Health Infrastructure, Health Outcome and Economic Wellbeing: A District Level Study in India

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Abstract

Healthy population is considered to be the engine of economic growth. A healthy person can work with efficiency to earn wealth. Collective wealth of all those persons gives rise to the wealth of the nation. Against this backdrop, the present paper analyses health infrastructure and health outcome in India by constructing composite indices. To have a wider implication at ground level and also to identify the regional disparity in health infrastructure and outcome, the study has been conducted at district level across all general category states of India using data from District Level Household Survey (DLHS-III) and National Sample Survey (NSS). Using appropriate econometric tools, Health infrastructure has been critically viewed from the basic aspects of availability and accessibility of Promotive, Preventive and Curative health services, whereas health outcome/status has been analysed using three basic indicators of Reproductive & Child Health., Morbidity and Mortality. The paper further extends the analysis by discussing the interlinkage between health infrastructure and health outcome as well as that between health status and economic wellbeing. Relative position of the districts within the states is explored to identify the determinants of health status using simple econometric exercise. Results indicate strong relation between primary health infrastructure and preventive & curative health achievements. Close relation between health and economic status/wellbeing of a district underlines the role of health in determining socioeconomic situation of a region. Gaps in health infrastructure in the region needed to be taken care of to tap the full economic potential of the region has also been estimated and highlighted.

Key Words: Health Infrastructure, Health Outcome, Regional Disparity, Economic Wellbeing

JEL Classification: I14, I15, I18, R11

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I. Introduction

Healthy population is considered to be the engine of economic growth. A healthy person can work with efficiency to earn wealth. Collective wealth of all those persons gives rise to the wealth of the nation and makes her economically stronger thereby. On the other hand, poor health of the people leads to production loss for an economy in terms of reduced productivity of the workers/employees. This in turn hampers the growth of the country as a whole. It does mean that, health is not only the absence of illness but also being productive at the fullest extent so as to produce at the optimum level. Apart from this direct health-wealth relation in the present state of well-being, health may also affect the future growth potential of the economy. Malnutrition among children leading to non-capability to impart knowledge and thereby lack of skill formation will finally end up with low quality and less productive human resource. This would again dampen the productivity in future, leading to loss of potential income. Peoples' physical health being such an important determinant of nations' economic health, the social scientists as well as UNDP has considered health as one of the key ingredients of Human Development. So, it's really important to have a good health infrastructure in terms of institutional setup to provide health service delivery across all corners of a country with an easy accessibility and affordability of the people of all income clusters. This would bring in a good health outcome and consequent better well-being as well as standard of living.

Against this backdrop, the present paper primarily focuses on exploring the health infrastructure and outcome at the very district level across all states of India and then extends the study further to discuss the interlinkage between health infrastructure and health outcomes as well as that between health status and economic well-being. To have a wider implication at ground level and also to identify the regional disparity in health infrastructure and outcome, the study has been conducted at district level across all states of India using data from District Level Household Survey (DLHS-III) and National Sample Survey (NSS). Using appropriate econometric tools Health infrastructure has been critically viewed from the basic aspects of availability and accessibility of promotive, preventive and curative health services. Health outcome/status has been analysed using three basic indicators of Reproductive & Child Health, Morbidity and Mortality. Finally, the concept of economic well-being of a district is proxied through the Average Monthly Per capita Expenditure.

The paper is structured as follows. The second section talks of the previous researches in this area, the third section describes the detailed methodology, the fourth section talks of the data source, fifth and sixth section explores the health infrastructure and health outcome

respectively for districts of India, seventh section looks at the possible association between health infrastructure and health status and develops a Composite Health Index as a proxy for overall health attainment for the districts of India, eighth section highlights the causality between health status and economic well-being. The last section concludes.

II. Review of Related Literature

Presence of health infrastructure in terms of having medical facilities is a key to have a good health status of the people. Many researchers have tried to explore the existing health care system pattern and the health status of the people so far. In Indian context some recent studies on health care system and utilization pattern of health care service include those by (Gangolli, Duggal, and Shukla (2005), Datar, Mukherji and Sood (2007), Shariff and Gumber (2008), Gill (2009), Saikia and Das (2012), Goswami and Dutta (2012). Gangolli, Duggal and Shukla (2005) in their recent edited book Review of Healthcare in India brought together a broad array of issues and possess a certain ideological clarity. This book has come out as an input to support the activities of the Peoples Health Movement in India (Jan Swasthya Abhiyan-JSA). The articles in this volume try to analyse and reinterpret the health situation and health statistics from people's perspective and with a view to strengthen the emerging movement demanding a people's health policy in India. The work by (Datar, Mukherji and Sood (2007) examined the role of health infrastructure and community health workers in expanding immunization coverage in rural India. The study is based on NFHS data but is constrained to rural India only. They have found that the availability of health infrastructure had only a modest effect on immunization coverage and the presence of community health workers in the village was not associated with increased immunization coverage. The study by Shariff and Gumber (2008) concentrated on Health Care Services in rural India and its implications for Reproductive Health. The objective of the paper is to examine health care utilization pattern across gender, especially seeking inpatient and outpatient services at public and private facilities. Discussing the pattern of health care utilisation the authors find that the incidence of morbidity for women in the reproductive age group is higher than those for men. Scheduled Castes and Scheduled Tribes reported lower levels of hospitalization, which is largely due to their inaccessibility to health care facilities. A recent evaluation study to assess the service delivery under the National Rural Health Mission (NRHM) by Gill (2009) in states of Andhra Pradesh, Uttar Pradesh, Bihar and Rajasthan has highlighted the quantity and quality of service delivery in rural public health facilities under NRHM. Very recently, Saikia and Das (2012) tries to review the progress in health infrastructure and health care facilities, the status of manpower and the quality of health care services in the rural areas

across the north-eastern States. The findings say that after the implementation of NRHM in 2005 though there has been significant improvement in the rural health infrastructure, especially in case of health centres in the region, the condition of the region has been atrocious in terms of other components of health care infrastructure, especially in terms of quality of health care services and availability of specialists and well trained personnel. However, the study has been made restricted up to state level only. Following this Goswami and Dutta (2012) have worked on the status of rural health infrastructure in Assam at District level.

Studies on Health outcome in Indian context are more in number. Notable among them are by Visaria (1985), Jain (1985), Beenstock and Sturdy (1990), Gillespiel and McNeill (1992), Reddy and Selvaraju (1993), Murthi, Guio and Drèze (1995), Agnihotri (2001), Dilip and Duggal (2002), Gaudin and Yazbeck (2006), Chandhiok et al. (2006), Masset and White (2008), Borooah (2010). The study by Visaria (1985) concentrates on the level, trends and determinants of Infant Mortality in India. The objective of the paper is to review the state level estimates of neonatal, post natal and overall infant mortality by sex and rural urban residence and also to focus on the contribution of various prenatal, natal and post natal factors to infant mortality. Jain (1985) later on has done a similar kind of a study to find the determinants of infant mortality by distinguishing between factors at three levels – village, household and individual and finds preventive medical interventions to be extremely influential to reduce the high level of infant mortality currently prevalent in many states in India. Studies by Beenstock and Sturdy (1990), Reddy and Selvaraju (1993) and recent one by Masset and White (2008) are also of related pattern. Murthi, Guio and Drèze (1995) made another district level study on Mortality, Fertility and Gender bias in India. Authors have examined the determinants of fertility, child mortality across gender in India using district level data. Agnihotri (2001) made a state level study on Infant mortality variation in space and time, analysis of West Bengal Data. The author basically used mapping technique to identify regions of high mortality levels using the 1981 and 1991 district level estimates. It also reveals regions, especially urban where the gender gap in the mortality levels is considerable. State level time series data from SRS[3] is used to amplify the issue further. The author also tried to show the differences in mortality levels by social and regional groups. Dilip and Duggal (2002) have focused on incidence of non-fatal health outcomes and debt in urban India. The study examines how expenditure on health care affects economic condition

[3] Sample Registration System, Census of India

of the ailing person's household, by analysing source of financing of health care services. The work by Gaudin and Yazbeck (2006) focusses on assessment of immunization of children in India using the NFHS – II data both at sub-national and national level. Chandhiok et al. (2006) has made a study to analyse the possible factors contributing to women obtaining antenatal care services and to determine whether these services influence their decision regarding the place of delivery. The study is based on a cross-sectional survey of 7005 pregnant women in the sampled areas of 28 districts in 14 states of India. A recent study by Borooah (2010) concentrates on the inequality in health outcomes in India with special reference to caste and religion. The purpose of this paper is to evaluate the relative strengths of economic and social status in determining the health status of persons in India. In other words, the paper investigates whether there is a social gradient to health in India with respect to four health outcomes: the age at death; the self-assessed health status of elderly persons; the likelihood of elderly persons, who were in poor health, taking treatment for their ailments; and the likelihood of receiving prenatal and postnatal care.

