

HEALTH IN RURAL INDIA: TOWARDS A COMPREHENSIVE HEALTH INDEX

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ABSTRACT

This paper constructs a determinants-based comprehensive indicator of health that can better capture the health status of population by taking into account the necessary facilities that promote a longer as well as disease-free life. Annual time series of health index comprising three sub-indices, namely, material access index, health infrastructure index and healthcare utilisation index, are constructed for fifteen major States of India for the period 1983-84 to 2005-06. The health index indicates an increased access to basic facilities over the years; levels of access being still low, health infrastructure being stagnant since mid-1990s and low levels of health care utilisation. Better rural health status requires reducing health risks, strengthening health infrastructure and increasing health awareness.

Introduction

Desired health outcome essentially implies a longer and disease-free life, thereby including notions of mortality and morbidity. Life expectancy and infant mortality rate (IMR), most often used as health status indicators, suffer from serious limitations such as IMR completely ignoring the non-infant population, computation of life expectancy requiring life tables and its

failure to capture morbidity situation (see Svedberg (2000) for a detailed discussion). There is a vast literature that studies impact of health on economic growth, wages, production and productivity. Most of the studies use a single-metric measure of health. Life expectancy as a health indicator has been used by several studies such as Preston (1976), Knowles and Owen (1995, 1997), Pritchett and Summers (1996), Bhargava et al. (2001) and Keleher and

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Murphy (2004). Deaton (2006) and Spence and Lewis (2011) use infant mortality rate to indicate health status. Strauss and Thomas (1998) use height to depict health. Mc Carthy et al. (2000) take incidence of malaria to capture population health. Deolalikar (1988) and Haddad and Bouis (1991) use weight-for-height as health outcome indicator. A few studies take into account multiple indicators of health either in the same regression or run the regression again for each health indicator such as Croppenstedt and Muller (2000) and Cole and Neumayer (2005).

Other health outcome metrics include life years adjusted for health and morbidity (Disease Adjusted Life Years, Quality Adjusted Life Years) and anthropometric measures [height, body mass index and the deficit situations, such as wasting (weight-for-height), stunting (height-for-age) and underweight (weight-for-age)] that are not available annually/ at State level in India.

Although there has been a significant rise in life expectancy and a sharp decline in the infant mortality rate, India still suffers from high levels of malnutrition and disease; and its dismal performance in the provision of safe drinking water and sanitation which impact hygiene and health of its population, is also well recognised. This illustrates the inability of any single metric to adequately capture the status of, as well as changes in, health. Also, the state of health differs with the outcome indicator chosen [see Dasgupta (1993) and Svedberg (2000)].

An alternative to using health outcome metric is adopting determinants approach and construct a Health Index using various inputs or facilities that impact health, thereby making it a much more comprehensive and broad-based health metric. A typical epidemiological health production function expresses health outcome as a function of determinants such as nutrition, access to health-related facilities, such as water, sanitation, clean cooking fuel, literacy, health infrastructure, ethnicity, occupational hazards and health endowments. There are two notable studies that construct multi-metric measure of health status. Human Development in South Asia (2004) constructed Health Index for 177 countries for the year 2004 using a set of thirteen indicators. Joshi (2007) computes a composite Health Status Index for 32 districts and all Panchayat Samitis of Rajasthan for the year 1991 and 2001.

Towards Constructing Health Index

If various dimensions of health are in good shape, that is, if people have adequate nutrition, have access to safe drinking water, inhale clean air, have access to sanitation, are immunised, are literate, have access to good medical care facilities, then they are likely to have better state of health. Eleven parameters are taken to construct three sub-indices, namely, Material Access Index (MAI)/ Income Index (INCI), Health Infrastructure Index (HINFI) and Health Care Utilisation Index (HCUI) that are then aggregated to form Health Index (Table 1).

A brief discussion on determinants of health, not being included in the construction of Health Index, is in order. First, non-availability of data constrains the inclusion of employment conditions as risks to health to be a part of Health Index. Second, tobacco consumption is found to be significantly higher in poor, less educated, scheduled caste and scheduled tribe populations by Subramanian et al (2004), Rani et al. (2003), Daniel et al. (2008), Rooban et al. (2010). Subramanian et al. (2006) reiterate the overall importance of socio-economic status for reducing population level health disparities, regardless of indigeneity. Since material access / income index already captures socio-economic status, tobacco / alcohol consumption and ethnicity are not being taken separately. Third, the issue of morbidity could not be taken into account due to lack of reliable data. That the low-income population may self-report low morbidity incidence has been borne out by several studies such as Pitt and Rosenzweig (1985), Strauss and Thomas (1998) and Sen (2002).

