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Health Status Inequalities In North-Eastern States Of India: An Analytical Study By Considering Selected Indicators

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Abstract: *The 15th Finance Commission Report (2020) suggests that India has underperformed in terms of controlling maternal and child mortality and fertility rate. The* ***objective*** *of this paper is to examining health status of North Eastern states of India which comprises of 45.77 million populations (Census, 2011). Among the various indicators as declared by World Health Organization, we have considered three health indicators named infant mortality rate, neonatal mortality rate and under five (5) mortality rate over the period of seven years from 2005-16 to 2020-21.* ***Methodology****: the present study is based on secondary data published by various reports of National Family Health Survey and yearly report of National Health Profile. Tabular presentation and multiple bar diagram are used to explain the health status of the states. Lorenz curve and Gini coefficient are used in measuring the inequality in distribution of health positions.* ***Findings****: It is observed that except Assam and Meghalaya all other states of the region are able to reach below the national level in controlling infant and neonatal mortality. The hilly states like Sikkim, Manipur, Mizoram and Nagaland has achieved better positions in controlling all the three mortality rates over the year. On the other hand the distribution of health facilities are more heterogeneous among states that has shown by the moderate Gini value (0.426) and deviations of Lorenz curve from the line of equality. It has been observed that though the health status indicators are poor in Assam, Meghalaya and Tripura but all of them are able to improve their positions.*

Key words*: health indicators, Lorenz curve, infant mortality, under five mortality, neonatal mortality*

INTRODUCTION

Any form of morbidity becomes a burden for the family at first and the nation as a whole. Poor health, low level of efficiency and less working hour resulted low income level that aggravated poverty and other social issues. Poor health not only brings us misery in life but also throws us in the cobweb of poverty. In any case, health plays an obvious role in determining physical capacities (e.g. strength, stamina, and endurance) and mental capacities (e.g. cognitive functioning, reasoning ability, intelligence). Health is therefore an important form of human capital, the improvement of which should enhance workers´ productivity (Husain 2009). The dynamic interplay of social and environmental factors has profound and multifaceted implications on health (Kamalapur et al. 2013).

Health is a State subject, and about 70% of public expenditure on health is incurred by States, with 30% spent by the Centre (Venkateswaran, 2022). The health infrastructure facilities across states are heterogeneous and their achievements in different indicators are different. The 15th Finance Commission Report (2020) suggests that India has underperformed in terms of controlling maternal and child mortality and fertility rate. The availability of health services is uneven across states because of difference in infrastructure, human resources, supplies and distribution. (Baru et al. 2010).

Health sector is a composition of both physical and human capital like adequate number of well qualified doctors, nurses, midwives, laboratory staffs and sufficient number of hospitals, medical colleges, laboratories, hospital beds etc. and ground level involvement of health workers motivation and performance. Better health status is the outcomes of proper cooperation and coordination of all those elements.

Table 1: Socio-Economic Indicators of N-E States
(Amount in rupees, population living below poverty line in percentage (2019-21)

State	Geographical Area (sq.km)	Population	People living below poverty line (2019-21)	Per capita NSDP (2020-21)
Arunachal Pradesh	83743	1383727	13.76	192360
Assam	78438	31205576	19.35	86857
Manipur	22327	2855794	8.10	87832
Meghalaya	22429	2966889	27.76	84638
Mizoram	22081	1097206	5.30	144394
Nagaland	16579	1978502	15.43	123385
Tripura	10468	3673917	13.11	119789
Sikkim	7098	610577	2.60	412754

Source: Economic Survey 2022-23, Statistical Appendix, Census report, 2011

In our study we are straightly examined the health status that has gained by these states from the last few years (2015-2020) by considering three health indicators as declared by WHO and part of the Sustainable Development Goals (SDGs), set in 2015 by the UN General Assembly i.e. Infant Mortality Rate (IMR), Under 5 Mortality rate (U5MR) and Neonatal Mortality Rate (NMR). Our study area has covered the North Eastern states of India spread over an area of 2, 62, 179 sq. km. occupying 7.98 percent of the country's total geographical area and providing shelter to 45.77 million population (Census, 2011). It has eight states, viz., Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, and Sikkim.

