Geographical analysis of multidimensional poverty in India from 2005-2006 to 2021: An emerging scenario

Soumyabrata MONDAL[1,*], Saheli KUMAR[1], Anand Prasad MISHRA[1]

[1] Institute of Science, Department of Geography, Banaras Hindu University, Varanasi, India
* Corresponding author: soumyamondal1992@gmail.com

Abstract

The present study has made a thorough investigation into the spatial clustering, trend, and intensity of multidimensional poverty in India between 2005–2006 and 2021. Data has been obtained from the global multidimensional poverty report [developed by the Oxford Poverty and Human Development Initiative (OPHI) and UNDP] and the national report of the Multidimensional Poverty Index (MPI) for 2021 [prepared by NITI Aayog] for India based on the NFHS-3 and NFHS-4 datasets. The study shows that, despite significant interstate disparities, multidimensional poverty in India has decreased from 0.279 in 2005–2006 to 0.118 in 2021. States like Bihar, Jharkhand continue to experience extreme multidimensional poverty. The study demonstrates that even though the intensity of poverty has remained relatively constant, the poorer states are significantly more advanced in reducing poverty than the nation's wealthier states. This suggests a pattern of pro-poor poverty reduction. Besides the study explores indicator-wise deprivation of MPI among the states and it is witnessed that Chhattisgarh, Jharkhand, Tripura, and Bihar have made splendid progress in reducing deprivation in different indicators (antenatal care, electricity, drinking water, assets) of multidimensional poverty, while the magnitude of deprivation is acute in several indicators like nutrition, cooking fuel, sanitation, and housing in these states. Based on the analysis, the present study suggests that India should undertake target-based interventions in poverty-prone regions to reduce poverty.

Keywords: *poverty in India, multidimensional poverty, Multidimensional Poverty Index (MPI), spatial pattern of poverty, decomposition, deprivation*

Introduction

During the previous two decades, India has attained remarkable progress in its growth trajectory (World Bank 2018). However, the growth performance of the Indian subcontinent has been exclusive and inconsistent. As a result, regional disparities, the rural-urban divide, and socio-economic and gender inequities have all worsened (Dev, 2010). Various studies (Das & Barua, 1996; Ohlan, 2013) have discussed that over the years, regional disparities in India have been increasing at an alarming rate. Even after seven decades of independence, a large section of Indian society does not have access to essential services including health, education, housing, and safe drinking water. The government of India faces challenges to overcome the problem of inter-regional poverty and income disparity that are not explicit at aggregative levels.

During the first four decades of development studies (1950–90), poverty was mainly measured in money-metric terms, either from household income or consumption expenditure. The World Bank sets poverty line at $2.15 a day in 2017 PPP (Purchasing Power Parity). Although the monetary-based poverty estimates have provided valuable insights into poverty, they have some flaws. The major limitation of money-metric poverty is its inability to express the multiple deprivations of human life. Sen (1980, p-198) stated that "income may not be translated into basic needs. As a result, deprivations in education, health, social, and political dimensions are critical in determining poverty because they are difficult to define through price". Moreover, there is ample possibility of inaccurate measurement of a household's income and expenditure (Deaton, 1997). Apart from income, poverty measure fails to consider the spatiality of living costs, which are considerably higher in urban areas than in rural areas (Wratten, 1995). These limitations of money-metric poverty put emphasis on developing the multidimensional approach to poverty measurement, which considers poverty as i) capability deprivation (Sen, 1993) and ii) a counting measure of deprivation (Atkinson, 2003). The emergence of the human development paradigm during 1990 provided a solid theoretical framework for measuring multidimensional poverty. The United Nations Development Programme (UNDP) developed a set of composite indices such as the Capability Poverty Measure (CPM), Human Poverty Index 1 (HPI-1), and Human Poverty Index 2 (HPI-2) to compute multidimensional poverty (UNDP, 1996). The Multidimensional Poverty Index (MPI) differs from the HPI in that it identifies people at the micro level who are disadvantaged in a variety of overlapping ways and captures both the amount and intensity of poverty in a more appropriate way (Alkire & Santos, 2010). The Oxford Poverty and Human Development Initiative (OPHI), jointly with UNDP,

developed the Multidimensional Poverty Index (MPI) in 2010. The major goal of MPI was to identify those who were unable to meet a certain level of resources, requirements, or functioning in order to maintain a minimum standard of living (Alkire & Santos, 2014; Walker, 2015). MPI has grown into a formidable instrument that is now used by over 18 nations to track poverty alleviation (UNDP, 2019). The index's strength comes from its capacity to disaggregate the MPI into numerous categories, ensuring that no region is left behind. It also serves as a powerful tool for assessing a country's progress toward reaching the Sustainable Development Goals (UNDP, 2019).

The study of multidimensional poverty and deprivation on a regional scale is critical in such a large country as India. The extant seam of literature on multidimensional poverty has significantly expanded in recent years following the ground breaking contributions of Atkinson and Bourguignon (1982), Bourguignon and Chakravarty (2003), and later the significant theoretical as well as empirical contributions of Alkire and Foster (2011), Alkire and Seth (2015), Das et al. (2021), and Alkire et al. (2021). In order to measure and estimate multidimensional poverty, a number of researchers (Chakravarty & D'Ambrosio, 2006; Alkire & Foster, 2008, 2011; Calvo, 2008; Wagle, 2008; Alkire & Santos, 2010; Mohanty, 2011; Mishra & Ray, 2013; Alkire & Seth, 2015) around the world have made significant contributions. Most of these studies used education, health, and standard of living as criteria for defining multidimensional poverty, while a few studies also took into account subjective well-being factors like fear of hardship (Calvo, 2008). Regarding measurement of multidimensional poverty, some researchers have considered the "union" (poor in any dimension) approach (Bourguignon & Chakravarty, 2003); while others have applied the "intersection" (poor in two or more dimensions) or "relative" approach (Wagle, 2008).

Though a large number of studies have delved into the dynamics of multidimensional poverty at the global level, studies on multidimensional poverty at a regional level for developing nations in general and India, in particular, are few and far between. Following the methodology of Alkire and Foster (2011), Alkire et al. (2015), Das et al. (2021), and Alkire et al. (2021), this paper revisits the measurement of multidimensional poverty in the Indian context during two different periods of time: 2005–2006 and 2021.

The contribution of the paper is threefold. The primary objective of this study is to investigate the spatial disparities in the concentration of multidimensional poverty among the different states of India during two distinct periods, i.e., 2005–06 and 2021. In addition, the study has attempted to investigate the trends of changes in the MPI's absolute and relative dimensions, headcount ratio (H), and poverty intensity (A), over these periods, across the states of India. The paper's final section further explores the disparities in MPI indicators across the states.

The study will make a novel contribution to understanding the recent scenario of multidimensional poverty, intensity, and deprivation across the states of India, which may be helpful for the easy formulation of state-level policies.

Literature review

The existing literature on development economics suggests that assessing poverty across several dimensions of deprivation provides a more comprehensive picture of poverty. In India a plethora of studies have addressed the relevance of multidimensional poverty measurement using variety of indicators.

Alkire and Seth (2008) calculated the MPI in the context of India using the Below Poverty Line (BPL), 2002 methodology, with the help of NFHS (National Family Health Survey) dataset. Mohanty (2011) tried to assess multidimensional poverty using NFHS-3 unit-level data and discovered that infant mortality and under-five mortality rates are particularly high among people living in abject multidimensional poverty. Sarkar (2012) calculated multidimensional poverty using data from the National Sample Survey Organization (NSSO) and concluded that while rural poverty has declined over time in India, it is still very acute among socially vulnerable groups. Using NFHS data, Alkire and Seth (2013) looked at how multi-dimensional poverty changed in India between 1999 and 2006 and found that some indicators of the standard of living—like access to electricity, decent housing, safe drinking water, and improved sanitation—were comparatively more significant than other social indicators in promoting national poverty reduction. However, the reduction was not consistent across different population subgroups, and the pattern of reduction among states was less pro-poor than the pattern of income poverty. Mishra and Ray (2013) performed a wide-ranging analysis of the Indian population's living standards using NFHS and NSSO data between 1992 and 2005 and concluded that the decomposable dimensions of poverty deprivation explained vulnerability across socio-economic groups better than total deprivation levels. Using NFHS data, Alkire and Seth (2015) observed that although poverty level in India has decreased during 1999 to 2006, the reduction in poverty among the lower sub-groups has been modest, resulting in a widening of the income gap throughout the population. Gathering data from several issues of periodic reports produced by OPHI as well as various other research reports, Kumar et al. (2015) have calculated the MPI for India based on health and household status and contend that Kerala is the most secure in multidimensional poverty, while Goa, Punjab, Himachal Pradesh, and Tamil Nadu are the most susceptible. While the rest of the states are in a miserable state of affairs. Dehury and Mohanty (2015) estimated and decomposed multidimensional poverty in 82 natural regions of India using unit data from the Indian Human Development Survey (IHDS), 2011–2012. According to the findings, around 43 per cent of India's population is

multidimensionally poor, with considerable regional differences. Based on data from three NFHS rounds: 1992–1993, 1998–1998, and 2005–2006, Chaudhuri et al. (2017) determined the state-level MPI in India and revealed that the country's progress has been unbalanced, with poorer states (like Bihar) continuing to stay impoverished and there is a prevalence of intra-urban inequities and female multi-dimensional destitution. Using the NFHS-3 and NFHS-4 datasets, Alkire et al. (2018) attempted to analyze the changes in the MPI from 2005–2006 to 2015–2016 and found that multidimensional poverty in India decreased from 54.7 percent in 2005–2006 to 27.5 percent in 2015–2016. As per their observation, the reductions in MPI are rarely connected with GDP growth at the state level. Using NSSO data on consumer expenditure Tripathi and Yenneti (2020) tried to estimate multidimensional poverty across Indian states and disclosed that household members' lack of education, followed by their income, was the biggest factor contributing to their poverty. Between 2005–2006 and 2015–2016, Alkire, et al. (2021) looked at how poverty levels changed across socioeconomic groups and among the poorest of the poor in India. Using NFHS-4 datasets, Vasishtha and Mohanty (2021) investigated the spatial clustering and association of multidimensional and consumption poverty in Indian districts and unveiled that in comparison to consumption poverty, multidimensional poverty is spatially more concentrated. Based on the results, they suggested multidimensional poverty measures should be integrated with consumption poverty measures and those districts with high levels of multidimensional and consumption poverty should be prioritized for evidence-based planning. Das et al. (2021) used NSSO data to examine how consumption and multidimensional poverty changed in India between 2004–2005 and 2011–2012 as a result of changes in population subgroups and household characteristics. According to their observations, multidimensional poverty has dropped for both consumption-poor and non-poor people, but the decline is more rapid among the poorest segments, which is encouraging. Additionally, they concluded that a sizable portion of Indians is multidimensionally poor but not consumption poor, making it ineffective to combat poverty using conventional methods due to exclusionary bias. Mohanty and Vasishtha (2021) estimated and decomposed multidimensional poverty in urban India using the urban sample from the NFHS-4. According to the findings, approximately one-third of the urban Indian population is multidimensionally poor, one-sixth is vulnerable to multidimensional poverty, and poverty is more prevalent among large households, female-headed households, widowed individuals, and scheduled tribes. Based on NFHS-4 dataset Mondal et al. (2023) tried to estimate the spatial pattern of multidimensional poverty in both rural and urban context across the states of India and confirms that the magnitude of poverty and deprivation is acute in most of the poverty indicators in the poorer states of India like Bihar,

