4.1. Introduction

Health is one of the components of human development. The concept of development has been changed after the introduction of the concept of human development. Human development has emphasis more on human rather than the economy. Accordingly, providing and ensuring good health to the people has become the most important priority of government and it is the pre-requisite for the human development. In this background, development of healthcare infrastructure has become not only necessary it is the pre-requisite. Having said this, in the present chapter an attempt has been made to examine the development of health care infrastructure in Karnataka.

There are two types of infrastructure; physical and human infrastructure. In the present chapter the following indicators have been used to examine the physical and human infrastructure of health. At the same time investment is also important determinant of development of physical infrastructure. Therefore, expenditure on healthcare infrastructure also considered for analysis and examination. To examine the relationship of healthcare infrastructure with economy, per capita gross state domestic product (PCGSDP) and gross state domestic product (GSDP) have also used as representatives of economy.

4.2. Indicators used for the Study;

a. Representative Indicators for the Economy
   - PCGSDP (in Rupees)
   - GSDP (in Crore Rupees)

b. Expenditure on Health
   - Revenue Expenditure on Health (in Lakhs)
   - Capital Expenditure on Health (in Lakhs)
   - Total Expenditure on Health (in Lakhs)

c. Physical Infrastructure
   - Hospitals
   - Beds
• PHCs in Karnataka
• Beds in PHCs
• Primary Hospitals in Mandya
• Beds in Mandya

d. **Human Infrastructure**
• Doctors

e. **Ratio Parameters**
• Persons per hospital
• Persons per bed

The present analysis has used time series data. The objective of the study is to analyze the performance of healthcare service and not to forecast the values. Therefore, normality tests have been conducted to test the normality of data. After testing the normality, the data have been used for analysis. Data have presented in the form of graphs and tables wherever necessary. CAGR (computed with log linear exponential function) has used to analyze the performance of the healthcare. Regression models used to measure the impact of PCGSDP, revenue expenditure and capital expenditure on physical and human healthcare infrastructures. Dummy variable regression models used to measure the regional disparities in health infrastructure development.

4.3. **Normality of Data:**

The Jarque Bera test has been conducted to find normality of data and the results are presented bellow;

**The Null Hypothesis: Data normally distributed.**

**Table 4.1**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Variables</th>
<th>JB-Value</th>
<th>P-value</th>
<th>Argument</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PCGSDP in Rs</td>
<td>1.14286</td>
<td>0.564</td>
<td>Normally distributed</td>
</tr>
<tr>
<td>2</td>
<td>GSDP in Crore Rs</td>
<td>1.17986</td>
<td>0.554</td>
<td>Normally distributed</td>
</tr>
<tr>
<td>3</td>
<td>Revenue Expenditure in Lakhs</td>
<td>1.87718</td>
<td>0.391</td>
<td>Normally distributed</td>
</tr>
<tr>
<td>4</td>
<td>Capital Expenditure in Lakhs</td>
<td>1.08575</td>
<td>0.581</td>
<td>Normally distributed</td>
</tr>
<tr>
<td>No.</td>
<td>Parameter</td>
<td>Mean (μ)</td>
<td>SD (σ)</td>
<td>Distribution</td>
</tr>
<tr>
<td>-----</td>
<td>----------------------------------------</td>
<td>-----------</td>
<td>---------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>5</td>
<td>Total Expenditure in Lakhs</td>
<td>1.41988</td>
<td>0.491</td>
<td>Normally distributed</td>
</tr>
<tr>
<td>6</td>
<td>Hospitals</td>
<td>1.87148</td>
<td>0.392</td>
<td>Normally distributed</td>
</tr>
<tr>
<td>7</td>
<td>Beds</td>
<td>4.96426</td>
<td>0.083</td>
<td>Normally distributed</td>
</tr>
<tr>
<td>8</td>
<td>Doctors</td>
<td>1.08612</td>
<td>0.580</td>
<td>Normally distributed</td>
</tr>
<tr>
<td>9</td>
<td>PHCs</td>
<td>1.00168</td>
<td>0.606</td>
<td>Normally distributed</td>
</tr>
<tr>
<td>10</td>
<td>Beds in PHC's</td>
<td>1.04848</td>
<td>0.592</td>
<td>Normally distributed</td>
</tr>
<tr>
<td>11</td>
<td>Primary Hospitals in Mandya</td>
<td>1.08067</td>
<td>0.582</td>
<td>Normally distributed</td>
</tr>
<tr>
<td>12</td>
<td>Beds in Mandya</td>
<td>1.54747</td>
<td>0.461</td>
<td>Normally distributed</td>
</tr>
</tbody>
</table>

Source: Karnataka at a Glance 2001-2015

It has been found from the Jarque-Bera test that the data for all parameters the Jarque-Bera test values are insufficient to reject the null hypotheses. Therefore, all the variables follow normal distribution and they have considered for further analysis.

4.4. Trend Analysis: In this section an attempt has been made to analyze growth and trends of each parameter used in this chapter. Data have presented in the form of graph and compound annual growth rates (CAGR) have computed by using log linear exponential growth model.

Each of the parameters have been presented in the form of graph and followed by their growth rates.

Graph 4a: Trends in Per Capita Gross State Domestic Product in Karnataka

(In Rupees)

Source: Karnataka at a Glance
PCGSDP trends have presented in the above graph. It has been found from the graph that PCGSDP has shown positive trend.