In international context studies are again found to be focusing more on health outcome only. Or (2000) has made a study to find the determinants of health outcomes in industrialised countries. This is a cross country study based on time series data. Nisar and White (2003) focussed on exploring the factors affecting utilization of Antenatal Care among reproductive age group women in an urban squatter settlement of Karachi. They have also concentrated on comparing the knowledge on antenatal care between women who received and those who did not receive antenatal care. Buitendijk et al. (2003) tried to assess the ability of the member states of the European Union to produce the indicators recommended by the PERISTAT project on perinatal health indicators and to provide an overview of fetal and infant health outcomes for these countries.

Apart from individual studies by many researchers, India Infrastructure Report, 2007 by Oxford University Press also discussed important issues in health infrastructure in India and Millennium Development Goals India Country Report 2005 of Government of India discussed on health outcome especially in context of achieving specific targets that are to be met according to Millennium Development Goal.

It is quite evident from the previous researches that studies were made either to assess the utilization pattern or availability of a component of health infrastructure or the same for health outcome. Study discussing both health infrastructure as whole along with health outcome/status across all districts of India is sparse and the present authors did not come across any study on this aspect. Moreover, there has been hardly any study based on

household level data of districts across all states of India to assess health infrastructure and health status. The present paper aims to fill this gap in existing literature.

III. Methodology

The paper seeks to analyse the Health Infrastructure and resulting Health Outcome/Status across all districts of India. In continuation to this, the association between the availability of infrastructure and status of health across districts has been explored. The phenomenon of causality between health and economic wellbeing has been tested using simultaneous equation structure. It is significant to note that as we intend to make the study at district level, the variables considered for discussion are aggregated up to districts from the household level surveys conducted by International Institute of Population Sciences, Mumbai and Ministry of Statistics and Programme Implementation, Govt. of India. A detailed thematic diagram of the methodology is provided in Figure: 1.

Thus, there are four major methodological sections in the paper. First, method to explore the Health infrastructure, second, method to measure Health Outcome, third, interlinking health infrastructure and health outcome through possible association between the two and lastly, method for interlinking health with economic wellbeing. The methodological sections as well as the individual methods to compute different indices are elaborately described as follows.

III.1 Health Infrastructure - Components

Health infrastructure is presumed to be composed of three basic indicators, namely, (i) Promotive Health Infrastructure, (ii) Preventive Health Infrastructure and (iii) Curative Health Infrastructure.

(i) *Promotive Health Infrastructure:* This component is expected to enlighten the role of various social awareness campaign and some nutritional schemes introduced to provide proper nutrition/health service to rural people, especially to child and women. Moreover, the main motive of these schemes is to promote awareness among people about various diseases and the ways to prevent those diseases. The calculation of Promotive Health Infrastructure Index is based on four indicators, namely, percentage of villages in a district with availability of Integrated Child Development Scheme (ICDS), Accredited Social Health Activist (ASHA), Village Health and Sanitation Committee (VHSC) and Janani Suraksha Yojna (JSY).

(ii) *Preventive Health Infrastructure:* It is always better to prevent the disease rather than curing it. However, prevention essentially needs certain health friendly conditions to be met. Accordingly, the Preventive Health Infrastructure Index is computed to represent the

existence of healthy condition in terms of two basic aspects, percentage of villages in a district with availability of safe drinking water and Sanitation.

(iii) *Curative Health Infrastructure:* If the diseases can be barred to destroy the immunity of a human being by adopting some preventive measures then the role of curative health system reduces to a large extent. However, in a developing country, promotive and preventive infrastructure being very poor, the dependency on curative health services is at its maximum. Keeping this role of curative health services in mind, an index has been developed capturing the availability and accessibility of medical institutions at district level. Six such indicators are used to construct the index. On the availability part the indicators are percentage of villages in a district with availability of Sub Health Centre, Health Service Provider and 24 hour open Primary Health Centre. On the accessibility part those are namely, percentage of villages having connectivity to Community Health Centre through Road, Percentage of villages having connectivity to District Hospital through Road and lastly average distance to Medical Shop. The accessibility indicators are considered to reflect the extent of ease of access to better medical institutions in case of any critical illness.

Composite Health Infrastructure: The Composite Health Infrastructure Index is developed to have a single indicator representation of the aforesaid components of health infrastructure for each and every district. Thus, it is a composite indicator developed by combining the Promotive Health Infrastructure Index, Preventive Health Infrastructure Index and Curative Health Infrastructure Index.

III.2 Health Outcome - Components

Similarly, health outcome/status is composed of (i) Reproductive and Child Health Care status, (ii) Morbidity Status and (iii) Mortality Status.

(i) *Reproductive and Child Health Care:* Pregnant Women and new born babies are most vulnerable to be affected by critical diseases and consequent death. Proper care during pregnancy reduces maternal morality on the one hand and ensures healthy baby on the other. Hence, indicators with respect to natal care, delivery and immunization would serve as a good indicator for Reproductive and Child Health Care. Accordingly this index has been composed of four indicators – percentage of women who received Ante Natal Care during their pregnancy, percentage of institutional delivery, percentage of women and child who received Post natal care and Percentage of children (0 to 4 age) who received immunization. All are aggregated at district level.

(ii) *Morbidity Status*: The term morbidity refers to sickness due to any disease and related compulsions. Thus the morbidity index is composed to capture three aspects – percentage of

people hospitalized in last 365 days, average day stay in hospital and percentage share of per capita medical expenditure to monthly per capita consumption expenditure. It is to be noted that the last variable i.e. share of per capita medical expenditure to monthly per capita consumption expenditure is chosen to avoid the income effect of rise medical expenditure. Medical expenditure for an individual may rise due to two reasons, firstly, due to prevalence of diseases and secondly, due to rise in income. In our context, what we intend to check is the expenditure due to prevalence of diseases. So, we have to control for the effect of rise in income. The proposed ratio would serve the purpose.

(iii) *Mortality Status*: Death at a very low age is most likely because of poor health attainment. This crucial aspect has been captured through the Infant Mortality Rate to develop a morality index across the districts.

Composite Health Outcome: Unlike the composite health infrastructure index, here again, the pre discussed health outcome indicators of Reproductive and Child Health Care, Morbidity and Mortality are combined to develop a unique indicator for the Health outcome of the people as a whole.

Having developed the composite indices for health infrastructure and health outcome at district level, the possible association between the two is tested using Pearson chi-squire test. This basically helps us in finding the overlapping districts i.e. the districts with poor infrastructure and poor outcome and vice versa.

Use of thematic map has been made to have an easy and pictorial understanding of regional disparity of health infrastructure and outcome. In context to this, districts with computed index score greater than mean score of the districts plus half of standard deviation of the respective values are classified as good in terms of infrastructure/outcome. Whereas, districts with computed index score less than mean score of the districts minus half of standard deviation of the respective values are classified as poor in terms of infrastructure/outcome. Rest are called to be having moderate for the same. At the end, the poor performing districts both in terms of infrastructure and outcome as well as the good performing districts for the same is identified using same kind of a mapping technique.

The last section of the paper enlightens on the role of health in determining economic status. Districts with more healthy population are expected to have a better economic status. Accordingly, we have modelled Economic Wellbeing/Status as a function of Health Outcome. But the relationship may also be other way round. To do away with this endogeneity issue we have modelled a simultaneous equation structure. So, we have two equations. First one is health outcome as a function of health infrastructure and economic