Jharkhand, Uttar Pradesh, Madhya Pradesh etc. The study further revealed that in both rural and urban space among the dimension health and among the indicators nutrition have made most significant contribution in overall score of multidimensional poverty in India. Not only at national level but also at micro level several studies have been performed in India to investigate the pattern and intensity of multidimensional poverty. Like Mondal and Mishra (2021) in their study have tried to explore and analyze spatial interlinkages of poverty in Hooghly district of West Bengal with the help of twelve indicators and unveiled that geographical dimension of poverty has many linkages with the socio economic and cultural aspects of society.

Even though numerous studies have been carried out at the national level, no comparisons between the states using the MPI for the years 2005–2006 and 2021 have been made so far in India. The current study aims to fill this significant gap in the body of existing literature. This type of research will shed light on the spatial and temporal dimensions of multidimensional poverty in the context of a vastly dispersed country like India.

Data and methods

The present study is based on secondary sources of data. The data relating to the MPI of India for the year 2005–2006 has been obtained from the Global Multidimensional Poverty Index prepared by UNDP and OPHI using the Alkire–Foster (A–F) Method. The data on multidimensional poverty in India for 2021 is gathered from the report prepared by the National Institution for Transforming India (NITI) Aayog using the same methodology as UNDP and OPHI. The widely used Foster-Greer-Thorbecke (FGT) class of poverty measures is extended by the A-F methodology, which has several technical and practical benefits that make it suitable for use in non-monetary poverty estimation. While the MPI of 2021 has used the NFHS-4 dataset collected during 2015–16, the MPI of 2005–06 is based on NFHS-3 datasets. The NFHS is conducted by the International Institute of Population Sciences (IIPS), Mumbai and is the major source for demographic and health indicators in India with support from the ICF International, the National AIDS Research Institute (NARI) and Demographic Health Surveys (DHS). It should be noted that it will be NFHS 4 which is representative at both the state and district levels, as opposed to NFHS 3, which is only representative at the state level. The sample size thus increased almost six-fold between NFHS-3 and NFHS-4. Both surveys use a two-stage stratified sampling design. The two datasets are thus comparable at the state level, though not at the district level. Therefore, we have used these two data sets for inter-spatial and temporal comparisons.

According to the UNDP's Human Development Reports (2015 and 2019), the MPI of 2005–2006 and 2021 both have considered three dimensions, namely health, education, and standard of living. The global MPI used 10

indicators (two from health, two from education and six from standard of living) for the construction of MPI for India in 2005-06 while NITI Aayog has used twelve indicators with the inclusion of two new indicators (Child and adolescent mortality from health and bank account from standard of living) for 2021 (Fig. 1).
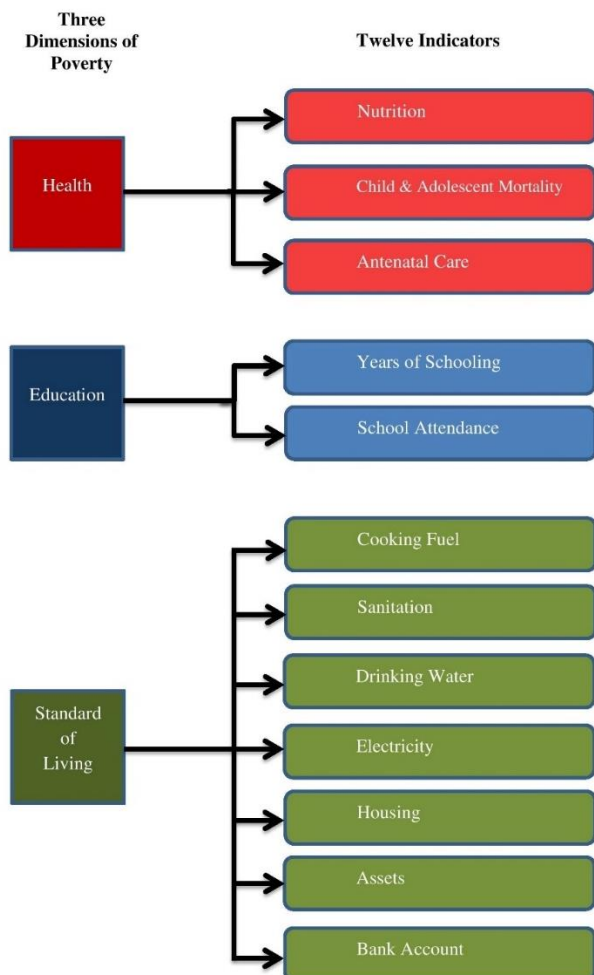

Figure 1. Dimensions and indicators of MPI for India 2021 *Source:* **Prepared by the authors based on NITI Aayog Report of MPI, 2021**

These indicators reflect different Sustainable Development Goals (SDGs). The descriptions of the dimensions, the indicators, and the cut-off point that have been considered by NITI Aayog have been enlisted in Table 1. Equal weights were assigned to each dimension, and within each dimension, equal weights were given to each indicator (Alkire & Santos, 2010; Alkire & Seth, 2015; UNDP, 2015, 2019). The percentage of weighted deprivations that the state's population experiences is shown in the deprivation score, which adds up the weights on each indicator of deprivation and summarizes the

state's deprivation profile. After Sen (1976), the next step is to determine who is poor using the poverty cut-off. If they experience one-third of the weighted deprivations or more, they are identified as MPI poor.

Thereafter, the proportion of multidimensionally poor individuals in the total population has been determined which is known as the Headcount Ratio (H) of multidimensional poverty and is the first of two partial indices used to determine the MPI.

Percentage of multidimensionally poor is denoted by H and defined as

$$H = \frac{q}{n} * 100$$

Where, q is the number of multidimensional poor households and n is the total population.

Thereafter intensity of poverty (A) which is the second partial index to formulate MPI has been calculated. The intensity of poverty (denoted by A) is the average proportion of deprivations which is experienced by multidimensionally poor individuals.

In percentage form, it is expressed as

$$A = \frac{1}{q} \sum_{i=1}^{q} Ci(k)$$

Where, Ci(k) is the deprivation score of multidimensionally poor individuals up to the ith individual and q is the number of multidimensionally poor individuals.

The Multidimensional Poverty Index (MPI) is the product of the two partial indices, the (H) and (A). Hence, the index reflects both the incidence and the intensity of poverty.

Thus MPI is calculated as

$$MPI = H * A$$

Further we have decomposed the MPI by dimensions and indicators to assess the contribution of the various dimension/indicators to overall poverty. The contribution of a particular indicator to overall multidimensional poverty is computed as

$$Contribution\ of\ indicator\ i\ to\ MPI = \frac{wiCHi}{MPIc} \times 100$$

Where wi is the weight of the ith indicator (Table 1) CHi is the censored headcount ratio of the ith indicator and MPIc denotes the India's national MPI.

The study has made use of a variety of analytical tools, including tabular analysis, absolute and relative change detection, scatter plots, bubble charts, etc. With the aid of ArcGIS 10.5, SPSS 22, and MS-Excel 2010 software, a number of maps, charts, and diagrams have been prepared for better visual representation.

Table 1. Dimensions, indicators, deprivation cut-offs and weights of the multidimensional poverty

Dimension	Indicator (Weight)	Deprivation cut-off
Health (1/3)	Nutrition (1/6)	A household is considered deprived if any child between the ages of 0 to 59 months, or woman between the ages of 15 to 49 years, or man between the ages of 15 to 54 years -for whom nutritional information is available - is found to be undernourished.
	Child and Adolescent Mortality (1/12)	A child/adolescent under 18 years of age has died in the family in the five-year period preceding the survey.
	Antenatal Care (1/12)	A household is deprived if any woman in the household who has given birth in the 5 years preceding the survey, has not received at least 4 antenatal care visits for the most recent birth, or has not received assistance from trained skilled medical personnel during the most recent childbirth.
Education (1/3)	Years of Schooling (1/6)	Not even one member of the household aged 10 years or older has completed six years of schooling.
	School Attendance (1/6)	Any school-aged child is not attending school up to the age at which he/she would complete class 8.
Standard of Living (1/3)	Cooking Fuel (1/21)	A household cooks with dung, agricultural crops, shrubs, wood, charcoal or coal.
	Sanitation (1/21)	The household has unimproved or no sanitation facility or it is improved but shared with other households.
	Drinking Water (1/21)	The household does not have access to improved drinking water or safe drinking water is at least a 30-minute walk from home (as a round trip).
	Electricity (1/21)	The household has no electricity.
	Housing (1/21)	The household has inadequate housing: the floor is made of natural materials, or the roof or walls are made of rudimentary materials.
	Assets (1/21)	The household does not own more than one of these assets: radio, TV, telephone, computer, animal cart, bicycle, motorbike, or refrigerator; and does not own a car or truck.
	Bank Account (1/21)	No household member has a bank account or a post office account.

Source: National Multidimensional Poverty Index, 2021 Based on NFHS-4 (2015-16), NITI Aayog

Results and discussions

Spatial pattern of MPI, H and A of poverty in 2005-2006 and 2021

India has achieved a momentous progress in reducing multidimensional poverty and headcount ratio in between 2005-06 and 2021. The headcount ratio has dropped down from 54.7 percent in 2005-2006 to 25.0 percent in 2021. The MPI score has more than halved during this period from 0.279 to 0.118. Though intensity of poverty has remained more or less the same during 2005-2006 (51.1 percent) and 2021 (47.1 percent) which is a serious concern among the policy makers and social scientists in respect to poverty in India. Though poverty has been reduced at the national level, large interregional disparities in the pattern of multidimensional poverty persist in our country. The section that follows provides an example of a comparative analysis of the regional variation in multidimensional poverty, headcount Ratio, and poverty intensity over two distinct time periods, namely 2005–2006 and 2021.

