

Performance of Healthcare of Indian States: An Analysis of Depth of gap and Severity of Healthcare

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Abstract

Public health often operates quietly in the background, unnoticed when functioning well, yet it is one of the most powerful forces driving economic progress. Like an engine that keeps a vehicle running smoothly, public health keeps societies functioning by preventing disease, promoting wellness and ensuring that people can live, work and contribute productively to their communities. The present study focuses on the health performance on the basis of five significant parameters like physical infrastructure, workforces, healthcare facilities of health sector, encompassing India in the year of 2014 & 2023. The overall comprehensive Composite Health Index (CHI) is intended to help government agencies, policymakers, stakeholders and administrators to understand the quality of healthcare facilities and services across twenty-seven Indian states and identify areas for enhancing quality. The study considers statewide health performance of twenty-seven Indian states comprises of twenty larger states and seven smaller states on the basis of five significant indices. This present study is comprising of four sections i.e. Section I: Introduction, Review of Literature and Objective of the study, Section II: Methodology and Data Source, Section III: Analysis and Discussions of the study and Section IV: Conclusions of the study.

Keywords: Composite Health Index (CHI), Physical Infrastructure Index (PII), Manpower Index (MI), Healthcare Facilities Index (HCFI), Economic Index (EI) and Outcome Index (OI)

Section I: Introduction, Review of Literature and Objective of the study

Introduction

Health is the silent engine of economic growth. Health is not a side concern, it is the foundation upon which economic growth is built. Nations that invest in the health of their citizens enjoy more robust economies, greater innovation, and stronger social stability. In the journey toward economic development, ensuring public health must be viewed not as a cost, but as a powerful and necessary investment. In the contemporary world, no sector holds as much universal importance as public health. More than just the prevention and treatment of disease, public health encompasses the very essence of a nation's strength, prosperity, and future. In a country like India, home to more than a billion people; prioritizing public health is not just beneficial; it is essential.

A healthy population is the bedrock of any thriving nation. Economic progress, educational achievements, and even social harmony are deeply connected to the health of the population. When citizens are healthy, they are more productive, can work longer, learn better, and contribute more meaningfully to the nation's development. Without robust public health, all other developmental goals are undermined. Public health focuses on reaching the unreached. In India, where rural populations and marginalized communities often struggle to access quality healthcare, public health systems play a crucial role in delivering essential services. Government-led initiatives like Ayushman Bharat aim to bridge this gap and ensure that every citizen, regardless of income or location, receives the care they need. Investments in public health yield returns that span generations. Programs focusing on maternal and child health, early childhood nutrition, mental health awareness, and lifestyle disease prevention create a healthier society for the future. These long-term benefits far outweigh the initial costs, making public health one of the most strategic areas for investment.

Public health is more than a government responsibility, it is a societal commitment. In a fast-developing nation like India, where disparities in health access still persist, strengthening public health must be a national priority. By investing in the health of its people, India can secure not only a brighter future for individuals but also a stronger, more resilient nation for generations to come. Public health is more than a government responsibility, it is a shared societal obligation and a reflection of collective humanity. Public health is woven into the fabric of daily life, and its success depends not only on top-down governance but also on bottom-up responsibility. It requires empathy, cooperation, and foresight. It thrives where there is a culture of care, where protecting one another's well-being is not an obligation, but a value. In short, public health is the mirror of a society's maturity, and safeguarding it is everyone's business.

Health performance can be assessed based on several key factors, depending on whether the focus is on individual health, organizational healthcare systems, or public health. Public health performance in India includes a wide range of indicators and activities that reflect the health status of the population, the effectiveness of the healthcare system, and the success of public health policies. Unlike flashy infrastructure projects or visible economic reforms, public health doesn't always grab headlines. However, its impact is deep and far-reaching. Health is not merely a personal concern; it is a national asset and a driving force behind economic growth. A nation's prosperity is deeply tied to the well-being of its citizens. As countries like India aim for rapid development, it is essential to recognize that a healthy population is one of the most powerful engines of economic progress.

Review of Literature

According to Raphael Rolim de Moura and his coordinators (2022)^[1] titled "One Health Index (OHI) applied to Curitiba, the ninth-largest metropolitan area of Brazil, with concomitant assessment of animal, environmental, and human health indicators" have stated that higher OHI was associated with greater city

^[1] de Moura, R. R., de Castro, W. A. C., Farinhas, J. H., Pettan-Brewer, C., Kmetiuk, L. B., Dos Santos, A. P., & Biondo, A. W. (2022). One Health Index (OHI) applied to Curitiba, the ninth-largest metropolitan area of Brazil, with concomitant assessment of animal, environmental, and human health indicators. *One Health*, 14, 100373.

income, population, and proximity to the capital. The study's objective was to evaluate environmental, animal, and human health indicators in order to determine the One Health Index (OHI) for 29 cities in the Curitiba metropolitan area of Brazil. They examined using Permutational Multivariate Analysis of Variance (PERMANOVA) and Principal Component Analysis (PCA) and founds that OHI varied significantly by population, income, and distance from the capital. The study presents a comprehensive method for assessing city health and emphasises the significance of incorporating animal health into sustainability studies.

Sehgal, Jatrana & Johnson (2024)^[2] have presented their research paper related to development, testing, and spatial variation of an innovative India Health Index. The study takes a comprehensive and multi-dimensional approach. It covers indicators across various life stages: child, adolescent, and adult which encompasses six domains influencing health: socio-cultural factors, health status, health determinants (both risk and protective factors), household environment, and health system and policy. The study used data from the latest round of the National Family Health Survey and employed Principal Component Analysis for constructing the India Health Index. Subsequent statistical tests confirmed its internal reliability and construct validity. External validity was indicated by its association with under-five mortality rates, and the sub-national human development index for India. Spatial analyses revealed significant inter-district and inter-state variation in India Health Index scores. The findings underscore the utility of the India Health Index as a measurement tool and its potential for tracking progress and policy intervention for improving health equity in India.

