AN ECONOMIC ANALYSIS ON HEALTH INDICATORS AND GROSS DOMESTIC PRODUCT OF INDIA

Abstract

The study aims at establishing the relationship between macroeconomic variables such as GDP and macro health indicators like birth rate, infant mortality rate, neo-natal mortality rate. The data used for the study goes for two decades and the study will be done for India. The paper will assess the potential effects of health care policies that affect the macro health indicators. The techniques applied for the study are trend analysis and OLS regression model which will be used to analyse the empirical relationship between the selected variables. The findings and suggestion of the studies are presented in detail in the paper.

Authors

Arun Venkatesh. D
Research Scholar
Department of Economics
Bharathidasan University, Tiruchirappalli.

Siby. B
Research Scholar
Department of Economics
Bharathidasan University, Tiruchirappalli.

I. INTRODUCTION

"It is health that is real wealth and not a piece of gold and silver"

-Mahatma Gandhi

The general socioeconomic well-being of a society is influenced by health and health care. While, comparing a relatively ill workforce to one with good health is likely to result in lower absenteeism and higher production. An extension in life expectancy influences decisions, regarding health care spending and savings. This raises the rate of savings and encourages investment and economic expansion. Through education, awareness is created among children by way of cleanliness and balanced diet. Healthier children typically attend school more frequently, which raises the standard of the future labour force and increases output. Thus, there is a relationship between economic growth and health.

A better health care facility increases the life expectancy which influences the decisions made by individuals regarding their need for healthcare expenditure which in turn increases their rate of savings and increases their investment in other sectors.

Since the resources required to provide it, including human capital, are scarce, health care is generally categorized as an economic benefit. But there is no end for the needs and desires of society. The only way to boost the production and consumption of healthcare is to transfer funds from other economic sectors to the healthcare system. These choices are predicated on the basis of "opportunity cost," which is the benefit which is forgone when resources are allocated to the next best alternative.

Grossman (1972) suggested that people both demand and produce health. Health care has a 'derived demand' from health since people purchase goods such as health care to meet their needs, thus indirectly purchasing health improvements. In Grossman's model, health is considered as a capital good since it can affect a person's ability to work, hence the linkage between health and economic growth.

Health

World Health Organization "Health" is defined as "State of complete Mental, Physical, and Social wellbeing, not merely the absence of disease".

"Health is multifaceted. It defies definition, and no single variable summarizes it, especially at the aggregate level".

In fact, the studies discussed below include a number of different health indicators to try to capture the overall effect of health. The indicators are as follows,

Birth Rate: Birth rate is said to be the frequency of annual births in a given population which is mostly calculated per 1000 inhabitants. It is usually a dominant factor that determines the rate of growth of population which mostly depends on fertility rate and the structure of age.

Infant Mortality Rate: Infant mortality rate is the probability of a child born in a specific year, if subject to age-specific mortality rates of that period. Infant Mortality Rate is said to

be the death of infants per every 1000 live births under one year of age at a particular period of time. Infant mortality rate is strictly speaking not a rate i.e. the number of deaths divided by the number of populations at risk during a certain period of time but a probability of death derived from a life table and expressed as rate per 1000 live births".

Neo-Natal Mortality Rate: It indicates the number of deaths of new born within 28 days. Neo-Natal deaths (deaths among live births during the first 28 completed days of life) may be subdivided into early neonatal deaths, occurring after the 7th day but before the 28th day of life".

Health Expenditure: Total expenditure on health is the sum of general government health expenditure and private health expenditure in a given year, calculated in national currency units in current prices.

Health spending consists of health and health-related expenditures. Expenditures are defined on the basis of their primary or predominant purpose of improving health, regardless of the primary function or activity of the entity providing or paying for the associated health services.

Health care expenditure and its related activities which include medical education, training in medicine and research and development in health care. The sources of Fund for health care come from public health expenditure, health insurance, health care loans, budgets of local, state and federal governments and gifts from non-governmental organization. The total health care expenditure includes both public and private costs. This excludes the provision of water and sanitation but takes into account other services such as family planning, proper nutrition and emergency care.