State wise pattern of poverty in 2005-2006

Table 2 and Figure 2 reveal that during 2005-2006 very high multidimensional poverty (MPI>0.198) persisted in 16 out of 28 states in India. Among the states Bihar was the poorest in multidimensional poverty followed by Jharkhand and Uttar Pradesh. Lack of education, a high rate of illiteracy, a lack of infrastructure and industries, unequal land distribution, caste-based politics, a heavy population burden on natural resources, a problem with youth unemployment, and a lack of urbanization are the main causes of the high incidence of poverty in these states (Mondal et al., 2023).

Table 2. State wise MPI, Headcount Ratio (H) and Intensity (A) in 2005-2006 and 2021

State	2005/06*			2021**		
	MPI	H Incidence	A Intensity	MPI	H Incidence	A Intensity
INDIA	0.279	54.7	51.1	0.118	25.0	47.1
Andhra Pradesh	0.234	49.9	47.0	0.053	12.3	43.2
Arunachal Pradesh	0.309	59.7	51.8	0.115	24.3	47.3
Assam	0.312	60.7	51.4	0.156	32.7	47.9
Bihar	0.446	77.1	57.8	0.265	51.9	51.0
Chhattisgarh	0.353	70.0	50.5	0.134	29.9	44.6
Goa	0.087	20.4	42.5	0.015	3.8	40.2
Gujarat	0.185	38.5	48.0	0.084	18.6	45.0
Haryana	0.182	38.5	47.2	0.055	12.3	44.4
Himachal Pradesh	0.129	31.1	41.5	0.03	7.6	39.4
Jammu & Kashmir***	0.189	40.8	46.4	0.055	12.6	44.1
Jharkhand	0.425	74.7	57.0	0.202	42.2	47.9
Karnataka	0.224	48.1	46.5	0.056	13.2	42.7
Kerala	0.052	13.2	39.6	0.003	0.7	39.0
Madhya Pradesh	0.358	67.7	52.8	0.173	36.7	47.3
Maharashtra	0.182	39.4	46.2	0.065	14.9	43.8
Manipur	0.207	45.1	45.8	0.08	17.9	44.4
Meghalaya	0.334	60.5	55.2	0.157	32.7	48.1
Mizoram	0.139	30.8	45.0	0.046	9.8	47.4
Nagaland	0.294	56.9	51.6	0.117	25.2	46.3
Odisha	0.330	63.5	52.0	0.136	29.4	46.4
Punjab	0.108	24.0	45.0	0.024	5.6	43.8
Rajasthan	0.327	61.7	52.9	0.140	29.5	47.4
Sikkim	0.176	37.6	46.7	0.016	3.8	41.2
Tamil Nadu	0.155	37.0	41.8	0.02	4.9	40.0
Telangana	-	-	-	0.059	13.7	43.2
Tripura	0.265	54.4	48.6	0.075	16.7	45.0
Uttar Pradesh	0.360	68.9	52.2	0.180	37.8	47.6
Uttarakhand	0.179	38.7	46.1	0.079	17.7	44.4
West Bengal	0.298	57.3	52.0	0.097	21.4	45.5

*Source: * Global Multidimensional Poverty Index 2018, Oxford Poverty and Human Development Initiative (OPHI), University of Oxford, P. 31 ** National Multidimensional Poverty Index, 2021 Based on NFHS-4 (2015-16), NITI Aayog *** Value of Jammu & Kashmir includes J & K and Ladakh UT*

Table 2 also shows that during the years 2005–2006, 11 of the 16 states with the highest rates of poverty exceeded the national MPI value of 0.279. As shown in Fig. 2, these states are primarily located in India's central and eastern regions. Table 2 further reveals that high MPI (considering cut off 0.133) is observed in eight states in the country during 2005-06 with highest MPI 0.189 for Jammu and Kashmir to 0.139 MPI of Mizoram falling in this category. These states do not follow any spatial clustering, rather they are scattered. Only three states, Goa, Punjab, and Himachal Pradesh, fall within the MPI's moderate category (considering cut off 0.068). While only the state Kerala having the lowest MPI value of 0.052 falls under the low poverty category (Fig. 2 and Table 2).

Table 2 also portrays the spatial pattern of the headcount ratio of multidimensional poverty in India during 2005-2006. As shown in Table 2, 12 states have surpassed the country's headcount ratio of 54.7 percent. Similar to MPI, Bihar (77.1%) had the highest headcount ratio, followed by Jharkhand, Chhattisgarh, and Uttar Pradesh. In contrary, Kerala (13.2%) had the lowest multidimensional poverty headcount ratio in 2005–2006 (Table 2). Figure 3 exhibits that, of the 28 states in our nation, 18 had very high multidimensional headcount ratios (using a cut-off of 39.10 percent) at that time. While, seven states continued to have high multidimensional poverty headcount ratios (using 26.31 percent as the cut-off). As witnessed in Figure 3, these states are primarily located in the country's central, eastern, and north-eastern regions, with a few small pockets in the western and northern regions. The remaining three states had a moderate or low multidimensional headcount ratio in 2005-06.
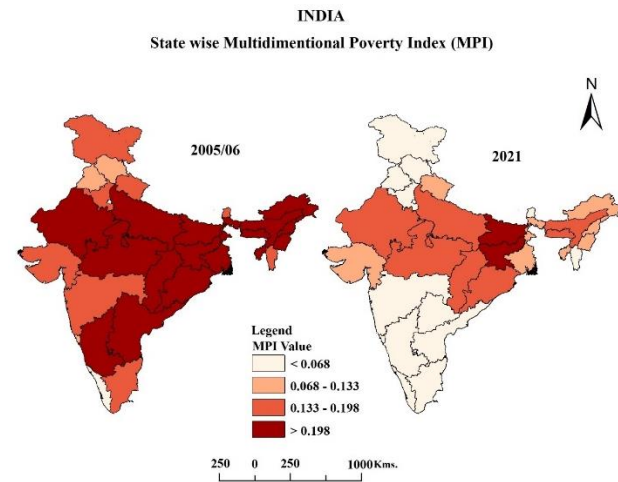
INDIA
State wise Multidimentional Poverty Index (MPI)

Figure 2. Spatial pattern of MPI in 2005-2006 and 2021
Source: Prepared by authors

INDIA
State wise Headcount Ratio of Multidimentionally Poor (H)
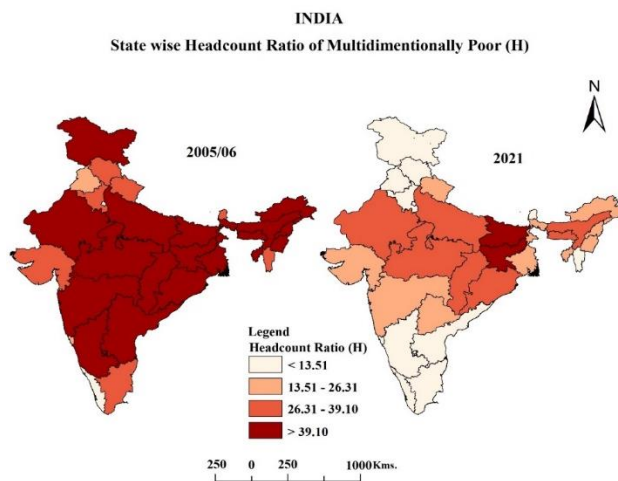

Figure 3. Spatial pattern of Headcount Ratio of Multidimensionally Poor in 2005-2006 and 2021
Source: Prepared by authors

Table 2 further reveals that Bihar had the highest intensity of poverty, at 57.8 percent in 2005–06, followed by Jharkhand and Meghalaya. While, Kerala had the lowest intensity, followed by Himachal Pradesh and Tamil Nadu. The spatial pattern of poverty intensity shows that intensity is not always associated with the MPI and headcount ratio. Even though Chhattisgarh has an MPI score of 0.353 and a headcount ratio of 70.0 percent, its poverty intensity is lower (50.5 percent) than the national average. It may be due to the result of focusing on the poorest of the poor (OPHI, 2018). Likewise in Tripura, the headcount ratio is 54.4 percent and the poverty intensity is 48.6 percent. Figure 4 portrays state-wise intensity of poverty in India during 2005-2006, and it is observed that a very high intensity of poverty (considering the cut-off point of 48.02 percent) is concentrated among the states located in the central and eastern parts of our country,

while the low intensity of poverty is found in the southern portion (Kerala and Tamil Nadu) of the country with an isolated patch in the northern part (Himachal Pradesh). During 2005-2006, out of 28 states, 11 states exceeded the national intensity of poverty, which was 51.1 percent.
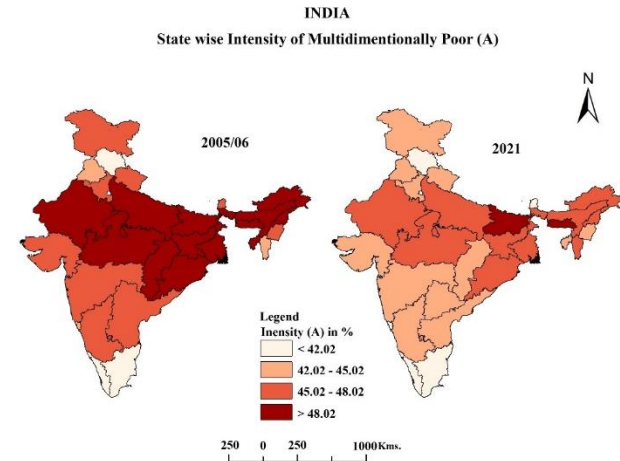
INDIA
State wise Intensity of Multidimentionally Poor (A)

Figure 4. Spatial pattern of Intensity (A) of Poverty in 2005-2006 and 2021 *Source: Prepared by authors*

State wise pattern of poverty in 2021

This section of our study focuses on exposing regional disparities in the pattern of multidimensional poverty, headcount ratio, and intensity of poverty in India according to the most recent report from NITI Aayog, 2021. According to Table 2, Bihar has achieved the highest MPI score in 2021 (0.265), while Kerala has the lowest (0.003). Among the states except for Bihar, a very high level of multidimensional poverty (>0.198) also persists in Jharkhand (Table 2). Consequently, only two Indian states have experienced extremely high levels of multidimensional poverty in 2021, as opposed to sixteen states in 2005–2006. In addition, high poverty (0.133-0.198) persists in seven states, ranging from Chhattisgarh (0.134) to Uttar Pradesh (0.180) in terms of MPI scores. Figure 2 shows that, even in 2021, the central and eastern parts of India have remained significantly poorer than the rest of the country. As shown in Table 2, eight states—out of the total 29 states, including Jammu and Kashmir—have crossed the national MPI threshold of 0.118 in 2021, necessitating special attention. The spatial pattern of MPI reveals that severe conditions of poverty are still being persisted in 28 percent of areas of India. Six states— Nagaland, Arunachal Pradesh, West Bengal, Gujarat, Uttarakhand, and Tripura—fall into the moderate MPI (0.068–0.133) score category in 2021 (Fig. 2). The remaining 14 states are under the low MPI score category, with a score of less than 0.068. According to Figure 2, most of the states located in the southern and northern parts of India have a low concentration of multidimensional poverty. It should be noted that only the state of Kerala fell into the low MPI category in 2005–06; whereas during

2021, nearly half of the states in India fall into this category.