Daniel H. Kress, Yanfang Su & Hong Wang (2016)^[3] have explore that Nigeria's primary health care (PHC) system is underperformed despite income growth, limiting health improvements over the past 25 years in his research entitled "Assessment of Primary Health Care System Performance in Nigeria: Using the Primary Health Care Performance Indicator Conceptual Framework". Their findings revealed that while Nigeria has many PHC centres, good geographic access, and a high health worker density, systemic issues hinder performance. Key challenges include fragmented supply chains, financial barriers, inadequate infrastructure, drug shortages, and poor health worker performance. These issues stem from broader financing and governance problems. Compared to poor African countries, Nigeria ranks low on PHC performance. Although the government has taken steps to address these challenges, policy gaps remain in achieving sustainable and equitable PHC delivery.

Jean-Baptiste Gartner & Célie Lemaire (2022)^[4] in their research entitled "Dimensions of performance and related key performance indicators addressed in healthcare organisations: A literature review" have explained that performance measurement systems (PMS) are crucial for managing healthcare organizations, aiding decision-making and assessing institutional progress. The study reviewed existing

^[2] Sehgal, M., Jatrana, S., & Johnson, L. (2024). A comprehensive health index for India: development, validation, and spatial variation. *Journal of Population Research*, 41(3), 21

^[3] Kress, D. H., Su, Y., & Wang, H. (2016). Assessment of primary health care system performance in Nigeria: using the primary health care performance indicator conceptual framework. *Health Systems & Reform*, 2(4), 302-318.

^[4] Gartner, J. B., & Lemaire, C. (2022). Dimensions of performance and related key performance indicators addressed in healthcare organisations: A literature review. *The International journal of health planning and management*, 37(4), 1941-1952

literature on performance measures and compares 49 studies using 16 proposed frameworks to identify key performance dimensions. These dimensions have been categorized based on their frequency of use. The findings highlight that underrepresented areas in PMS, emphasizing the need for structured key performance indicators (KPIs) and interconnected, dynamic dashboards to better support healthcare managers.

It is quite clear that there are so many studies have been done using PCA method so, a multidimensional index is constructed as Composite Health Index (CHI) which is a comprehensive measure designed for analysing, evaluating and comparing the healthcare facilities and services for improving health performance of Indian states. The study focuses specifically on the health assessment of physical infrastructure and workforces of health sector, encompassing India in the year of 2014 & 2023. The overall comprehensive Composite Health Index (CHI) is intended to help government agencies, policymakers, stakeholders and administrators to understand the quality of healthcare facilities and services across twenty-seven Indian states and identify areas for enhancing quality.

Objective of the study

The main objectives of study are:

- To identify the lagging states is Dimensional Health Index (DHI) and Composite Health Index (CHI) among Indian states.
- To categorise the Indian states on the basis of value of Health performance.
- To find out the depth of gap and severity in health performance of Indian states.

Section II: Methodology & Data Source

Area of the study

The study is comprising of **twenty larger Indian states** i.e. Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh Uttarakhand and West Bengal and **smaller Indian states** are **seven** i.e. Goa, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura.

Points of time for the study

The points of time for the study is 2014-15 and 2023-24.

Data Source

For the collection of secondary data, Rural Health Statistics 2014-15 & Dynamics Health of India 2023-24, National Family Health Survey (NFHS-4 & 5) and various issues from Sample Registration System (SRS) Bulletin, Office of the Registrar General and Census of India, Ministry of Home Affairs, Government of India are used. The Census of India 2011 and estimated population for the midyear of 2023 have been taken.

Method of the study

This study is mainly an Analytical and Descriptive in nature. The study is based upon the secondary data. Dimensional Health Index (DHI) comprises of five significant indices i.e. Physical Infrastructure Index

(PII), Manpower Index (MI), Healthcare Facilities Index (HCFI), Economic Index (EI) and Outcome Index (OI) while Composite Health Index (CHI) is the average of aggregates of all the five significant indices.

Box 1: Indicators used to construct Dimensional Health Index (DHI) and Composite Health Index (CHI in the present study

Parameters	Notations	Variables
Physical Infrastructure Index (PII)	H1	Number of Sub-Centres per 10 lakhs of population
	H2	Number of PHCs per 10 lakhs of population
	H3	Number of CHCs Functioning per 10 lakhs of population
	H4	Building position for Sub Centres (Govt. Building) per 10 lakhs of population
	H5	Building position for Primary Health Centres (Govt. Building) per 10 lakhs of population
	H6	Building position for Community Health Centres per 10 lakhs of population
Manpower Index (MI)	H7	Doctors (rural area) per 10 lakhs of rural population at Primary Health Centres
	H8	Specialists (rural area) per 10 lakhs of rural population at CHCs
	H9	Radiographers (rural area) per 10 lakhs of rural population at CHCs
	H10	Pharmacists (rural area) per 10 lakhs of rural population at PHCs & CHCs
	H11	Laboratory (rural area) per 10 lakh of rural population Technicians at PHCs & CHCs
	H12	Nursing Staff (rural area) per 10 lakhs of rural population at PHCs & CHCs
Health Facilities Index (HCFI)	H13	Children age 6-59 months who are anaemic (<11.0 g/dl) (%)
	H14	Pregnant women age 15-49 years who are anaemic (<11.0 g/dl) (%)
	H15	Institutional births (%)
	H16	Current Use of Family Planning Methods (currently married women age 15–49 years) (Any method)
Economic Index (EI)	H17	State-Wise Net State Domestic Product (In Crore Rupees)
	H18	State-Wise Per Capita Net State Domestic Product (In Rupees)
	H19	Expenditure on Medical and Public Health and Family Welfare – As per cent of Aggregate Expenditure
Outcome Index (OI)	H20	Sex Ratio
	H21	Neonatal Mortality Rate (NNMR)
	H22	Infant Mortality Ratio (IMR)
	H23	Under5 Mortality Ratio (U5MR)
	H24	Maternal Mortality Ratio (MMR)
Composite Health Index (CHI)	Physical Infrastructure Index (PII), Manpower Index (MI), Health Facilities Index (HCFI), Economic Index (EI) and Outcome Index (OI)	