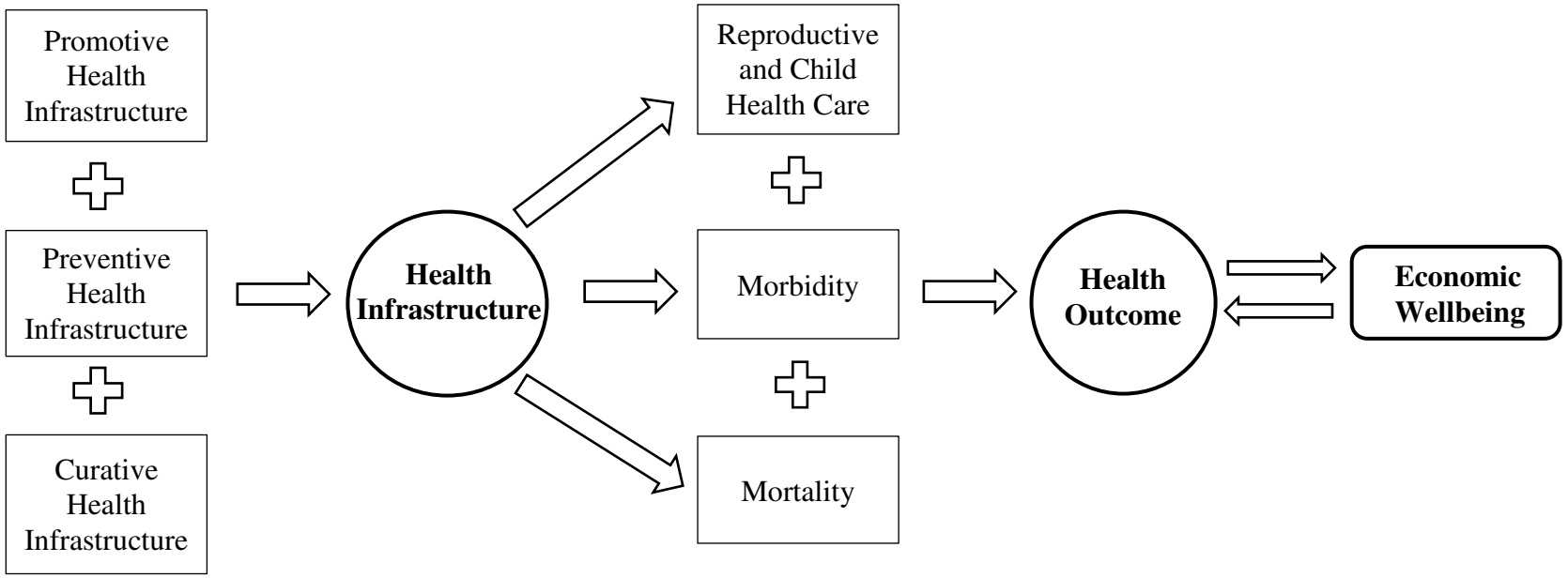
status and the second one is economic status as a function of health status and percentage of rural population. For estimation purpose, the economic status of a district is measured through the average monthly per capita consumption expenditure (MPCE). The variable called percentage of rural population is introduced in the second equation because we believe that MPCE increases with urbanization and related expansion of tertiary sector. The data for the same has been pulled from the NSS unit level survey being used for the paper. The equations are solved using three stage least squires (3SLS) method of solving simultaneous equation.

The choice of indicators to reflect health infrastructure and health outcome across districts and then converting them into composite indices depends primarily on the objective of the study – what specifically is being investigated and which view point it is sought to be looked from. But an important issue might be the uni-directionality of the chosen indicators. In the infrastructure part we have 12 indicators to be merged into three sub-indices and further into one to develop one composite score for health infrastructure. While doing so, it is to be ensured that the chosen indicators are uni-directional, positive in our case. As for example, in the promotive health infrastructure part, we have considered a variable called percentage of villages in a district with availability of ICDS. For this indicator, higher value represents better outcome. This sort of anonymity is to be maintained for all other indicators. Here, in the analysis for infrastructure, all the indicators except for average distance to medical shop are positive. Distance to medical shop is a negative indicator in the sense that higher value represents poor situation as the ease of access to get medicine becomes harder. So, in order to maintain the uniformity, the reciprocal of the variable has been taken to compute the composite index. Same applies to health outcome indicators as well. Accordingly, four negative outcome indicators are converted to have positive dimension. Those are namely, percentage of people hospitalized in last 365 days in a district, average day stay in hospital in a district, average per capita treatment expenditure in a district and lastly, infant mortality rate. Having converted the chosen indicators to positive dimension, our composite indices would also be positive with higher value for better performing districts and lower value for poor performing districts in terms of health attainment of their citizens.

The next issue is regarding the method of deriving composite indices. In the first stage, the objective is to prepare composite indices of Promotive Health Infrastructure, Preventive Health Infrastructure and Curative Health Infrastructure for the empirical exploration of overall health infrastructure scenario and Reproductive and Child Health Care, Morbidity and Mortality status for analyzing the health outcome scenario for all districts across the country.

Figure: 1

Methodological Layout of the Study



Factor analysis has been the preferred method of preparing composite indices under such situations. Consequently, Principal Component Analysis technique of Factor analysis was used to prepare the six composite indices (3 for infrastructure and 3 for outcome) mentioned above. At the second stage, Promotive, Preventive and Curative Health Infrastructure are combined to produce Composite Health Infrastructure Index; while Reproductive and Child Health Care, Morbidity and Mortality are combined to form Composite Health Outcome index. While computing the principal components, it was checked as to how many principal components are capable of explaining around 85 – 90 per cent of the variation. The number of principal components extracted is decided accordingly. In case of more than one component extracted, the simple arithmetic mean of the extracted components has been taken to construct the index.

IV. Data

Our data for Health Infrastructure come from the third round of District Level Household Survey (DLHS – III) under Reproductive and Child Health Project conducted by the International Institute of Population Sciences (IIPS), Mumbai and that for Health Outcome come from the 60th Round of National Sample Survey (NSS) on Morbidity and Health Care (Schedule 25.0), 66th Round of National Sample Survey on consumer expenditure (Schedule 1.0, Type 1 & 2) and Census of India. District wise average monthly per capita consumption expenditure (MPCE) has been computed from the 66th Round of National Sample Survey on consumer expenditure. Apart from MPCE, we have also computed the share of per capita medical expenditure to that of total expenditure using the NSS 66th Round data on consumption expenditure. All are commercially available data sets. The data for infant mortality rate is taken from the census of India website.

DLHS provides data on health infrastructure for all districts of India. There are three rounds of DLHS in 1998-99 (DLHS – I), 2002-04 (DLHS - II) and 2007-08 (DLHS – III) respectively conducted by IIPS so far. For our purpose we are using the latest round (DLHS-III). For the health outcome, initially it was thought that the National Family Health Survey (NFHS) data provided by IIPS will be used. But there were two problems. First, the NFHS provides data up to state level only which fails to fulfill the basic need of the study at district level, second, the NFHS data would also not be appropriate for this study as the purpose of the national family health survey was to evaluate the reproductive and child health care. Accordingly a purposive random sampling is used to conduct the survey only among the households with at least one women in the child bearing age or at least one child in the age group of 0 – 4. This merely serves our purpose of evaluating the general health status across

the districts of India. Thus, analysis using NFHS data is contradicts with our purpose of study.

To get rid of this problem, we have used the unit level National Sample Survey (NSS) data on Morbidity and Health Care. Chosen health outcome indicators are computed at district level and are kept side by side with the infrastructure variables computed from the DLHS –III data set. But there were some problems regarding the matching of districts between DLHS and NSS data because of administrative breakup and formation of new districts subsequently between census 2001 and 2011. As both the data sets belong to the mid of two censuses, we have followed the administrative setup of the districts provided in census 2001 and the newly formed districts are merged to their mother districts based on the Administrative Divisions Report of Census 2011. Accordingly, the study is made for districts as per census 2001 administrative setup. Weighted average technique is followed to move back the new districts in their respective original form.

In this discussion, we have considered all general category states except for Delhi and Goa. So, the analysis is based on 16 major states of India with 451 districts and 17,787 villages. We are not considering Delhi and Goa as they have recently been designated as states. Apart from that Delhi is privileged to get some added benefits for being the capital of India. The special category states and union territories are excluded from our analysis as they may end up in being outlier. These states and union territories are treated separately because of their socio economic background, geographic location and economic condition. Hence, analyzing general category stats with special category states along with union territories would result in an erroneous result.

V.1 Health Infrastructure

Health infrastructure is known to be the elementary need to have a good health condition. In developing countries like India, the quality of the underlying health system is poor as compared to those of comparable nations. High population pressure coupled with wide geographical area is making the existing infrastructure insufficient and inaccessible. Following the Millennium Development Goal, making healthcare affordable and accessible for all its citizens is one of the key focus areas of the country today. However, the Government's spending towards health sector is too low (less than 1 per cent of GDP)[4] as compared to the other emerging nations. In this circumstance, the present section of the paper tries to assess the existing health infrastructure in the districts of India by way of dividing the

[4] World Health Organization (WHO) Statistics 2012

infrastructure in three broad categories – Promotive Health Infrastructure, Preventive Health Infrastructure and Curative Health Infrastructure; finally combining them to Composite Health Infrastructure to have a single indicator representation of overall health infrastructure for each district. The idea behind this classification is the following. If we can prevent the diseases by promoting awareness among people and thereby convincing them to come for preventive measures then the importance of curative services becomes lesser slowly and gradually. Thus, promotion of awareness to prevent the diseases makes it easy to implement the statement 'prevention is better than cure'.

i) Promotive Health Infrastructure

Promotion of awareness about determinants of healthy life among the people plays a crucial role to make health act as an engine of economic growth for a nation. For example, these days many death causing diseases like polio, measles, hepatitis, etc. is being protected by providing vaccination at the very early age of a child. So, awareness about these diseases and about the process to prevent them acts as an instrument to a healthy life for any child. In other words, promotion of this awareness is the key. Having understood this, the policy makers have introduced many schemes to spread awareness among people. To capture this aspect, we have tried to see the extent of availability of these promotional schemes for betterment of existing health infrastructure. Four leading promotional schemes have been considered to develop a promotive infrastructure index at district level. Those are namely, Percentage of villages in a district with Availability of Integrated Child Development Scheme (ICDS), Accredited Social Health Activist (ASHA), Village Health and Sanitation Committee (VHSC), Janani Suraksha Yojna (JSY).