Objectives of the Study

The present study has focused on the following objectives firstly to analyse the health status among the North Eastern states in terms of Infant Mortality Rate, Under 5 Mortality rate and Neonatal Mortality Rate. Secondly, examine the nature of distribution of health care facilities across the states.

METHODOLOGY OF THE STUDY

Data source

The present study is based on the secondary data published by the government agencies and published research reports. Health status related information are collected from the various round of report published by the National Family Health Survey, yearly publications of National Health Profile by the government of India, WHO report.

Tools and Techniques

The present analysis is performed by using descriptive statistical methods. Tabulation and graphical presentation has been used to do comparative analysis among the states. The Lorenz curve and Gini coefficient are calculated to measure the relative degree of inequality. The Lorenz curve represents cumulative income share as a function of the cumulative population share (Shkolnikov et al. 2003). Gini coefficient is the most common statistical index of diversity or inequality in social sciences (Kendall and Stuart, 1969, Allison, 1978). In some studies, Gini coefficient has been used to measure variability in levels of mortality among socio-economic groups (Leclerc et al. 1990). Gini coefficient can also be used as a measure of inequality in length of life (or as a degree of inter-individual variability in age at death) (Shkolnikov et al. 2003). Gini coefficient to measure the relative degree of inequality that has been obtained by calculating the ratio of the area between the diagonal and the Lorenz curve divided by the total area of the half-square in which the curve lies (Todoro et al. 2019). Available literature has shown that both the measures can be used to measure inequalities among states in achieving the health status indicators over the period of time.

Selection of Indicators

In most of the studies health status has been measured by using the parameters recommended by World Health Organization (WHO) to assess the performance. These included Infant Mortality Rate (IMR), Under 5 Mortality Rate (U5MR), Neonatal Mortality Rate (NMR), Maternal Mortality Rate (MMR), Deaths due to HIV, Deaths Due to TB and Deaths due Malaria (Singha et al. 2019). It was also found

that WHO also uses a list of 47 diseases under the classification of communicable and non-communicable. Thus health status is a composition of various indicators. Among the several indicators, we are considering three mortality indicators; Infant Mortality Rate (IMR), Under 5 Mortality Rate (U5MR) and Neonatal Mortality Rate (NMR) across states of India. It is well known that reduction in mortality and morbidity is partly due to preventive and curative intervention of health services has been able to depict the availability as well as accessibility of health services across states.

Conceptual framework

The present analysis has used several concepts related with mortality. Those are Neonatal Mortality Rate (NNMR) is defined as the probability of dying within the first month of life per 1000 live birth. Infant mortality rate (IMR) is the probability of dying between birth and the first birthday per 1000 live birth. The term live birth is used in this study is defined of live birth is a sign of life such as breathing, heartbeat, or voluntary muscular movements of the newborn after separation from the mother, regardless of the gestational age (Tekin (2021) Under-five mortality is the probability of dying between birth and the fifth birthday per 1000 live birth (NFHS 5, 2019-21). The creation of physical and human infrastructure largely depends on the availability and allocations of funds for health sector. The high rates of mortality decrease the availability of resources and shrinking the energy level of the productive group of population. All these have pushed the economy towards low productivity, wastage of resources and backwardness.

REVIEW OF LITERATURE

The present analysis has framed after surveying literature related with the study area. It has been observed that large numbers of literatures are available in international and national level. Among them, we are selecting and incorporating a few literatures in this present study.