Health expenditure, as a total percentage of GDP of India was 4.69 as of 2014. Its highest value over the past 19 years was 4.69 in 2014, while its lowest value was 3.90 in 1996. From this, the public Health expenditure (% of GDP) in India was 1.41 as of 2014 and private Health expenditure (% of GDP) in India was 3.28 as of 2014. A recent report says that India's health spending is a measly 3.9 per cent of GDP of this public spending is just 1.15 per cent, which the government aims to raise to 2.5 per cent by 2025.

Objective of the Study

1. To analyze the relationship between GDP and the selected Macro health indicators.
2. To identify the relationship between the selected Macro health indicators and other economic variables associated with GDP.

Methodology

Methodology will be used in the form of Secondary data. Secondary data has been obtained from various sources for the study. For the study, secondary data obtained from journals, articles, reports and from other government websites have been used. Statistical tools such as Correlation, Regression with OLS have been used in the study including various tables and charts have also been used where ever necessary.

AN ECONOMIC ANALYSIS ON HEALTH INDICATORS AND GROSS DOMESTIC PRODUCT OF INDIA

Table 1

Year	Health Expenditure (Billion)
2000	3.82632168
2001	3.73719061
2002	3.67565856
2003	4.11719685
2004	4.50721688
2005	5.56846623
2006	6.06210023
2007	7.49355412
2008	8.57171899
2009	9.80957714
2010	11.82685003
2011	14.03344591
2012	13.69979178
2013	12.94719751
2014	13.50609052
2015	15.10636847
2016	16.26476444
2017	18.96377172
2018	18.12649097
2019	20.90209403

Source: World Bank

Chart 1

Health Expenditure(Billion)
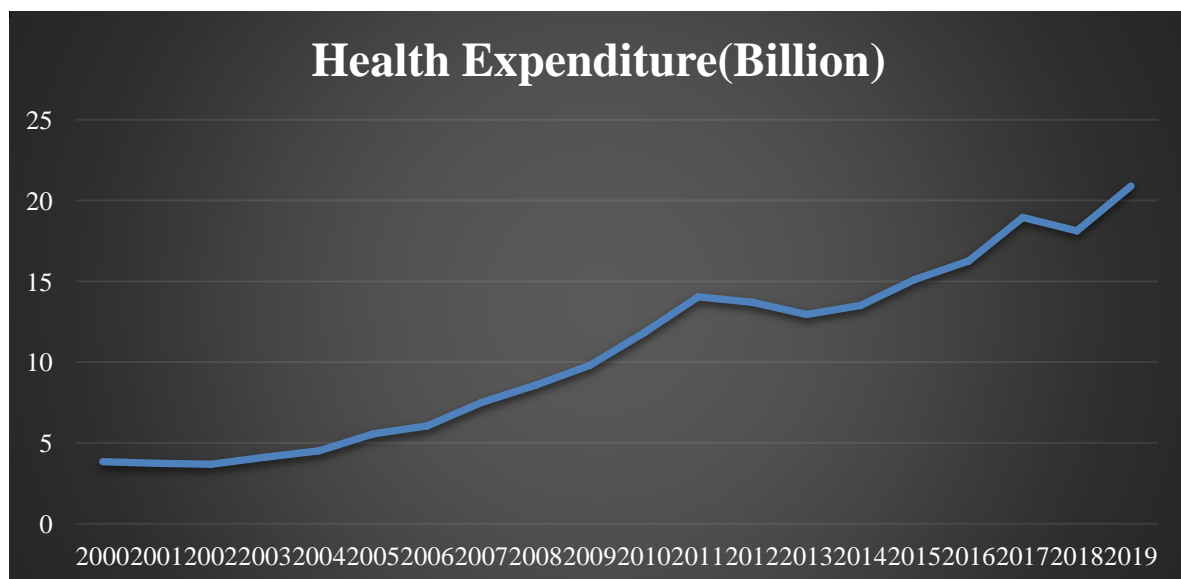
Health Expenditure: The above table and chart represent the health expenditure over the years. This shows that there has been continues increase in the health expenditure by the government over the year, which will possibly increase in the future.