Table: 1

Promotive Health Infrastructure

Promotive Infrastructure	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Percentage of Villages in a district with Availability of					
Integrated Child Development Scheme	0.00	100.00	87.36	24.1386	0.2763
Accredited Social Health Activist	0.00	100.00	42.27	40.6858	0.9626
Village Health and Sanitation Committee	0.00	100.00	19.20	31.1839	1.6242
Janani Suraksha Yojna	0.00	100.00	74.29	34.9184	0.4700
Promotive Infrastructure Score	**0.68** (Banka, *Bihar*)	**4.01** (Kasaragod, *Kerala*)	**3.00**	**0.6171**	**0.2057**

Note: Texts in the parenthesis are the districts followed by states to which the values belong
Source: Authors' own calculation based on DLHS – III data provided by IIPS, Mumbai

As found through the computed index the districts of Kerala are among the best performers in terms of promoting awareness with Kasaragod district scoring highest; whereas the districts of Bihar, Jharkhand, Uttar Pradesh and Madhya Pradesh are among the poor performers (Refer Table: 5). To account for the variation in computed index score, we have considered both standard deviation and coefficient of variation across districts. Going by the value of the coefficient of variation (as it encompasses relative measure of dispersion) for the chosen indicators, it can be observed that the variation in the availability of VHSC is largest among all other promotional schemes followed by ASHA, JSY and ICDS. This is mere implication of the fact that the availability of VHSC is too poor in some districts, absent rather. This is also reflected by the mean score of the variable (19.2). The ICDS has reached in almost all districts as reflected by its Coefficient of variation as well as the mean score. Implementation of JSY can be said at the modest level with ASHA still in unsatisfactory zone.

ii) Preventive Health Infrastructure

Promotion of awareness should be associated with some preventive measures. Being motivated through those awareness campaigns people are expected to go for such preventive measures to curb the infectious diseases. Access to safe drinking water and sanitation are among those factors which can prevent some death causing diseases like Cholera, Diarrhea, etc. Children of developing countries are mostly affected by various forms of waterborne diarrheal diseases. According to the World Health Organization, such diseases account for an estimated 4.1 per cent of the total daily global burden of disease, and cause about 1.8 million human deaths annually. So, it is really important to have the safe drinking water and sanitation facility available in each and every hamlet. Based on the availability of these indicators at village level we have developed the Preventive Infrastructure Index and it is found that out of the 451 districts considered for discussion, districts of Uttar Pradesh are better equipped with these facilities; whereas the districts of Orissa are among the places where the availability is at stake (Table: 5). The overall score for the index varies between 0.26 to 4.49, indicating large disparity across the districts. Some districts might have done better, where as some others are lagging behind to a large extent.

Coefficient of Variation (hereafter referred to as CV) for individual indicators says that variation is more in case of availability of sanitation compared to the same for safe drinking water. Mean values of the variables says, in around 62 percent villages in any district of India the drinking water facility has been made available; whereas the availability of sanitation is a distant reality as 60 per cent of the total villages of any district is yet to be provided with sanitation facility.

Table: 2
Preventive Health Infrastructure

Preventive Infrastructure	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Percentage of Villages in a District with Availability of					
Safe Drinking Water	2.08	100.00	61.42	35.3588	0.5757
Sanitation	0.00	100.00	39.07	29.1484	0.7461
Preventive Infrastructure Score	**0.26** (Baudh, *Orissa*)	**4.49** (Baghpat, *UP*)	**2.00**	**1.0439**	**0.5219**

Note: Texts in the parenthesis are the districts followed by states to which the values belong
Source: Authors' own calculation based on DLHS – III data provided by IIPS, Mumbai

iii) Curative Health Infrastructure

Prevention is always better than cure. If any disease cannot be prevented then the access to curative health service becomes important. In India, Public health infrastructure consists of a three-tier system, a sub centre for every 5,000 population with a male and female worker; a Primary Health Centre (PHC) for every 30,000 population with a medical doctor and other Para medical staff, and a Community Health Centre (CHC) for every 100,000 population with 30 beds and basic specialists. In urban areas, it is two tier systems with Urban Health Centre (UHC)/Urban Family Welfare Centre (UFWC) for every 1,00,000 population followed by general hospital. So, it is important to have access to those facilities in order to get rid of any serious health disorder. Accordingly, we have tried to develop a Curative Infrastructure Index by looking at the indicators provided in Table: 3.

Table: 3
Curative Health Infrastructure

Curative Infrastructure	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Percentage of Villages in a District with Availability of					
Sub Health Centre	0.00	100.00	21.15	29.1386	1.3774
Health Service Provider	0.00	100.00	88.19	24.6478	0.2795
Medical Shop	0.00	100.00	9.14	20.8981	2.2871
24 Hour open Primary Health Centre	0.00	100.00	36.63	35.1022	0.9583
Percentage of Villages in a District with Road Connectivity to					
Community Health Centre	10.26	100.00	74.73	19.3920	0.2595
District Hospital	10.26	100.00	76.41	19.0035	0.2487
Average Distance to Medical Shop in Kilo Meter	0.00	36.14	7.45	4.0362	0.5416
Curative Infrastructure Score	**0.82** (Sonbhadra, *UP*)	**4.13** (Kozhikode, *Kerala*)	**2.00**	**0.5945**	**0.2973**

Note: Texts in the parenthesis are the districts followed by states to which the values belong.
Source: Authors' own calculation based on DLHS – III data provided by IIPS, Mumbai

The variability of the computed index across the districts is too high as reflected by the maximum and the minimum value of the index and statistically supported by the CV of the index. Most importantly, a Sub-health Centre being the first contact point between primary health care system and the community is not available up to its required level. On an average, only 21 per cent villages of a district has a sub health centre within the village. However, this is not true across all districts the value of CV indicates large variation in the availability. Worrying situation is there in case of availability of medical shop as well. In terms of overall availability of Curative Health Infrastructure across the districts (reflected by computed index for curative infrastructure), the districts of Kerala are among the best performers; the poor performing districts being Sonbhadra (*UP*), Ganganagar (*Rajasthan*), Barddhaman (*WB*), Ganjam (*Orissa*), Medak (*AP*), Rajgarh (*MP*), Jabalpur (*MP*), Gonda (*UP*), Sagar (*MP*), Sheopur (*MP*) [refer to Table: 5].

iv) Composite Health Infrastructure Index

To develop a single composite index capturing every aspects of health infrastructure at district level across all states considered for discussion the pre developed indictors has been combined together to formulate a Composite Health Infrastructure Index using Principle Component Analysis technique. As shown in Table: 4, the computed index varies from 0.51 to 5.16 across all 451 districts of India with a considerable level of regional imbalance as reflected by the coefficient of variance. This basically highlights the extent of heterogeneity in terms of infrastructural availability; some districts are privileged to have a good infrastructure whereas some others are not. It is significant to note that the districts of Kerala are consistently on the top in providing all types of health infrastructure. It is to be mentioned that Uttar Pradesh, known to be as a backward state have made significant progress in providing the preventive health services.

Table: 4
Composite Health Infrastructure

Health Infrastructure Indices	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Promotive Infrastructure Score	0.68	4.01	3.00	0.6171	0.2057
Preventive Infrastructure Score	0.26	4.49	2.00	1.0439	0.5219
Curative Infrastructure Score	0.82	4.13	2.00	0.5945	0.2973
Health Infrastructure Score	**0.51** (Ganganagar, *Rajasthan)*	**5.16** (Pathanamthitta, *Kerala)*	**3.00**	**0.7871**	**0.2623**

Note: Texts in the parenthesis are the districts followed by states to which the values belong
Source: Authors' own calculation based on DLHS – III data provided by IIPS, Mumbai

Major number of districts of Jharkhand, Bihar, Madhya Pradesh are among the poor performers in terms of providing health facility to its people with bottom ten districts being Giridih (*Jharkhand*), Ganganagar (*Rajasthan*), Ganjam (*Orrissa*), Kodarma (*Jharkhand*), Hazaribagh (*Jharkhand*), Rajgarh (*MP*), Panna (*MP*), Bhopal (*MP*), Sagar (*MP*) and Banka (*Bihar*) [refer to table: 5]. Pictorial representation of the index is provided using thematic map in figure -2.