In terms of headcount ratio, Bihar has the highest percentage (51.9 percent) in 2021, followed by Jharkhand. In India, the patterns of MPI and headcount ratio are more or less similar in 2021. According to the NITI Aayog report, 25.0 percent of Indians are now multidimensionally poor. A state-by-state analysis shows that 10 out of the 29 Indian states have surpassed this threshold. Kerala, on the other hand, with a poverty rate of just 0.7 percent, has the lowest headcount ratio of multidimensional poverty. It is encouraging from the standpoint of India's poverty that during 2021 few states like Goa, Sikkim, and Tamil Nadu have multidimensional poverty headcount ratios of less than 5 percent. Figure 3 also shows that in 2021, the central, eastern, and north-eastern parts of India have a moderate to high poverty headcount ratio, while the southern and northern parts have a low multidimensional headcount ratio.

To comprehend the ground reality of poverty disparities, it is necessary to discuss the spatial pattern of poverty intensity among India's states. As per the latest estimate, the highest intensity of poverty is observed in Bihar, followed by Meghalaya (Table 2). Besides these two states, a high intensity of poverty is noticed (Fig. 4) in eleven states ranging from Jharkhand (47.9 percent) to Tripura (45.0 percent). According to NITI Aayog estimates for 2021, nine Indian states have exceeded the national intensity of poverty, i.e., 47.1 percent, while the remaining 19 states are below the national average. Table 2 shows that even in states with low multidimensional poverty rates (less than 15 percent), such as Mizoram, Punjab, Haryana, Jammu and Kashmir, and Karnataka, the intensity of poverty is higher than average (more than 42 percent). The spatial analysis of poverty explains that poverty intensity often deviates from the pattern of the MPI and headcount ratio and is associated with other socioeconomic and cultural dynamics.

Changes in Multidimensional Poverty Index, Headcount Ratio and Intensity of Poverty between 2005-2006 and 2021

The spatial pattern of absolute and relative changes in multidimensional poverty, headcount ratio, and intensity of poverty from 2005-06 to 2021 is more relevant to understanding the poverty scenario in India in greater detail. According to Table 3, between 2005–2006 and 2021, India has succeeded to reduce MPI by more than half (from 0.118 to 0.279), which represents a significant accomplishment. Similar to MPI, the multidimensional poverty headcount ratio has significantly decreased over the same period, falling from 54.7 to 25.0 percent, or 29.7 percent. In addition, Table 3 further shows that during this

time, the intensity of poverty has also lessened from 51.1 percent to 47.1 percent, or 4 percent, which is not particularly impressive. To further explain the interstate disparities in the reduction of poverty in India from 2005–2006 to 2021, the study also makes an effort to assess the state-by-state pattern of changes in absolute and relative terms.

It is noteworthy that all Indian states have been successful in lowering MPI, H, and A. However, large interstate disparities persist in poverty reduction. Fig. 5 plots the absolute change in MPI on the vertical axis and the initial 2005–06 levels of MPI at the state level horizontally. It demonstrates that between 2005–2006 and 2021, 14 of 28 states were successful in reducing MPI at an apprehending rate (>0.165). During this period, it is clear that the poorer states of India are far ahead of the better-off states in terms of poverty reduction. The state's highest absolute change in MPI is observed in Jharkhand (-0.223), followed by Chhattisgarh and West Bengal (Table 3). Alkire and Seth (2015) in their study revealed that from 1998–99 to 2005–06, the reduction of monetary poverty had been faster among the slowest states, and progress in terms of the MPI headcount ratio, as well as the MPI value, had been slower for the poorer states.

Figure 5. Absolute changes in MPI across Indian states between 2005-06 and 2021, *Source: Prepared by authors*

Several states like Arunachal Pradesh, Odisha, Tripura, Rajasthan, Madhya Pradesh, Andhra Pradesh, Uttar Pradesh, Meghalaya, Nagaland, and Karnataka have also made significant advancements in the absolute change of MPI (Fig. 5). On the other hand, Kerala (-0.049) has the lowest MPI reduction in absolute terms, followed by Goa and Punjab (Table 3). As a result, we can conclude that the rate of poverty reduction is much faster in poverty striken states compared to the less poorer states of India. It is mainly because the rate of absolute change is capped in less poor areas. Most Indian states attempt to explain this emerging dynamics of poverty through their spatial patterns.

Table 3. State wise Absolute and Relative Change in MPI, H and A

State	Absolute Change			Relative Change		
	MPI	H	A	MPI	H	A
INDIA	-0.161	-29.7	-4.0	-57.7	-54.3	-7.8
Andhra Pradesh	-0.181	-37.6	-3.8	-77.4	-75.3	-8.0
Arunachal Pradesh	-0.194	-35.4	-4.5	-62.8	-59.4	-8.7
Assam	-0.156	-28.0	-3.5	-50.0	-46.2	-6.8
Bihar	-0.181	-25.2	-6.8	-40.6	-32.7	-11.7
Chhattisgarh	-0.219	-41.0	-5.9	-62.0	-57.3	-11.6
Goa	-0.072	-16.6	-2.3	-82.8	-81.6	-5.5
Gujarat	-0.101	-19.9	-3.0	-54.6	-51.7	-6.3
Haryana	-0.127	-26.2	-2.8	-69.8	-68.1	-5.9
Himachal Pradesh	-0.099	-23.5	-2.8	-76.7	-75.5	-5.0
Jammu & Kashmir*	-0.134	-28.2	-2.3	-70.9	-69.2	-4.9
Jharkhand	-0.223	-32.5	-9.1	-52.5	-43.6	-16.0
Karnataka	-0.168	-34.9	-3.8	-75.0	-72.6	-8.2
Kerala	-0.049	-12.5	-0.6	-94.2	-94.6	-1.5
Madhya Pradesh	-0.185	-31.1	-5.6	-51.7	-45.9	-10.5
Maharashtra	-0.117	-24.6	-2.4	-64.3	-62.3	-5.2
Manipur	-0.127	-27.2	-1.4	-61.4	-60.3	-3.0
Meghalaya	-0.177	-27.8	-7.1	-53.0	-46.0	-12.9
Mizoram	-0.093	-21.0	2.4	-66.9	-68.2	5.3
Nagaland	-0.177	-31.7	-5.3	-60.2	-55.7	-10.2
Odisha	-0.194	-34.2	-5.6	-58.8	-53.8	-10.7
Punjab	-0.084	-18.4	-1.3	-77.8	-76.7	-2.8
Rajasthan	-0.187	-32.2	-5.5	-57.2	-52.3	-10.3
Sikkim	-0.160	-33.8	-5.5	-90.9	-89.8	-11.8
Tamil Nadu	-0.135	-32.1	-1.8	-87.1	-86.8	-4.4
Tripura	-0.190	-37.8	-3.6	-71.7	-69.4	-7.4
Uttar Pradesh	-0.180	-31.1	-4.6	-50.0	-45.2	-8.8
Uttarakhand	-0.100	-21.0	-1.7	-55.9	-54.2	-3.8
West Bengal	-0.201	-35.9	-6.5	-67.5	-62.6	-12.5

* Value of Jammu & Kashmir includes J & K and Ladakh UT
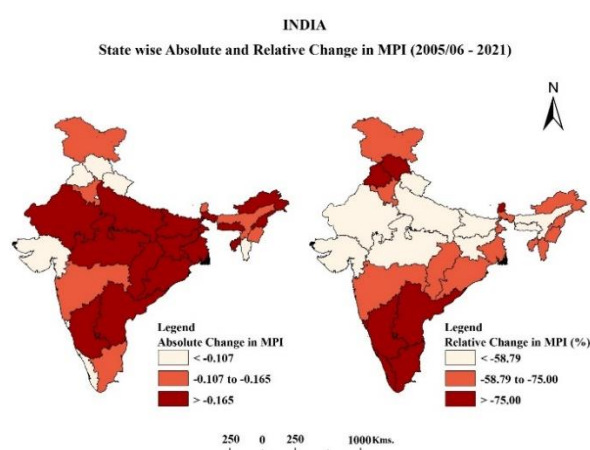*Source: Authors' own calculation*

Figure 6. Absolute and relative changes in MPI across Indian states from 2005-2006 to 2021 Source: Prepared by authors

However, the scenario is completely different if we consider the relative change in poverty reduction. A relative measure shows what percentage of change occurred in the present year compared to the previous year. Table 3 shows that from 2005–06 to 2021; Kerala was able to reduce its MPI by approximately 94.23 percent. In a similar vein, Sikkim has dramatically decreased its MPI during that time by 90.91 percent. Figure 6 shows that eight states have been able to reduce poverty by more than seventy-five percent. It should be noted that eight of the nine states with the lowest levels of per capita income in 2021, including Chhattisgarh, Odisha, Rajasthan, Meghalaya, Jharkhand, Madhya Pradesh, Assam, and Uttar Pradesh, have been able to reduce their starting MPI levels by more than 50 percent (Table 3). In terms of the relative change in multidimensional poverty, the majority of the southern states and some of the northern states in India are significantly ahead than the rest of the states of India. On the other hand, from 2005–2006 to 2021, the central and some eastern states of the nation lag behind in terms of relative poverty reduction.