Birth Rate: The data on Birth Rate has been showed below from the year 2001 to 2020.

Table 2

Year	Birth Rate (thousands)
2001	17.3
2002	18.5
2003	16.89
2004	17.1
2005	16.5
2006	16.2
2007	15.8
2008	16.0
2009	16.3
2010	15.9
2011	15.7
2012	15.5
2013	15.4
2014	15.2
2015	15.1
2016	14.9
2017	14.8
2018	14.6
2019	14.5
2020	14.3

Source: NITI AYOG

Chart 1.1
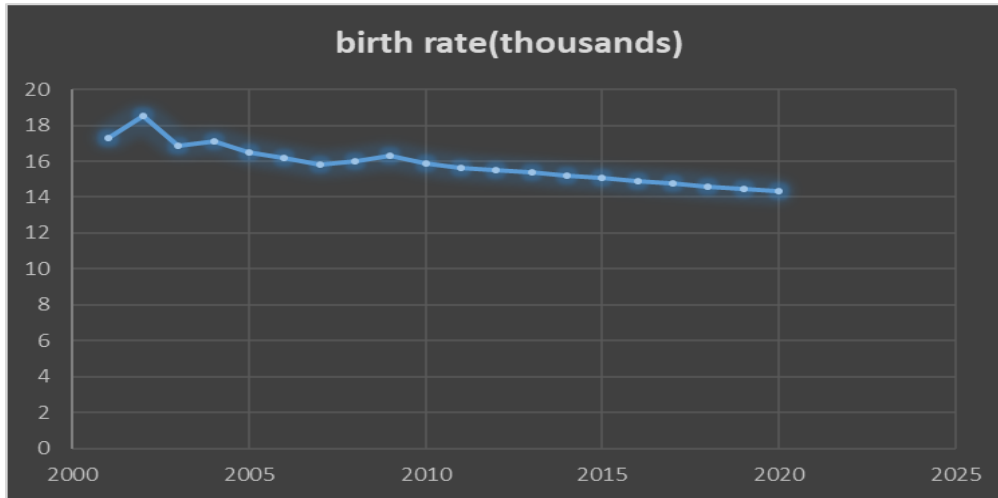
The above table and chart shows the birth rate in India over the years from 2001 to 2020, there has been a gradual decrease in the birth rate over the years which can be seen from the above data. The data has also been pictorially represented by way of a line chart which shows the gradual fall of birth rate over the years. This shows that over the years due to transitional development there has been a gradual fall in the birth rate, which may further fall as there in development.

Table 3

Year	GDP at Current Prices (crores)	Birth Rate(thousands)
2001	148,861	17.3
2002	158155	18.5
2003	175371	16.88
2004	219,003	17.1
2005	257,833	16.5
2006	310,526	16.2
2007	350,819	15.8
2008	401,336	16.0
2009	479,733	16.3
2010	584,896	15.9
2011	667,202	15.7
2012	744,859	15.5
2013	854238	15.4
2014	976703	15.2
2015	928,073	15.1
2016	991535	14.9
2017	1054996	14.8
2018	1118458.11	14.6
2019	1197183.122	14.5
2020	1274341.92	14.3