Table: 5

Health Infrastructure - High and Low Performing Districts of India

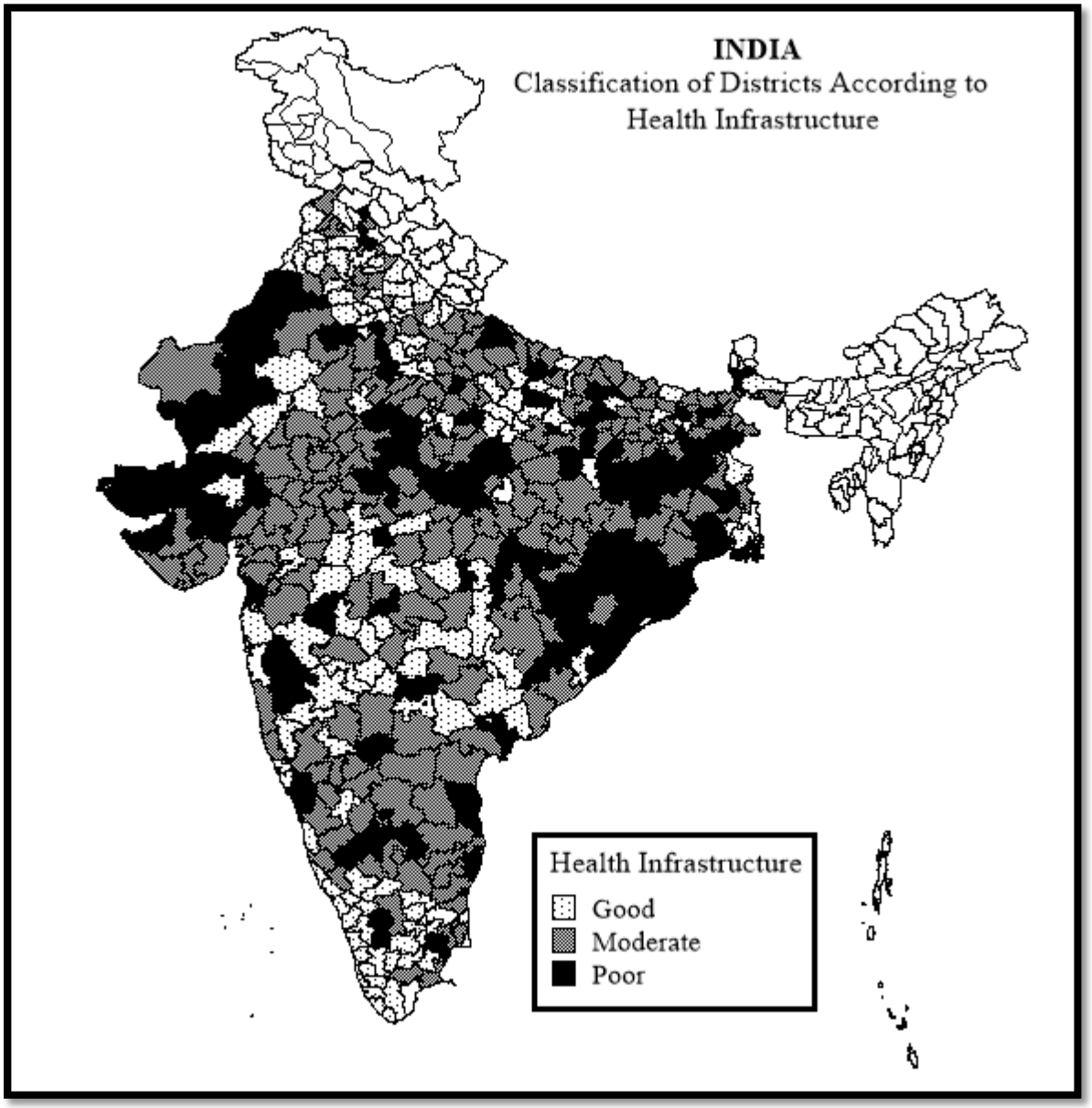
Health Infrastructure Indices	***Top Ten Districts in India***	***Bottom Ten Districts in India***
Promotive Infrastructure Index	Kannur (*Kerala*), Thrissur (*Kerala*), Malappuram (*Kerala*), Kasaragod (*Kerala*), Kottayam (*Kerala*), Pathanamthitta (*Kerala*), Alappuzha (*Kerala*), Thiruvananthapuram (*Kerala*), Kollam (*Kerala*), Ernakulam (*Kerala*)	Auraiya (UP), Kodarma (Jharkhand), Hazaribagh (Jharkhand), Giridih (Jharkhand), Banka (Bihar), Aurangabad (Bihar), Rajgarh (MP), Saharsa (Bihar), Srikakulam (AP), Ghazipur (UP)
Preventive Infrastructure Index	Baghpat (*UP*), Faizabad (*UP*), Agra (*UP*), Meerut (*UP*), Saharanpur (*UP*), Ghaziabad (*UP*), Kanpur Nagar (*UP*), Bulandshahar (*UP*), Gautam (*UP*) Buddha Nagar (*UP*), Barabanki (*UP*)	Debagarh (*Orrissa*), Balangir (*Orrissa*), Sambalpur (*Orrissa*), Rayagada (*Orrissa*), Bhadrak (*Orrissa*), Jharsuguda (*Orrissa*), Baudh (*Orrissa*), Koraput (*Orrissa*), Kendujhar (*Orrissa*), Jajapur (*Orrissa*)
Curative Infrastructure Index	Kozhikode (*Kerala*), Thrissur (*Kerala*), Ernakulam (*Kerala*), Thiruvananthapuram (*Kerala*), Malappuram (*Kerala*), Wayanad (*Kerala*), Kannur (*Kerala*), Kasaragod (*Kerala*), Kottayam (*Kerala*), Alappuzha (*Kerala*)	Sonbhadra (*UP*), Ganganagar (*Rajasthan*), Barddhaman (*WB*), Ganjam (*Orissa*), Medak (*AP*), Rajgarh (*MP*), Jabalpur (*MP*), Gonda (*UP*), Sagar (*MP*), Sheopur (*MP*)
Health Infrastructure Index	Pathanamthitta (*Kerala*), Ernakulam (*Kerala*), Kozhikode (*Kerala*), Alappuzha (*Kerala*), Idukki (*Kerala*), Kottayam (*Kerala*), Kasaragod (*Kerala*), Thiruvananthapuram (*Kerala*), Kollam (*Kerala*), Wayanad (*Kerala*)	Giridih (*Jharkhand*), Ganganagar (*Rajasthan*), Ganjam (*Orrissa*), Kodarma (*Jharkhand*), Hazaribagh (*Jharkhand*), Rajgarh (*MP*), Panna (*MP*), Bhopal (*MP*), Sagar (*MP*), Banka (*Bihar*)

Note: Texts in the parenthesis are the districts followed by states to which the values belong; UP – Uttar Pradesh, MP – Madhya Pradesh

Source: Authors' own calculation based on DLHS – III data provided by IIPS, Mumbai

Figure – 2

Health Infrastructure across Districts of India



Source: Authors' own calculation.
Note: Districts within white shade are not covered in the study.

V.2 Health Outcome

So far we have discussed the health infrastructural facility across the districts but we are equally, sometimes even more concerned about health outcome/status as social development depends more on the health of the people. Infrastructure can act as an aid to have a good health outcome but ultimately it is health outcome which is more needed, not the health outlay. In some circumstances, the quality of health services has a relatively minor role in determining health outcome, in other circumstances, a major role. But never the less quality

of health services has an impact on health outcome. This section of the paper assesses health outcome across all districts of India in three different categories – Reproductive and Child Health Care, Morbidity Status and Mortality Status; finally combining them to Composite Health Outcome to have a single indicator representation of health status of the people spread across all districts of the country.

i) Reproductive and Child Health Care

Reproductive health is a crucial part of general health for a woman as well as for a newborn. The health of an infant largely depends on mother's health and nutritional status as well as on her access to health care services. Proper nourishment during the pre and post natal period helps to reduce maternal as well as infant mortality. All these aspects are taken care of through the reproductive and child health care. So, under the heading of Reproductive and Child Health Care (RCH) we have assessed four basic parameters – Percentage of women in a district who received pre natal care, had institutional delivery, received post natal care and lastly percentage of children immunized.

