# Regional disparities in health outcome indicators : A study across Indian states

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# Regional Disparities in Health Outcome Indicators: A Study across Indian States

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**Abstract:** This paper focuses on the disparities that persist in India's health sector across different states. As health is an important ladder for economic development, the fall (increase) in inequality in terms of outcomes will demonstrate the convergence (divergence) among the states in terms of these basic health parameters. Following the conventional measures of regional inequality such as standard deviation and coefficient of variation, we investigate the spatial variations across the Indian states in terms of three basic health indicators viz**.** infant mortality rate (IMR), under five mortality rate (UMR) and maternal mortality rate (MMR). Using the data from the Sample Registration System (SRS), 2013, we have investigated the temporal variations of regional disparities of IMR for the period 1998 to 2012. Our study also investigates the regional variations in IMR by employing a multiple regression for the year 2012 where we found the explanatory variables viz., per capita state domestic product, female literacy and the physical health infrastructure as significant in determining health outcomes. We have also analyzed the state of UMR among Indian states in 1998-9 and 2005-6. This exercise also analyzed the changes in regional inequalities in terms of male-female child, social and religious groups between the above two time points for the health outcome indicators IMR and UMR, considered in the study. Applying the same methodology we have also studied the maternal mortality rate among the Indian states for the years 2001-03, 2004-05 and 2007-08.

**Keywords:** Health Outcome Indicators, Infant mortality rate, Under five mortality rate, maternal mortality rate Regional disparities

*JEL Classification:* I1, C1, C5

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## 1. Introduction

Health is fundamental to one of the main inputs for economic development namely human capital. Apart from financial, social and political capital, economic growth also depends on skilled and healthy individuals as labourers as well as consumers. There is a long tradition in the efficiency wage theory of development economics literature hypothesizing the positive association between better health (nutrition based) and economic productivity (Strauss and Thomas (1998)). Improved nutrition and reduced diseases, particularly in early childhood, leads to improved cognitive development, enhancing the learning ability of children as healthy children can gain more from schooling, having better school attendance, fewer days absent due to ill health. Enhanced learning through either of these mechanisms will add to human capital – an important determinant of economic growth. In the alternative approach to development economics, development is seen as an expansion of capability (Sen (1984)). This capability based approach sees capability as a set of "functionings" which include escaping morbidity and mortality at childhood. Considering this importance of health being so fundamental, both as an input and outcome of economic development, we investigate the regional imbalance in health status and see whether convergence is achieved, across the Indian states in terms of three basic health indicators viz**.** infant mortality rate (IMR) and under five mortality rate (UMR) and maternal mortality rate (MMR) using the data from the Sample Registration System(SRS), 2013, National hHealth Mission, 2013, and India Human Development Report 2011. For this investigation, we use the conventional measures of regional disparities such as standard deviation and coefficient of variation across the states and Union territories in the levels (natural logarithm) of health parameters mentioned above. As a result it will be possible to see whether lagging regions (states) in terms of health outcomes are catching up with leading regions (states) over time.

There are widespread evidences of income related health inequality in India which shows ill health burden is borne disproportionately by different population subgroups (William et al. (2008)). It is also observed that people with lower socio-economic status consistently experience

poor health outcomes (Macinko et al (2003)). Moreover, health outcomes are also related to geography, religion, caste, rural urban divide, gender, education etc. and health inequalities along these dimensions continue to persist in India. Health care issue has now become very important from poverty alleviation policy as a sizeable proportion of vulnerable section of people are forced to be poor due to unbearable private health expenditure and this high health expenditure has been one of the major causes of poverty in India. About 3.5% of the population fall the below the poverty line and 5% households suffer catastrophic health expenditure due to unaffordable health cost (Shahrawat and Rao (2011)). Again, health insurance coverage is very low in India, only 17% people have access to this facility (The Hindu, December 22, 2014). As a result, out of pocket expenditure at the household level has been continuously increasing. So state level investment are very important in determining provisioning of health services in particular, public health. Or (2000) pointed out the role of both medical and non-medical conditions in determining health outcomes in the context of industrialized countries. Therefore, apart from the regional disparities of health outcomes namely, infant mortality rate (IMR), under five mortality rate (UMR) and maternal mortality rate (MMR), the sources of regional variations in one of the outcome indicators namely IMR are also determined by running a multiple regression by considering a set of explanatory variables viz., state level per capita income, female literacy, health infrastructure and air quality measures for the year 2012.