In order to achieve the objectives of the study, the paper is organised in two methods based on the following manner: Methodological frameworks for the construction of dimensional health index (DHI) and Composite health index (CHI) have been provided in this section and Method II: Depth of gap and severity of the health performance are discussed in the second part.

Method I: Statewise Health Performance

Normalisation of variables of the study:

The study aims at computing different sub-indices for different variables of health performance and then using them to compute dimensional health index (DHI) and Composite health index (CHI) of larger and smaller Indian states. The methodology for normalising the variables is as under:

$$\text{Performance Index (PI)} = \frac{X_i - X_{\min}}{X_{\max} - X_{\min}}$$

X_i stands for actual value of the variables;

$X_{\min}$ stands for minimum value of the variables;

$X_{\max}$ stands for maximum value of the variables.

Indices calculated for the indicators on the basis of above formula lies in between 0 to 1. The Composite Health Index (CHI) for Indian states has been calculated as the average of the indices of various indicators. Based on their indices value, states have been categorised into three top and bottom as per their indices value of health performance.

Method II: Depth of gaps and Severity of Indian states

The original indicators that measure the health performances are measured in usually measured in different scales. The following procedure is adopted to convert indicators into their normalized form:

$$NV_{ij} = \frac{\text{Observed}_{ij} - \text{Worst}_i}{\text{Best}_i - \text{Worst}_i}$$

Where, NV_{ij} is the normalised value for the i th indicator of the j th Indian states. Best_i is the best value of the i th indicator, Worst_i is the worst value of the i th indicator and Observed_{ij} is the observed value of the j th states. NV_{ij} always lies between 0 and 1.

To measures the depth and severity of gaps in health performance across Indian states from one is used as the benchmark for the Indian states under consideration. The depth of gap is defined as the difference between one and the value of composite health index of the states. Therefore,

$$\text{Depth}_j = (1 - \text{CHI}_j)$$

Where, Depth_j is the difference from one of j th states and CHI_j is the value of composite index of the j th states. The value of Depth_j would lay between 0 and 1. The larger value of the depth implies larger average gap among the states from the best performing states. The severity of gaps is calculated which is defined as the squared value of the depth of gaps. Therefore,

$$\text{Severity}_j = (\text{Depth}_j)^2$$

Where, Severity_i is the severity of gaps of i th states. The value of Severity_i would lie between 0 and 1.

Section III: Analysis and discussion of the study

The analysis of the study is divided into two sections as per the requirements of objectives of the study. In this section, Part A: Statewise Health Performance for larger and smaller states has been done and in Part B: Depth and severity of gaps analysis for larger and smaller states of the study has been given.

Statewise Health Performance

The table 1 presents the categorisation of twenty larger states into top three and bottom three states of India based on their Dimensional health indices (DHI) value and Composite Health Index (CHI) value for the year 2014 and 2023. In case of physical health infrastructure (PII), Arunachal Pradesh, Himachal Pradesh and Karnataka have been acquired top three i.e. first, second and third position in the year 2014 while Bihar, Jharkhand and West Bengal have been acquired bottom three i.e. first, second and third position in the year 2014 in this regard. On the other hand, Andhra Pradesh Arunachal Pradesh and Kerala have acquired top three positions in the year 2023 while Bihar Jharkhand and Punjab have been acquired bottom three position in this regard. In case of manpower index (MI), Arunachal Pradesh, Himachal Pradesh and Kerala have been acquired top three i.e. first, second and third position in the year 2014 while Uttar Pradesh Bihar and Jharkhand have been acquired bottom three i.e. first, second and third position in the year 2014 in this regard. On the other hand, Andhra Pradesh Arunachal Pradesh and Kerala have acquired top three positions in the year 2023 while Bihar, Uttar Pradesh and Jharkhand have been acquired bottom three position in this regard. In case of healthcare facility index (HCFI), Kerala Punjab and Tamil Nadu have been at top position while Jharkhand Bihar and Uttar Pradesh have been acquired bottom three position in this regard in the year 2014. While Kerala Tamil Nadu and Karnataka have acquired top three position while Bihar Jharkhand and Uttar Pradesh have acquired bottom three positions in this regard in the year 2023. In short, Jharkhand Bihar and Uttar Pradesh have acquired bottom 3 positions in the year 2014 and 2023 while Kerala and Tamil Nadu have acquired top position during the study period in this regard. In case of economic index (EI), Gujarat and Tamil Nadu have remained top three position in the year 2014 and 2023 while Bihar Jharkhand and Assam have acquired bottom three position in the year 2014 on the other hand Arunachal Pradesh Jharkhand and Punjab have acquired bottom three position in the year 2023 in this is regard. In case of outcome index (OI), Kerala and Tamil Nadu remain in top 3 position in the year 2014 and 23 while Assam and Madhya Pradesh have remained bottom three position in the year 2014 and 2023 in this regard. In case of composite health index (CHI), Kerala acquired top position in both the year 2014 and 2023 while Jharkhand and Bihar have remained bottom position in both the year in this regard. In the year 2023, Andhra Pradesh and Kerala have acquired top position in terms of dimensional health index (DHI) and composite health index (CHI) except in economic index (EI) while Bihar and Jharkhand have acquired bottom positions in terms of dimensional health index (DHI) and composite health index (CHI) except in economic index (EI) and outcome index (OI).