In international level neonatal mortality, under 5 mortality, infant mortality has attracted attention while the UN General Assembly has declared the target to reduced such mortality level globally. Therefore researchers like Sharrow et al. (2022) estimated levels and trends in under-5 mortality for 195 countries from 1990 to 2019, and conducted scenario-based projections of the U5MR and NMR from 2020 to 2030 to assess country progress in, and potential for, reaching SDG targets on child survival and the potential under-5 and neonatal deaths over the next decade. They have observed that the global U5MR decreased from 93·deaths per 1000 live births in 1990 to 37·7 in 2019, while the annual number of global under-5 deaths declined from 12·5 million in 1990 to 5·2 million in 2019, a 58% reduction. The global NMR decreased by 52% from 36·6 deaths per 1000 live births in 1990, to 17·5 in 2019. Tekin (2021) has observed that the most common causes of death under 5 years old are acute respiratory infections, diarrhea, deaths due to infections and birth complications are high in Lower and Middle Income Countries. The improvement in access to well-equipped healthcare professionals during pregnancy and childbirth, vaccinations, breastfeeding and the provision of low-cost medicines, access to clean water, food, and sanitation are necessary for prevention of such mortality. Literatures have been reviewed related with the national and state level for increasing conceptual clearness about the mortality level causes and remedies. Nassir et al. (2013) have observed the relationship between health and development is mutually reinforcing- while health contributes to economic development, economic development, in turn, tends to improve the health status of the population in a country. Public expenditure on health is less than 1 per cent of GDP in India. In India there are large disparities amongst states in achieving health outcomes. Singh et al. (2017) have examined the trends on inequality in length of life in Indian states. They used Gini coefficient to measure the level of inequalities in expectancy of life among male and female across the states. Venkateswaran et al., (2022) have observed that India's healthcare system is not at par with the low- and middle-income countries. India is still far behind achieving the Sustainable Development Goals (SDGs) in most health- and nutrition-related indicators, despite the considerable progress over the decades. The 15th Finance Commission Report (2020) suggests that India has underperformed in terms of controlling maternal and child mortality, fertility rate. Rao et al. (2012) states with higher health worker density tend to have lower infant mortality rates and better health. Bihar and Uttar Pradesh have low health worker density and poor health, while Goa and Kerala are at the opposite extreme. Interestingly, there is considerable variation in infant mortality for given density levels indicating that there are several

factors other than workforce availability which influence health and service utilization. It also suggests that some states have more efficient health workers. In general, states with higher per capita health spending have higher workforce density and better health outcomes. Again, Goa with higher government spending on health has a higher health worker density and substantially lower infant mortality compared to states such as Bihar and Uttar Pradesh. Saikia et al. (2013) has observed that the infant mortality rate in rural India is more than urban areas. They mentioned that socioeconomic factors and child care related programmes affected the gap in infant mortality in rural and urban places. Hose-hold economic conditions, female education and knowledge about family planning are more effective in reducing the mortality rate. Rao et al. (2011) has observed that India has a severe shortage of qualified health workers. Indians, especially those living in rural areas, receive care from unqualified providers. Nurses do not have much authority or say within the health system, and the resources to train them are still inadequate. Researcher has observed that the rapid privatization of medical and nursing education has created issues for its quality and poor governance of the health sector. The above literature survey gives us insightful awareness about the issue and helps to find out cause and remedies for the problem.

Analysis and findings

Infant Mortality Rate (IMR)

We are examining the positions of health indicators of the selected states during the year period from 2015 to 2020. It has been observed that during the time period (2015-16 to 2019-20), Assam and Meghalaya has experienced higher Infant Mortality Rate (IMR) in comparison to the other states. Sikkim, Manipur, Mizoram and Nagaland have sustained less number of mortality in comparison to the all India level. It has been observed that the female mortality rate is more among all the selected states during the entire time period. The high rates of female mortality rate has indicates gender preferences in receiving medical and health care facilities in the study area.

Table 2: State wise Infant Mortality Rate by Sex in N-E States of India

States	2015		2016		2017		2018		2019		2020	
	M	F	M	F	M	F	M	F	M	F	M	F
India	35	39	33	36	32	34	32	33	30	31	28	28
Arunachal Pradesh	31	30	35	37	40	45	31	43	23	34	19	22
Assam	47	47	43	45	41	46	40	44	38	41	35	37
Manipur	08	10	10	13	11	13	08	14	09	11	05	06
Meghalaya	42	43	41	37	42	36	34	31	34	33	27	30
Mizoram	32	33	26	29	12	18	02	09	02	04	01	04
Nagaland	10	15	05	21	02	13	03	06	03	02	03	05
Sikkim	15	21	13	19	10	13	06	08	06	05	05	05
Tripura	19	21	25	22	30	27	30	23	23	19	18	17

Source: National Health Profile -2016, 2018 & 2023

We further examining the trends of total infant mortality across the states over the year. It has been observed that Assam and Meghalaya have higher mortality rate that requires serious attention to address the issue. States like Manipur, Sikkim and Nagaland have been able to reach less than 5 per 1,000 live births in 2020. (Below national level) The low IMR has indicates better health infrastructure facilities (both physical and human infrastructure) more accessible, highest amount of institutional delivery, health awareness among women and more involvement of health workers at ground level.