Spatial variations are present across the Indian states in terms both input and output indicators of health performances. There are states like Kerala and Tamilnadu which perform very well in health indices in particular and human development index in general. On the other hand, states like Uttarpradesh (UP) and Bihar despite having similar distribution of social groups compared to the above high performing southern states perform very poorly on various health parameters. In fact, health outcome indicators of scheduled castes (SC) and other backward castes (OBCs) of Tamilnadu and Kerala are better compared to the health indicators of upper castes in Bihar and UP. Major reasons for these differences are these southern states' role in good governance and historical social movements. The health performances of north eastern states in general, and Nagaland in particular, are commendable despite having majority of scheduled tribes (ST) population. The states like Chhattisgarh, Jharkhand, Orissa and Madhyapradesh having high concentration of ST population perform very poorly on health parameters compared to the north eastern states. This is due to lack of proper development

initiatives addressing the health issues of STs living in remote forest areas of central and eastern India which has been properly taken care of by the north eastern states through community based health centres. However, poor performing states like Bihar, Jharkhand, Chahattisgarh are now taking various initiatives to move upwardly on their health performances. So it is an interesting research issue to see how health inequality across Indian states is declining over time indicating presence of regional convergence on health development performances. An important feature of Indian health sector is noteworthy in this regard, that in India, majority of health expenditure is borne through private expenditure as its share in GDP is 4.13% whereas public health expenditure as share of GDP is only 1.10% in 2008-09. In this study we investigate the variations across Indian states in terms of three basic health indicators viz. infant mortality rate (IMR), under five mortality rate (UMR) and maternal mortality rate (MMR) following the conventional measures of regional disparities such as standard deviation and coefficient of variation. Using the data from the Sample Registration System(SRS), 2013, we have investigated the temporal variations of regional disparities of IMR for the period 1998 to 2012. We have also analyzed the state of UMR among Indian states in 1998-9 and 2005-6, using data from the India Human Development Report 2011 and examined whether the regional inequality has fallen, which is highly desirable from the human development perspective. This exercise also analyzed the changes in regional inequalities in terms of male-female child, social and religious groups between two different time points namely 1998-99 and 2004-05considered. We have compared the health inequality in terms of MMR in the three years namely 2001-03, 2004-05 and 2007-08 across 18 major Indian states. This paper has been organized as follows. Section II deals with data and methodology. Section III discusses empirical observations. The summary and conclusions are presented in Section IV.

## 2. Data and Methodology

This paper has considered three basic health outcome indicators namely, infant mortality rate (IMR), under five mortality rate (UMR) and maternal mortality rate (MMR). State wise[2] IMR data are taken for the period 1998 to 2012 from the Sample Registration System (SRS) estimates,

[2] We have considered 28 states and 6 union territories for this analysis. However, depending on the availability of data we have taken less number of states/union territories for social and religious groups.

September 2013. All the data on UMR and MMR and social/religious group for IMR are obtained from the India Human Development Report, 2011, published by the Institute of Applied Manpower Research, Planning Commission, Government of India. These data are also considered gender wise. The IMR data for four social groups namely. Scheduled caste(SC), scheduled tribe(ST), other backward castes(OBC) and others are analyzed for two different years 1998-99 and 2005-06 across 18 states. In a similar way, the IMR data for two religious groups the Hindus and the Muslims are used for two years 1998-99 and 2005-06. All the above data and the subsequent data are collected from the India Human Development Report, 2011, published by the Institute of Applied Manpower Research, Planning Commission, Government of India. Apart from infant mortality rate, another outcome indicator which considers children health and nutritional status is under five mortality rate (UMR). We take this data for measuring health inequality at two different time points namely 1998-99 and 2005-06 for 24 different states gender wise. We have also compared health inequality measures both with reference to social groups as well as religious groups as discussed above. Health inequality measures in terms of maternal mortality rate (MMR) are compared in three time points namely 2001-03, 2004-06, 2007-09 for 18 states[3] . Heath outcomes are crucially dependent on input indicators such as number of primary health centres and number of doctors in those hospitals.[4] An important point to note is that apart from development of physical health infrastructure, nutrition, health awareness and sanitation play a key role in determining children and women health. So is the role of air quality or environmental variables (see, Or(2000). For this purpose we have run a regression with IMR as the dependent variable and female literacy, per capita state-wise income, three heath infrastructure variables, two environmental variables (measures of air quality) as the explanatory variables across 25 Indian states/UTs in the year 2012 as discussed later. The data on female literacy is obtained from the Census, 2011, Government of India. The per capita state-wise income is obtained from the Press Information Bureau, Government of India. The data on health infrastructure variables are collected from National Rural Health Statistics, 2012. Air quality data are taken from (data.gov.in).