**Graph 4b: Trends in Gross State Domestic Product in Karnataka**

(In Crore Rupees)

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Variable</th>
<th>Co-efficient (CAGR)</th>
<th>Standard Error</th>
<th>t-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PCGSDP in Rs</td>
<td>12.86</td>
<td>0.004</td>
<td>29.18</td>
<td>0.000</td>
</tr>
<tr>
<td>2</td>
<td>GSDP in Crore Rs</td>
<td>13.87</td>
<td>0.005</td>
<td>29.12</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Source: Karnataka Economic Survey

It has been found from the above table that the average growth of PCGSDP at current prices in Karnataka is 12.86 percent and it is significant at one percent level. The average growth of GSDP at current prices in Karnataka is 13.87 percent and it is significant at one percent level. Therefore, growth of GSDP is significantly high.
compared to PCGSDP. Accordingly, GSDP has been significantly increased in Karnataka at higher rate compared to growth of PCGSDP.

**Graph 4c: Trends in Revenue Expenditure on Health in Karnataka**

(In Lakh Rupees)

Source: Karnataka Performance Budget 2002-2015

Revenue expenditure on health trends have presented in the above graph. It has been found from the graph that revenue expenditure on health has shown positive trend in long run though they have fluctuation in short run.

**Graph 4d: Trends in Capital Expenditure on Health in Karnataka**

(In Lakh Rupees)

Source: Karnataka at a Glance
Capital expenditure on health trends have presented in the above graph. It has been found from the graph that capital expenditure on health has shown positive trend in long run though they have fluctuation in short run.

**Graph 4e: Trends in Total Expenditure on Health in Karnataka**
(In Lakh Rupees)

Total expenditure on health trends have presented in the above graph. It has been found from the graph that total expenditure on health has shown positive trend in long run though they have fluctuation in short run.

**Table 4.3**
Growth Performance of Expenditure on Health
(In Percent)

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Variable</th>
<th>Co-efficient (CAGR)</th>
<th>Standard Error</th>
<th>t-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Revenue Expenditure on Health in Lakhs</td>
<td>8.30</td>
<td>0.011</td>
<td>7.563</td>
<td>0.000</td>
</tr>
<tr>
<td>2</td>
<td>Capital Expenditure on Health in Lakhs</td>
<td>20.27</td>
<td>0.071</td>
<td>2.863</td>
<td>0.014</td>
</tr>
<tr>
<td>3</td>
<td>Total Expenditure on Health in Lakhs</td>
<td>8.97</td>
<td>0.011</td>
<td>8.127</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Source: Karnataka Health Performance budget
It has been found from the above table that the average growth of revenue expenditure on health at current prices in Karnataka is 8.3 percent and it is significant at one percent level. The average growth of capital expenditure on health at current prices in Karnataka is 20.27 percent and it is significant at five percent level. The average growth of total expenditure on health at current prices in Karnataka is 8.97 percent and it is significant at one percent level. Therefore, growth of capital expenditure on health is significantly high compared to revenue expenditure on health in Karnataka. Accordingly, capital expenditure on health in Karnataka has been significantly increased in Karnataka at higher rate compared to growth of revenue expenditure on health. Hence, it has been revealed from the growth analysis that the government of Karnataka has given more importance to create physical infrastructure compared to human infrastructure.

**Graph 4f: Trends in Hospitals in Karnataka**

(In Numbers)

Hospitals trends in Karnataka have presented in the above graph. It has been found from the graph that hospitals in Karnataka have shown positive trend.
Graph 4g: Trends in Hospital Beds in Karnataka

(In Numbers)

Source: Karnataka at a Glance

Hospital beds trends in Karnataka have presented in the above graph. It has been found from the graph that hospital beds in Karnataka have shown positive trend. Particularly, since 2010 numbers of hospital beds have been significantly increased.

Graph 4h: Trends in PHCs in Karnataka

(In Numbers)

Source: Karnataka at a Glance
Trends in PHCs in Karnataka have presented in the above graph. It has been found from the graph that PHCs in Karnataka have shown positive trend.

**Graph 4i: Beds in PHCs of Karnataka**

(In Numbers)

![Graph 4i: Beds in PHCs of Karnataka](image)

Source: Karnataka at a Glance

Beds in PHCs of Karnataka have presented in the above graph. It has been found from the graph that beds in PHCs of Karnataka have shown positive trend.

**Graph 4j: Trends in Primary Hospitals in Mandya**

(In Numbers)

![Graph 4j: Trends in Primary Hospitals in Mandya](image)

Source: Mandya District at a Glance
Primary hospitals in Mandya have presented in the above graph. It has been found from the graph that primary hospitals in Mandya have shown positive trend.

**Graph 4k: Beds in Primary Hospitals in Mandya**

(Beds in Mandya)

Source: Mandya district at a Glance

Beds in primary hospitals in Mandya have presented in the above graph. It has been found from the graph that beds in primary hospitals in Mandya have shown mixed trend.