1. Material Access Index/ Income Index

This sub-index indicates command over five basic facilities that strongly impact health, namely, level of nutrition, access to safe drinking water, use of clean cooking fuel, access to sanitation and literacy levels. Since inadequacy or lack of these would imply greater susceptibility and exposure to disease, thereby increasing health risks, it may alternately be called as Risks to Health Index or Income Index. A higher income gives greater command over these goods and services that

promote good health. People/ regions that are poor tend to have worse health outcomes than people/ regions that are relatively richer (the Social Gradient). The components of material access index are discussed below.

Nutrition: Ideally, this should be captured by calorie intake¹. However, due to lack of data on calories, nutrition intake is proxied by real per capita expenditure on food at 1986-87 prices [National Sample Survey Organisation (NSSO) Consumer Expenditure Survey].

Access to Safe Drinking Water: The sources of drinking water in rural areas are classified as tap, tube wells / hand pumps, wells, ponds, springs, rivers, lakes and others. The definition of “safe” drinking water varies across Census and NSS reports. The water sources reported as “safe” by the Census of India include taps and hand pumps / tube wells. Sample Registration System (2005) includes the “safe” sources of water to be hand pumps, piped systems and wells² that make the list almost exhaustive. This sub-index, therefore, takes into account percentage of households having primary source of drinking water within their premises to signify a greater command over water as a resource. The distance of drinking water component, however, is not expected to capture the hygiene factor³. [NSSO Consumer Expenditure Survey and “The Comprehensive Survey on Housing Condition” during 28th Round (1973-74), 44th Round (1988-89), 49th Round (1993), 58th Round (2002) and 65th Round (2008-09)].

Access to Clean Cooking Fuel: The Material Access Index uses percentage of households using clean fuel, that is, kerosene, LPG and electricity for cooking purposes (NSSO Consumer Expenditure Survey).

Access to Sanitation: The sanitation parameter is captured by percentage of households having toilet facility at home (NSSO Consumer Expenditure Survey).

Literacy: The literacy component is captured by literacy rate in the rural areas (NSSO Consumer Expenditure Survey and Census of India).

2. Health Infrastructure Index

Health Infrastructure Index (HINFI) takes into account three components. The physical health care infrastructure is represented by number of primary health centres and hospital beds per hundred thousand of population. Health manpower includes medical as well as para-medical personnel in rural areas per thousand of population, including doctors, health workers, nurses and midwives, radiologists, pharmacists and lab technicians (Health Information of India renamed as National Health Profile since 2005).

3. Health Care Utilisation Index

This index should ideally include the parametre of utilisation of medical care facilities for rural population as a whole. However, data are available for utilisation of medical care only for two population groups, that is, children (in the form of immunisation data) and women (in the form of immunisation data for expectant mother and skilled attendant

at the time of delivery of child). Even these data do not cover the entire child and female population⁴. However, these three components are best available proxies for rural utilisation of health care facilities. (Health and Family Welfare Programme in India and Sample Registration System).

Methodology

The present study seeks to combine multiple parameters to construct health index using weights derived statistically, using two-stage Principal Component Analysis, that is, the sub-indices, namely, Material Access index, Health Infrastructure Index and Health Care Utilisation Index which are constructed and then aggregated into Health Index (HI).

Principal component analysis is a non-parametric statistical technique used to transform or reduce the set of correlated variables ($x_1, \dots, x_p$) to a set of uncorrelated variables ($y_1, \dots, y_p$). The latter are called principal components. The total variance in the x 's is apportioned among different principal components such that all the principal components together explain the total variance completely. The first component y_1 explains the maximum possible of the total variance, y_2 the maximum possible of the remaining variance and so on. The first principal component can be taken as the best one-dimensional summary of the data. The component scores corresponding to this component can be obtained as the linear combination of the x 's.

$$y_1 = a_{11}x_1 + a_{21}x_2 + \dots + a_{p1}x_p \quad (1)$$

where a_{ij} 's are the weights (eigenvectors) and they reflect the relative contribution made by each variable to the component. These weights are obtained such that they satisfy the conditions that the sum of their squares equals one and that the weights for various successive components are orthogonal to each other. These conditions can be written as :

$$(i) \quad \sum_{i=1}^p a_{ij}^2 = 1$$

$$\sum_{i=1}^p a_{ij}a_{ik} = 0$$

$$(j \neq k; j = 1, \dots, p; k = 1, \dots, p) \quad (2)$$

Since PCA is performed on standardised data, the weights are called component score coefficients and are computed as follows:

$$\tilde{a}_{ij} = \frac{a_{ij}}{\sqrt{\lambda_j}} \quad j=1,2,\dots,p$$

where λ_j denotes variance of each principal component.