Table: 6
Reproductive and Child Health Care

Reproductive and Child Health Care (RCH)	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Percentage of Women in a District					
Received Pre Natal Care	0.00	100.00	73.67	26.3015	0.3569
Had Institutional Delivery	0.00	100.00	32.63	26.4553	0.8106
Received Post Natal Care	0.00	100.00	62.22	30.1190	0.4840
Percentage of Immunized Children in a District	24.09	100.00	93.76	10.9466	0.1167
RCH Score	**0.67** (Madhubani, *Bihar)*	**4.86** (Davanagere, Karnataka)	**4.00**	**0.6241**	**0.1560**

Note: Texts in the parenthesis are the districts followed by states to which the values belong
Source: Authors' own calculation based on 60th Round of NSS unit level data on Morbidity and Health Care

Out of the four discussed indicators, percentage of institutional delivery seems to be quite low across the country. However, the immunization programme is found to be very successful with almost 94 out of every 100 children being immunized in every district on an average, coefficient of variation is also low; implying a near similar scenario in all districts with almost no regional disparity (refer to Table: 6). Combining all four indicators we have developed a composite index for reproductive and child health care. It is interesting to note that a significant number of districts of the so called backward states like Uttar Pradesh, Rajasthan, and Orissa have improved enough in terms of reproductive and child health care. However, some other districts belonging to the same states are among the bottom performers,

implying large disparity/inequality within state and between districts. This is also reflected by the variation in computed RCH index score.

ii) Morbidity

The term Morbidity refers to sickness due to any particular disease. Morbidity is something which retards a person from being productive and efficient and thereby reducing his/her earning or economic status. To account for this aspect we have developed an index for morbidity using three parameters – Critical Morbidity Percentage in a district, average day stay in hospital in a district and lastly the share of per capita medical expenditure to that of total expenditure (in Rupees). Critical morbidity percentage refers to percentage of population hospitalized out of total population in last one year in a district. Higher values of this variable would be representative of more number of unhealthy persons in a district. Secondly, spending more days in hospital is an indicator of poor health. If someone is critically ill, then it takes time to be cured and consequently the duration of stay in hospital gets lengthy. However, the quality of health services provided in medical institutions may also be responsible for a patient to stay long in hospital as it might take longer than usual to be cured with such poor service. Hence, the duration of stay at hospital also serves as an indicator for quality of health service. Lastly, spending more on treatment as part of total expense reflects the prevalence of diseases. Instead of considering the absolute value of the treatment expenditure we have taken the ratio i.e. the share of medical expenditure to total expenditure so as to control for the income effect of rise in medical expense of an individual. All the said morbidity indicators are negative in nature with higher values representing poorer situation and vice versa. Having converted these indicators into positive direction a composite index for morbidity is computed (refer Table-7).

Table: 7

Morbidity – The Prevalence of Diseases

Morbidity	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Critical Morbidity Percentage in last One Year in a District	0.09	14.70	2.27	1.7149	0.7541
Average Day Stay in Hospital in a District	2.26	31.91	9.48	4.9786	0.5253
Percentage Share of Per capita Treatment Expenditure in MPCE in a District	0.63	19.83	5.42	2.8300	0.5221
Morbidity Score	**0.69** (Sangrur, *Punjab*)	**7.13** (Bellary, *Karnataka*)	**3.00**	**0.7465**	**0.2488**

Note: Texts in the parenthesis are the districts followed by states to which the values belong; MPCE – Monthly Per Capita Consumption Expenditure

Source: Authors' own calculation based on 60th Round of NSS unit level data on Morbidity and Health Care.

The index varies largely from 0.69 to 7.13 across the districts considered for discussion. Along with the computed morbidity score, the individual parameters are subject to large variation (represented by the coefficient of variation). In terms of prevalence of diseases, it is found that noticeable number districts of backward states are better than that of advanced ones. However it is not the general scenario. Table: 10 summarize the top and bottom ten districts in terms of computed morbidity index score.

iii) Mortality

Mortality is always considered to be a useful indicator of health status for any economy. Non availability of curative health service along with improper infrastructure, absence of preventive mechanism leads to unnatural deaths. We have tried to capture this aspect by considering the infant mortality rate i.e. the number of deaths in children under 1 year of age per 1000 live births in the same year. India has made considerable progress in reduction of Infant Mortality Rate since independence. IMR has decreased by about 50 per cent from 1961 to 1991. Though National population policy has set an ambitious goal of reducing the IMR to 30 by the year 2010, in 2008 the number of infants dying under one year of age per thousand live births is calculated to be 58 for India[5]. To calculate the index for mortality, we did not have to use the method of principal components as the variable itself serves as the index. But it is to be noted that the IMR serves as a negative indicator. So, the reciprocal of IMR, may be conceptualized as Infant Survival Rate has been considered for our purpose. However, to scale down the values and also to make it comparable to other computed indices, a natural log of the said indicator has been taken (refer Table: 8). Districts of some backward states along with Orissa are having the maximum number of child death. Add to that the some districts of Madhya Pradesh are also in the danger zone.

Table: 8
Mortality – The Prevalence of Death

Mortality	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
District wise Child Mortality Rate	14	136	71.13	24.8456	0.3493
Mortality Score	**6.76** (Baudh, *Orissa)*	**6.89** (Alappuzha, *Kearala)*	**6.83**	**0.0271**	**0.0040**

Note: Texts in the parenthesis are the districts followed by states to which the values belong
Source: Authors' own calculation based on sample registration system, Census of India.

[5] United Nation's Children's Fund (unicef)'s report on profile on Indian children published in May, 2011.

However, unlike other indicators, for infant mortality also, majority of districts of Kerala has proved to be the best to ensure the survival of a new born. Apart from Kerala the districts of Andhra Pradesh, Karnataka, Tamil Nadu and Maharashtra has also shown better prospect in terms of child mortality. This is quite similar finding to what unicef published in its report in 2011. The coefficient of variation (CV) for the variable is moderate as the reduction of infant mortality has been a focal point of the planners since a long time. Hence, the fruits has started showing up irrespective of the region. Backward districts/states seemed to have been reduced IMR to a large extent. It is to be noted that the CV for computed mortality score (after taking log of infant mortality rate) is not the true reflection of the actual variation across districts. Taking log reduces the heterogeneity in data. So, one must look at the CV for the variable itself to understand the actual variation.

iv) Composite Health Outcome Index

Having combined the three dimensions of health outcome, namely, Reproductive and Child Health Care, Morbidity and Mortality we have developed a Composite Health Outcome Index for all districts of India (refer Table:9 and Table: 10).

Table – 9

Composite Health Outcome

Health Outcome Indices	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
RCH Score	0.67	4.86	4.00	0.6242	0.1561
Morbidity Score	0.69	7.13	3.00	0.7465	0.2488
Mortality Score	6.76	6.89	6.83	0.0268	0.0039
Health Outcome Score	**0.73** (Pashchim Champaran, *Bihar*)	**5.49** (Ernakulam, *Kerala*)	**4.00**	**0.7420**	**0.1855**

Note: Texts in the parenthesis are the districts followed by states to which the values belong
Source: Authors' own calculation based on 60th Round of NSS unit level data on Morbidity and Health Care

Unlike health infrastructure, most of the districts of Kerala have again emerged to be the best in health outcome whereas a major number of districts of Bihar, Uttar Pradesh and Jharkhand are among the poor performers. Table: 10 provide a complete list of best and poor performing districts in each and every dimension of health outcome indices along with of the composite outcome index itself.