**Table 4.4**

Growth Performance of Physical Indicators of Healthcare Services

(In Percent)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Variable</th>
<th>Coefficient (CAGR)</th>
<th>Standard Error</th>
<th>t-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hospitals in Karnataka</td>
<td>20.41</td>
<td>0.0150722</td>
<td>13.54</td>
<td>0.000</td>
</tr>
<tr>
<td>2</td>
<td>Hospital Beds in Karnataka</td>
<td>11.06</td>
<td>0.0197719</td>
<td>5.598</td>
<td>0.000</td>
</tr>
<tr>
<td>3</td>
<td>PHCs in Karnataka</td>
<td>0.89</td>
<td>0.00107584</td>
<td>8.284</td>
<td>0.000</td>
</tr>
<tr>
<td>4</td>
<td>Beds in PHCs of Karnataka</td>
<td>8.79</td>
<td>0.00645187</td>
<td>13.640</td>
<td>0.000</td>
</tr>
<tr>
<td>5</td>
<td>Primary Hospitals in Mandya</td>
<td>1.55</td>
<td>0.00282379</td>
<td>5.509</td>
<td>0.000</td>
</tr>
<tr>
<td>6</td>
<td>Hospital Beds in Mandya</td>
<td>11.21</td>
<td>0.0209225</td>
<td>5.359</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Source: Karnataka at a Glance
It has been found from the above table that the average growth of hospitals in Karnataka is 20.41 percent and it is significant at one percent level. The average growth of hospital beds in Karnataka is 11.06 percent and it is significant at one percent level. The average growth of PHCs in Karnataka is 0.89 percent and it is significant at one percent level. The average growth of beds in PHCs of Karnataka is 8.79 percent and it is significant at one percent level. The average growth of primary hospitals in Mandya is 1.55 percent and it is significant at one percent level. The average growth of hospital beds in Mandya is 11.21 percent and it is significant at one percent level. Therefore, the growth of hospitals in Karnataka is significantly high compared to other parameters namely, hospital beds in Karnataka, hospitals beds in PHCs of Karnataka and PHCs in Karnataka. Accordingly, government of Karnataka has given more importance to build hospitals than providing beds at state level. At the same time, less importance has given to construct PHCs and given more importance to provide beds in existing PHCs. The similar phenomenon has been observed in Mandya district that less importance has given to construct primary health centers and given more importance to provide beds in existing primary health centers.

**Graph 4I: Doctors in Karnataka**  
(In Numbers)

Source: Karnataka at a Glance

Beds in primary hospitals in Mandya have presented in the above graph. It has been found from the graph that beds in primary hospitals in Mandya have shown mixed trend.
Table 4.5
Growth Performance of Human Indicator of Healthcare Services
(In Percent)

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Variable</th>
<th>Co-efficient (CAGR)</th>
<th>Standard Error</th>
<th>t-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Doctors in Hospitals of Karnataka</td>
<td>13.95</td>
<td>0.00628754</td>
<td>22.20</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Source: Karnataka at a Glance

It has been found from the above table that the average growth of doctors in Karnataka is 13.95 percent and it is significant at one percent level. Therefore, growth of doctors is relatively significant in Karnataka.

4.5. Impact Analysis:

Econometric models have been constructed and used to identify the impact of Economic development and expenditure on healthcare infrastructure development. Models have tried to estimate the impacts PCNSDP, GSDP, revenue expenditure, and capital expenditure, and total expenditure on hospitals, hospital beds in Karnataka, PHCs in Karnataka, beds in PHCs of Karnataka and number of doctors. The step wise method has used to construct the models and the most appropriate models have chosen for analysis. The values have converted to log form to avoid the magnitude of variances and interpretation of data in terms of elasticity. All necessary steps have taken to solve the problems in the regression. Since the data is stationary, the Durbin Watson test also conducted to verify the auto correlation problem in the models.

The following section presents the models and results along with their interpretation and analysis;

Model: the following model used to estimate the impact of PCGSDP, revenue expenditure and capital expenditure on hospitals.
\[ \ln\text{Hospitals} = \alpha + \beta_1 \ln\text{PCGSDP} + \beta_2 \ln\text{REH} + \beta_3 \ln\text{CEH} + e \]

Where;

\[ \ln\text{Hospitals} = \log \text{of hospitals in Karnataka} \]
\[ \ln\text{PCGSDP} = \log \text{of per capita gross state domestic product} \]
\[ \ln\text{REH} = \log \text{of revenue expenditure on healthcare} \]
\[ \ln\text{CEH} = \log \text{of capital expenditure on healthcare} \]

\[ \beta \text{'s} = \text{Elasticity coefficients for independent variables} \]
\[ \alpha = \text{Constant of the model, expressed in terms of log} \]
\[ \varepsilon = \text{Error term for the model} \]

\[^{\ln}\text{Hospitals} = -10.11 + 0.92 \ln\text{PCGSDP} + 0.69 \ln\text{REH} + 0.13 \ln\text{CEH} \]
\[ t\text{-value:} \quad (-5.4355) \quad (4.591) \quad (2.441) \quad (2.542) \]
\[ P\text{-value:} \quad 0.000 \quad 0.001 \quad 0.035 \quad 0.029 \]

\[ R^2 = 0.968, \text{Adjusted } R^2 = 0.959, F = 102.846, \text{ P-value: } 0.000, \text{ and DW: } 1.784 \]

It has been found from the above result that the model is highly good fitted with \( R \)-squared and adjusted \( R \)-squared value. Since the DW test values are around 2 and above the \( R \)-squared value, there are no autocorrelation problems. Hence, the results are not spurious. Accordingly the model, explained variance in the model and results are reliable and acceptable. The constant value is negative and significant at one percent level. Means, if there is no contribution from the independent variables, there will be negative change in number of hospitals. The \( F \) - value is highly significant. Therefore, the total variability of hospitals has been significantly explained by independent variables. The \( t \)-value explains individual impact of each independent variable on dependent variable. It has been found from the elasticity coefficients that there is positive elasticity between PCGSDP and hospitals; and this is significant at one percent level. Accordingly, increase in PCGSDP has been significantly and positively influenced the number of hospital. There is relatively positive elasticity between revenue expenditure on health sector and hospitals; and this is significant at five percent level. There is relatively positive elasticity between capital expenditure on health sector and hospitals; and this is significant at five percent level.

