a pivotal role in maintaining and improving maternal health. Public maternal healthcare facilities encompass a comprehensive range of services related to women's health, ranging from counselling on appropriate childbearing age and essential health prerequisites to institutional deliveries, and subsequent health and nutritional support. In the Indian context, initiatives such as 'Conditional Cash Transfers'—of which the 'Janani Suraksha Yojana' is an excellent example—have proven to be highly effective in reducing maternal mortality rates. These initiatives have played a pivotal role in addressing nutritional needs, promoting institutional deliveries, ensuring access to healthcare services in rural areas through ambulance networks, and providing pregnant women with improved counselling and access to health facilities through 'ASHA' health workers.

Infant Mortality Rate

The statistical analysis presented above clearly demonstrates that fluctuations in health expenditure may account for 88 percent of the variations observed in the Infant Mortality Rate (IMR). These findings align with the research conclusions of Gwatkin et al. (2000), which indicate that public investment in maternal and child health services leads to improvements in infant health and, concomitantly, a reduction in infant mortality. Infant health services encompass a range of medical interventions; prominent among these are maternal immunisation and nutrition during pregnancy, access to trained delivery facilities, the availability of Neonatal Intensive Care Units (NICUs), nutritional support for infants, and preventive measures against diseases caused by external factors. In India, a multi-dimensional approach has been adopted for 'child protection programs,' wherein special priority is accorded

to nutrition and immunisation initiatives; these initiatives are closely integrated with maternal health services. Public health centres—particularly the Primary Health Centres (PHCs) located in rural areas—have played a pivotal role in this endeavour. These public health centres provide infants with routine care and immunisation services, and promote awareness regarding exclusive breastfeeding and nutritionally balanced diets to ensure adequate nutrition. Furthermore, these health centres are equipped with facilities for immediate treatment to prevent infections in newborns and possess appropriate referral mechanisms. Currently, efforts are underway to develop these facilities in accordance with recommendations made by various international organisations—such as the United Nations Children's Fund (UNICEF), the World Health Organisation (WHO), and the United States Agency for International Development (USAID). The collective objective of all these initiatives is to reduce the IMR. All these international organisations concur that public financing in the health sector is an indispensable factor in ensuring the long-term success of health-protection measures for infants and children.

Life Expectancy at the time of Birth

Life expectancy denotes the expected duration of survival for individuals within any given age group; specifically, life expectancy at birth is a complex outcome influenced by a multitude of factors. According to Sen (1998) and Marmot (2005), life expectancy is a complex, composite metric, shaped by a diverse array of determinants. These factors extend far beyond mere health expenditure, encompassing various social, economic, lifestyle-related, and other demographic variables. The statistical analysis presented above clearly demonstrates a profound correlation between the Infant Mortality Rate (IMR) and life expectancy. As individuals age, factors such as nutrition, sanitation, economic inequality, lifestyle-related diseases, and the availability of geriatric care facilities exert distinct influences on life expectancy—effects that vary significantly across different age groups.

This implies that government expenditure plays a pivotal role in fostering greater integration within public health services and in tailoring them to meet the specific health requirements of each distinct age group. This is because the private sector, in addition to being comparatively expensive, is often constrained by limitations pertaining to gender-specific, geographical, and socio-economic nuances. Consequently, adequate public health expenditure becomes an indispensable measure for ensuring a demand-driven supply of health services—ranging from those provided at primary health centres to those offered by highly specialised public health

institutions. However, life expectancy possesses an inherent upper limit, beyond which achieving further improvements becomes progressively more difficult. For this reason, the marginal impact of public health expenditure on life expectancy—as evidenced in the statistical analysis presented above—appears to be somewhat attenuated. These findings are consistent with the Preston Curve (1975), which posits that beyond a certain threshold, the relationship between health expenditure and life expectancy manifests as "diminishing returns".

Total Fertility Rate

Public health facilities exert a significant influence on the Total Fertility Rate (TFR), although these effects are not always immediately or directly apparent. A decline in neonatal mortality rates—coupled with an increase in life expectancy at birth resulting from institutional deliveries—impacts decisions regarding childbearing (WHO, 2021). Furthermore, improvements in economic status also contribute to lowering birth rates, thereby reducing the perceived need for families to have children as a form of "insurance" in contexts where the risk of infant mortality is high (Harvey Leibenstein, 1957). In India, beyond these two factors, Anganwadi programs have had a positive impact on child health; additionally, the socio-economic empowerment of women has led to their decisions within the family being accorded greater significance. The combined effect of these various factors—particularly improvements in nutrition and health conditions—has resulted in a decline in "compensatory births" (births undertaken to replace lost children), leading, on average, to women having fewer children.

Moreover, increased awareness—as well as the availability—of modern methods of family limitation through family welfare programs at health centres has played a substantial role in reducing the TFR. Increased government expenditure on healthcare enhances access to family planning services, contraceptives, and reproductive health education, thereby contributing to a reduction in the TFR. The statistical findings presented in this paper align with empirical research conducted by Cleland et al. (2006), Bongaarts (2010), and the World Bank (2016); their studies demonstrate that increased expenditure on reproductive health services in low-income countries has a significant impact on lowering fertility rates.

CONCLUSION

The analysis presented above clearly demonstrates that an increase in public health expenditure leads to improvements across various health and demographic indicators—a finding

corroborated by statistical analyses and regression models. The aforementioned research findings indicate that increased public health spending reduces the Total Fertility Rate, Maternal Mortality Rate, and Infant Mortality Rate while simultaneously enhancing life expectancy.

From a policy perspective, these findings advocate for assigning high priority to the health sector. This entails improving health infrastructure, prioritising the equitable delivery of health services, and increasing budgetary allocations. Particularly in low- and middle-income countries—where "out-of-pocket" expenditure still accounts for a significant share of total health spending—the goal of achieving "Universal Health Coverage" (UHC) can only be realised through public expenditure. According to the WHO (2023), only those countries that allocate at least five percent of their GDP to healthcare are able to make meaningful progress toward achieving UHC goals.

Ultimately, this chapter posits that public health expenditure is not merely a financial investment, but a moral and strategic imperative that plays a pivotal role in fostering a healthy, productive, and equitable society.

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