[3] The MMR data for all north eastern states and union territories are unavailable for these years.
[4] National Rural Health Mission initiated in April 2005 is an important step in this regard.

It is expected that convergence would be achieved in health status across different regions within a country because of diminishing returns on health inputs such as health expenditure, efforts in education and economic development and also upper bounds in health outcomes (Gachter and Theurl (2011)). But there can also be the presence of 'Matthew effect' in health performances where increasing returns in performances can be observed if divergence is achieved. For the purpose of spatial variation investigation across the Indian states over time in health outcomes, we employ the conventional measures of regional disparities such as standard deviation and coefficient of variation. The trend of these regional disparities will also imply the status of convergence (sigma) across the Indian states. This kind of convergence/divergence analysis at the local level within a country has profound implications for policy decisions at the state and central level with reference to provision of basic public health services. We do not have a long time series data for the health outcome indicators, UMR and MMR, so we could get any trend of the regional disparities. For the purpose of calculating standard deviation and coefficient of variation of health indicators we consider those measures as follows:

$$CV_t = \frac{\sigma_t}{\mu_t}$$

where $\mu_t$ is the cross regional mean of the logarithm(natural) of the concerned health outcome/input and $\sigma_t$ is the standard deviation of cross regional health outcome/input at time t. $CV_t$ is the coefficient of variation of the logarithm of the concerned health outcome/input at time t. We compare these measures of regional health inequality at different time points for the concerned health variable and declining values of these measures indicate lowering of regional disparities in these outcome indicators. We also conduct two linear regressions of standard deviation and coefficient of variation for IMR for the period 1998 to 2012 on time trend applying ordinary least squares method (OLS) as the continuous data are available only for this series.

$$\sigma_t = a_1 + b_1 t + \varepsilon_{1t} \quad (1)$$

$$CV_t = a_2 + b_2 t + \varepsilon_{2t} \quad (2)$$

The significant negative slope coefficient will indicate declining trend of regional disparities in health outcome namely, IMR. This also implies presence of sigma convergence in this series. However, as already pointed out we have compared these regional dispersion measures at two or

three time points depending on the availability of data, for this health outcome indicator and the other namely, UMR over all possible social groups and genders. We have also examined whether gaps like male-female, inter caste, inter religion are falling for all indicators namely IMR, UMR, MMR data over time. Alternatively, if these convergence measures indicate rising trend then there will exist 'Matthew effect' in the concerned health status.

There are two types of determinants of health outcomes namely, medical and non-medical. Medical determinants are mainly health related infrastructure such as adequate number of doctors and medical centres along with trained staff. On the other hand, non-medical determinants may be socio-economic and environmental. In this context we take into account these explanatory in order to find out spatial differences in health outcomes across the Indian states. We now run a multiple regression in order to understand the factors behind spatial variations in infant mortality rate for the year 2012. For this we have considered a cross section regression given in equation (3) below with infant mortality rate as the dependent variable and three independent variables for which data are available.

$$Y_i = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + \delta_1 Z_{1i} + \delta_2 Z_{2i} + \delta_3 Z_{3i} + \gamma_1 E_{1i} + \gamma_2 E_{2i} + \varepsilon_i, \; i = 1,2,...,n, \qquad (3)$$

where $Y_i$ is the infant mortality rate for the state *i in* 2012, $X_{1i}$ and $X_{2i}$ are female literacy (in percentage) and per capita state level income, respectively, in the *i*th state, and *n* (=25)[5] is the number of states for this study. $Z_{1i}$ is the health infrastructure variable 1 denoting the percentage shortfall in the required number of primary health centres in the ith state as on March 2012. $Z_{2i}$ is the health infrastructure variable 2 denoting the percentage shortfall in the required number of sub-centres in the ith state as on March 2012. $Z_{3i}$ is the health infrastructure 3 variable denoting the percentage shortfall in the required number of doctors in primary health centres in the ith state as on March 2012. The environmental variables (measuring average state-level air quality) $E_{1i}$ and $E_{2i}$ denote the annual average concentration of the major air pollutants sulphur dioxide ($SO_2$ ,($\mu g/m^3$)) and nitrogen dioxide ($NO_2$ ($\mu g/m^3$)), respectively, in the ith state for the year 2012. The error term $\varepsilon_i$ is assumed to follow the standard assumptions of the classical linear regression. However, we have used the heteroscedasticity (consistent) covariance matrix