Therefore, PCGSDP, revenue expenditure, and capital expenditure on healthcare have significant influence on hospitals. Accordingly, the increases in hospitals have been significantly depending upon PCGSDP, revenue expenditure, and
capital expenditure on healthcare. Hence, the growth of hospitals depends on the
growth of the economy and its contribution to healthcare sector in the form of both
revenue and capital expenditure. Therefore, there is a need of revenue and capital
allocations for healthcare sector to increase the number of hospitals.

Source: Karnataka at a Glance

To illustrate the reliability of functional form and efficiency of fitted values, the
above graph has been constructed. It has been found from the graphical representation
that the functional form for hospitals and followed by the independent variables is
reliable and the fitted values of hospital have been efficiently explained the actual
values of hospitals. Accordingly, both the functional form and the models are efficient
and reliable.
The above graph has been constructed to illustrate the reliability and to efficiency of fitted values, against the actual values. It has been found from the graphical representation that both actual and fitted values have been followed sequence of time period and PCGSDP has been efficiently explained the variations in number of hospitals in Karnataka. Therefore, PCGSDP is the efficient explanatory variable of hospitals in Karnataka.

Source: Karnataka at a Glance
Source: Karnataka Health Performance Budget

The above graph has been constructed to illustrate the reliability and to efficiency of fitted values, against the actual values. It has been found from the graphical representation that both actual and fitted values have been fairly followed sequence of time period and revenue expenditure on healthcare has been reasonably explained the variations in number of hospitals in Karnataka. Therefore, revenue expenditure on healthcare is relatively the efficient explanatory variable of hospitals in Karnataka.
The above graph has been constructed to illustrate the reliability and to efficiency of fitted values, against the actual values. It has been found from the graphical representation that both actual and fitted values have been fairly followed sequence of time period and capital expenditure on healthcare has been reasonably explained the variations in number of hospitals in Karnataka. Therefore, capital expenditure on healthcare is relatively the efficient explanatory variable of hospitals in Karnataka.

**Model:** the following model used to estimate the impact of PCGSDP, revenue expenditure and capital expenditure on beds in hospitals.

\[
\ln BH = \alpha + \beta_1 \ln PCGSDP + \beta_2 \ln REH + \beta_3 \ln CEH + e
\]

Where;
\[
\ln BH = \text{Log of beds in hospitals in Karnataka}
\]
\[
\ln PCGSDP = \text{log of per capita gross state domestic product}
\]
\[
\ln REH = \text{log of revenue expenditure on healthcare}
\]
\[
\ln CEH = \text{log of capital expenditure health care.}
\]
\[
\beta\text{'s} = \text{Elasticity coefficients for independent variables}
\]
\[
\alpha = \text{Constant of the model, expressed in terms of log}
\]
\[ e = \text{Error term for the model} \]

\[ ^{\ln}BH = -4.08 + 0.25 \ln PCGSDP + 0.116 \ln REH - 0.11 \ln CEH \]

<table>
<thead>
<tr>
<th>t-value</th>
<th>P-value</th>
<th>t-value</th>
<th>P-value</th>
<th>t-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1.307</td>
<td>0.200</td>
<td>2.524</td>
<td>0.030</td>
<td>-1.341</td>
<td>0.209</td>
</tr>
</tbody>
</table>

\[ R^2 = 0.789, \text{Adjusted } R^2 = 0.726, F = 12.512, \text{P-value: } 0.001, \text{and DW: } 1.550 \]

It has been found from the above result that the model is good fitted with R-squared and adjusted R-squared value. Since the DW test values are near to two and above the R-squared value, there are no autocorrelation problems. Hence, the results are not spurious. Accordingly the model, explained variance in the model and results are reliable and acceptable. The constant value is negative but not significant even at ten percent level. Means, if there is no contribution from the independent variables, there will not be negative change in number of beds in hospitals. It means beds in hospitals have not been wholly depending on the independent variables incorporated in the above model. The F - value is significant. Therefore, the total variability of hospitals has been significantly explained by independent variables. The t-value explains individual impact of each independent variable on dependent variable. It has been found from the elasticity coefficients that there is positive elasticity between PCGSDP and beds in hospitals; but this is not significant even at ten percent level. Accordingly, increase in PCGSDP has not been significantly influenced the number of beds in hospital. There is relatively positive elasticity between revenue expenditure on health sector and beds in hospitals; and this is significant at five percent level. There is relatively negative elasticity between capital expenditure on health sector and beds in hospitals; but this is not significant even at ten percent level.