Table – 10

Health Outcome - High and Low Performing Districts of India

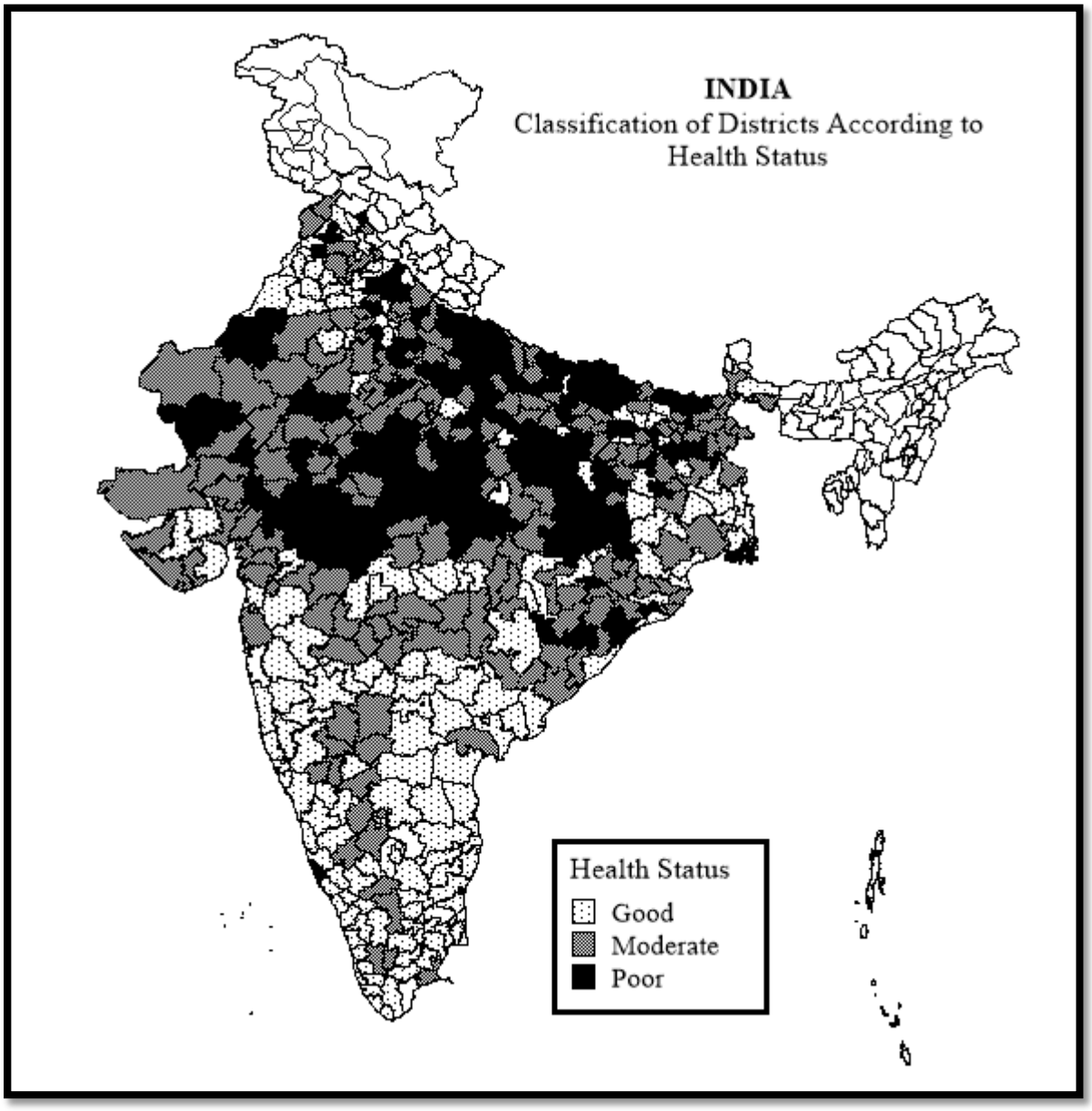
Health Outcome Indices	*Top Ten Districts in India*	*Bottom Ten Districts in India*
Reproductive and Child Health Care Index	Malkangiri (*Orissa*), Davanagere (*Karnataka*), Kandhamal (*Orissa*), Bhadrak (*Orissa*), Sant Kabir Nagar (*UP*), Dungarpur (*Rajasthan*), Baghpat (*UP*), Baudh (*Orissa*), Katni (*MP*), Puri (*Orissa*)	Madhubani (*Bihar*), Purba Champaran (*Bihar*), Pashchim Champaran (*Bihar*), Sabar Kantha (*Gujrat*), Vidisha (*MP*), Banka (*Bihar*), Sant Ravidas Nagar (*UP*), Bhojpur (*Bihar*), Gurgaon (*Haryana*), Moga (*Punjab*)
Morbidity Index	Madhepura (*Bihar*), Lohardaga (*Jharkhand*), Bellary (*Karnataka*), The Dangs (*Gujrat*), Panch Mahals (*Gujrat*), Barwani (*MP*), Gondiya (*Maharashtra*), Pashchimi Singhbhum (*Jharkhand*), Dohad (*Gujrat*), Rayagada (*Orrissa*)	Sangrur (*Punjab*), Kollam (*Kerala*), Satara (*Maharashtra*), Hathras (*UP*), Ernakulam (*Kerala*), Kottayam (*Kerala*), Pathanamthitta (*Kerala*), Idukki (*Kerala*), Namakkal (*Tamilnadu*), Alappuzha (*Kerala*)
Mortality Index	Alappuzha (*Kerala*), Wayanad (*Kerala*), Ernakulam (*Kerala*), Kannur (*Kerala*), Idukki (*Kerala*), Kottayam (*Kerala*), Malappuram (*Kerala*), Kollam (*Kerala*), Pathanamthitta (*Kerala*), Thiruvallur (Tamil Nadu)	Baudh (*Orissa*), Hamirpur (*UP*), Banswara (*Rajasthan*), Rewa (*MP*), Kandhamal (*Orissa*), Koraput (*Orissa*), Satna (*MP*), Chittaurgarh (*Rajasthan*), Malkangiri (*Orissa*), Nabarangapur (*Orissa*)
Health Outcome Index	Ernakulam (*Kerala*), Wayanad (*Kerala*), Kannur (*Kerala*), Kottayam (*Kerala*), Kollam (*Kerala*), Thiruvananthapuram (*Kerala*), Palakkad (*Kerala*), Kozhikode (*Kerala*), Malappuram (*Kerala*), Thiruvarur (*Tamilnadu*)	Pashchim Champaran (*Bihar*), Madhubani (*Bihar*), Purba Champaran (*Bihar*), Vidisha (*MP*), Sant Ravidas Nagar (*UP*), Sabar Kantha (*Gujrat*), Banka (*Bihar*), Shahjahanpur (*UP*), Bhojpur (*Bihar*), Rayagada (*Orissa*)

Note: Texts in the parenthesis are the districts followed by states to which the values belong; UP – Uttar Pradesh, MP – Madhya Pradesh

Source: Authors' own calculation based on 60th Round of NSS unit level data on Morbidity and Health Care

Figure – 3

Health Status/Outcome in Districts of India



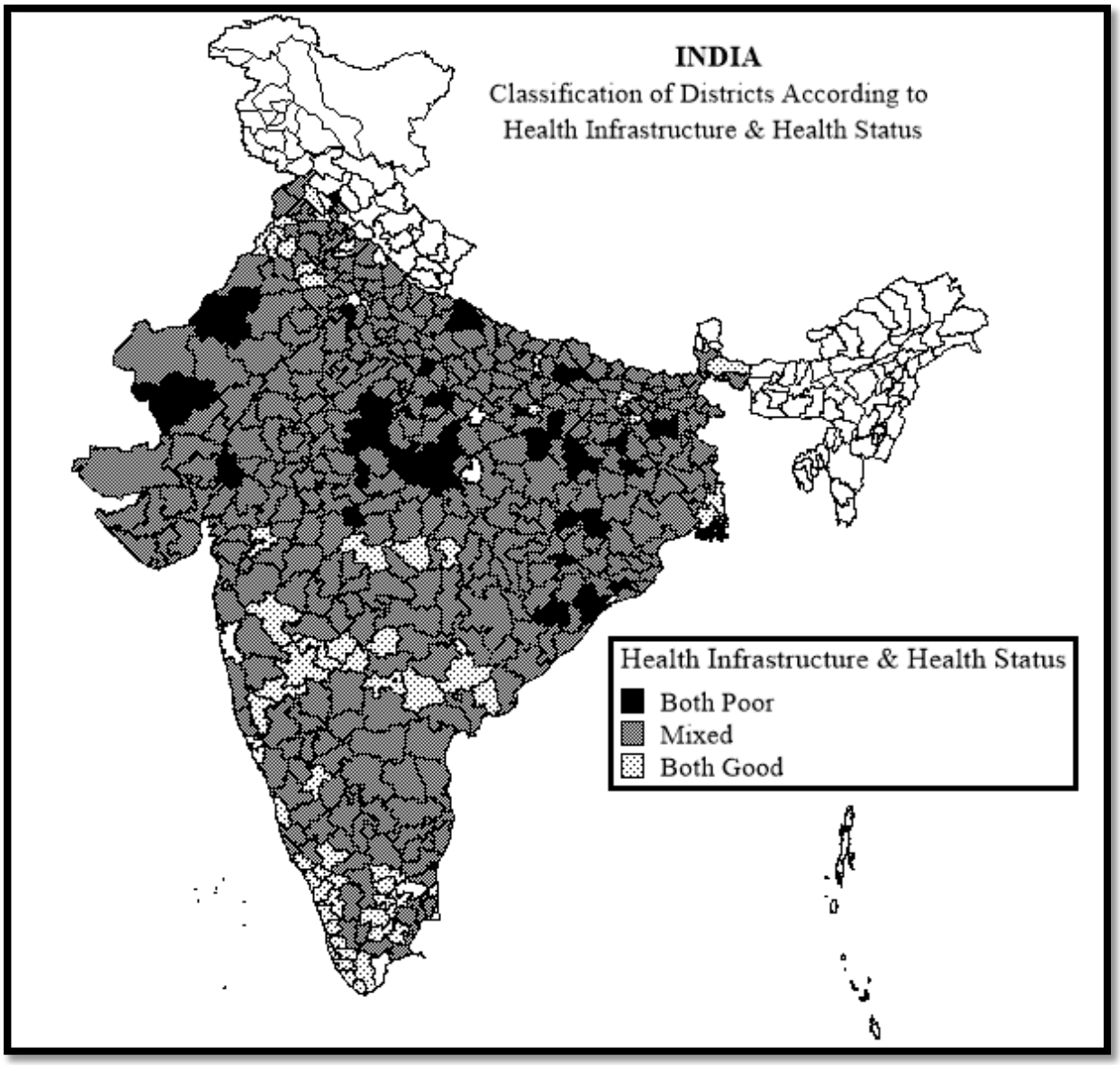
Source: Authors' own calculation.
Note: Note: Districts within white shade are not covered in the study.