The component scores so obtained from principal component analysis have been rescaled using linear transformation, to an index ranging from 1 (worst performance) to 10 (best performance).

Results

This section presents the results for the three sub-indices and the Health Index for selected years 1983-84, 1994-95 and 2005-06. The summary statistics for various health parameters are presented in Table 1.

The sub-indices are described first. There has been a steady improvement in material access index or Income Index (INCI) for all the States over time, the mean index rising from 1.89 in 1983-84 to 5.14 in 2005-6 (Table 2 and Figure 1). The ranking of the States across the years remains almost unaltered. Kerala and Punjab are the States with better access to food, clean cooking fuel, having principal source of drinking water within premises, sanitation facilities at home and higher literacy levels. The States with lowest INCI include Madhya Pradesh, Odisha, Bihar and Rajasthan. The rise in Income Index over the years, however, needs to be taken with caution since the levels of access to basic facilities in 2005-06 still remains low (as mentioned in Table 1) with mean real per capita expenditure on food (at 1986-87 prices) at ₹ 96, 41 per cent of households having source of drinking water within premises, 36 per cent of households having sanitation facility, 13 per cent of households using clean cooking fuel and literacy levels being 66 per cent.

Table 1: Selected Health Parameters: Summary Statistics

Parameter	1983-84				2005-06			
	Mean, sd	Max	Min		Mean, sd	Max	Min	
PC Food	89, 16	124	Pun	73 Odi	96, 15	130 Ker	70 MP	
Water	17, 16	55	Ker Pun	4 Mah	41, 20	82 Pun	16 Odi	
Sanitation	11, 16	59	Ass	1 Har	36, 27	93 Ker	11 MP	
Cooking fuel	1, 1	4	Mah	0.4 Bih	13, 9	31 Pun	2 Bih	
Literacy	33, 12	70	Ker	18 Raj	66, 10	92 Ker	51 Bih	
PHCs	13, 1	4	Mah	1 WB	2.8, 1	5 Odi	2 WB	
Hospital beds	16, 25	104	Ker	1 Bih	17, 10	38 Ker	5 Bih	
Manpower	39, 11	54	Kar	20 TN	54, 16	74 Ker	18 Bih	
Immunisation-expectant mother	81, 21	129	Mah	44 Ass	83, 17	97 Ker	28 Bih	
Immunisation- children	73, 22	137	Mah	40 Ass	93, 11	101 Pun	62 Bih	
Skilled attendance at birth	36, 24	80	Ker	10 Raj	66, 21	99 Ker	40 Bih	