Therefore, PCGSDP, and capital expenditure on healthcare have not significantly influenced beds in hospitals. Accordingly, the increases in hospitals have not been significantly depending upon PCGSDP and capital expenditure on healthcare. However, revenue expenditure has been significantly influenced beds in hospitals. Hence, the growth of beds in hospitals depends on the growth of revenue expenditure on healthcare sector. Therefore, there is a need of revenue allocations for healthcare sector to increase the number of beds in hospitals.
To illustrate the reliability of functional form and to efficiency of fitted values, the above graph has been constructed. It has been found from the graphical representation that the functional form for beds in hospitals and followed by the independent variables is reliable and the fitted values for beds in hospitals have been efficiently explained the actual values of beds in hospitals. Accordingly, both the functional form and the models are efficient and reliable.

Source: Karnataka Economy Survey

The above graph has been constructed to illustrate the reliability and efficiency of fitted values, against the actual values of each explanatory variable. It has been found from the graphical representation that both actual and fitted values have been fairly followed sequence of time period and PCGSDP has been reasonably explained the variations in number of beds in hospitals of Karnataka. Therefore, PCGSDP is relatively the efficient explanatory variable of beds in hospitals of Karnataka.
The above graph has been constructed to illustrate the reliability and efficiency of fitted values, against the actual values of each explanatory variable. It has been found from the graphical representation that both actual and fitted values have been fairly followed sequence of time period and revenue expenditure on healthcare has been reasonably explained the variations in number of beds in hospitals of Karnataka. Therefore, revenue expenditure is relatively the efficient explanatory variable of beds in hospitals of Karnataka.
The above graph has been constructed to illustrate the reliability and efficiency of fitted values, against the actual values of each explanatory variable. It has been found from the graphical representation that both actual and fitted values have been fairly followed sequence of time period and capital expenditure on healthcare has been reasonably not efficiently explained the variations in number of beds in hospitals of Karnataka. Therefore, capital expenditure is not an efficient explanatory variable of beds in hospitals of Karnataka.

**Model:** the following model used to estimate the impact of PCGSDP, revenue expenditure and capital expenditure on PHCs.

\[
\ln PHC = \alpha + \beta_1 \ln PCGSDP + \beta_2 \ln REH + \beta_3 \ln CEH + e
\]

Where;

- \(\ln PHC\) = Log of primary healthcare centers in Karnataka
- \(\ln PCGSDP\) = log of per capita gross state domestic product
- \(\ln REH\) = log of revenue expenditure on healthcare
lnCEH = log of capital expenditure health care.

β’s = Elasticity coefficients for independent variables

α = Constant of the model, expressed in terms of log
e = Error term for the model

\[ \ln\text{PHC} = 6.933 + 0.07 \ln\text{PCGSDP} + 0.01 \ln\text{REH} + 9.67 \ln\text{CEH} \]

t-value (37.957) (3.294) (0.215) (0.019)
P-value: 0.000 0.008 0.834 0.984

R\(^2\) = 0.856, Adjusted R\(^2\) = 0.813, F = 19.828, P-value: 0.000, and DW: 2.363

It has been found from the above result that the model is good fitted with high R-squared and adjusted R-squared value. Since the DW test values are near to two and above the R-squared value, there are no autocorrelation problems. Hence, the results are not spurious. Accordingly the model, explained variance in the model and results are reliable and acceptable. The constant value is positive and significant at one percent level. Means, if there is no contribution from the independent variables, even then there will be positive change in number of PHCs. It means primary healthcare centers have not been wholly depending on the independent variables incorporated in the above model. The F-value is significant. Therefore, the total variability of hospitals has been significantly explained by independent variables. The t-value explains individual impact of each independent variable on dependent variable. It has been found from the elasticity coefficients that there is positive elasticity between PCGSDP and PHCs; and this is significant at one percent level. Accordingly, increase in PCGSDP has been significantly influenced the number of PHCs in Karnataka. There is relatively positive elasticity between revenue expenditure on health sector and PHCs; but this is not significant even at ten percent level. There is relatively positive elasticity between capital expenditure on health sector and PHCs; but this is also not significant even at ten percent level.

Therefore, revenue and capital expenditure on healthcare have not been significantly influenced PHCs. Accordingly, the increases in hospitals have not been significantly depending upon revenue and capital expenditure on healthcare. However, PCGSDP has been significantly influenced PHCs in Karnataka. However, the rate of change in PHCs due to change in PCGSDP is very low. Hence, the growth of PHCs depends on the growth of the economy and not the allocation of revenue and capital expenditure. At the same time, growth of PHCs has been also depends on other
variables other than the variables included in the above model. Therefore, there is a need of overall development of the economy to increase the number of PHCs in Karnataka.

Source: Karnataka at a Glance

To illustrate the reliability of functional form and to efficiency of fitted values, the above graph has been constructed. It has been found from the graphical representation that the functional form for PHCs in Karnataka and followed by the independent variables is reliable and the fitted values for PHCs in Karnataka have been efficiently explained the actual values of PHCs in Karnataka. Accordingly, both the functional form and the models are efficient and reliable.
The above graph has been constructed to illustrate the reliability and efficiency of fitted values, against the actual values of each explanatory variable. It has been found from the graphical representation that both actual and fitted values have been efficiently followed sequence of time period and PCGSDP has been efficiently explained the variations in PHCs in Karnataka. Therefore, PCGSDP is an efficient explanatory variable of PHCs in Karnataka.