Is this same result noticeable if we consider Headcount Ratio (H), instead of the MPI? To solve this dilemma here we have plotted state-level absolute changes of H in Y-axis and level of H in 2005-06 on X-axis (Fig. 7).
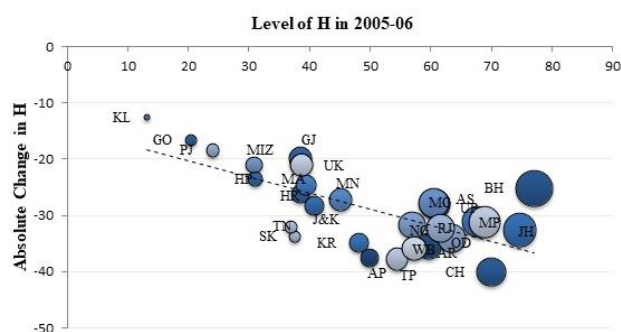

Figure 7. Changes in Headcount ratio (H) across Indian states between 2005-2006 and 2021, *Source: Prepared by authors*

After plotting, the true picture of poverty becomes more visible. Table 3 displays the type and pattern of India's absolute change in the number of people living in poverty, which decreased from 54.07 in 2005–2006 to 25.01 in 2021. Chhattisgarh (-40.09 percent), followed by Tripura and Andhra Pradesh, has experienced the highest absolute headcount ratio reduction (Table 3). In addition, states like West Bengal, Arunachal Pradesh, Karnataka, and Odisha have fair headcount reductions. In contrast, Kerala (-12.49 percent) has the lowest reduction in absolute headcount, followed by Goa and Punjab. Additionally, the rate of reduction is modest in states like Gujarat, Uttarakhand, Mizoram, Himachal Pradesh, Maharashtra, and Bihar (Fig. 7). While the highest relative change of H is found in Kerala (94.62 percent), then Sikkim, Tamil Nadu, and Goa (Table 3). Contrarily, Bihar (32.67 percent) has the lowest relative change in H reduction, followed by Jharkhand, Uttar Pradesh, and Madhya Pradesh (Table 3). Thus, the study shows that between 2005–2006 and 2021, the states with the highest levels of poverty performed worse in terms of the relative change of H reduction among the states of India.
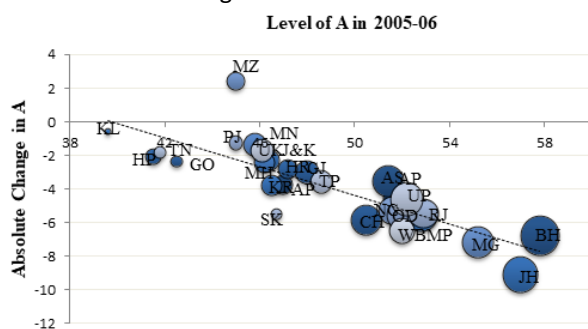

Figure 8. Changes in intensity of poverty (A) across Indian states between 2005-2006 and 2021 *Source: Prepared by authors*

Why are these two depictions of MPI and H changes so dissimilar? Which is the correct one? To answer this conundrum, we look at trends in poverty intensity (A), the overlapping deprivations among the poor, which is the second component of the MPI after H. Figure 8 displays the absolute change in poverty intensity (A), which has been plotted on the Y-axis against the baseline level of poverty intensity in 2005/06 on the X-axis.

According to Figure 8, the poorest states are experiencing a markedly faster decline in poverty intensity. Jharkhand, for example, leads all other Indian states in terms of reducing the intensity of poverty (A), followed by Meghalaya, Bihar, and then West Bengal in both absolute and relative terms (Table 3). On the other hand, Kerala has experienced the smallest reduction in the severity of poverty (Table 3), followed by Punjab, Manipur, and Uttarakhand (Fig. 8). It should be noted that the intensity of poverty in Mizoram has increased from 45 to 47 percent (Table 3), despite decreases in MPI and H from 2005-06 to 2021.

Indicator wise Deprivation of Multidimensional Poverty

Even though we looked at how multidimensional poverty changed in terms of its distribution across the states of India from 2005–2006 to 2021, we still need to understand how deprivations varied by indicator over these years to fully grasp the situation. As opposed to the headcount ratio, the MPI can be broken down into its component indicators, and hence there is a direct relationship between each indicator and the MPI. So how did the indicators of deprivation change among the poor in India? To answer this question, a comparison of each indicator's censored headcount ratio between 2005–2006 and 2021 was performed because the censored headcount ratio indicates the proportion of the population that is MPI poor and deprived for each indicator.
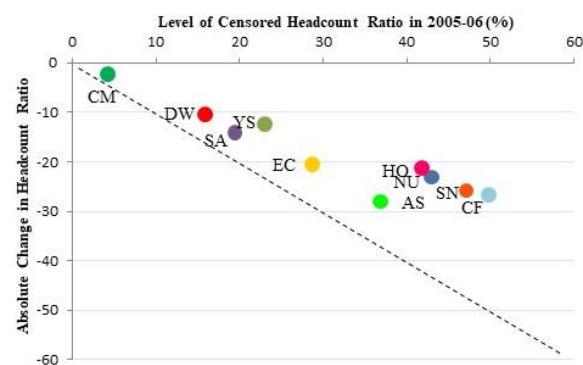

Figure 9. Change in censored headcount (CH) ratios of 10 indicators, *Source: Prepared by authors*

Figure 9 shows how each of the ten indicators has contributed to India's progress in reducing multidimensional poverty. Malnutrition is one of the indicators that are typically high in India, despite having

decreased by half between 2005–2006 and 2021. With at least one malnourished child or adult in the household in 2005–2006, 43 percent of India's population was multidimensionally poor (Table 4); however, by 2021, this proportion has dropped to 19.9 percent (Table 5).

Table 4. Censored Headcount Ratio by Indicator (in Percentage Points) in 2005-2006

Censored Headcount Ratio	Education		Standard of Living							
	Nutrition	Child & Adolescent Mortality	Years of Schooling	School Attendance	Cooking Fuel	Sanitation	Drinking Water	Electricity	Housing	Assets
INDIA	43.0	4.2	23.0	19.4	49.8	47.1	15.9	28.7	41.9	36.9
Andhra Pradesh	36.7	2.2	24.3	12.7	43.2	42.1	11.9	8.7	29.4	34.8
Arunachal Pradesh	39.0	6.1	31.1	31.0	54.0	44.6	16.0	20.9	55.9	47.1
Assam	45.9	4.6	24.8	15.4	55.8	47.2	22.1	51.0	55.6	43.4
Bihar	63.9	7.5	39.8	42.7	74.9	70.4	6.6	63.7	67.3	55.8
Chhattisgarh	51.9	5.5	29.5	19.8	62.1	60.9	29.1	23.8	58.0	41.5
Goa	14.9	0.4	5.8	5.9	15.6	14.5	9.7	2.3	12.6	11.9
Gujarat	30.0	2.8	15.0	11.0	32.7	32.1	11.7	8.8	23.7	27.0
Haryana	33.4	2.9	13.6	15.6	38.6	33.7	12.6	7.5	27.6	23.6
Himachal Pradesh	26.8	1.2	6.4	4.7	29.3	26.9	9.2	1.5	23.5	19.0
Jammu & Kashmir*	29.4	2.8	10.5	17.1	35.7	37.5	17.7	4.8	30.7	25.4
Jharkhand	57.3	7.0	32.9	33.9	70.0	67.6	46.5	55.0	59.8	50.9
Karnataka	38.6	2.2	14.6	15.3	42.1	41.3	17.5	8.4	32.0	32.1
Kerala	10.7	0.5	2.3	2.4	12.7	4.0	8.1	4.4	6.1	10.3
Madhya Pradesh	52.6	5.6	29.4	24.1	62.2	60.8	40.0	25.3	57.8	47.6
Maharashtra	33.1	1.9	10.6	10.9	34.0	35.2	10.1	13.7	29.6	26.8
Manipur	29.3	2.3	9.0	18.4	37.4	33.2	26.9	9.5	40.0	23.2
Meghalaya	41.8	3.8	31.8	38.0	58.9	44.3	32.4	27.3	46.2	51.6
Mizoram	23.5	2.4	8.7	11.1	24.1	13.0	8.7	6.1	29.2	27.9
Nagaland	39.7	4.8	23.1	31.4	54.6	36.8	28.6	17.5	54.3	46.8
Odisha	45.6	4.0	29.6	15.8	57.1	56.0	26.4	43.9	48.2	47.0
Punjab	16.5	1.4	11.9	10.2	20.2	19.5	1.1	2.5	16.1	10.9
Rajasthan	46.9	5.6	28.7	25.3	57.9	56.6	29.5	30.4	40.9	44.3
Sikkim	17.9	1.3	21.8	17.4	31.8	21.3	15.5	7.5	29.0	32.0
Tamil Nadu	26.6	0.8	13.8	3.9	32.7	33.7	11.1	8.2	18.8	26.6
Tripura	41.0	3.0	22.4	11.2	49.8	27.4	27.3	26.6	50.6	39.4
Uttar Pradesh	56.5	7.2	26.2	27.9	62.8	58.9	9.2	48.2	56.0	40.0
Uttarakhand	32.9	2.5	12.5	9.1	37.8	32.4	12.2	14.6	32.8	26.0
West Bengal	42.8	3.1	30.3	16.7	52.3	42.4	11.6	41.4	44.6	41.3

Source: Author's calculation based on Alkire et al. (2021)

In terms of health, the censored headcount ratio of child mortality has decreased from 4.18 percent to 1.88 percent in only 15 years during the same period. A notable improvement in education is also readily apparent: between 2005–2006 and 2021, the censored headcount ratios for years of schooling and school attendance have more than halved. Similarly, the censored headcount ratio of each indicator of standard of living has improved during this period. The proportion of people who are deprived of housing has decreased from 41.9 percent to 20.6 percent.

While deprivation in drinking water has reduced from 15.9 percent to 5.5 percent, the percentage of people using solid cooking fuel has lessened from 49.8 percent to 23.1 percent (Tables 4 and 5). Similarly, the sanitation sector's censored headcount ratio has dropped from 47.1 to 21.3 percent. The lack of access to electricity and asset ownership also more than halved between 2005–2006 and 2021.