Table 1: Top three and bottom three larger states of India based on their Dimensional health indices value and Composite Health Index value (CHI)

2014						2023					
Physical Infrastructure Index (PII)											
Top States	Index Value	Rank	Bottom States	Index Value	Rank	Top States	Index Value	Rank	Bottom States	Index Value	Rank
Arunachal Pradesh	0.951	1	Bihar	0.015	1	Andhra Pradesh	0.947	1	Bihar	0.002	1
Himachal Pradesh	0.579	2	Jharkhand	0.115	2	Arunachal Pradesh	0.503	2	Jharkhand	0.042	2
Karnataka	0.397	3	West Bengal	0.132	3	Kerala	0.348	3	Punjab	0.044	3
Manpower Index (MI)											
Arunachal Pradesh	0.887	1	Uttar Pradesh	0.051	1	Andhra Pradesh	1.000	1	Bihar	0.017	1
Himachal Pradesh	0.655	2	Bihar	0.062	2	Arunachal Pradesh	0.332	2	Uttar Pradesh	0.026	2
Kerala	0.572	3	Jharkhand	0.166	3	Kerala	0.309	3	Jharkhand	0.033	3
Healthcare Facility Index (HCFI)											
Kerala	0.897	1	Jharkhand	0.135	1	Kerala	0.805	1	Bihar	0.080	1
Punjab	0.679	2	Bihar	0.143	2	Tamil Nadu	0.692	2	Jharkhand	0.169	2
Tamil Nadu	0.665	3	Uttar Pradesh	0.268	3	Karnataka	0.669	3	Uttar Pradesh	0.229	3
Economic Index (EI)											
Maharashtra	0.689	1	Bihar	0.061	1	Karnataka	0.685	1	Arunachal Pradesh	0.280	1
Gujarat	0.663	2	Jharkhand	0.148	2	Gujarat	0.674	2	Jharkhand	0.284	2
Tamil Nadu	0.568	3	Assam	0.151	3	Tamil Nadu	0.613	3	Punjab	0.291	3
Outcome Index (OI)											
Kerala	1.000	1	Uttar Pradesh	0.124	1	Kerala	1.000	1	Madhya Pradesh	0.143	1
Arunachal Pradesh	0.932	2	Assam	0.178	2	Himachal Pradesh	0.797	2	Uttarakhand	0.224	2
Tamil Nadu	0.757	3	Madhya Pradesh	0.190	3	Tamil Nadu	0.782	3	Assam	0.311	3
Composite Health Index (CHI)											
Arunachal Pradesh	0.723	1	Bihar	0.118	1	Andhra Pradesh	0.761	1	Bihar	0.180	1
Kerala	0.679	2	Jharkhand	0.193	2	Kerala	0.587	2	Madhya Pradesh	0.203	2
Himachal Pradesh	0.575	3	Uttar Pradesh	0.223	3	Tamil Nadu	0.474	3	Jharkhand	0.222	3

Source: Author's own calculations based on Rural Health Statistics 2014-15 & Dynamics Health of India 2023-24, National Family Health Survey (NFHS-4 & 5) and various issues of RBI Bulletin

The table 2 presents the categorisation of seven smaller states into top three and bottom three states of India based on their Dimensional health indices (DHI) value and Composite Health Index (CHI) value for the year 2014 and 2023. In case of physical infrastructure index (PII), Mizoram and have acquired top position in both the year while on the other hand Goa have remained at bottom position in both the year regarding this. In case of manpower index (MI), Manipur has acquired in top three positions in both the year while Tripura have bottom three positions in this regard. In case of health care facility index (HCFI),

Goa and Sikkim have acquired in top three position while Meghalaya and Tripura have bottom three position in both the year in this regard. In case of economic index (EI), Goa and Meghalaya have acquired top three positions while Nagaland Mizoram and Manipur have remained at bottom three positions in this regard in both the year 2014 and 2023. In case of outcome index (OI), Goa acquired top position while Meghalaya have bottom three positions in this regard during the study period 2014 and 2023 In terms of composite health index (CHI), Goa and Mizoram have acquired top three positions while Meghalaya and Tripura have remained at bottom three positions in this regard during the study period.

Table 2: Top three and bottom three smaller sates of India based on their Dimensional health indices value and Composite Health Index value (CHI)