Source: Karnataka Economy Survey & Karnataka at a Glance
The above graph has been constructed to illustrate the reliability and efficiency of fitted values, against the actual values of each explanatory variable. It has been found from the graphical representation that both actual and fitted values have been not efficiently followed sequence of time period and revenue expenditure on healthcare has not been efficiently explained the variations in PHCs in Karnataka. Therefore, revenue expenditure on healthcare is not an efficient explanatory variable of PHCs in Karnataka.

Source: Karnataka at a Glance
The above graph has been constructed to illustrate the reliability and efficiency of fitted values, against the actual values of each explanatory variable. It has been found from the graphical representation that both actual and fitted values have been not efficiently followed sequence of time period and capital expenditure on healthcare has not been efficiently explained the variations in PHCs in Karnataka. Therefore, capital expenditure on healthcare is also not an efficient explanatory variable of PHCs in Karnataka.

**Model:** the following model used to estimate the impact of PCGSDP, revenue expenditure and capital expenditure on beds in PHCs.

\[
\ln BPHC = \alpha + \beta_1 \ln PCGSDP + \beta_2 \ln REH + \beta_3 \ln CEH + e
\]

Where;

\[\ln BPHC = \text{Log of beds in primary healthcare centers in Karnataka}\]
\[\ln PCGSDP = \text{log of per capita gross state domestic product}\]
\[\ln REH = \text{log of revenue expenditure on healthcare}\]
\[\ln CEH = \text{log of capital expenditure health care}\]
\( \beta \)'s = Elasticity coefficients for independent variables
\( \alpha \) = Constant of the model, expressed in terms of log
\( e \) = Error term for the model

\(^{\ln} BPHC = 2.191 + 0.74 \ln \text{PCGSDP} - 0.06 \ln \text{REH} - 0.01 \ln \text{CEH} \)

t-value: (2.485) (7.731) (-0.465) (-0.289)
P-value: 0.032 0.000 0.652 0.777

R\(^2\) = 0.962, Adjusted R\(^2\) = 0.951, F = 84.389, P-value: 0.000, and DW: 2.103

It has been found from the above result that the model is highly good fitted with high R-squared and adjusted R-squared value. Since the DW test values are near to two and above the R-squared value, there are no autocorrelation problems. Hence, the results are not spurious. Accordingly the model, explained variance in the model and results are reliable and acceptable. The constant value is positive and significant at five percent level. Means, if there is no contribution from the independent variables, even then there will be positive change in number of beds in PHCs. It means beds in primary healthcare centers have not been wholly depending on the independent variables incorporated in the above model. The F-value is significant. Therefore, the total variability of beds in hospitals has been significantly explained by independent variables. The t-value explains individual impact of each independent variable on dependent variable. It has been found from the elasticity coefficients that there is positive elasticity between PCGSDP and beds in PHCs; and this is significant at one percent level. Accordingly, increase in PCGSDP has been significantly influenced the number of beds in PHCs of Karnataka. There is relatively negative elasticity between revenue expenditure on health sector and beds in PHCs; but this is not significant even at ten percent level. There is relatively negative elasticity between capital expenditure on health sector and beds in PHCs; but this is also not significant even at ten percent level.

Therefore, revenue and capital expenditure on healthcare have not been significantly influenced beds in PHCs. Accordingly, the increase in beds in hospitals have not been significantly depending upon revenue and capital expenditure on healthcare. However, PCGSDP has been significantly influenced beds in PHCs of Karnataka. And, the rate of change in beds in PHCs due to change in PCGSDP is also relatively high. Hence, the growth of beds in PHCs depends on the growth of the economy and not the allocation of revenue and capital expenditure. At the same time,
growth of beds in PHCs has been also depends on other variables other than the variables included in the above model. Therefore, there is a need of overall development of the economy to increase the number of beds in PHCs of Karnataka.

Source: Karnataka at a Glance

To illustrate the reliability of functional form and to efficiency of fitted values, the above graph has been constructed. It has been found from the graphical representation that the functional form for beds in PHCs of Karnataka and followed by the independent variables is reliable and the fitted values for beds in PHCs of Karnataka have been efficiently explained the actual values of beds in PHCs of Karnataka. Accordingly, both the functional form and the models are efficient and reliable.
The above graph has been constructed to illustrate the reliability and efficiency of fitted values, against the actual values of each explanatory variable. It has been found from the graphical representation that both actual and fitted values have been not efficiently followed sequence of time period and PCGSDP has been efficiently explained the variations in beds in PHCs of Karnataka. Therefore, PCGSDP is an efficient explanatory variable of beds in PHCs of Karnataka.

Source: Karnataka at a Glance
The above graph has been constructed to illustrate the reliability and efficiency of fitted values, against the actual values of each explanatory variable. It has been found from the graphical representation that both actual and fitted values have been not efficiently followed sequence of time period and revenue expenditure on healthcare has not been efficiently explained the variations in beds in PHCs of Karnataka. Therefore, revenue expenditure on healthcare is not an efficient explanatory variable of beds in PHCs of Karnataka.
The above graph has been constructed to illustrate the reliability and efficiency of fitted values, against the actual values of each explanatory variable. It has been found from the graphical representation that both actual and fitted values have been not efficiently followed sequence of time period and capital expenditure on healthcare has not been efficiently explained the variations in beds in PHCs of Karnataka. Therefore, capital expenditure on healthcare is not an efficient explanatory variable of beds in PHCs of Karnataka.