Source: World Bank

Chart 1.2
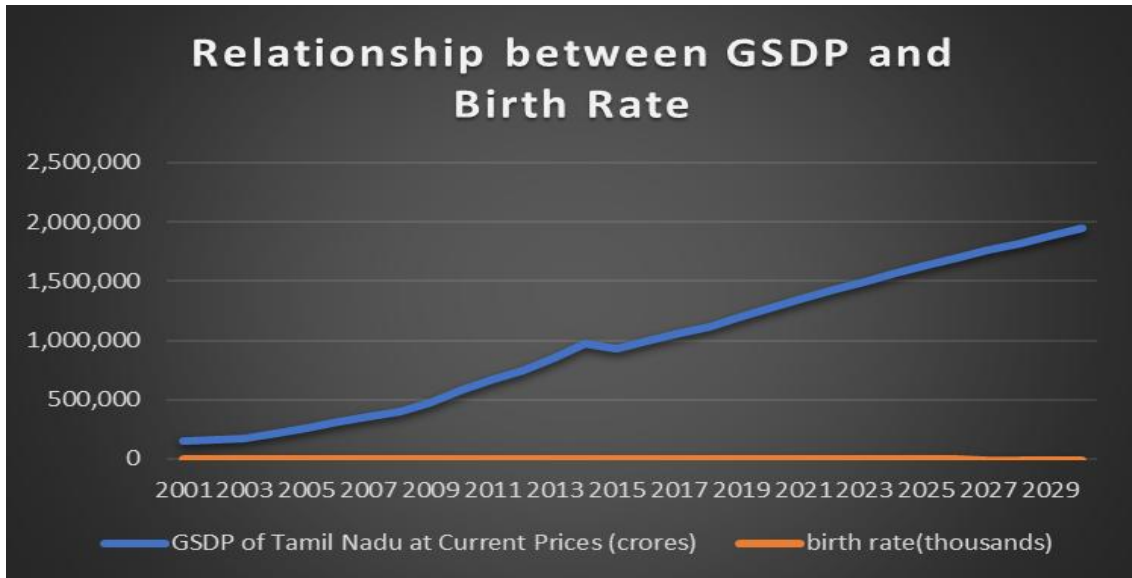
Table 3.1

Correlations		GDP	Birthrate
GDP	Pearson Correlation	1	-.979[**]
	Sig. (2-tailed)		.000
	N	30	30
Birthrate	Pearson Correlation	-.979[**]	1
	Sig. (2-tailed)	.000	
	N	30	30
**. Correlation is significant at the 0.01 level (2-tailed).			

Table 3.2

Variables Entered/Removed[a]			
Model	Variables Entered	Variables Removed	Method
1	birthrate[b]	.	Enter
Dependent Variable: GDP			
All requested variables entered.			

Table 3.3

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.979[a]	.959	.958	54878.54755
a. Predictors: (Constant), birthrate				

AN ECONOMIC ANALYSIS ON HEALTH INDICATORS AND GROSS DOMESTIC PRODUCT OF INDIA

Table 3.4

ANOVA[a]					
Model	Sum of Squares	Df	Mean Square	F	Sig.
1 Regression	1977473580311.991	1	1977473580311.991	656.607	.000[b]
Residual	84326339466.486	28	3011654980.946		
Total	2061799919778.476	29			
a. Dependent Variable: GDP					
b. Predictors: (Constant), birthrate					

Table 3.5

Coefficients[a]					
Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
1 (Constant)	3310109.968	107778.355		30.712	.000
Birthrate	-182703.987	7130.095	-.979	-25.624	.000
a. Dependent Variable: GDP					

From table 3 we can see the data on GDP and birth rate from the years 2001 to 2020. The data shows that there has been a gradual decrease in birth rate as the GDP increases. This has been shown in a graphical format in chart 2.1, where it is clear that birth has been falling over the years, for a much clear look correlation analysis has been used. In table 2.2 the correlation table shows that with every 1 percent increase in GDP there has been -0.979 percentage fall in birth rate, which shows the correlation is significant at 0.01 level. The above table it is clear that there is an inverse relationship between GDP and Birth rate. From the above table 2.6 we can see that with 1 crore increase in GDP there -182703.987 fall in birth rate, with R value of 0.979 and R^2 value 0.959 and adjusted R^2 value 0.958.

Table 4

Year	GDP	Infant Mortality rate
2001	148,861	49
2002	158155	44
2003	175371	43
2004	219,003	41
2005	257,833	37
2006	310,526	37
2007	350,819	35
2008	401,336	31
2009	479,733	28
2010	584,896	24
2011	667,202	22

2012	744,859	21
2013	854238	21
2014	976703	20
2015	928,073	19
2016	991535	17
2017	1,054,996	16
2018	1118458.11	15
2019	1197183.12	14.5
2020	1274341.92	14.3