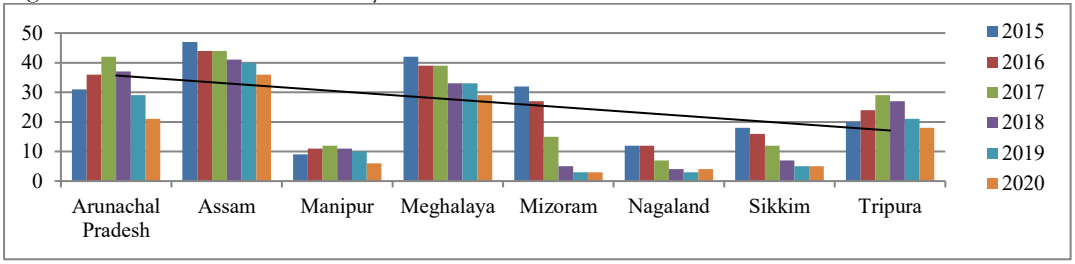
Table 3: State wise Infant Mortality Rate in N-E States of India (2015-2020)

States	2015	2016	2017	2018	2019	2020
Arunachal Pradesh	31	36	42	37	29	21
Assam	47	44	44	41	40	36
Manipur	9	11	12	11	10	06
Meghalaya	42	39	39	33	33	29
Mizoram	32	27	15	05	03	03

Nagaland	12	12	07	04	03	04
Sikkim	18	16	12	07	05	05
Tripura	20	24	29	27	21	18
All India	37	34	33	32	30	28

Source: National Health Profile -2023

Fig.1: State wise Infant Mortality Rate in N-E States of India from 2015-2020



Source: table no.3

On the other hand states like Assam has higher IMR rate followed by Meghalaya, Arunachal Pradesh and Tripura but have slowly improving their positions. This falling rates of IMR has indicates an improvement in the health status of the region.

Neonatal Mortality Rates (NMR)

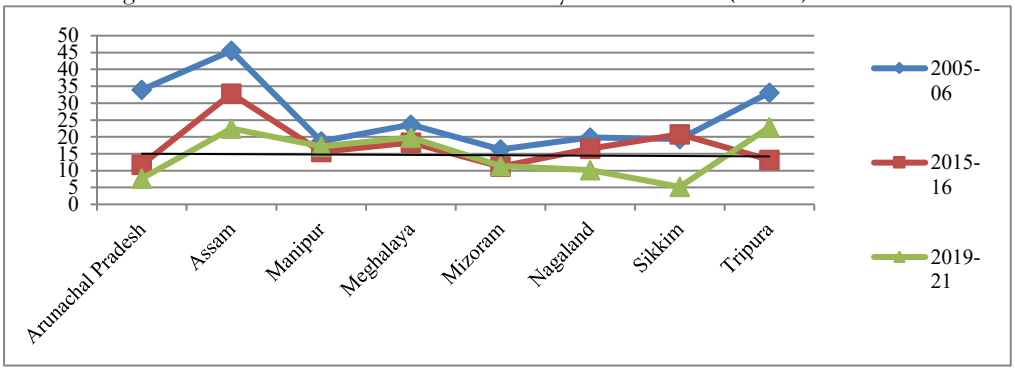
The Neonatal Mortality Rate (NMR) has been defined as the probability of dying within the first month of life per 1000 live birth (NFHS-2023). It is defined as the probability of dying between birth and exact age 28 days, expressed per 1,000 live births (Sharrow et al. 2022). This is another important factor that determines the health status of a country. We have examined the trends of NMR by using the linear curve of the North Eastern states for the last seventeen years (2005-06 to 2019-21). It has been observed that all the N-E states are able to reduce the NMR below the national level.