**Model:** the following model used to estimate the impact of PCGSDP, revenue expenditure and capital expenditure on number of doctors in hospitals of Karnataka.

\[
\ln(\text{DOC}) = \alpha + \beta_1 \ln(\text{PCGSDP}) + \beta_2 \ln(\text{REH}) + \beta_3 \ln(\text{CEH}) + e
\]

Where:
\[
\ln(\text{DOC}) = \text{Log of doctors in Karnataka}
\]
\[
\ln(\text{PCGSDP}) = \text{log of per capita gross state domestic product}
\]
\[
\ln(\text{REH}) = \text{log of revenue expenditure on healthcare}
\]
\[
\ln(\text{CEH}) = \text{log of capital expenditure health care}
\]
\[ \beta's = \text{Elasticity coefficients for independent variables} \]
\[ \alpha = \text{Constant of the model, expressed in terms of log} \]
\[ e = \text{Error term for the model} \]

\[ ^{\ln}\text{DOC} = -2.797 + 1.21 \ln\text{PCGSDP} - 0.11 \ln\text{REH} - 0.03 \ln\text{CEH} \]

- Value: (-3.865) (15.437) (-1.020) (-1.807)

P-value: 0.003 0.000 0.332 0.101

R² = 0.989, Adjusted R² = 0.986, F = 312, P-value: 0.000, and DW: 2.661

It has been found from the above result that the model is highly good fitted with high R-squared and adjusted R-squared value. Since the DW test values are near to two and above the R-squared value, there are no autocorrelation problems. Hence, the results are not spurious. Accordingly the model, explained variance in the model and results are reliable and acceptable. The constant value is negative and significant at five percent level. Means, if there is no contribution from the independent variables, then there will be negative change in number of doctors. It means, though the numbers of doctors have not been wholly depending on the independent variables incorporated in the above model, number of doctors will be decreased. The F - value is significant. Therefore, the total variability number of doctors has been significantly explained by independent variables. The t-value explains individual impact of each independent variable on dependent variable. It has been found from the elasticity coefficients that there is positive elasticity between PCGSDP and number of doctors in Karnataka; and this is significant at one percent level. Accordingly, increase in PCGSDP has been significantly influenced the number of doctors in Karnataka. There is relatively negative elasticity between revenue expenditure on health sector and doctors in hospitals of Karnataka; but this is not significant even at ten percent level. There is relatively negative elasticity between capital expenditure on health sector and doctors in hospitals of Karnataka; but this is also not significant even at ten percent level.

Therefore, revenue and capital expenditure on healthcare have not been significantly influenced the number of doctors in Karnataka. Accordingly, the increase in number of doctors in hospitals of Karnataka has not been significantly depending upon revenue and capital expenditure on healthcare. However, PCGSDP has been significantly influenced number of doctors in Karnataka. And, the rate of change in number of doctors in hospitals of Karnataka due to change in PCGSDP is
also relatively high. Hence, the growth of doctors in hospitals of Karnataka depends on the growth of the economy and not the allocation of revenue and capital expenditure. At the same time, growth of number of doctors has been also depends on other variables other than the variables included in the above model. Therefore, there is a need of overall development of the economy to increase the number of doctors in hospitals of Karnataka.

Source: Karnataka at a Glance

To illustrate the reliability of functional form and to efficiency of fitted values, the above graph has been constructed. It has been found from the graphical representation that the functional form for doctors in hospitals of Karnataka and followed by the independent variables is reliable and the fitted values for doctors in hospitals of Karnataka have been efficiently explained the actual values of doctors in hospitals of Karnataka. Accordingly, both the functional form and the models are efficient and reliable.
The above graph has been constructed to illustrate the reliability and efficiency of fitted values, against the actual values of each explanatory variable. It has been found from the graphical representation that both actual and fitted values have been not efficiently followed sequence of time period and PCGSDP has been efficiently explained the variations in number of doctors in Karnataka. Therefore, PCGSDP is an efficient explanatory variable of number of doctors in Karnataka.
The above graph has been constructed to illustrate the reliability and efficiency of fitted values, against the actual values of each explanatory variable. It has been found from the graphical representation that both actual and fitted values have been not efficiently followed sequence of time period and revenue expenditure on healthcare has not been efficiently explained the variations in number of doctors in Karnataka. Therefore, revenue expenditure on healthcare is not an efficient explanatory variable of number of doctors in Karnataka.
The above graph has been constructed to illustrate the reliability and efficiency of fitted values, against the actual values of each explanatory variable. It has been found from the graphical representation that both actual and fitted values have been not efficiently followed sequence of time period and capital expenditure on healthcare has not been efficiently explained the variations in number of doctors in Karnataka. Therefore, capital expenditure on healthcare is also not an efficient explanatory variable of number of doctors in Karnataka.

Analysis of Disparity in Healthcare Facilities:

In this section an attempt has been made to analyze the disparity in provision of healthcare services in Karnataka. Karnataka has been divided into four groups based on administrative division. Availability of hospitals and availability of beds have been considered for disparity analysis. The parameters have converted to ratio form and calculated number of people per hospital and per bed. The census 2011 population data has used for conversion. The dummy variable regression technique has been used for the disparity analysis.
Number of People per Hospital:

The following dummy variable model has constructed to analyze the disparity in number of people per hospital.