V.3 Interlinking Health Infrastructure and Health Outcome

As we all know, health outcome largely depends on availability and accessibility of health infrastructure. So, it is necessary to have a good infrastructural support so as to have healthy population. However, for an economy as a whole, health to act as an engine of growth, both infrastructure and outcome has to show up simultaneously. In other words, there must be close association between infrastructure and outcome. For statistical validation of this association, a Pearson chi squire test of association has been carried out after having the

districts classified according to their performance (good/moderate/poor). The value of the test statistic is reported to be 16.44 with a significance level of 1 per cent.

Figure – 4
Overlapping Districts



Source: Author's own calculation.
Note: Note: Districts within white shade are not covered in the study.

Hence, with 99 per cent confidence we may say that there is close association between health infrastructure and health outcome across districts of India. This seems to be much expected as a good support system brings in a good outcome. It is to be noted that, the classification of the districts needed for the purpose of the test is done through cluster analysis technique. Accordingly, the overlapping districts (districts with poor infrastructure and poor outcome &/or good infrastructure and good outcome) are identified and represented using a thematic map. The tabular distributions of the districts are provided in Table – 11.

Table – 11

Classification of Districts According to Infrastructure and Outcome

		Health Outcome		
		Good	**Medium**	**Bad**
Health Infrastructure	**Good**	59	46	21
	Medium	63	87	66
	Bad	30	49	31

Note: Figures in each cell of the table represents number of districts.

Test of Association: Pearson $\chi^2(4) = 16.44$ Pr. = 0.002

It clearly says that there are 59 districts in India spread over various general category states are good in both infrastructure and outcome. These districts are mostly located in states of South India (refer to Figure: 4). 31 districts seemed to be facing the problem of both infrastructure and outcome. Rest are mixed; good infrastructure but poor outcome /status or else. The overlapping districts are better represented in Figure-4.

V.4 Health and Wellbeing/Economic Status

Health is not only the absence of sickness; it is also about developing potential. Health may impact economic development in a number of ways – it may lead to production loss due to worker illness, it may lead to an increase in the productivity of the worker as a result of better nutrition and it may also lead to learning capability among school children, thereby helping to create human capital to strengthen future economic growth. Good health raises productivity of any individual which in turn enhances his/her economic status. Adding together, substantial improvement in health status of the people increases the wellbeing of a society as a whole and finally contributes to long run economic growth. This section of the paper tries to empirically validate this health-wellbeing relationship across districts. We proxy economic wellbeing of a district by two indicators – mean monthly per capita expenditure and percentage of population lying below the poverty line[6]. A simple correlation technique has been followed to establish the relation (refer Table – 12).

[6] District wise percentage of population lying below the poverty line has been calculated from NSS 66th Round data on Consumer expenditure using the poverty line provided by Planning Commission, Govt. of India dated 19th March 2012 based on the same NSS round conducted in 2009-10.

Table-12

	Health Infrastructure Score	Health Outcome Score	Percentage of BPL Population	Average MPCE
Health Infrastructure Score	1			
Health Outcome Score	0.2741*	1		
Percentage of BPL Population	- 0.2434*	- 0.4030*	1	
Average MPCE	0.2628*	0.3497*	- 0.6318*	1

Note: * denotes significance at 1 per cent; MPCE stands for Monthly Per Capita Consumption Expenditure; BPL stands for Bellow Poverty Line

The correlation coefficient between health outcome and percentage of population lying below the poverty line is significantly negative, implying poverty is closely associated with poor health status and vice versa. And the correlation coefficient between health outcome and mean monthly per capita expenditure is significantly positive, implying the same as earlier. This substantially proves our hypothesis of direct causality between health and wellbeing.

But health status of an individual may also be dependent on his/her economic status. Poor people are not expected to have sufficient money to be spent in case of any health disorder. This reflects in poor health, resulting low productivity and low income at the end. So, there may an endogeniety problem involved here. To highlight little more on this causality, we have modled a simultaneous equation structure with following set of equations and solved using the Three Stage Least Squires (3SLS) technique.

$$h\_out = \alpha + \beta\, h\_inf + \gamma\, lna\_mpce + \epsilon \quad \ldots (1)$$

$$lna\_mpce = \alpha_1 + \beta_1\, h\_out + \gamma_1\, r\_pop + \varepsilon_1 \quad \ldots (2)$$

Where, h_out – Health Outcome Score, h_inf – Health Infrastructure Score, lna_mpce – Natural log of Average Monthly Per capita Consumption Expenditure of the District and r_pop – Percentage of rural population in the district.

Table: 13

Equations	Coefficients
Health Outcome (*h_out*)	
Health Infrastructure Index (*h_inf*)	0.16*
Log Average MPCE (ln*a_mpce*)	0.65*
Constant (α)	- 1.05
R – Squired 0.15	
Chi- Squired 54.25*	
Log Average MPCE (ln*a_mpce*)	
Health Outcome (*h_out*)	0.40*
Percentage of Rural Population (*r_pop*)	- 0.01*
Constant (α_1)	6.27**
R – Squired 0.10	
Chi- Squired 234.90*	

Note: * denotes significance at 1 per cent level, ** denotes significance at 5 per cent level and *** denotes significance at 10 per cent level.

The estimation result says that the causality is valid from both the sides and accordingly both (1) and (2) are valid equations (refer Table - 13). However, looking at the fitness of the models, it is evident that causality is stronger in case of equation (1). This implies, the impact of economic status on health outcome is more as compared to the impact from the opposite direction.

VI. Conclusion

It may thus be inferred from our exploratory analysis that the availability of health infrastructure in terms of discussed indicators is unequal across districts and variation is more in districts belonging to economically poor and socially backward states. In case of health status, pattern is more or less similar. Intense problem is noticed especially for the districts of Bihar, Jharkhand, Orissa, Uttar Pradesh, Madhya Pradesh and Rajasthan. Add to that, the overall availability of infrastructure is poor for those districts. Poor availability coupled with lack of awareness brought them in a state of poor health attainment. This finally resulted in poor economic status of the districts as well as of the states. For densely populated states, one must note that the existing health infrastructure is insufficient to handle the patient pressure. This in turn reduces the quality of health service and increases the risk of Mortality. Good health as we know generates a number of positive outcomes, ranging from demographic dividend to more productive workforce, thereby reducing poverty by enhancing the earning potential of the people.

Given the variation in health facilities and the close link between it and health outcome and general development level, several measures can be suggested. The primary facilities must be strengthened to provide proper and effective preventive and curative services at the grassroots level. This would release the immense pressure presently exerted on the referral, secondary and tertiary institutions, which they are finding hard to cope. Additional manpower is also urgently needed, especially at the countryside. These steps may not be the panacea, but will go a long way in 'curing' the ailing health sector in India.

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Appendix

Appendix Table: 1

Health Infrastructure and Health Outcome across States

State	No. of Districts	Health Infrastructure Score					Rank (According to Mean Infrastructure Score)	Health Outcome Score					Rank (According to Mean Outcome Score)
		Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation		Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation	
Andhra Pradesh	22	1.10	4.40	3.02	0.82	0.27	8	3.72	4.97	4.63	0.30	0.07	2
Bihar	37	0.89	3.68	2.86	0.75	0.26	11	0.73	4.94	3.53	1.08	0.31	15
Chhattisgarh	16	2.12	3.60	2.88	0.38	0.13	10	2.92	4.59	3.81	0.53	0.14	12
Gujarat	25	1.51	3.78	2.72	0.55	0.20	13	1.77	4.83	3.88	0.68	0.17	11
Haryana	19	1.85	4.42	3.41	0.65	0.19	3	2.51	5.06	4.30	0.67	0.16	7
Jharkhand	18	0.52	2.84	2.15	0.75	0.35	16	3.18	4.72	3.95	0.56	0.14	10
Karnataka	27	1.21	3.67	2.97	0.52	0.17	9	4.01	5.08	4.50	0.30	0.07	4
Kerala	14	4.25	5.16	4.91	0.23	0.05	1	3.13	5.49	5.03	0.61	0.12	1
Madhya Pradesh	44	0.72	3.67	2.69	0.78	0.29	14	1.23	4.31	3.34	0.62	0.19	16
Maharashtra	33	2.22	4.44	3.32	0.48	0.14	5	3.88	5.13	4.45	0.32	0.07	5
Orissa	30	0.56	3.19	2.16	0.50	0.23	15	2.24	4.66	3.96	0.54	0.14	9
Punjab	18	1.74	4.25	3.50	0.57	0.16	2	2.69	5.01	4.39	0.61	0.14	6
Rajasthan	32	0.51	3.56	2.85	0.54	0.19	12	2.27	4.71	3.73	0.59	0.16	13
Tamil Nadu	29	2.37	4.76	3.38	0.65	0.19	4	3.76	5.16	4.62	0.30	0.07	3
Uttar Pradesh	70	1.09	4.12	3.10	0.65	0.21	6	1.66	4.75	3.59	0.56	0.16	14
West Bengal	17	2.41	4.10	3.06	0.52	0.17	7	3.68	4.69	4.27	0.29	0.07	8

Source: Authors' own calculation based on IIPS and NSS data

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