Table 4: Neonatal Mortality Rates (NMR) of N-E States

States	Neonatal Mortality Rates (NNMR)		
	2005-06	2015-16	2019-21
Arunachal Pradesh	34.0	11.8	7.7
Assam	45.5	32.8	22.5
Manipur	18.7	15.6	17.2
Meghalaya	23.6	18.3	19.8
Mizoram	16.3	11.2	11.4
Nagaland	19.8	16.5	10.2
Sikkim	19.4	20.8	5.2
Tripura	33.1	13.2	22.9
India	39.0	29.5	24.9

Source: NFHS Reports, Government of India

Fig. 2: Neonatal Mortality Rates (NMR) trends of N-E States



Source: Table no 4.

States like Assam, Manipur and Meghalaya are suffering from comparatively higher rate of such mortality. Whereas Sikkim (5.2), and Arunachal Pradesh (7.7) have been able to reduce such mortality rates below 10 per 1,000 live births which is below the target set by UN General Assembly in 2015. (12 deaths per 1000 live births by 2030) In Assam, Tripura and Meghalaya such mortality rate is higher in comparison to other states. The high rate of such mortality arises due to lack of proper institutional health care of pregnant mother and baby, lack of proper medicine, hygiene and care about the newborn. The inadequate health care facilities reflect poor hose-hold economic conditions, lack of female education and knowledge about family planning and underdevelopment of the economy (Saikia et al. 2013). Thus across the states there is inequalities in distribution and accessibility of health care facilities.

Under-five mortality Rates

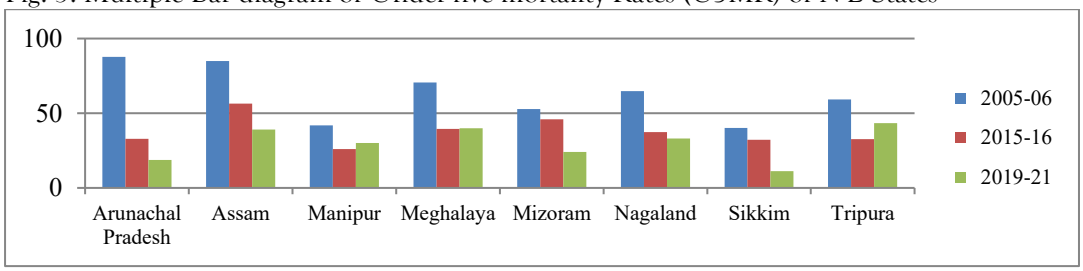
The under-five mortality rate (U5MR) represents children who die before reaching the age of 5 per 1,000 live births. It is directly related to the development and economic income levels of countries (Tekin, 2021). The child survival targets aim for all countries to achieve of 25 or fewer deaths per 1000 live births by 2030 (Sharrow et al. 2022). The risk of mortality is more among the newly born babies and those under 5 years of age. The most common causes of death under 5 years old are acute respiratory infections, diarrhea, malaria, and birth complications. (Tekin, 2021) Other reasons of such mortality are low level of immunity, lack of proper medical care, nutritional deficiencies and lack of proper nourishment. Socio economic factors like absence of parent's knowledge about basic health care and hygiene, neglect of girl child, absence of either parents or both parents.

Table 5. Under-five mortality Rates (U5MR) of N-E States from 2005-06 to 2019-21

States	U5MR Under-five mortality Rates		
	2005-06	2015-16	2019-21
Arunachal Pradesh	87.7	32.9	18.8
Assam	85.0	56.5	39.1
Manipur	41.9	25.9	30.0
Meghalaya	70.5	39.6	40.0
Mizoram	52.9	46.0	24.0
Nagaland	64.7	37.4	33.0
Sikkim	40.1	32.2	11.2
Tripura	59.2	32.7	43.3
India	74.3	49.7	41.9

Source: Source: National Family Health Survey Reports, Government of India

Fig. 3: Multiple Bar diagram of Under-five mortality Rates (U5MR) of N-E States



Source: NFHS Reports, Government of India

The UN General Assembly (2015) has called for all countries to reach an under-5 mortality rate (U5MR) at least as low as 25 deaths per 1000 live births. Our study has observed that Sikkim and Arunachal Pradesh lower the death rate below 20 per 1,000 live births. Assam, Meghalaya and Tripura are still reaching far from the desired target. That has revealed low and inadequate level of health infrastructure facilities and health services for their people. It further reveals the poor economic conditions, low per capita income and poverty are the reason for absence of health care, pure drinking water are the reason for increasing such mortality rate.