Table 5. State wise Censored Headcount Ratio of MPI Indicators in 2021

Censored Headcount Ratio	Health			Education		Standard of Living						
	Nutrition	Child & Adolescent Mortality	Maternal Health	Years of Schooling	School Attendance	Cooking Fuel	Sanitation	Drinking Water	Electricity	Housing	Assets	Bank Account
INDIA	19.9	1.9	14.7	10.7	5.2	23.1	21.3	5.5	8.3	20.6	8.9	5.4
Andhra Pradesh	9.2	0.9	4.8	7.7	1.5	9.7	10.5	4.4	0.6	5.7	4.8	1.7
Arunachal Pradesh	13.8	1.2	14.9	13.5	5.9	21.3	16.7	6.2	7.2	23.3	12.9	9.2
Assam	25.5	2.2	17.8	14.3	5.6	31.6	24.4	8.3	14.7	31.4	13.9	10.5
Bihar	41.6	3.9	36.5	24.7	11.6	50.2	46.6	1.6	28.8	47.1	18.7	19.6
Chhattisgarh	24.0	2.3	17.0	10.9	4.3	29.1	26.6	10.2	2.8	26.8	10.4	3.4
Goa	3.0	0.2	1.4	2.2	0.6	2.1	2.8	0.3	0.0	1.8	0.9	0.8
Gujarat	15.4	1.1	8.7	6.7	4.8	17.3	15.5	4.7	2.9	11.4	8.2	4.4
Haryana	10.4	1.2	9.4	4.6	2.8	10.2	6.2	3.4	0.8	7.4	2.6	2.9
Himachal Pradesh	6.8	0.6	5.7	1.5	0.4	7.1	4.8	1.4	0.2	5.2	2.2	0.7
Jammu & Kashmir*	9.7	0.9	6.1	4.5	2.5	11.3	10.6	5.0	1.7	9.4	6.7	1.4
Jharkhand	34.4	2.7	26.5	16.5	7.2	41.3	39.4	17.5	13.6	35.9	15.5	6.6
Karnataka	10.1	0.7	5.4	5.5	2.4	11.6	11.0	3.5	1.0	9.4	5.0	3.4
Kerala	0.6	0.0	0.2	0.2	0.2	0.6	0.3	0.1	0.2	0.4	0.3	0.2
Madhya Pradesh	29.1	2.7	20.9	14.0	7.3	34.9	33.2	17.6	6.5	32.7	13.7	7.4
Maharashtra	12.4	0.8	7.1	4.3	3.0	12.5	12.5	5.3	3.1	10.1	6.7	3.8
Manipur	13.4	1.0	10.1	4.7	1.8	16.3	11.7	13.6	3.5	17.3	6.9	8.9
Meghalaya	23.8	2.1	22.5	16.7	5.3	31.8	18.6	13.7	6.4	23.3	19.4	12.9
Mizoram	6.2	0.6	6.0	5.5	2.3	8.7	5.7	2.8	3.0	7.6	6.7	2.7
Nagaland	17.2	1.4	18.3	11.3	3.7	24.0	8.7	6.9	2.5	24.0	16.7	15.8
Odisha	22.4	1.5	12.8	13.8	4.3	28.8	27.1	9.9	8.9	24.9	13.3	6.5
Punjab	4.4	0.5	3.1	3.4	1.4	4.2	3.0	0.3	0.2	3.3	0.6	1.0
Rajasthan	23.3	2.1	17.1	13.4	7.2	27.7	24.8	13.1	6.6	18.7	13.3	2.2
Sikkim	2.9	0.3	1.8	2.5	0.4	2.9	1.1	0.2	0.1	2.3	1.8	1.1
Tamil Nadu	3.6	0.3	1.7	2.3	0.5	3.6	4.5	1.2	0.4	2.6	1.4	1.5
Telangana	10.2	0.8	0.1	8.5	1.1	10.5	12.2	4.5	0.9	8.3	6.0	2.7
Tripura	12.0	0.9	7.8	8.1	1.7	15.5	11.1	7.3	4.3	16.2	9.4	2.2
Uttar Pradesh	30.5	3.8	25.3	15.1	10.0	34.3	31.8	2.4	18.4	33.4	8.9	3.3
Uttarakhand	14.7	1.6	13.1	6.7	3.2	15.8	11.2	3.2	1.4	12.4	6.2	3.2
West Bengal	16.2	1.0	9.4	11.3	2.8	20.8	16.9	4.4	3.7	18.8	8.7	7.1

*Source: National Multidimensional Poverty Index, 2021 Based on NFHS-4 (2015-16), NITI Aayog * Value of Jammu & Kashmir includes J & K and Ladakh UT*

In Figure 9, the Y-axis represents the change in the censored headcount ratio in absolute terms, and the 45-degree line represents the change necessary to achieve a 100 percent decrease in each indicator. Therefore, the distance between each indicator bubble and the 45-degree line represents the amount required to completely remove the deprivation. Additionally, it offers details on the relative decline of each indicator. The larger the relative reduction, the closer the bubble is to the line. For example, despite the small absolute change in child mortality, the relative rate of reduction has been enormous. Large deprivation is still present across several indicators, including housing, sanitation, cooking fuel, and nutrition, which call for special attention if India wants to end multidimensional poverty in near future.

Though India has made sensational improvements in reducing deprivation in each indicator of MPI, the question still arises: have all the states been equally successful in reducing multidimensional deprivation? A comparison of the state-by-state censored headcount ratios for each MPI indicator between 2005–2006 and 2021 is necessary to provide the answer (Fig. 10 and 11).

Among the states, Tripura, Karnataka, Chhattisgarh, and Andhra Pradesh have made outstanding strides in terms of the magnitude of the reduction in nutritional deprivation (Table 6). Arunachal Pradesh and Jharkhand have made significant progress in lowering child and adolescent mortality. In a similar vein, Table 6 shows that Sikkim, West Bengal, and Chhattisgarh have greater reductions in the deprivation of school years. In school attendance criteria, states like Meghalaya, Nagaland, and

Jharkhand have made notable progress. When it comes to cooking fuel, Tripura, Andhra Pradesh, and Chhattisgarh have been able to significantly reduce deprivation (Table 6). Similar improvements in sanitation have been countersigned by Chhattisgarh, Rajasthan, and Andhra Pradesh. Among the states, Jharkhand, Madhya Pradesh, and Nagaland have made a notable advancement in the degree of reduction in the lack of access to clean drinking water (Table 6). Deprivation from electricity has been reduced mostly in states like Jharkhand, West Bengal, Assam and Odisha. Table 6 also depicts that Tripura, Arunachal Pradesh and Chhattisgarh had larger reductions in housing. While magnitude of asset deprivation has reduced sharply in states like Bihar, Jharkhand and

Arunachal Pradesh (Table 6). Overall we can state that in between 2005-06 to 2021 among the states of India 5 states, namely Chhattisgarh, Jharkhand, Tripura, Bihar and Andhra Pradesh have made splendid progress in reducing deprivation in different indicators of multidimensional poverty.

Even though the indicator-wise reduction rate of the censored headcount ratio is discernible among the poorer states, the situation of extreme deprivation still exists in these states that require serious attention. Figure 10 and Figure 11 illustrate the scenario of state-by-state censored headcount ratios in various MPI indicators between 2005–2006 and 2021.
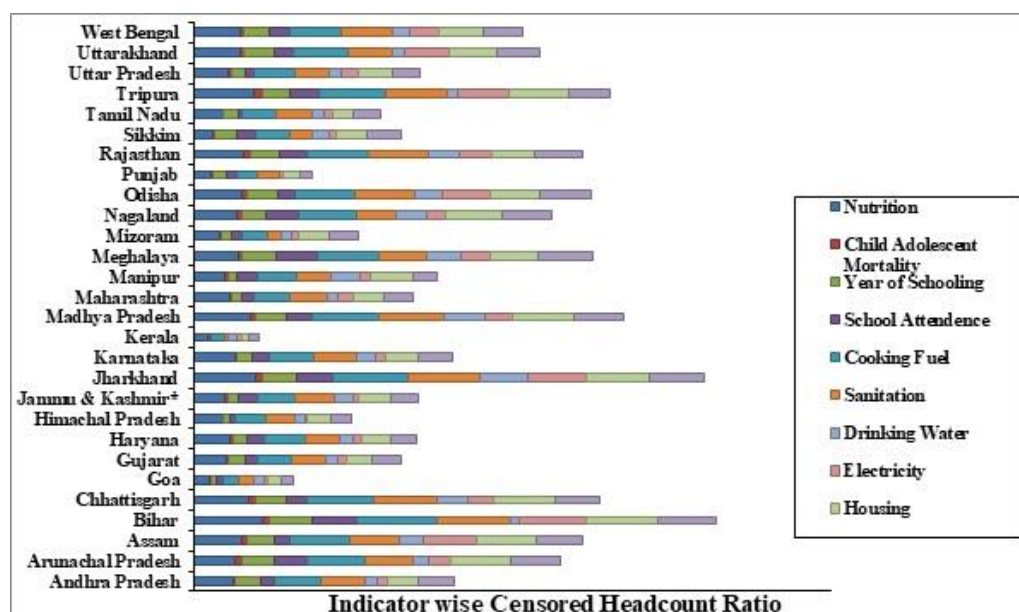

Figure 10. Indicator wise censored headcount ratio in states of India, 2005-2006, *Source: Prepared by authors*
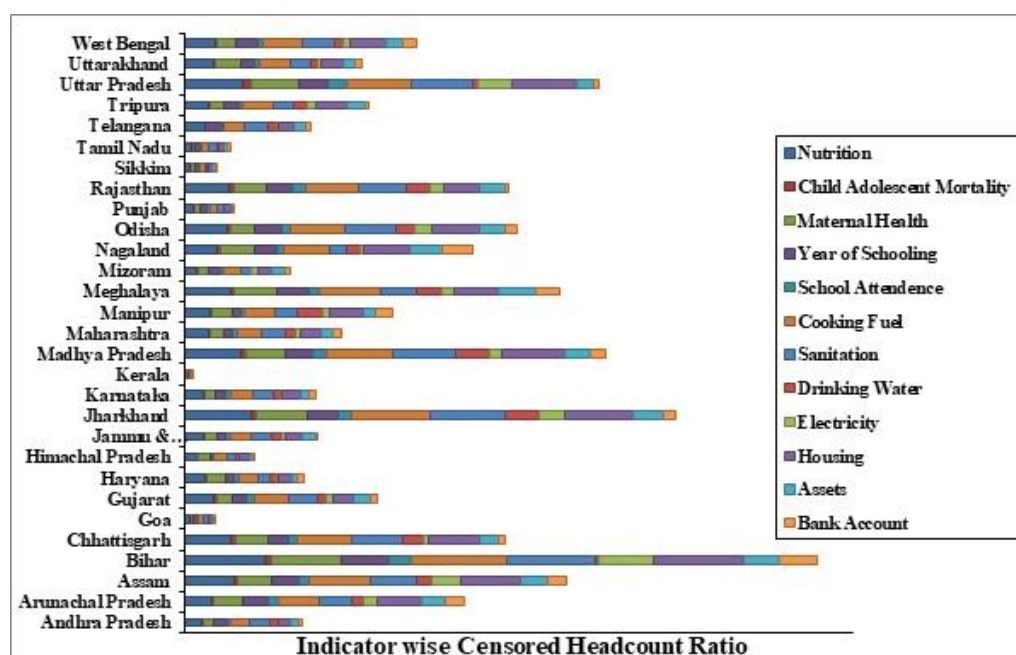