2014						2023					
Physical Infrastructure Index (PII)											
Top States	Index Value	Ran k	Bottom States	Index Value	Ran k	Top States	Index Value	Ran k	Bottom States	Index Value	Ran k
Mizoram	1.000	1	Goa	0.170	1	Mizoram	0.990	1	Manipur	0.028	1
Nagaland	0.608	2	Tripura	0.172	2	Nagaland	0.584	2	Goa	0.250	2
Meghalaya	0.272	3	Sikkim	0.200	3	Sikkim	0.471	3	Meghalaya	0.264	3
Manpower Index (MI)											
Mizoram	0.940	1	Tripura	0.292	1	Goa	0.769	1	Manipur	0.218	1
Manipur	0.610	2	Sikkim	0.339	2	Mizoram	0.521	2	Nagaland	0.249	2
Nagaland	0.523	3	Meghalaya	0.352	3	Sikkim	0.516	3	Tripura	0.317	3
Healthcare Facility Index (HCFI)											
Mizoram	0.823	1	Meghalaya	0.189	1	Goa	0.759	1	Meghalaya	0.385	1
Sikkim	0.750	2	Nagaland	0.441	2	Sikkim	0.684	2	Tripura	0.395	2
Goa	0.612	3	Tripura	0.454	3	Nagaland	0.662	3	Manipur	0.592	3
Economic Index (EI)											
Goa	0.736	1	Nagaland	0.053	1	Goa	0.990	1	Manipur	0.025	1
Meghalaya	0.452	2	Mizoram	0.084	2	Meghalaya	0.405	2	Nagaland	0.099	2
Tripura	0.351	3	Manipur	0.241	3	Sikkim	0.336	3	Mizoram	0.115	3
Outcome Index (OI)											
Goa	0.933	1	Sikkim	0.265	1	Goa	0.981	1	Tripura	0.000	1
Manipur	0.591	2	Meghalaya	0.294	2	Sikkim	0.946	2	Meghalaya	0.210	2
Tripura	0.558	3	Mizoram	0.333	3	Mizoram	0.592	3	Manipur	0.376	3
Composite Health Index (CHI)											
Mizoram	0.636	1	Meghalaya	0.312	1	Goa	0.750	1	Manipur	0.248	1
Goa	0.561	2	Tripura	0.365	2	Sikkim	0.591	2	Tripura	0.256	2
Manipur	0.451	3	Sikkim	0.370	3	Mizoram	0.573	3	Meghalaya	0.340	3

Source: Author's own calculations based on Rural Health Statistics 2014-15 & Dynamics Health of India 2023-24, National Family Health Survey (NFHS-4 & 5) and various issues of RBI Bulletin

The table 3 describes the high and low frequency occurring in health performance of the larger and smaller states of India during the study period. Kerala, Tamil Nadu, Arunachal Pradesh and Andhra Pradesh are showing high frequency in health performance while Jharkhand, Bihar and Uttar Pradesh are

showing low frequency in health performance of larger states in this regard during the study period. On the other hand, Sikkim, Goa and Mizoram are showing high frequency in health performance while Manipur, Meghalaya and Tripura are showing low frequency in health performance of smaller states in this regard during the study period.

Table 3: Maximum frequencies in health performance of the states under top and bottom category

Larger states			
Top states in 2014 and 2023	Frequency	Bottom states in 2014 and 2023	Frequency
Kerala	5	Jharkhand	5
Tamil Nadu and Arunachal Pradesh	4	Bihar	4
Andhra Pradesh	3	Uttar Pradesh	2
Smaller states			
Sikkim	6	Manipur	6
Goa	5	Meghalaya	4
Mizoram	4	Tripura	4

Source: Compiled based on table 1 and 2

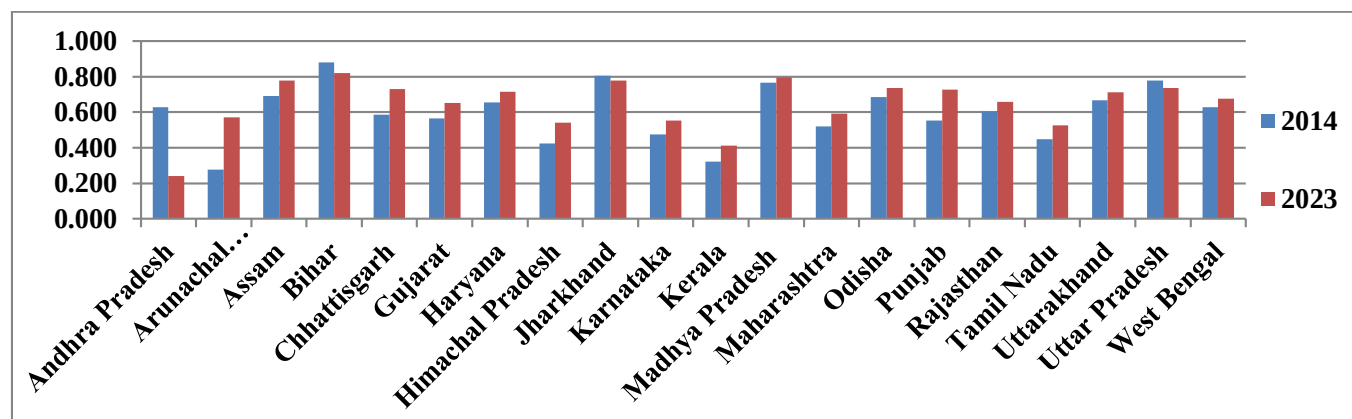
Analysis of Depth and severity of gaps in health performance

The table presents the calculated depth (Figure 1) and severity (Figure 2) of gaps of health performance of twenty larger states at two points of time 2014-15 and 2023-24. Arunachal Pradesh, Kerala, Himachal Pradesh, Tamil Nadu and Karnataka have shown less depth and severity of gaps in health performance among twenty larger states in the year of 2014 and 2023 except Arunachal Pradesh while Andhra Pradesh, Kerala, Tamil Nadu, Himachal Pradesh and Karnataka shows increased value of depth and severity of gaps in health performance during the study periods. Bihar, Jharkhand, Uttar Pradesh, Madhya Pradesh and Assam have shown higher depth of gaps and severity in health performance among twenty larger states in the year of 2014 and 2023 except Assam.