Comparative Analysis

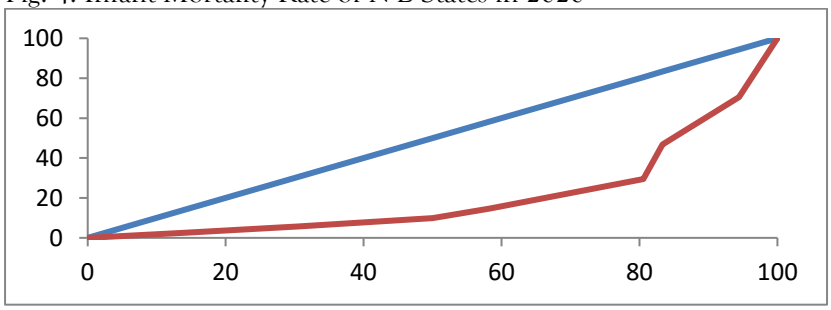
The distribution of health care facilities has been assessed through comparing the level of inequalities in performing health status indicators i.e. Under-five mortality Rates (U5MR) and Neonatal Mortality (NMR) and Infant Mortality Rate (IMR) across the N-E States during the period of study.

The Lorenz (or concentration) curve is the most common device for a full description of distribution of income in a population. The Lorenz curve is simply a diagonal, connecting points (0, 0) and (1, 1). The Lorenz curves for real income distributions would lie under the diagonal. The diagonal line make an angle of 45^0 with the Y- axis is called the line of equal distribution. Any point on this diagonal shows the same percent of X on Y. (Gupta, 2019). The higher the variability in income across a population, the greater the divergence between the diagonal and the Lorenz curve (Shkolnikov et al. 2003).

Lorenz Curve and health status

In our present analysis we are measuring the distribution three types of mortality rate by using Lorenz curve and Gini coefficient. We have considered states on X axis and the number of mortality that has achieved by each states as frequencies on the Y axis. We are considering the cumulative percentage of both X and Y values. We are getting the line of equality or equal distribution of Infant Mortality Rate (IMR) of N-E the eight (08) states during 2020. The Lorenz curve moved away from the line of equality that has indicates that states of the region has received higher variability in the distribution of health status (IMR) during the year period.

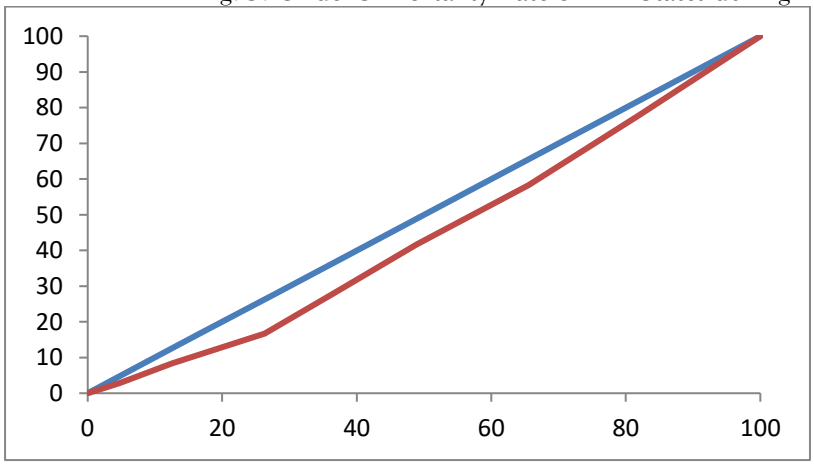
Fig. 4: Infant Mortality Rate of N-E States in 2020



Source: Table no 3.

We are analyzing the distributional inequalities in Neonatal Mortality Rate and Under 5 Mortality Rate of N-E States during 2020 by using the Lorenz curve technique. We have observed that the deviations of the Lorenz curve from the line of equality are less in both the NMR and U5MR in comparison to the IMR among the states during the 2019-21. It reveals that the health status of N-E States is uneven during the entire year period. States like Sikkim, Manipur and Nagaland has been able to achieve remarkable progress in reducing all the three types of mortality rates and becomes equal to developed nation.