Source: NITI AYOG, World Bank

Chart 1.4
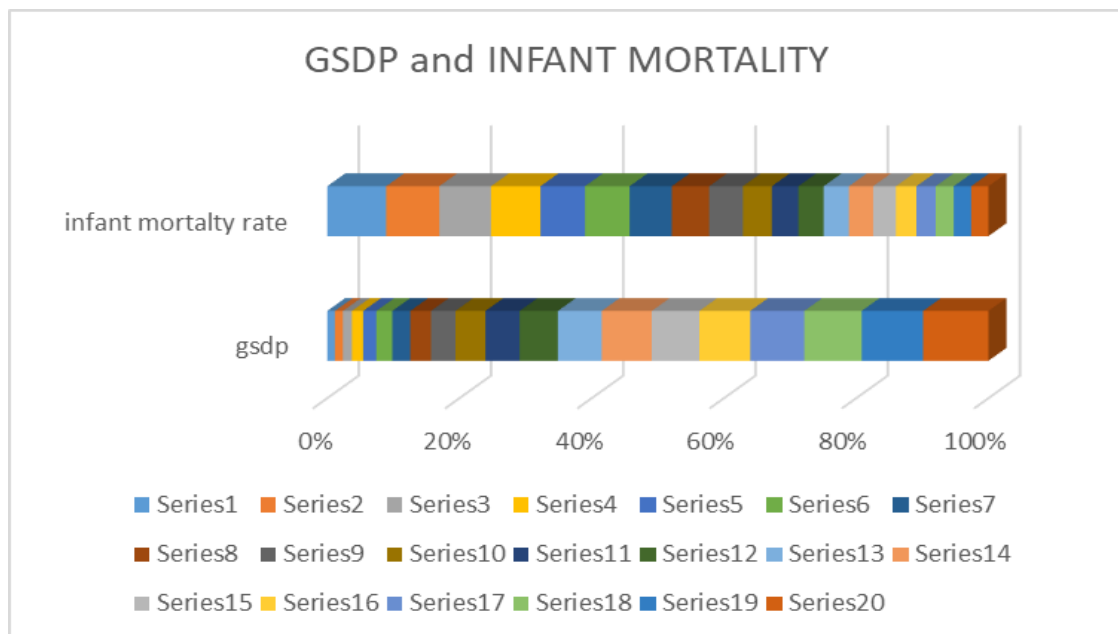
Table 4.1

Descriptive Statistics			
	Mean	Std. Deviation	N
Infant mortality	26.9944	11.86088	20
GDP	644706.1076	382617.86965	20

Table 4.2

Correlations		Infant mortality	GDP
Pearson Correlation	Infant mortality	1.000	-.970
	GDP	-.970	1.000
Sig. (1-tailed)	Infant mortality	.	.000
	GDP	.000	.
N	Infant mortality	20	20
	GDP	20	20

Table 4.3

Variables Entered/Removed[a]			
Model	Variables Entered	Variables Removed	Method
1	gdp[b]	.	Enter
a. Dependent Variable: infantmortality			
b. All requested variables entered.			

Table 4.4

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.970[a]	.940	.937	2.97444
a. Predictors: (Constant), gdp				

Table 4.5

ANOVA[a]						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	2513.676	1	2513.676	284.118	.000[b]
	Residual	159.251	18	8.847		
	Total	2672.927	19			
a. Dependent Variable: infantmortality						
b. Predictors: (Constant), gdp						

Table 4.6

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	46.375	1.328		34.913	.000
	gdp	-3.006E-5	.000	-.970	-16.856	.000
a. Dependent Variable: infantmortality						

The relationship between GDP and infant mortality is shown in the table 4 and pictorially in the chart 4.1, which shows inverse relationship. This is also shown in the table 4.2 descriptive statistics, the mean and standard deviation values of infant mortality are 26.9944 and 11.86088 respectively, same way the mean and Standard deviation value of GDP are 644706.1076 and 382617.86965 respectively. The GDP and infant mortality was found to have inverse relationship. When GDP increases by one percent the infant mortality rate falls by -0.970, this shows they are negatively correlated. The regression results are also significant which shows one percent increase in GDP there is -3.006 percent fall in infant mortality rate, with r square value of 0.970.