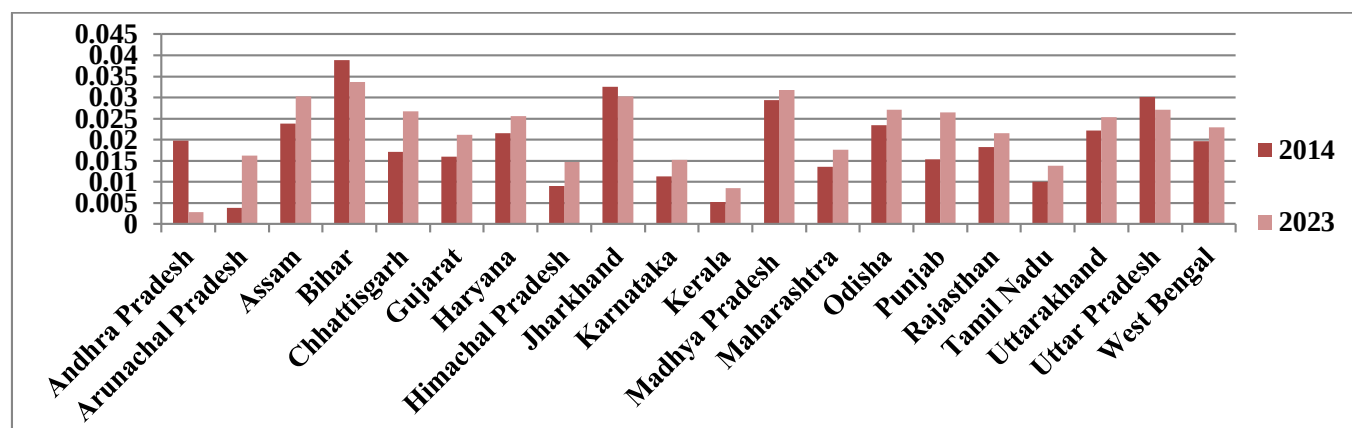
Table 4: Five minimum and five maximum gaps states in depth of gaps and severity of the health performance of twenty larger states

States	2014		States	2023	
	Low depth	Low severity		Low depth	Low severity
Arunachal Pradesh	0.277	0.004	Andhra Pradesh	0.239	0.003
Kerala	0.321	0.005	Kerala	0.413	0.009
Himachal Pradesh	0.425	0.009	Tamil Nadu	0.526	0.014
Tamil Nadu	0.447	0.010	Himachal Pradesh	0.542	0.015
Karnataka	0.475	0.011	Karnataka	0.552	0.015
States	High depth	High severity	States	High depth	High severity
Bihar	0.882	0.039	Bihar	0.820	0.034
Jharkhand	0.807	0.033	Madhya Pradesh	0.797	0.032
Uttar Pradesh	0.777	0.030	Jharkhand	0.778	0.030
Madhya Pradesh	0.767	0.029	Assam	0.778	0.030
Assam	0.690	0.024	Odisha	0.737	0.027

Source: Author's own calculations based on Rural Health Statistics 2014-15 & Dynamics Health of India 2023-24, National Family Health Survey (NFHS-4 & 5) and various issues of RBI Bulletin (Annexure 3).

Figure 1: Depth of gap of health performance of twenty larger states

Source: Chart based on table 4 (see Annexure 3).

Figure 2: Severity of health performance of twenty larger states

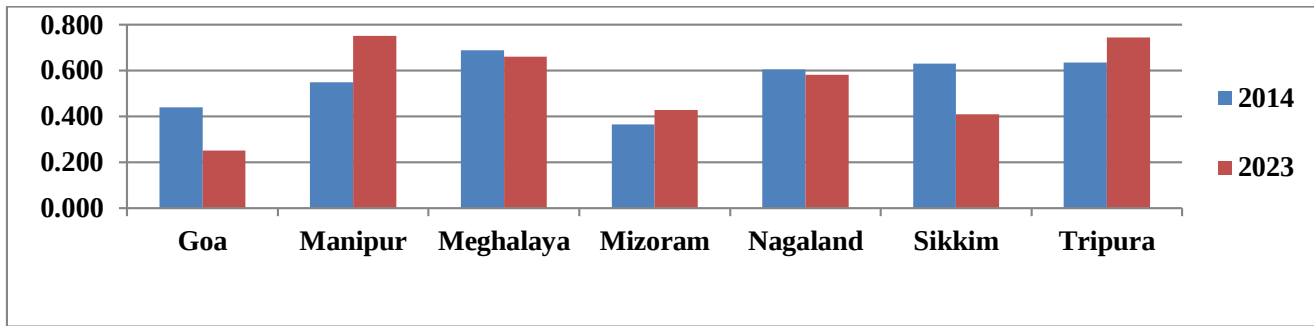
Source: Chart based on table 4(see Annexure 3)

The table 5 presents the calculated depth (Figure 3) and severity (Figure 4) of gaps of health performance of seven smaller states at two points of time 2014-15 and 2023-24. Goa shows less depth of gaps and severity while Tripura shows higher depth of gaps and severity in seven smaller states during the study period. Mizoram, Goa and Manipur have shown less depth and severity of gaps in health performance among seven smaller states in the year of 2014 while Goa, Sikkim and Mizoram show less value of depth and severity of gaps seven smaller states in the year of 2023. Meghalaya and Tripura have shown higher depth of gaps and severity in health performance among seven smaller states in the year of 2014 while in the year of 2023; Manipur and Tripura have shown higher depth of gaps and severity in health performance among seven smaller states.