Table 2: Material Access and Health Infrastructure Index for Selected Years

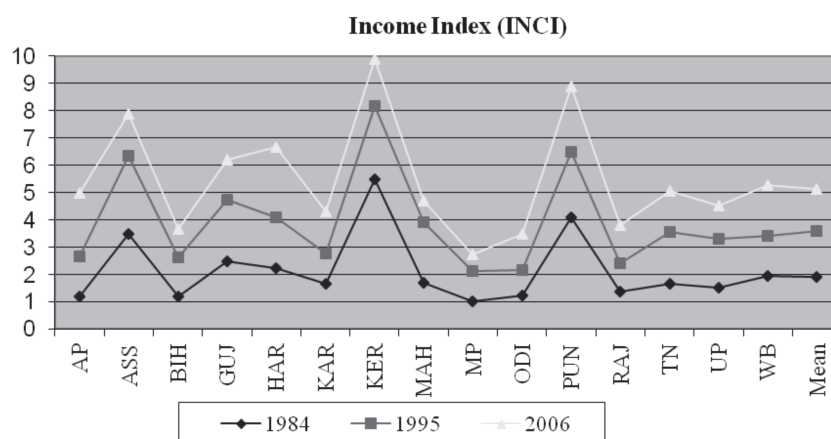
State	Material Access Index (MAI)/ Income Index (INCI)				Health Infrastructure Index (HINFI)			
	1983-84	1994-95	2005-06	Mean	1983-84	1994-95	2005-06	Mean
AP	1.18	2.66	5.00	2.82	2.31	3.93	4.58	3.64
ASS	3.48	6.35	7.88	5.59	2.00	3.52	3.55	3.29
BIH	1.19	2.62	3.67	2.71	1.04	2.20	1.68	1.87
GUJ	2.47	4.73	6.21	4.79	2.32	5.19	4.88	4.63
HAR	2.23	4.08	6.66	4.39	2.02	4.52	4.20	4.27
KAR	1.67	2.77	4.31	3.02	2.85	5.84	6.98	5.55
KER	5.50	8.15	9.88	8.05	2.96	9.55	7.25	7.21
MAH	1.70	3.90	4.68	3.95	4.25	4.98	5.19	5.18
MP	1.00	2.12	2.74	2.08	1.61	4.24	4.43	3.76
ODI	1.24	2.16	3.50	2.35	1.94	4.28	6.05	4.40
PUN	4.09	6.49	8.88	6.83	2.20	5.46	4.72	4.91
RAJ	1.38	2.41	3.79	2.73	2.31	5.17	6.10	4.60
TN	1.64	3.54	5.04	3.47	1.19	5.80	5.29	4.90
UP	1.52	3.31	4.52	3.21	2.30	3.34	2.84	3.09
WB	1.93	3.41	5.28	3.65	2.57	4.28	2.37	3.56
Mean	1.89	3.59	5.14	3.69	2.14	4.59	4.37	4.15

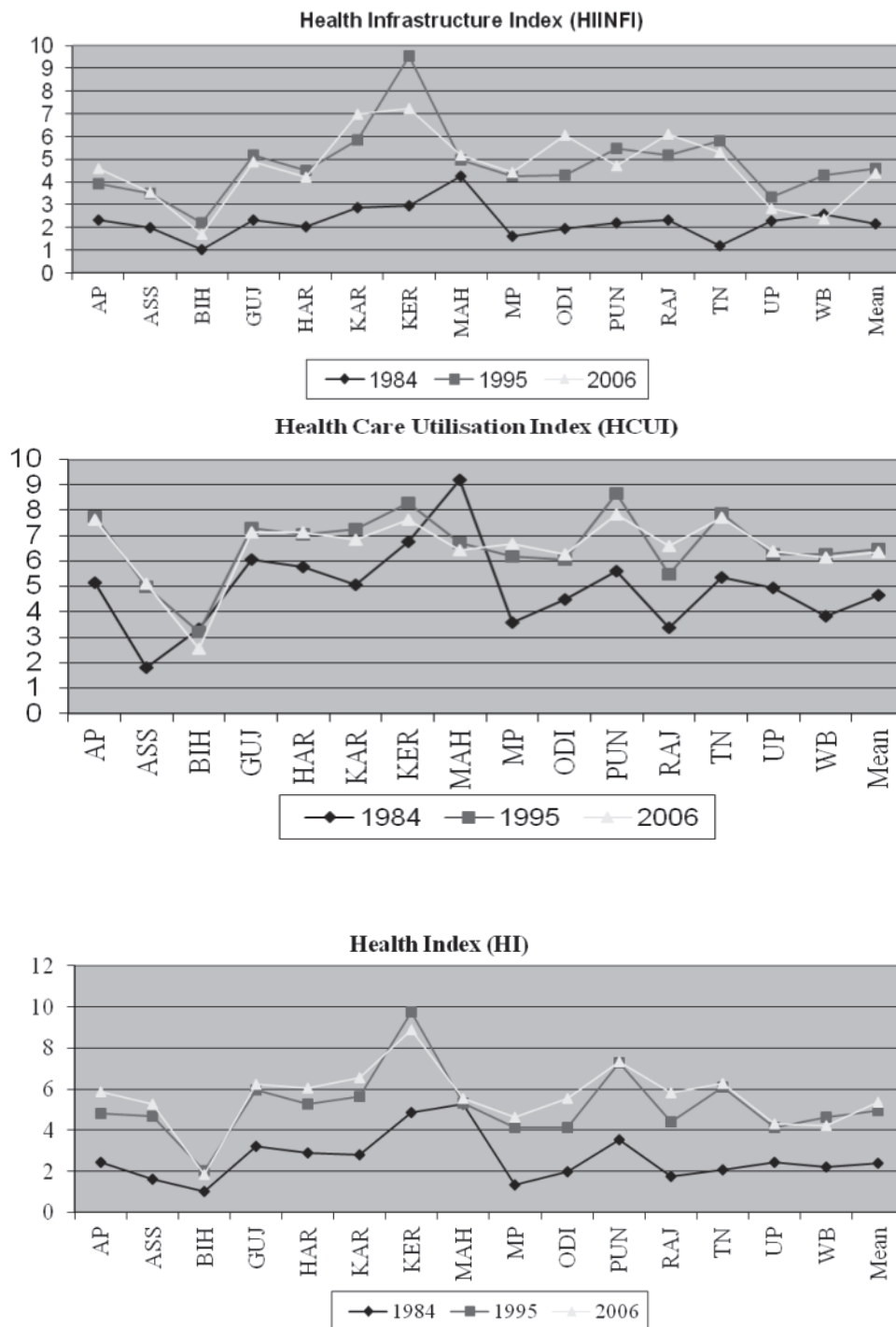
The mean Health Infrastructure Index (HINFI) exhibits an improvement from 2.14 in 1983-84 to 4.59 in 1994-95, thereafter declines to 4.37 in 2005-06 (Table 2 and Figure 2). In 1983-4, Maharashtra had highest HINFI, the rank later taken over by Kerala. Although Kerala retains the rank through 2005-6, its performance on this front has declined in comparison to its own past performance that peaked in 1992-93. The