[5] States and UTs are Andhra Pradesh, Assam, Bihar, Delhi, Goa, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Mizoram, Nagaland, Orissa, Puducherry, Punjab, Rajasthan, Tamil Nadu, Uttrakhand, Uttar Pradesh, West Bengal

estimator of White (1980) to compute the standard errors of the estimates involved as the usual OLS standard error formula is not appropriate here. All the regression results have been run by using Eviews 7.

## 3. Empirical Findings

The India Human Development Report 2011 shows that among the three component indices of human development index (HDI), health index has increased only at 18% between 1999-2000 to 2007-08 whereas the percentage increase for income index and education index are 21% and 28.5% during the same period. This report also shows that the states with lower base values of health index (UP, Orissa, Assam etc.) increase at a higher rate compared to the states with higher base values like (Himachalpradesh, Kerala, Punjab etc.) indicating convergence. As already mentioned, we study in this paper the regional health inequality consisting of three basic health outcome indicators namely IMR, UMR and MMR. We have reported latest health profile of different states in Table 1. In describing health profile we have considered health outcome indicators namely, IMR and MMR, social infrastructure female literacy which is very important in lowering these outcomes. In addition, the health infrastructure determines whether there is any shortfall of primary health centre and number of doctors. These health profile data are taken from the National Health Mission, Government of India. The infant mortality rate in 2013 in India is 40 where state wise spatial variation is widespread. Many big states like UP, MP, Rajasthan, Bihar, Odisha, Chattisgarh and Assam have higher IMR compared to the national average. The same remark can also be made for MMR. These states which have poor health outcome indicators in terms of the national average also lack in social infrastructure i.e., female literacy and also in health infrastructure. For instance, the lowest female literacy rate is in Rajasthan which is 52.66% as per the 2011 Census. The shortfall both in terms of the primary health centres and number of doctors is the highest in UP.

In order to understand the health changing status of the Indian states we have first compared the health inequality measures (i.e., s.d. and c.v.) of the health index at two time points 2000 and 2008. We find that both the values of s.d. and c.v. have fallen from 2000 to 2008. While the value of s.d has fallen from 0.125 to 0.110, the corresponding values for c.v. are 0.246 to 0.189.

The skewness value falls from 0.241 to -0.006 which shows distribution becomes less skewed from 2000 to 2008 indicating lower regional disparity in health indicators taken together. This result clearly indicates presence of convergence in the overall health situation across the Indian states. However, in order to investigate this convergence issue more comprehensively it is necessary to look into the convergence of components of this health index along with other relevant health indicators not directly included in the health index for example, maternal mortality rate and under five child mortality rate which have strong association with nutritional status of mother and child.

Infant mortality rate is the most important and widely used health outcome indicator and this is a component of human development index by the United Nation Development Programme (UNDP) since 1990. As already mentioned in the previous section, the infant mortality rate has been taken for the period 1998 to 2012 to understand the regional disparity in health outcome. We have presented the graphics of regional variation by the measures of standard deviation and coefficient variation in figures 1 and 2 below. We find from figures 1 and 2 that s.d. and c.v. rose initially for some years then fell and remaining more or less the same for quite last couple of years. We have reported our dispersion-trend linear regression results on health disparity measures in Table 2. We find from this table that the regression coefficient of time trend on s.d. is negative and statistically significant at 1% level with the t statistic value being 30.350 implying declining regional disparity with respect to infant mortality rate over time. This is also an evidence of sigma convergence of health outcome indicator, IMR across the 35 Indian States and Union Territories over the period 1998 to 2012. However, when we regress time trend on c.v., we do not get any statistically significant result. We now report the regional disparity results in Table 3 with reference to social groups based on castes and religious groups for infant mortality rates in 1998-99 and 2005-6. As far as the social groups are concerned, the values of standard deviation and coefficient of variation have risen for all groups except others (general caste) in 2005-6 compared to 1998-99. The religious group results show that although regional inequality has risen for the Hindus in terms of both the measures, the inequality measures have fallen for the Muslims indicating sigma convergence for the latter religious group. However, state-wise inequality is higher for the Muslims compared to the Hindus in both the years and this is true with both the measures.