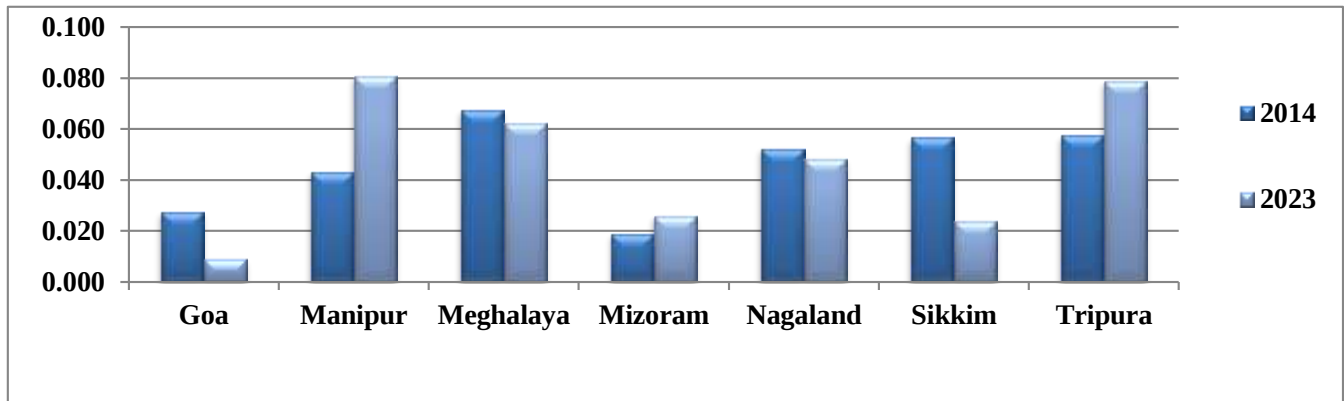
Table 5: Depth and severity of the health performance of seven smaller states

S.no.	Smaller states	2014		2023	
		Depth of gaps	Severity	Depth of gaps	Severity
1	Goa	0.439	0.028	0.250	0.009
2	Manipur	0.549	0.043	0.752	0.081
3	Meghalaya	0.688	0.068	0.660	0.062
4	Mizoram	0.364	0.019	0.427	0.026
5	Nagaland	0.606	0.052	0.582	0.048
6	Sikkim	0.630	0.057	0.409	0.024
7	Tripura	0.635	0.058	0.744	0.079

Source: Author's own calculations (see Annexure 3).

Figure 3: Depth of gap of the health performance of seven smaller states

Source: Chart based on table 5.

Figure 4: Severity of gap of the health performance of smaller states

Source: Chart based on table 5.

Section IV: Conclusion

This paper examines the health performance of twenty-seven Indian states (twenty larger states and seven smaller states) based on the significant twenty-four variables through Dimensional Health Index (DHI) and Composite Health Index (CHI) in the year of 2014 & 2023. Among twenty larger states, Andhra Pradesh, Kerala, Tamil Nadu, Himachal Pradesh and Karnataka consistently secured the top position, reflecting low depth and severity of gaps during the study period. In contrast, Bihar, Madhya Pradesh, Jharkhand, Assam and Odisha remained at the bottom position, exhibiting high depth and severity of gaps in both the year in this regard. For seven smaller states, Goa and Mizoram consistently ranked among the top three, demonstrating lower health gaps whereas Meghalaya and Tripura occupied the bottom three positions with higher gaps in this regard during the study period. This study finds out that health performance inequalities among the states widened over the study period. Notably, the CHI value of Andhra Pradesh (0.761) compared with that of Bihar (0.180) highlights a substantial inter-state disparity in the year 2023. States with stronger health index scores tend to exhibit lower mortality rates, underscoring the strong dependence of mortality outcomes on the availability and quality of health facilities.

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Annexures

Annexure 1: Dimensional health index (DHI) and Composite health index (CHI) of larger and smaller states for 2014

2014							
Larger states							
S.no.	States	Physical Infrastructure Index (PII)	Manpower Index (MI)	Healthcare Facility Index (HCFI)	Economic Index (EI)	Outcome Index (OI)	Composite Health Index (CHI)
1	Andhra Pradesh	0.190	0.346	0.618	0.201	0.499	0.371
2	Arunachal Pradesh	0.951	0.887	0.295	0.552	0.932	0.723
3	Assam	0.236	0.460	0.525	0.151	0.178	0.310
4	Bihar	0.015	0.062	0.143	0.061	0.310	0.118
5	Chhattisgarh	0.339	0.368	0.647	0.294	0.428	0.415
6	Gujarat	0.272	0.312	0.443	0.663	0.488	0.436
7	Haryana	0.161	0.299	0.416	0.437	0.407	0.344
8	Himachal Pradesh	0.579	0.655	0.504	0.468	0.668	0.575
9	Jharkhand	0.115	0.166	0.135	0.148	0.403	0.193
10	Karnataka	0.397	0.507	0.562	0.514	0.644	0.525
11	Kerala	0.375	0.572	0.897	0.551	1.000	0.679
12	Madhya Pradesh	0.189	0.215	0.361	0.210	0.190	0.233
13	Maharashtra	0.207	0.291	0.528	0.689	0.685	0.480
14	Odisha	0.259	0.202	0.576	0.285	0.258	0.316
15	Punjab	0.186	0.433	0.679	0.375	0.562	0.447
16	Rajasthan	0.379	0.407	0.527	0.462	0.203	0.396
17	Tamil Nadu	0.341	0.436	0.665	0.568	0.757	0.553
18	Uttarakhand	0.337	0.213	0.426	0.371	0.322	0.334
19	Uttar Pradesh	0.132	0.051	0.268	0.541	0.124	0.223
20	West Bengal	0.132	0.182	0.487	0.392	0.671	0.373
Smaller states							
S.no.	States	Physical Infrastructure Index (PII)	Manpower Index (MI)	Healthcare Facility Index (HCFI)	Economic Index (EI)	Outcome Index (OI)	Composite Health Index (CHI)
1	Goa	0.170	0.353	0.612	0.736	0.933	0.561
2	Manipur	0.221	0.610	0.590	0.241	0.591	0.451
3	Meghalaya	0.272	0.352	0.189	0.452	0.294	0.312
4	Mizoram	1.000	0.940	0.823	0.084	0.333	0.636
5	Nagaland	0.608	0.523	0.441	0.053	0.348	0.394
6	Sikkim	0.200	0.339	0.750	0.294	0.265	0.370
7	Tripura	0.172	0.292	0.454	0.351	0.558	0.365