lowest value for HINFI is reported in Bihar, Madhya Pradesh, Odisha and Tamil Nadu in 1983-84 and States of Bihar, Uttar Pradesh and West Bengal in 2005-06. The States of Odisha and Rajasthan have considerably improved their health infrastructure in the post-2000 years. Deterioration in HINFI is observed in eight out of fifteen States- Bihar, Gujarat, Haryana, Kerala, Punjab, Tamil Nadu, Uttar Pradesh and West Bengal- since mid-1990s.

Table 3: Health Care Utilisation Index (HCUI) and Health Index (HI)

State	Health Care Utilisation Index (HCUI)				Health Index (HI)			
	1983-84	1994-95	2005-06	Mean	1983-84	1994-95	2005-06	Mean
AP	5.17	7.77	7.64	7.12	2.42	4.82	5.88	4.46
ASS	1.80	4.99	5.10	2.92	1.61	4.69	5.25	3.50
BIH	3.31	3.22	2.56	2.81	1.00	2.02	1.83	1.78
GUJ	6.05	7.31	7.13	7.11	3.23	5.96	6.23	5.64
HAR	5.78	7.03	7.13	7.40	2.88	5.29	6.03	5.49
KAR	5.08	7.26	6.85	6.81	2.82	5.61	6.53	5.37
KER	6.75	8.30	7.64	8.06	4.85	9.73	8.86	8.49
MAH	9.19	6.71	6.41	7.21	5.27	5.33	5.56	5.72
MP	3.57	6.20	6.69	5.32	1.33	4.14	4.65	3.49
ODI	4.48	6.06	6.25	5.80	1.96	4.12	5.54	4.13
PUN	5.60	8.67	7.85	8.02	3.52	7.26	7.34	6.85
RAJ	3.38	5.49	6.58	5.35	1.73	4.41	5.80	4.14
TN	5.34	7.89	7.70	7.79	2.08	6.12	6.28	5.64
UP	4.94	6.27	6.40	5.97	2.43	4.12	4.32	3.84
WB	3.81	6.25	6.14	5.43	2.23	4.62	4.22	4.04
Mean	4.65	6.46	6.35	5.94	2.39	4.95	5.36	4.57





When we consider the mean performance of the parameters included in HINFI, we find an almost stagnation in the number of hospital beds (see Table 1). The number of primary health centres (PHCs) has gone up from 1 per 100,000 population in 1983-84 to 2.8 in 2005-06. The norm of one PHC per 30,000 population is still to be achieved at all-India level as well as by the States of Andhra Pradesh, Assam, Bihar, Haryana, Punjab, UP and West Bengal. Health manpower density in India does not meet the international norm regarding adequacy of health manpower (a minimum of about 25 skilled health workers per 10,000 population). It ranges from a low of 1.8 per 10,000 population in Bihar to a high of 7.4 in Kerala in 2005-06. These numbers should be taken with caution as they represent positions filled but do not guarantee their presence at work⁶. These findings suggest that Kerala, often regarded as a good performer in health, does not seem to be doing well on Health Infrastructure front. Although it does satisfy the population norm related to primary health centres, the performance on hospital beds and health manpower density are far from satisfactory⁷.