Another crucial health outcome parameter is under five child mortality rate which takes care of child nutrition issue and its association with health. We have reported these results in Table 4. The values of inequality measures such as standard deviation and coefficient of variation are given for the years 1998-99, 2005-6 and 2008. The s.d values for these years for general castes (persons) are 0.614,0402 and 0.459 implying that although the value is lower in 2008 compared to 1998-99, but no declining trend is present. The same observation can be drawn with the values of coefficient of variation. The gender specific inequality measures however, show rising values over time for both the measures. The inequality measures with reference to four social groups namely, SC, ST, OBC and Others (general) are reported for 1998-99 and 2005-6. Although spatial variation have fallen for other groups during this period, the same is not true general castes. As already mentioned, we have also analyzed health inequality status with reference to under five mortality rate for two religious groups the Hindus and Muslims. We find substantial rise in inequality for the Hindus and marginal rise for the Muslims during this period.

The maternal mortality rate for the years 2001-3, 2004-6 and 2007-9 have been obtained for examining convergence status of this health outcome indicator of the 15 major states. The values of standard deviation (s.d.) for the above three years are 0.530. 0.530 and 0.501. The corresponding coefficient of variation (c.v.) values are 0.096, 0.098 and 0.095. This result indicates that the evidence of sigma convergence for the health outcome indicator MMR is not very conclusive with this data. Regional health inequality with reference to MMR has remained the same or rose marginally in the last decade.

The cross section regression results involving determinants of regional variation in infant mortality rate for the year 2012 are presented in Table 5. We have reported only the significant determinants. The results show that female literacy, shortfall of doctors (in percentages) in PMHcs and per capita state-wise income are statistically significant in explaining variation in infant mortality rate across the 25 states /UTs. The coefficient involving female literacy rate is negative implying higher is the female literacy rate, lower is the infant mortality rate. We also find from the regression that higher state level per capita income leads to decline in infant mortality level in the state. As expected, the shortfall in doctors' presence in the health centre has a positive impact on infant mortality rate. We have not found any statistical significance impact of other infrastructural variables and environmental factors in explaining regional disparities in health outcome. The adjusted $R^2$ value being 0.633 is moderately high for this regression. As

already pointed out in the previous section, we have taken care of heteroscedasticity by using White's variance-covariance consistent estimates.

## 4. Conclusions

This study aims at investigating the changes in regional health inequality status in terms of important health outcome indicators *viz*., infant mortality rate, under five mortality rate and maternal mortality rate across the Indian states by using the conventional measures such as standard deviation and coefficient of variation over the last fifteen years. Our study also considers these inequality measures for different gender, social groups and religious groups. Although we have found a fall in regional inequality in terms of state-wise dispersion of health index, the same conclusion cannot be drawn for the constituent health outcome indicators. Regional Health inequality in terms of both infant mortality and under five child mortality although has fallen in recent times compared to late 1990's but again, is showing some increasing dispersion. We also studied the regional disparities of infant mortality rate for the period 1998 to 2012 across the 34 states and Union territories and found declining trend of cross dispersion measures by linear trend regression. Both the medical and non-medical conditions are found to be significant in determining spatial differences in health outcomes. Among the medical factors, health infrastructure in terms of doctors' availability in primary health centres has an important role in reducing this social evil, infant mortality rate, thereby lead to achieve better health outcomes. Our cross section regression results clearly demonstrate the significant role of socio-economic variables such as female literacy and per capita state-wise income. However, we could not find any impact of air quality indicators in determining health outcome, infant mortality in this analysis. In order to achieve regional convergence decisively in major health outcome indicators across the Indian states policies should be oriented towards universal achievement of basic education for women and enhancing nutritional attainment of mother and child in the northern and central parts of the country. This study clearly demonstrates that regional disparities in major health outcomes in India are crucially dependent on social and economic inequalities across the states and the public policies must emphasize on reducing inequalities of at source.