Source: Author's own calculations based on Rural Health Statistics 2014-15 & Dynamics Health of India 2023-24, National Family Health Survey (NFHS-4 & 5) and various issues of RBI Bulletin

Annexure 2: Dimensional health index (DHI) and Composite health index (CHI) of larger and smaller states for 2023

2023							
Larger states							
S.no.	States	Physical Infrastructure Index (PII)	Manpower Index (MI)	Healthcare Facility Index (HCFI)	Economic Index (EI)	Outcome Index (OI)	Composite Health Index (CHI)
1	Andhra Pradesh	0.947	1.000	0.655	0.548	0.654	0.761
2	Arunachal Pradesh	0.503	0.332	0.481	0.280	0.551	0.429
3	Assam	0.069	0.087	0.242	0.404	0.311	0.222
4	Bihar	0.002	0.017	0.080	0.372	0.427	0.180
5	Chhattisgarh	0.104	0.095	0.446	0.367	0.336	0.270
6	Gujarat	0.116	0.085	0.290	0.674	0.579	0.349
7	Haryana	0.048	0.047	0.470	0.488	0.373	0.285
8	Himachal Pradesh	0.209	0.137	0.647	0.502	0.797	0.458
9	Jharkhand	0.042	0.033	0.169	0.284	0.585	0.222
10	Karnataka	0.090	0.112	0.669	0.685	0.686	0.448
11	Kerala	0.348	0.309	0.805	0.476	1.000	0.587
12	Madhya Pradesh	0.061	0.050	0.468	0.293	0.143	0.203
13	Maharashtra	0.061	0.086	0.589	0.606	0.696	0.407
14	Odisha	0.096	0.053	0.320	0.458	0.391	0.263
15	Punjab	0.044	0.063	0.390	0.291	0.578	0.273
16	Rajasthan	0.122	0.110	0.545	0.555	0.384	0.343
17	Tamil Nadu	0.129	0.154	0.692	0.613	0.782	0.474
19	Uttar Pradesh	0.124	0.101	0.450	0.546	0.224	0.289
20	Uttarakhand	0.047	0.026	0.229	0.601	0.415	0.263
21	West Bengal	0.054	0.039	0.414	0.452	0.659	0.324
Smaller states							
S.no.	States	Physical Infrastructure Index (PII)	Manpower Index (MI)	Healthcare Facility Index (HCFI)	Economic Index (EI)	Outcome Index (OI)	Composite Health Index (CHI)
1	Goa	0.250	0.769	0.759	0.990	0.981	0.750
2	Manipur	0.028	0.218	0.592	0.025	0.376	0.248
3	Meghalaya	0.264	0.436	0.385	0.405	0.210	0.340
4	Mizoram	0.990	0.521	0.646	0.115	0.592	0.573
5	Nagaland	0.584	0.249	0.662	0.099	0.495	0.418
6	Sikkim	0.471	0.516	0.684	0.336	0.946	0.591
7	Tripura	0.328	0.317	0.395	0.240	0.000	0.256

Source: Author's own calculations based on Rural Health Statistics 2014-15 & Dynamics Health of India 2023-24, National Family Health Survey (NFHS-4 & 5) and various issues of RBI Bulletin

Annexure 3: Depth and severity of the Health performance of twenty larger states and seven smaller states

States	2014		2023	
	Depth of gaps	Severity	Depth of gaps	Severity
Andhra Pradesh	0.629	0.020	0.239	0.003
Arunachal Pradesh	0.277	0.004	0.571	0.016
Assam	0.690	0.024	0.778	0.030
Bihar	0.882	0.039	0.820	0.034
Chhattisgarh	0.585	0.017	0.730	0.027
Gujarat	0.564	0.016	0.651	0.021
Haryana	0.656	0.022	0.715	0.026
Himachal Pradesh	0.425	0.009	0.542	0.015
Jharkhand	0.807	0.033	0.778	0.030
Karnataka	0.475	0.011	0.552	0.015
Kerala	0.321	0.005	0.413	0.009
Madhya Pradesh	0.767	0.029	0.797	0.032
Maharashtra	0.520	0.014	0.593	0.018
Odisha	0.684	0.023	0.737	0.027
Punjab	0.553	0.015	0.727	0.026
Rajasthan	0.604	0.018	0.657	0.022
Tamil Nadu	0.447	0.010	0.526	0.014
Uttarakhand	0.666	0.022	0.711	0.025
Uttar Pradesh	0.777	0.030	0.737	0.027
West Bengal	0.627	0.020	0.676	0.023
Smaller States				
Goa	0.439	0.028	0.250	0.009
Manipur	0.549	0.043	0.752	0.081
Meghalaya	0.688	0.068	0.660	0.062
Mizoram	0.364	0.019	0.427	0.026
Nagaland	0.606	0.052	0.582	0.048
Sikkim	0.630	0.057	0.409	0.024
Tripura	0.635	0.058	0.744	0.079

Source: Author's own calculations