The Health Care Utilisation Index (HCUI): is discussed next. The mean HCUI improves from 4.65 in 1983-84 to 6.46 in 1994-95 and then declines marginally to 6.35 in 2005-06 (Table 3 and Figure 3). In 2005-06, highest health services utilisation takes place in Punjab followed by Kerala. The lowest utilisation is reported in Assam, Bihar, Madhya Pradesh,

Rajasthan and West Bengal in 1983-84 while in Assam and Bihar in 2005-06. The HCUI exhibits stagnation in eight out of fifteen States- Andhra Pradesh, Assam, Gujarat, Haryana, Odisha, Tamil Nadu, Uttar Pradesh and West Bengal- since mid-1990s. The State of Kerala reports highest HCUI in 1988, thereafter showing a declining trend. The worst performance is observed in Bihar and Maharashtra where HCUI has declined over the entire time period.

A few comments in relation to healthcare utilisation are laid down. The use of medical facilities depends not only on availability of such facilities but also a host of other factors. Mahal et al. (2001) find the use of health services to be determined by distance of facilities from population, availability of medical staff, lack of education/information, transportation costs, waiting time involved, uncertainty about the availability of services and medicines and uncertainty about payment. World Development Indicators (2007:38) find "In India, immunisation rates are low, even though immunisation is free: mothers cited lack of knowledge of benefits of vaccination and of clinic location as main reasons why their child had not been immunised". However, there seems to be an increase in health awareness as is shown by decline in proportion of non-treatment of ailments due to the reason "ailment not serious" from 75 per cent in 1986-87 to 32 per cent in 2003-04 (Select Health Parametres, NSSO 2007). According to the NSS 60th Round, the year

2004 saw 28 per cent of ailments in rural areas go untreated due to financial reasons, while this figure was 15 per cent in 1995–96. Select Health Parametres, NSSO (2007) find that the share of public institutions in treatment of hospitalisation and non-hospitalisation cases has shown a downward trend. The reasons cited for going to private sector for treatment include “facilities too far” (19 per cent), “not satisfied with medical treatment by doctor/facilities” (42 per cent), “long waiting” (11 per cent) and required services not available (5 per cent).

We now discuss the results for **Health Index (HI)**. The mean HI increases substantially from 2.39 in 1983-84 to 4.95 in 1994-95 and then rises marginally to 5.36 in 2005-06 (Table 3 and Figure 4). All the States except Maharashtra exhibit an improvement in HI in 1993-94 in comparison to 1983-84. Comparing performance across 1994-95 and 2005-06, HI shows stagnation in six States, namely, Bihar, Gujarat, Maharashtra, Punjab, Tamil Nadu and West Bengal and a decline in Kerala and West Bengal. While the performance on health seems to have significantly improved in 1980s till mid 1990s, it has not shown major improvements in post-1995 years. The States of Bihar, Madhya Pradesh, Assam, Uttar Pradesh, West Bengal, Odisha and Rajasthan score lowest mean HI and face a serious challenge to health status of their populations.

It is useful to look at the relative positioning of the States as per the three sub-

indices (Table 4). The indices computed for the years 1983-84 and 2005-06 have been grouped into three equal categories, viz. low, medium and high. The States of Bihar, Haryana, Madhya Pradesh, Odisha and Tamil Nadu are found to be doubly disadvantaged in 1983-84 since they have lowest income indices implying most exposed to health risks as well as lowest healthcare infrastructure index. In 2005-06, Bihar and Uttar Pradesh have lowest income as well as infrastructure indices. On the other extreme is Kerala that has not only the least exposure to health risks but also highest ranking of health infrastructure. The States of Karnataka, Odisha and Rajasthan provide a scenario where there have been attempts to improve healthcare facilities over the years but they count low on income front. Assam, Haryana and Tamil Nadu exhibit an improvement in ranking on both fronts. It is highly unfortunate that in 2005-06, eight out of fifteen major States lie in the category of low scores of income index as measured by per capita expenditure on food, access to safe drinking water within premises, access to sanitation, access to clean cooking fuel and literacy. These States are clearly exposed to greater risks to health. Although some States do score high in Infrastructure Index, the fact that the number of PHCs, hospital beds and health manpower are far below the required norm shows the huge gaps existing in the field of rural medical care.