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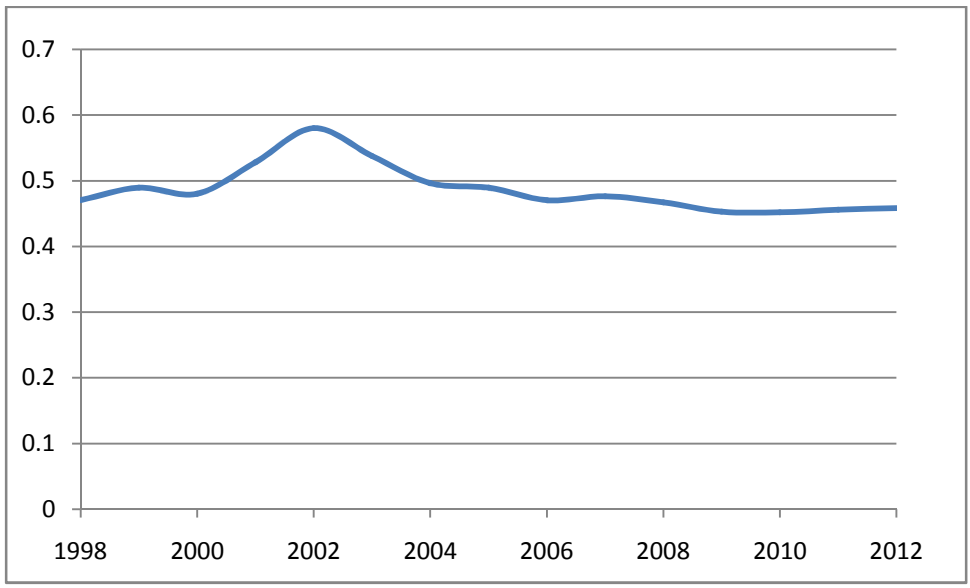
Figure I : IMR Dispersion based on standard deviation (1998- 2012)




Data source: SRS, Registrar General of India, 2013

Figure II: IMR Dispersion based on coefficient of variation (1998-2012)

Table 1: Health Profile of Indian States

| State/UT | Health Outcomes | | Social Infrastructure | Health Infrastructure (2012) | | | |
|---|---|---|---|---|---|---|---|
| | IMR(2013) | MMR(2010-12) | Female Literacy(2011) | No. of PMHc | Shortfall | Doctors at PMHc | Shortfall |
| All India | 40 | 178 | 65.46 | | | | |
| Andhra | 39 | 110 | 59.74 | 1624 | 380 | 3448 | No |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pradesh | | | | | | | |
| A & N Islands | 24 | NA | 81.84 | 1624 | 331 | 2348 | No |
| Arunachal Pradesh | 32 | NA | 59.57 | 97 | No | 92 | 5 |
| Assam | 54 | 328 | 67.27 | 975 | No | 1478 | No |
| Bihar | 42 | 219 | 53.33 | 1863 | 1220 | 3532 | No |
| Chhattishgarh | 46 | 269 | 60.59 | 755 | 21 | 435 | 302 |
| Goa | 9 | NA | 81.84 | 19 | NA | 41 | NA |
| Gujarat | 36 | 122 | 70.73 | 1158 | 275 | 778 | 380 |
| Haryana | 41 | 146 | 66.77 | 447 | 210 | 342 | 105 |
| Himachal P. | 35 | NA | 76.70 | 472 | No | 436 | 36 |
| J &K | 37 | NA | - | 396 | 60 | 845 | No |
| Jharkhand | 37 | 219 | 56.21 | 330 | 634 | 407 | No |
| Karnataka | 31 | 144 | 68.13 | 2310 | No | 2089 | 221 |
| Kerala | 12 | 66 | 91.98 | 809 | No | 1152 | No |
| Madhya P. | 54 | 220 | 60.02 | 1156 | 821 | 814 | 342 |
| Maharashtra | 24 | 87 | 75.48 | 1811 | 378 | 2947 | No |
| Manipur | 10 | NA | 73.17 | 80 | 14 | 170 | No |
| Meghalaya | 47 | NA | 73.78 | 109 | 9 | 104 | 5 |
| Mizoram | 35 | NA | 89.4 | 57 | No | 49 | 8 |
| Nagaland | 18 | NA | 76.69 | 126 | No | 99 | 27 |
| Odisha | 51 | 235 | 64.36 | 1226 | 82 | 1069 | 157 |
| Pudducherry | 17 | NA | 81.22 | 24 | 0 | 37 | No |
| Punjab | 26 | 155 | 71.34 | 449 | 128 | 457 | No |
| Rajasthan | 47 | 255 | 52.66 | 1528 | 798 | 1755 | No |
| Sikkim | 22 | NA | 76.43 | 24 | 0 | 32 | No |
| Tamilnadu | 21 | 90 | 73.86 | 1227 | 27 | 2271 | No |
| Telengana | 39 | 92 | NA | NA | NA | NA | NA |
| Tripura | 26 | NA | 83.16 | 79 | 56 | 119 | No |
| UP | 50 | 392 | 59.26 | 3692 | 1480 | 2861 | 831 |
| Uttarakhand | 32 | 292 | 70.7 | 257 | 94 | 205 | 52 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| West Bengal | 31 | 117 | 71.16 | 909 | 1257 | 1006 | 0 |