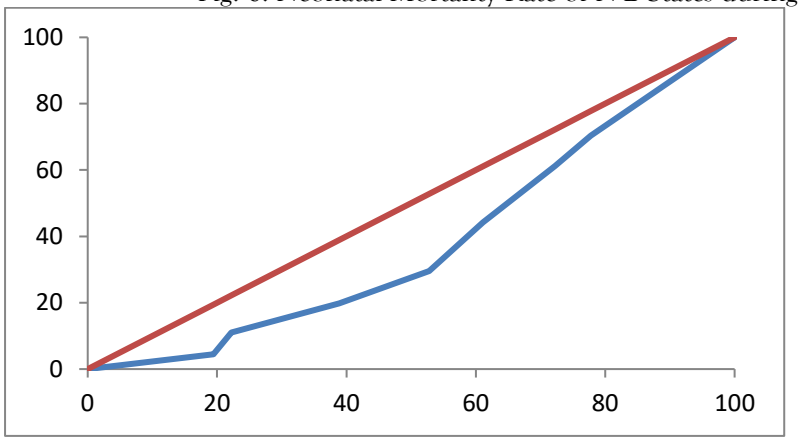
Fig. 5: Under 5 Mortality Rate of N-E States during 2019-21



Source : table no 5

Whereas Assam, Meghalaya, Arunachal Pradesh has been lying far below the national level in all the basic health status indicators.

Fig. 6: Neonatal Mortality Rate of N-E States during 2020



Source: table 4

Further we are calculating the Gini coefficient ratio of the area between the diagonal and the Lorenz curve divided by the total area of the half-square in which the curve lies (Todoro et al. 2019). We are getting Gini coefficient value of IMR is 0.426 indicates moderate level of inequalities in distribution of IMR among the states during the year period 2020. The Gini coefficient value 0.248 and 0.193 of U5MR is and NMR is which indicates low level of inequality among states.

It has been reveals that the states having low health status (high mortality rate) have low per capita income level and large number of people living below poverty line that has shown in the table no 1. Thus the poverty and low per capita become one of the causes for high level of mortality.

Now for more clear perception about the health status, we are comparing health indicators like NMR and U5MR with a few the developed countries. It has been observed that developed countries have already achieved remarkable progress as set by UN Assemble (2015) within 2030 in reducing number of Under-five mortality Rates (U5MR) and Neonatal Mortality Rates (NMR).

Table 6: Mortality Rates of other countries per 1,000 live births

Countries	2018		2021	
	NMR	U5MR	NMR	U5MR
China	04	09	03	07
Indonesia	13	25	11	22
Japan	01	02	01	02
Sri Lanka	04	07	04	07
French	03	04	03	04
Germany	02	04	02	04
United Kingdom	03	04	03	04
United states of America	04	07	03	06
South East Asian Region	20	34	17	29
Global	18	39	18	38

Source: World Health Statistics, WHO, 2018 & 2023

Countries like China, Sri Lanka and Indonesia are enjoyed better position in controlling such mortality rates. In the North East India, Assam Meghalaya and Tripura are still higher mortality rates in comparison to global and South East Asian Region level. Such high rates of mortality is has indicates poor health status of its citizens. But the other states like Sikkim has able to reduce such (U5MR) mortality level similar to the developed countries. Few other states like Manipur, Mizoram and Arunachal Pradesh has been able to reduce such mortality level lower than Global and region level.

CONCLUSION

Improving health status of a country or region is a necessary precondition for keeping steps in the path of development. It has been observed that the developed nations have been able to overcome health related issues and achieve reasonable positions in all such aspects. The unequal distribution of health facilities and poor health status of the region has indicates a number of socio-economic problems associated with the economy of such states. In our study we have focused on the current position of the health indicators and the trend of solving such issues over the period of time. there is no doubt that states are trying to control and improving such health indicators but still it is far behind from the desired level as has achieved by the developed nations. The growing burden of population and increasing requirements of well-trained medical service provider has become a barrier for the state to achieve the desired level of improvement in health sector. Three is no doubt that economic condition of an individual i.e. per capita income level has determined the health facilities enjoyed by the family. Therefore improving income level is one of the reasons that can help to reduce such issues. Government policies related with such problems regarding. Besides, the increasing awareness among the people especially among women and wide spread publicity about preliminary health issues can be More effective in controlling such problems.

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