Table 4(a): Categorisation of States as per Income Index and Health Infrastructure Index

HINFI	Income index					
	1983-84			2005-06		
	Low	Med	High	Low	Med	High
Low	BIH, HAR, MP, ODI, TN	ASS		BIH, UP	WB	
	AP, KAR, RAJ,	GUJ	KER,	AP, MAH,	GUJ,	ASS,
Med	UP, WB		PUN	MP	HAR, TN	PUN
High	MAHA			KAR,		KER
				ODI, RAJ		

(b): Categorisation of States as per Income Index and Health Infrastructure Index

HCUI	Income index					
	1983-84			2005-06		
	Low	Med	High	Low	Med	High
Low	BIH, MP, RAJ	ASS		BIH		
	AP, HAR, ODI,	GUJ	PUN			ASS,
Med	KAR, TN, UP, WB					
High	MAHA		KER	AP, KAR,	GUJ, HAR	KER,
				MAH, MP	TN, WB	PUN
				ODI, RAJ, UP		

The comparison of States across INCI and HCUI confirms low correlation between the two since a rise in healthcare utilisation over the years has occurred even in the States where income index is low in 2005-06. This illustrates the positive development in terms of an increase in health awareness and a subsequent rise in demand for healthcare. However, when the relative positioning of

the States showing high HCUI is seen in conjunction with HINFI, it reveals that only four such States belong to "high infrastructure" category. It is likely to result in undue burden on existing healthcare infrastructure thereby affecting quality of delivery of health services. The inadequate health infrastructure is likely to become a binding constraint in the years to come.

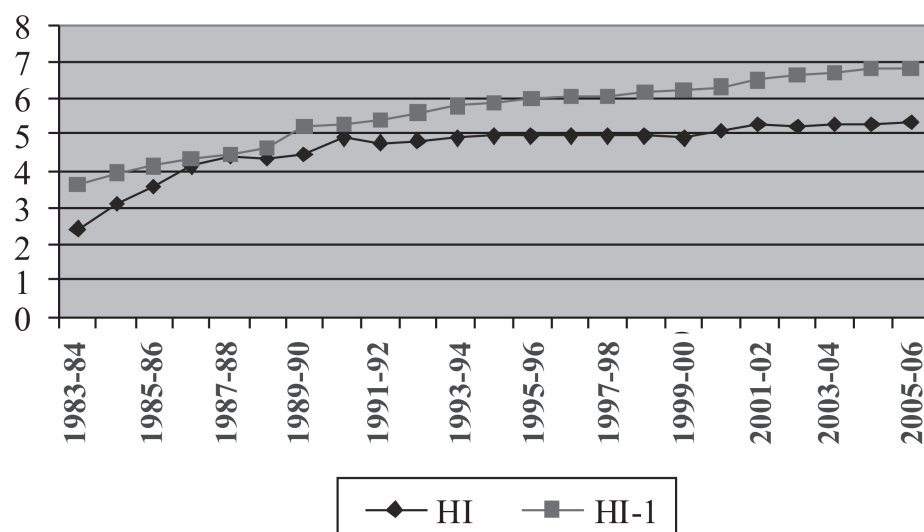
Comparison of Health Index with other Health Indicators

The observed improvement in the health index for the State of Rajasthan (although its mean health index is one of the lowest) is consistent with Joshi (2007) who also reports an improvement in the health status of Rajasthan over 1991-2001, using eight parameters with equal weights assigned to all, namely, percentage of rural population served by medical amenity, that having access to drinking water, education amenity, power amenity, connected by pucca road, percentage of villages having medical amenity, sex-ratio and female literacy rate. While Joshi (2007) reports nearly 20 per cent improvement in Health Status Index, we find a much higher rate of improvement in health index by 36 per cent, 32 per cent improvement in Material Access Index, 28 per cent rise in Health Infrastructure Index and 24 per cent rise in Health Care Utilisation Index between the two time periods.