Figure 11. Indicator wise censored headcount ratio in states of India, 2021, *Source: Prepared by authors*

Table 6. Indicator Wise Reduction in Censored Headcount Ratio across the States of India from 2005-2006 to 2021

States	Nutri-tion	Child & Adolescent Mortality	Years of School-ing	School At-tendance	Cooking Fuel	Sani-tation	Drinking Water	Elec-tricity	Hous-ing	Assets
India	23.1	2.3	12.3	14.2	26.7	25.8	10.4	20.4	21.3	28.0
Andhra Pradesh	27.5	1.3	16.6	11.2	33.5	31.6	7.5	8.1	23.7	30.0
Arunachal Pradesh	25.2	4.9	17.6	25.1	32.7	27.9	9.8	13.7	32.6	34.2
Assam	20.4	2.4	10.5	9.8	24.2	22.8	13.8	36.3	24.2	29.5
Bihar	22.3	3.6	15.1	31.1	24.7	23.8	5	34.9	20.2	37.1
Chhattisgarh	27.9	3.2	18.6	15.5	33.0	34.3	18.9	21.0	31.2	31.1
Goa	11.9	0.2	3.6	5.3	13.5	11.7	9.4	2.3	10.8	11.0
Gujarat	14.6	1.7	8.3	6.2	15.4	16.6	7.0	5.9	12.3	18.8
Haryana	23.0	1.7	9.0	12.8	28.4	27.5	9.2	6.7	20.2	21.0
Himachal Pradesh	20.0	0.6	4.9	4.3	22.2	22.1	7.8	1.3	18.3	16.8
Jammu & Kashmir*	19.7	1.9	6.0	14.6	24.4	26.9	12.7	3.1	21.3	18.7
Jharkhand	22.9	4.3	16.4	26.7	28.7	28.2	29.0	41.4	23.9	35.4
Karnataka	28.5	1.5	9.1	12.9	30.5	30.3	14.0	7.4	22.6	27.1
Kerala	10.1	0.5	2.1	2.2	12.1	3.7	8.0	4.2	5.7	10.0
Madhya Pradesh	23.5	2.9	15.4	16.8	27.3	27.6	22.4	18.8	25.1	33.9
Maharashtra	20.7	1.1	6.3	7.9	21.5	22.7	4.8	10.6	19.5	20.1
Manipur	15.9	1.3	4.3	16.6	21.1	21.5	13.3	6.0	22.7	16.3
Meghalaya	18.0	1.7	15.1	32.7	27.1	25.7	18.7	20.9	22.9	32.2
Mizoram	17.3	1.8	3.2	8.8	15.4	7.3	5.93	3.1	21.6	21.2
Nagaland	22.5	3.4	11.8	27.7	30.6	28.1	21.7	15.0	30.3	30.1
Odisha	23.2	2.5	15.8	11.5	28.3	28.9	16.5	35.0	23.3	33.7
Punjab	12.1	0.9	8.5	8.8	16.0	16.5	0.8	2.3	12.8	10.3
Rajasthan	23.6	3.5	15.3	18.1	30.2	31.8	16.4	23.8	22.2	31.0
Sikkim	15.0	1.0	19.3	17.0	28.9	20.2	15.3	7.4	26.7	30.2
Tamil Nadu	23.0	0.5	11.5	3.4	29.1	29.2	9.9	7.8	16.2	25.2
Tripura	29.0	2.1	14.3	9.5	34.3	16.3	20.0	22.3	34.4	30.0
Uttar Pradesh	26.0	3.4	11.1	17.9	28.5	27.1	6.8	29.8	22.6	31.1
Uttarakhand	18.2	0.9	5.8	5.9	22.0	21.2	9.0	13.2	20.4	19.8
West Bengal	26.6	2.1	19.0	13.9	31.5	25.5	7.2	37.7	25.8	32.6

Source: Author's own calculation

Tables 4 and 5 portray that between 2005–2006 and 2021, the poorer states in India display acute deprivation in the majority of the indicators. Bihar has the worst situation of the states, with the highest deprivation in ten out of twelve indicators, including nutrition, child and adolescent mortality, maternal health, years of schooling, school attendance, cooking fuel, sanitation, electricity, housing, and bank account in 2021. Except for electricity, assets, and bank accounts, Jharkhand's level of deprivation is similarly severe to Bihar's in most MPI indicators (Table 5). Uttar Pradesh, the most populous state of India is also facing the problem of intense deprivation in most of the indicators except drinking water, assets and bank account. According to Table 5, Madhya Pradesh has the highest level of drinking water deprivation in 2021. In Madhya Pradesh, the magnitude of deprivation is also severe in indicators like child mortality, cooking fuel, and sanitation. Meghalaya and Assam are the two northeastern states where the situation is the worst (Fig. 11). Table 5 portrays that in 2021, among the states of northeast India, the highest deprivation in assets is observed in Meghalaya. The opposite scenario is observed in all the southern states like - Kerala, Karnataka, Andhra Pradesh, Tamil Nadu and Telangana (Fig. 11). The magnitude of deprivation in all the indicators in these states is far below the national average. Except for

Rajasthan, none of the western states' censored headcount ratios are particularly extreme (Table 5).

Therefore, it can be said that the poorer states of India (Bihar, Jharkhand, Uttar Pradesh, Madhya Pradesh, and Chhattisgarh) require special attention in order to overcome multidimensional poverty, despite the significant decrease in the censored headcount ratio even after seven decades of independence. In addition, indicator-based special assistance programs must be developed in the country's poorest states.

Decomposition of Multidimensional Poverty

All of the indicators are crucial to the final MPI value. However, it may be a significant task for researchers to determine which indicators are more important to the final MPI score during these two distinct time periods (2005–06 and 2021). The contribution of an indicator offers insight into the relative deprivation of a particular indicator based on the weight assigned to that indicator, which is crucial to understanding where interventions would lead to a decrease in the overall MPI. The contribution of a particular indicator to overall multidimensional poverty can be estimated with the help of decomposition analysis.

Table 7. Indicator wise contribution to MPI for 2005-2006 and 2021

Indicators	Contribution in % (2005-2006)	Contribution in % (2021)
Nutrition	25.89	28.14
Child-Adolescent Mortality	2.75	1.33
Maternal Health	-	10.40
Years of Schooling	14.22	15.14
School Attendance	12.04	7.39
Cooking Fuel	10.13	9.34
Sanitation	9.59	8.61
Drinking Water	3.38	2.23
Electricity	5.92	3.35
Housing	8.54	8.31
Assets	7.55	3.58
Bank Account	-	2.17

Source: Compiled by authors based on NITI Aayog Report on MPI, 2021

Table 7 shows that, between 2005 and 2006, undernutrition contributed the most (about 26 percent) to multidimensional poverty, followed by years of schooling (14.22 percent) and school attendance (12.04 percent). The least significant factors in multidimensional poverty were found to be unimproved access to water and electricity, at 3.38 percent and 5.92 percent, respectively. Similarly, in 2021, undernutrition (28.14 percent) has become the MPI indicator with the highest influence, followed by years of education (15.14 percent) and maternal health (10.40 percent). Child and adolescent mortality (1.33%) and bank account (2.17%), on the other hand, are the least important contributors to MPI in 2021. If we look at contribution in terms of dimensions, the highest contribution among the three domains in 2005 belonged to standard of living, while the highest contribution to MPI in 2021 came from the health dimension. This change may be the result of the addition of two new indicators, such as maternal health in the "health" dimension and banking access in the "standard of living" dimension. This type of addition leads to a change in the weights assigned to the indicators, as the overall weight of MPI is now distributed among twelve indicators. This lessens the significance of each of the seven indicators in terms of both the health and standard of living dimensions (Maiti & Mehrotra, 2022).

Conclusions

The present study has made a thorough comparative assessment of the pattern of multidimensional poverty across the states of India between two different periods, namely 2005–2006 and 2021. The major findings of our study are as follows:

Firstly, the study looked at the spatial distribution of multidimensional poverty in India throughout the aforementioned two time periods. It is found that, while India has made significant progress in lowering its MPI score from 0.279 in 2005–2006 to 0.118 in 2021, there are still significant interstate disparities in the country. The

spatial pattern indicates that, despite nearly seven decades of independence, extreme multidimensional poverty persists in several Indian states, including Bihar, Jharkhand, and others. Geographically, India's central and eastern regions continue to be the poorest.

Secondly, the paper also focuses on the state-level absolute and relative changes in the multidimensional poverty, headcount ratio, and intensity of poverty over the period of 2005–2006 to 2021. The study unveils that the poorer states are much ahead in reducing poverty than the better-off states of India which implied a pattern of pro-poor poverty reduction. According to the study, while most states were able to reduce MPI and headcount ratios during this period, the intensity of poverty remained relatively constant, requiring special attention from policymakers and practitioners.

Thirdly, the study investigates indicator-wise deprivation in 2005–06 and 2021, not only at the national level but also among the states. The analysis claims that during this period, most of India's states have succeeded in reducing the severity of deprivation in several indicators like nutritional security, educational opportunities, access to electricity, and housing facilities. The Indian government has implemented a number of development initiatives, including the Integrated Child Development Service, Rashtriya Swasthya Bima Yojana, Mission Indradhanush, Pradhan Mantri Swasthya Suraksha Yojana, Mid Day Meal Programme, Universalizing Education and Enacting the Right to Education for All (2009), Beti Bachao Beti Padhao, Swachh Bharat Mission, National Rural Drinking Water Program, etc., which have played a crucial role in reducing deprivation in MPI (Das et al. 2021). Although India has made outstanding progress in reducing deprivation in the censored headcount ratio for the majority of the indicators, the study discloses that significant deprivation is still present in indicators like nutrition, cooking fuel, sanitation, and housing, which calls for further research.