Table 5

Year	GDP(Crores)	Neo-Natal Mortality Rate
2000	148,861	44.7
2001	158155	43.3
2002	175371	41.9
2003	219,003	40.5
2004	257,833	39.1
2005	310,526	37.9
2006	350,819	36.6
2007	401,336	35.4
2008	479,733	34.3
2009	584,896	33.1
2010	667,202	31.8
2011	744,859	30.6
2012	854238	29.4
2013	976703	28.2
2014	928,073	27
2015	991535	25.9
2016	1054996	24.8
2017	1118458.11	23.7
2018	1197183.12	22.7
2019	1274341.92	21.4
2020	1349141.17	20.3

Source: NITI AYOG and World Bank

Chart 5.1
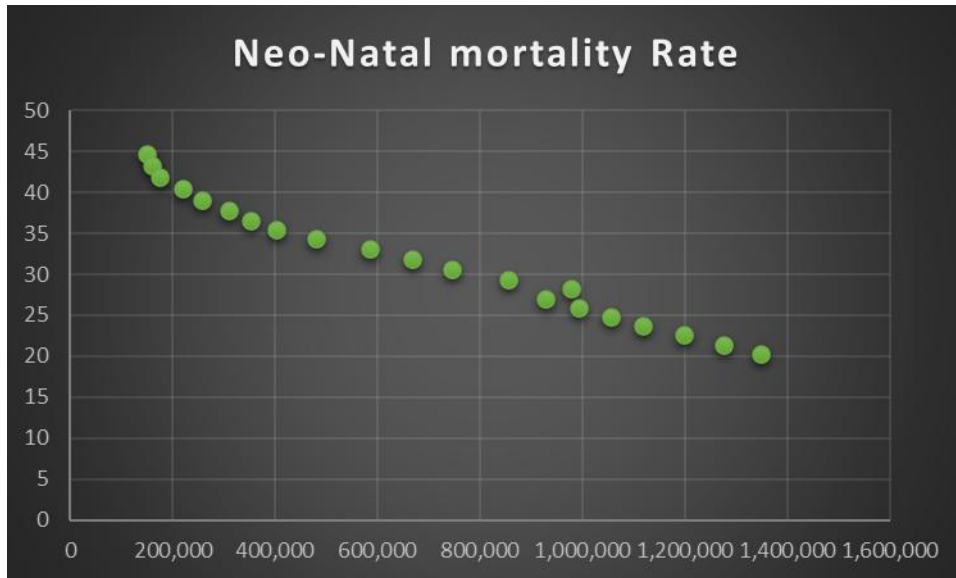
Table 5.2

Descriptive Statistics			
	Mean	**Std. Deviation**	**N**
Neo natal mortality	32.0286	7.50181	21
Gdp	678250.6343	403369.00371	21

Table 5.3

Correlations			
		neonatalmortality	Gdp
Pearson Correlation	Neonatalmortality	1.000	-.989
	Gdp	-.989	1.000
Sig. (1-tailed)	Neonatalmortality	.	.000
	Gdp	.000	.
N	Neonatalmortality	21	21
	Gdp	21	21

Table 5.4

Variables Entered/Removed[a]			
Model	Variables Entered	Variables Removed	Method
1	gdp[b]	.	Enter
a. Dependent Variable: neonatalmortality			
b. All requested variables entered.			

Table 5.5

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.989[a]	.978	.977	1.14444	.978	840.367	1	19	.000
a. Predictors: (Constant), gdp									

Table 5.6

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1100.658	1	1100.658	840.367	.000[b]
	Residual	24.885	19	1.310		
	Total	1125.543	20			
a. Dependent Variable: neonatalmortality						
b. Predictors: (Constant), gdp						

Table 5.7

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	44.502	.498		89.449	.000	43.461	45.544
	Gdp	-1.839E-5	.000	-.989	-28.989	.000	.000	.000
a. Dependent Variable: neonatalmortality								

The relationship between GDP and Neo-Natal Mortality has been shown in the Table-5. The table shows with the increase in GDP there has been a fall in the Neo-Natal Mortality. The relationship has been graphically shown in the chart 5.1, which shows there is a fall in the Neo-Natal Mortality with the increase in GDP. It can be seen from table 5.1the mean value of Neo-Natal Mortality is 32.0286 and standard deviation 7.50181. The mean value of GDP is said to be 678250.6343 and standard deviation is 403369.00371. The correlation between GDP and Neo-Natal Mortality is -0.989, which shows inverse relationship between the two components. The regression value -1.839 with independent variable GDP and dependent variable Neo-Natal Mortality, Both the correlation and regression values show negative relationship, which means with increase in GDP there is a fall in the Neo-Natal Mortality. This shows that there has been a gradual development over the years, in the health sector and health infrastructure, which results in the fall in the Neo-Natal Mortality.