Next, we compare the HI with three alternate composite health outcome indicators. The first alternate index (HI-1) is constructed using a time series of IMR and life expectancy at age one to denote expected length of life. The second alternate index (HI-2) is constructed for 1998-99 and 2005-06 taking the additional parameter of percentage of women having body mass

index less than 18.5 kg/m², information on which is available from National Family Health Survey-II and III. For the year 1998-99, a third index (HI-3) is constructed by augmenting HI-2 with percentage of women having height less than 145 cm⁸.

The mean performance of HI and HI-1 are compared first (Figure 5). While HI-1, based on IMR and life expectancy shows an improvement from 1983-84 till mid-1990s, thereafter slows down and picks up in post-2000 years. The HI, on the other hand, improves during the period 1983-84 to 1990-91 and almost stagnates in the decade of 1990s and improves marginally in 2001-02 and is stagnant thereafter. Table 5 presents correlation among various health outcomes and indices for the years 1998-99 and 2005-06. Although IMR and life expectancy are highly correlated, the correlation between mortality/ longevity statistics and anthropometric measures is not high. The HI is found to be reasonably correlated with each of the composite health outcome indices HI-1, HI-2 and HI-3, thereby strengthening the case for composite health inputs index. On the other hand, the constructed Health Index is found to be reasonably correlated with each of the health outcome indices, either taken singularly or composite.

**Table 5(a): Correlation Matrix of Various Health Outcome Indicators (2005-06)**

Description	IMR	LE at age one	Percentage of women with BMI <18.5 kg/m2	Percentage of women having height less than 145 cm
IMR	1			
LE at age one	-0.83	1		
Percentage of women with BMI <18.5 kg/m2	0.47	-0.52	1	
Percentage of women having height less than 145 cm	0.15	-0.58	0.41	1
Health Index 1998-99	-0.6	0.82	-0.45	-0.67
2005-06	-0.59	0.76	-0.75	Na

(b) Correlation of HI with

HI-1	HI-2	HI-3
0.731	0.76 ¹	0.8 ²

Note: 1- Correlation between health indices for the two years 1998-99 and 2005-06 combined.

2- Correlation between HI and HI-3 for the year 2005-06.

Summing Up

The sub-indices as well as the Health Index point out the poor performance on health front in the States of Bihar, Madhya Pradesh, Uttar Pradesh, Odisha and West Bengal. Even though Income Index shows a steady improvement over the years for all the States, the Health Infrastructure Index does not. This reinforces the role of State in making available good quality health infrastructure services in rural areas. This is particularly important since private players would not

enter this activity since the surplus likely to be earned is too small due to low spending capacity of rural areas. Also the task of improvement in population health cannot be achieved by efforts of health department alone - it needs to be complemented by the efforts from several departments in order to ensure adequate food supply, transport to ensure connectivity, water supply, sanitation facility, clean cooking fuel, education and information.

Notes

1. The occupational and measurement problems associated with calorie intake method are at length discussed by Svedberg (2000).
2. SRS (2005) finds the highest rate of child mortality in households with primary source of drinking water as hand pump and lowest for households with tap. It claims that hand pumps are safer than 'open wells' in rural India due to fast deterioration of the ground water resource quantity as well as quality. A similar claim for wells being a safe source of water has also been made by Raj (1996).
3. The NSS Report (2007) mentions that only about 18 per cent of rural households reported to have filtered their drinking water. A majority of households (about 56 per cent in rural areas) reported the practice of dipping in a vessel without a handle to take drinking water out of the storage container. This increases the chances of drinking water becoming unsafe.
4. The data on percentage of expectant mother and children fully immunised / vaccinated is available for selected time periods, that is, the three National Family Health Surveys.
5. The annual time-series of health indices are available on request.
6. The Approach Paper to the Tenth Five Year Plan (2002-2007) points out that one of the major factors responsible for poor performance in hospitals is the absence of

personnel of all categories who are posted there. It recommends delegation of powers to Panchayati Raj Institutions (PRIs) in order to establish local accountability of the public healthcare providers.

7. Suryanarayana (2008) points out the lopsided health strategy in the State of Kerala since it emphasises curative medicine to reduce death rates and not on sustained improvement in health status through nutrition, housing, water supply, sanitation and medicine.
8. While NFHS III reports information on body mass index for men as well as women, NFHS II reports only for women. The alternate index therefore, uses body mass index for women in order to enable comparison across the two years. The correlation between percentage of men and women with adequate BMI is found to be 0.9 as per NFHS III data. The information on height is discontinued in NFHS III.

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