Source: National Health Mission

Table 2: Regression results on time trend based on standard deviation

| Dependent Variable: s.d. | | | | |
|---|---|---|---|---|
| Variable | Coefficient | Standard error | t-statistic | *p*-value |
| Constant | 0.22 | 0.017 | 30.350 | 0.000 |
| time | -0.004 | 0.002 | -2.298 | 0.005 |
| Adj R-squared | 0.234 | | | |

Table 3: Dispersion results on infant mortality rate across Indian states

| Group | Standard deviation(s.d.) | | | Coefficient of variation (c.v.) | | |
|---|---|---|---|---|---|---|
| Gender | 2000 | 2009 | 2013 | 2000 | 2009 | 2013 |
| Males | 0.565 | 0.509 | | 0.149 | 0.144 | |
| Females | 0.558 | 0.434 | | 0.147 | 0.119 | |
| Persons | 0.533 | 0.452 | 0.455 | 0.140 | 0.126 | 0.135 |
| Social group | 1998-99 | 2005-6 | | 1998-99 | 2005-6 | |
| SC | 0.315 | 0.319 | | 0.074 | 0.078 | |
| ST | 0.199 | 0.291 | | 0.045 | 0.068 | |
| OBC | 0.457 | 0.478 | | 0.110 | 0.122 | |
| Others | 0.361 | 0.354 | | 0.091 | 0.092 | |
| Religious group | 1998-99 | 2005-6 | | 1998-99 | 2005-6 | |
| Hindu | 0.363 | 0.408 | | 0.088 | 0.103 | |
| Muslim | 0.448 | 0.421 | | 0.116 | 0.109 | |

Table 4: Dispersion results on under five mortality rate across Indian states

| Group | Standard deviation(s.d.) | | | Coefficient of variation (c.v.) | | |
|---|---|---|---|---|---|---|
| Gender | 1998-99 | 2005-6 | 2008 | 1998-99 | 2005-6 | 2008 |
| Males | 0.341 | 0.371 | 0.476 | 0.078 | 0.088 | 0.121 |
| Females | 0.420 | 0.437 | 0.468 | 0.097 | 0.106 | 0.115 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Persons | 0.614 | 0.402 | 0.459 | 0.139 | 0.099 | 0.114 |
| Social group | 1998-99 | 2005-6 | | 1998-99 | 2005-6 | |
| SC | 0.377 | 0.357 | | 0.082 | 0.081 | |
| ST | 0.295 | 0.262 | | 0.061 | 0.057 | |
| OBC | 0.317 | 0.311 | | 0.071 | 0.074 | |
| Others | 0.293 | 0.327 | | 0.068 | 0.079 | |
| Religious group | 1998-99 | 2005-6 | | 1998-99 | 2005-6 | |
| Hindu | 0.316 | 0.510 | | 0.293 | 0.317 | |
| Muslim | 0.07 | 0.074 | | 0.068 | 0.079 | |

Table 5 : Cross section regression results

| Dependent Variable: $Y_i$ | | | | |
|---|---|---|---|---|
| Variable | Coefficient | Std.error | t-statistic | *p*-value |
| $\alpha$ | 86.787 | 11.508 | 7.542 | 0.000 |
| $X_{1i}$ | -0.627 | 0.195 | -3.217 | 0.004 |
| $X_{2i}$ | -0.0001 | 6.25E-05 | -2.007 | 0.058 |
| $Z_{3i}$ | 0.228 | 0.117 | 1.950 | 0.065 |

*Note: The Adj. $R^2$ value is 0.633. Total number of observations is 25. We use White heteroskedasticity-consistent standard errors & covariance.*