Major Findings from the Study are as Follows

- There has been major change and improvements in the field of health sector in the State of Tamil Nadu.
- There has been an inverse relationship between GDP (Gross Domestic Product) and Birth Rate over the years which indicate there has been a demographic transition and development in minds of the people.
- This can be seen by the negative correlation between GDP and Birth Rate, which has been -0.979.
- The Regression results also showed negative relationship between GDP and Birth Rate -182703.987, with R value of 0.979^a and R^2 value of 0.959.
- There has been an inverse relationship GDP and Infant Mortality rate.
- This is shown by the descriptive statistic with mean value Infant Mortality rate 26.9944 and Standard deviation value to be 11.86088.
- There has been a negative correlation between GDP and Infant Mortality rate by -0.970.
- The regression results show negative relationship between GDP and Infant Mortality rate -3006, with R value of 0.970 and R^2 value of 0.940.
- There has been an inverse relationship between GDP and Neo-Natal Mortality, with the correlation value to be -0.989.
- The descriptive statistic shows the mean and standard deviation values of GDP to be 678250.6343 and 403369.00371respectively, same way the mean and standard deviation of Neo-Natal Mortality rate are 32.0286 and 7.50181 respectively.
- The regression coefficient also shows negative relationship with GDP and Neo-Natal Mortality rate by -1.839, with R value of 0.989 and R^2 value of 0.978.

Conclusion

The above findings show that there has been a development in the health sector in the state over the years. We can see that there has been a fall in the infant mortality rate and neo-natal mortality with the increase in the GDP which shows inverse relationship. From the above study we can conclude that there has been a good development in the health sector in the state. The study expects that there will be an increase in the development in the sector in the following years.

REFERENCES

[1] Grossman (1972), The Demand for Health A Theoretical and Empirical Investigation, Colombia University Press.
[2] Arora, S. (2001), "Health, human productivity, and long-term economic growth", Journal of Economic History, vol. 61, no. 3, pp. 699-749.
[3] Crude Birth Rate, Indicator Meta Data Registry List, Global Health Observatory, World Health Organization.
[4] Infant Mortality Rate, Indicator Meta Data Registry List, Global Health Observatory, World Health Organization.
[5] Neo-Natal Mortality Rate (0 to 27 days) per live births (SDG 3.2.2) Indicator Meta Data Registry List, Global Health Observatory, World Health Organization.
[6] Arora, S (2002, May 22) Health, Human Productivity, and Long-Term Economic Growth, The Journal of EconomicHistory, Cambridge Core.
[7] World Health Organization Global Health Expenditure database.

AN ECONOMIC ANALYSIS ON HEALTH INDICATORS AND GROSS DOMESTIC PRODUCT OF INDIA

[8]   https://www.cambridge.org/core/journals/journal-of-economic   history/article/abs/health-human-productivity-and-longterm-economic-growth/FB66D1E2A5F2E80557ED3E3287EB0CA9

[9]   *IndicatorMetadataRegistryDetails*.Https://Www.Who.Int/.https://www.who.int/data/gho/indicator-metadata-registry/imr-details/3138, world health organization.

[10]   Https://Www.Who.Int/about/Governance/Constitution.https://www.who.int/about/governance/constitution

[11]   https://www.who.int/about/governance/constitution

[12]   https://Www.Who.Int/Data/Gho/Indicator-Metadata-Registry/Imr-Details/67

[13]   https://apps.who.int/nha/database

[14]   (2018, May 18). Live Updates, News, Headlines, Videos And More. https://www.newindianexpress.com/, The New Indian Express.

[15]   http://www.newindianexpress.com