Fourthly, the current study investigates whether or not all the states have equally succeeded in lowering the deprivation of the multidimensionally poor. And it has been revealed that, compared to the other states, Chhattisgarh, Jharkhand, Tripura, Bihar, and Andhra Pradesh have made excellent progress in reducing deprivation in various indicators of multidimensional poverty between 2005–2006 and 2021. Nevertheless, the severity of poverty is particularly acute in India's poorer states (Bihar, Jharkhand, Uttar Pradesh, Madhya Pradesh, and Chhattisgarh).

Finally, the decomposition analysis of each MPI indicator sheds additional light on the study and demonstrates that undernutrition played a major role in multidimensional poverty in both 2005–06 and 2021. While, dimension-wise, the highest contribution among the three domains during 2005–06 belonged to standard of living, for 2021 the highest contribution is made by the health dimension to MPI.

Based on the above mentioned findings targeted interventions at the grassroots level in the deprived regions of our country should be introduced with special emphasis on several dimensions like health, education and standard of living to reduce poverty and inequality. This study, apart from contributing to the growing literature on poverty studies in the context of India, has identified the geographic dimension of multi-dimensional poverty over space and time. The study ensures that in addition to social and economic dimensions, policymakers should additionally incorporate spatial dimensions and spatial interventions into poverty eradication programs during plan formulation.

Funding

Author contribution

Conceptualization, methodology, writing – original draft – S.M.; Reviewing and Preparing Maps – S.K.; Reviewing and Editing – A.P.M. All authors have read and agreed to the published version of the manuscript.

Conflicts of interest

The authors declare no conflict of interest.

References

Alkire, S. & Foster, J. (2011). Counting and multidimensional poverty measurement. *Journal of Public Economics*, 95(7–8), 476–487. https://doi.org/10.1016/j.jpubeco.2010.11.006

Alkire, S. & Santos, M. E. (2010). Acute Multidimensional Poverty: A New Index for Developing Countries. *OPHI Working Paper* No. 38, University of Oxford

Alkire, S. & Santos, M. E. (2014). Measuring acute poverty in the developing World: robustness and scope of the multidimensional poverty index. *World Development*, 59, 251–274. https://doi.org/10.1016/j.worlddev.2014.01.026

Alkire, S. & Seth, S. (2015). Multidimensional poverty reduction in India between 1999 and 2006: Where and how? *World Development*, 72(C), 93–108, https://doi.org/10.1016/j.worlddev.2015.02.009

Alkire, S. & Foster, J. (2008). Counting and multidimensional poverty measures, *Oxford Poverty and Human Development Initiative (OPHI)* Working Paper 7, Oxford Department of International Development, University of Oxford. http://www.ophi.org.uk/wp-content/uploads/ophi-wp7.pdf

Alkire, S. & Seth, S. (2013). Selecting a targeting method to identify BPL households in India. *Social Indicators Research*, 112 (2), 417–446, https://doi.org/10.1007/s11205-013-0254-6

Alkire, S., Oldiges, C. & Kanagaratnam, U. (2018). Multidimensional Poverty Reduction in India 2005 /6 – 2015 /16: Still a Long Way to Go but the Poorest Are Catching Up. *Research in Progress Series* 54A, Oxford Poverty and Human Development Initiative, University of Oxford

Alkire, S., Oldiges, C. & Kanagaratnam, U. (2021). Examining multidimensional poverty reduction in India 2005/6–2015/16: Insights and oversights of the headcount ratio. *World Development*, https://doi.org/10.1016/j.worlddev.2021.105454

Alkire, S. & Seth, S. (2008). Measuring Multi-dimensional Poverty in India: A New Proposal, *OPHI Working Paper* No. 15, Available at http://ssrn.com/abstract=1815355orhttp://dx.doi.org/10.2139/ssrn.1815355

Atkinson, A. B. (2003). Multidimensional Deprivation: Contrasting Social Welfare and Counting Approaches. *Journal of Economic Inequality*, 1, 51–65. https://doi.org/10.1023/A:1023903525276

Atkinson, A. B. & Bourguignon, F. (1982). The comparison of multi-dimensioned distributions of economic status. *The Review of Economic Studies*, 49(2), 183–201, https://doi.org/10.2307/2297269

Bourguignon, F. & Chakravarty, S. R. (2003). The measurement of multidimensional poverty. The *Journal of Economic Inequality*, 1(1), 25–49, https://doi.org/10.1023/A:1023913831342

Calvo, C. (2008). Vulnerability to Multidimensional Poverty: Peru, 1998–2002. *World Development*, 36(6), 1011–1020. https://doi.org/10.1016/j.worlddev.2007.10.001

Chakravarty, S.R. & D'Ambrosio, C. (2006). The measurement of social exclusion. *Review of Income and Wealth*, 52(3), 377–398. https://doi.org/10.1111/j.1475-4991.2006.00195.x

Chaudhuri, B., Gulati, N., Banerjee, A., Roy, A., Halder, I., Karim, S. & Vertier, P. (2017). Multi-dimensional poverty index-a state level analysis of India. *Working Paper Brussels: European Commission*

Das, P., Paria, B. & Firdaush, S. (2021). Juxtaposing consumption poverty and multidimensional poverty: A study in Indian context. *Social Indicators Research*, 153(2), 469–501. https://link.springer.com/article/10.1007/s11205-020-02519-0

Das, S. K. & Barua, A. (1996). Regional inequalities, economic growth and liberalisation: A study of the Indian economy. *The Journal of Development Studies*, 32(3), 364–390. https://doi.org/10.1080/00220389608422420

Deaton, A. (1997). The analysis of household surveys: A micro econometric approach to development policy. *United States: John Hopkins University Press*

Dehury, B. & Mohanty, S. (2015). Regional Estimates of Multidimensional Poverty in India. *Economics*, 9(1), 1-

35. http://dx.doi.org/10.5018/economics-ejournal.ja.2015-36

Dev, M. S. (2010). Inclusive growth in India: Agriculture poverty and human development. *Oxford India Paperback*

Kumar, V., Kumar, S. & Sonu. (2015). Multi-dimensional poverty index (MPI): A state wise study of India in SAARC countries, *International Journal of Enhanced Research in Educational Development*. 3 (1), 14-21

Maiti, K. D. & Mehrotra, S. (2022). A Curious Case of the Millions of "Disappeared" Poor in India. Retrieved February 4, 2022, from https://www.impriindia.com/insights/poor-disappeared-millions/

Mishra, A. & Ray, R. (2013). Multi-dimensional deprivation in India during and after the reforms: Do the household expenditure and the family health surveys present consistent evidence? *Social Indicators Research*, 110(2), 791–818, https://doi.org/10.1007/s11205-011-9959-6

Mohanty, S. K. (2011). Multidimensional poverty and child survival in India. *PLOS One*, 6(10), https://doi.org/10.1371/journal.pone.0026857

Mohanty, S. K. & Vasishtha, G. (2021). Contextualizing multidimensional poverty in urban India. *Poverty & Public Policy*, 13(3), https://doi.org/10.1002/pop4.314

Mondal, S. & Mishra, A. P. (2021). Spatial interlinkages of poverty determinants and social space of poverty in Hooghly District of West Bengal: A geographical perspective. *Forum Geografic*, XX(2), 212-223. http://dx.doi.org/10.5775/fg.2021.063.d

Mondal, S., Kumar, S. & Mishra, A. P. (2023). Contextualizing spatiality of multidimensional poverty in rural and urban India: A geographical perspective. *Belgeo*, 1, https://doi.org/10.4000/belgeo.59421

Ohlan, R. (2013). Pattern of regional disparities in socio-economic development in India: District level analysis. *Social Indicators Research*, 114(3), 841–873, http://dx.doi.org/10.1007/s11205-012-0176-8

OPHI (2018). Multidimensional Poverty in Chhattisgarh: A Measure for Action. Retrieved from https://ophi.org.uk/wp-content/uploads/Chhattisgarh_2020_online_4vs.pdf

Sarkar, S. (2012). Multi-dimensional Poverty in India: Insights from NSSO data. *OPHI Working Paper*. Retrieved on 6th May, 2021 from

http://www.ophi.org.uk/wp-content/uploads/Sandip-Sarkar-Multi dimensional-Poverty-in-India.pdf.

Sen, A. (1976). Poverty: An ordinal approach to measurement. *Econometrica: Journal of the Econometric Society*, 44(2), 219–231, https://doi.org/1912718

Sen, A. K. (1980). Equality of What? In McMurrin, S (Ed.) The Tanner Lectures on Human Values, *University of Utah Press*, Salt Lake City, 197-220

Sen, A. (1993). Capability and Well-Being. In Nussbaum, M. and Sen, A. (Ed.) The Quality of Life. *Oxford: Clarendon Press*, 30-53

Tripathi, S. & Yenneti, K. (2020). Measurement of multidimensional poverty in India: A State-level analysis. *Indian Journal of Human Development*, 14(2), 257–274, https://doi.org/10.1177%2F0973703020944763

UNDP (2015). Human development report 2015: Work for human development. *United Nations Development Programme*. Retrieved February 3, 2021, from http://hdr.undp.org/sites/default/files/2015_human_development_report.pdf

UNDP (2019). The 2019 Global Multidimensional Poverty Index (MPI). Retrieved February 6, 2021, from http://hdr.undp.org/en/2019-MPI

Vasishtha, G. & Mohanty, S.K. (2021). Spatial Pattern of Multidimensional and Consumption Poverty in Districts of India. *Spatial Demography*, 9, 213-240, https://doi.org/10.1007/s40980-021-00089-4

Wagle, U.R. (2008). Multidimensional poverty: An alternative measurement approach for the United States? *Social Science Research*, 37(2), 559–580, https://doi.org/10.1016/j.ssresearch.2007.06.013

Walker, R. (2015). Multidimensional poverty. *GSDRC professional development* reading pack no. 22, Birmingham: University of Birmingham.

World Bank (2018). India development update India's growth story (English). *Washington, D.C. World Bank Group*. Retrieved, 17, May 2021 from http://documents.worldbank.org/curated/en/814101517840592525/Indiadevelopment-update-Indias-growth-story

Wratten, E. (1995). Conceptualizing urban poverty. *Environment and Urbanization*, 7(1), 11-38, https://doi.org/10.1177%2F095624789500700118