The Model:
\[ NPH = \alpha + \beta_1D_1 + \beta_2D_2 + \beta_3D_3 + e \]
Where;
\[ NPH = \text{Number of people per hospital} \]
\[ \alpha = \text{Average value for benchmark (i.e., for Mysore)} \]
\[ \beta = \text{Difference between dummy and benchmark} \]
\[ D_1 = \text{Dummy for Bangalore} \]
\[ D_2 = \text{Dummy for Belgaum} \]
\[ D_3 = \text{Dummy for Gulbarga} \]
N-1 dummies used in order to avoid dummy variable trap.

\[ NPH = \alpha + \beta_1D_1 + \beta_2D_2 + \beta_3D_3 + e \]
\[ ^\wedge NPH = 3260 + 923D_1 + 2067D_2 + 2203D_3 \]
\[ t\text{-ratio:} \quad (10.219) \quad (2.045) \quad (4.421) \quad (4.521) \]
\[ p\text{-value:} \quad 0.000 \quad 0.051 \quad 0.000 \quad 0.000 \]

The dummy variable regression ANOVA model presents information about difference in availability of hospital facility. The constant is significant at one percent level. In the present model constant represents the benchmark and benchmark in this case is Mysore.

In Mysore, there is a hospital for every 3260 people. The difference in availability of hospital between Mysore division and Bangalore division is 923 persons but this difference is not significant at five percent level.

The difference in availability of hospital between Mysore division and Belgaum division is 2067 persons and this difference is significant at one percent level.

The difference in availability of hospital between Mysore division and Gulbarga division is 2203 persons and this difference is significant at one percent level.
Therefore, there is no significant difference between Mysore and Bangalore division in availability of hospitals. There is significant difference between Mysore and Belgaum division in availability of hospitals. At the same time, there is significant difference between Mysore and Gulbarga division in availability of hospitals. Accordingly, availability of hospitals in Belgaum and Gulbarga division is significantly low compared to Bangalore and Mysore divisions. Hence, there is a need to construct more hospitals in Belgaum and Gulbarga division with priority, in order to reduce the regional disparity in providing healthcare services.

Number of People per Bed in Hospitals:

The following dummy variable model has constructed to analyze the disparity in number of people per bed in hospitals.

The Model:

\[ NPB = \alpha + \beta_1D1 + \beta_2D2 + \beta_3D3 + e \]

Where;

NPB = Number of people per Bed  
\( \alpha \) = Average value for benchmark (i.e., for Mysore)  
\( \beta \) = Difference between dummy and benchmark  
D1 = Dummy for Bangalore  
D2 = Dummy for Belgaum  
D3 = Dummy for Gulbarga  
N-1 dummies used in order to avoid dummy variable trap.

\[ ^\wedge NPH = \alpha + \beta_1D1 + \beta_2D2 + \beta_3D3 + e \]

\(^\wedge NPH = 762 + 250D1 + 416D2 + 369D3 \]

t-ratio: (7.903) (1.832) (2.943) (2.504)

p-value: 0.000 0.078 0.006 0.019

The dummy variable regression ANOVA model presents information about difference in availability of beds in hospital. The constant is significant at one percent level. In the present model constant represents the benchmark and benchmark in this case is Mysore.
In Mysore, there is a bed in hospital for every 762 people. The difference in availability of beds in hospital between Mysore division and Bangalore division is 250 persons but this difference is not significant at five percent level.

The difference in availability of beds in hospital between Mysore division and Belgaum division is 416 persons and this difference is significant at one percent level.

The difference in availability of beds in hospital between Mysore division and Gulbarga division is 369 persons and this difference is significant at five percent level.

Therefore, there is no significant difference between Mysore and Bangalore division in availability of beds in hospitals. There is significant difference between Mysore and Belgaum division in availability of beds in hospitals. At the same time, there is significant difference between Mysore and Gulbarga division in availability of beds in hospitals. Accordingly, availability of beds in hospitals in Belgaum and Gulbarga division is significantly low compared to Bangalore and Mysore divisions. Hence, there is a need to provide more beds in Belgaum and Gulbarga division with priority, in order to reduce the regional disparity in providing healthcare services.

It has been proved by the analysis that the healthcare facilities are very poor in Belgaum and Gulbarga division compared to Mysore and Bangalore division. Therefore, government needs to give more priority to Belgaum and Gulbarga divisions in enhancing the medical facilities and infrastructure provisions.

4.6. Conclusion

The present chapter analyzed the performance of healthcare sector in Karnataka. Physical and human parameters along with financial indicators have used in this chapter. It has been found from the research that growth of capital expenditure on healthcare and growth of significantly high in Karnataka compared to other parameters used in the chapter. It has been also proved by the analysis that only hospitals have been constructed with efforts of government and the growth of the economy. Beds in hospital have been also depending on the revenue contributions of the economy. But, growth of PHCs, beds in PHCs and doctors in Karnataka have not been depending upon government efforts or contribution and these parameters have been depending only depending upon the growth of the economy and not the efforts
of government. In other works it can be argued that the efforts made by the state government in the form of revenue and capital expenditure is insufficient to influence these parameters; PHCs, beds in PHCs and doctors in hospitals. Therefore, there is a need of state government to increase its efforts and contributions to develop better public healthcare services in Karnataka. It has been proved by the analysis that the healthcare facilities are very poor in Belgaum and Gulbarga division compared to Mysore and Bangalore division. Therefore, government needs to give more priority to Belgaum and Gulbarga divisions in enhancing the medical facilities and infrastructure provisions.