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RESEARCH ARTICLE

MONITORING CHILD MORTALITY IN THE NORTH EASTERN STATES OF INDIA: AN INDEX BASED APPROACH

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Abstract

Purpose: The Sustainable Development Goals (SDGs), adopted by the United Nations, seek to address pressing global challenges, with SDG 3 specifically targeting the reduction of child mortality by 2030. The purpose of this paper is to construct indices for two key indicators of SDG 3.2: End preventable deaths of newborns and children under five years of age, in the eight North Eastern (NE) states of India, one for neonatal mortality and the other for under five mortality using data from the National Family Health Surveys (NFHS). This research highlights the importance of targeted approaches to lower child mortality in the region, emphasizing the role of localized efforts in achieving global health goals.

Design / Methodology: Data is taken from the NFHS India V and the eight State Reports. Through min-max normalization, first, separate indices are developed for neonatal and under-five mortality for each of the eight states of North East India. These two are then aggregated into a composite index for each state.

Findings: The findings reveal significant regional variations, with states like Mizoram, Nagaland, and Arunachal Pradesh achieving notable progress, while Assam and Tripura continue to face higher mortality rates. The paper concludes that separate indices offer more precise insights than aggregate indices, facilitating better decision-making in the context of localized healthcare challenges in North Eastern India. By constructing separate indices for neonatal and under-five mortality rates in the NE states, this study provides a clearer understanding of where each state stands in relation to the SDG targets, allowing for more focused interventions and data-driven policymaking.

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Introduction:-

The Indian model of Sustainable Development Goals (SDG) Localization (**Aayog, 2022**) refers to the country's unique approach to integrating and implementing the Sustainable Development Goals (SDGs) at the sub national (state and district) levels. India's model emphasizes the involvement of local governments, customized state-level strategies, and robust monitoring mechanisms to achieve the SDG goals across its 28 states and 8 UTs. India adopts a bottom-up approach where individual states and union territories (UTs) have a crucial role to play in driving SDG implementation. This is essential because of the diversity in development levels, resources, and governance capacities across states. While the National Indicator Framework (NIF) is developed at the national level, states are

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encouraged to design their own State Indicator Frameworks (SIFs) based on local conditions to measure progress at the sub national level. Composite Indices are often used to monitor the progress of the 17 SDG goals at international and national levels for effectively tracking progress, identifying gaps, and promoting accountability. Indices provide quantifiable measures of progress toward SDG targets, which is critical for data-driven decision-making (Sachs et al., 2021). By aggregating different indicators of each SDG goal into a score or rank, indices can act as a performance management tool, helping to identify specific bottlenecks or areas where interventions are not yielding the desired impact. Composite or aggregate indices can sometimes obscure important variations within the targets by aggregating diverse indicators into a single score (Morse, 2013). SDG 3: Good Health and Well Being, for example has 13 Targets and 28 Indicators (WHO, 2021). These targets cover a broad spectrum of concerns including maternal health, child health, communicable diseases, universal health coverage and access to medicines. Each of these targets requires distinct strategies, interventions, and resource allocations. Separate indices in such situations allow for more precise tracking of how well a region or country is performing on a specific target, such as reducing maternal mortality (SDG 3.1) versus addressing HIV/AIDS, malaria, and other infectious diseases (SDG 3.3) (Booyesen, 2002). For example, a state might make significant progress in reducing maternal mortality but lag behind in combating diseases like tuberculosis. The composite index might not capture such variability in levels of progress if combined into a composite score of many diverse indicators. Focusing on a separate index for each target helps identify such discrepancies and allows focused attention on areas that require more intervention. SDG 3, one of the 17 SDGs formulated by the United Nations in 2015, aims to “ensure healthy lives and promote well-being for all at all ages.” Within this broader goal, SDG 3.2 aims to “End preventable deaths of newborns and children under five years of age”, and specifically targets the two indicators - reducing neonatal mortality and under-five mortality, which are key measures of a country's healthcare quality and social development. The global targets of SDG 3.2 (WHO, 2023) are:

Neonatal mortality rate: Reduce the neonatal mortality rate to at least as low as 12 deaths per 1,000 live births.

Under-five mortality rate: Reduce the under-five mortality rate to at least as low as 25 deaths per 1,000 live births by 2030.

The objective of this study is to develop a separate index for each of the two indicators of SDG 3.2 for all eight states in the North Eastern region of India comprising of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. A composite index based on these two indicators is then constructed based on the two separate indices. By developing these indices, the study aims to offer targeted insights into areas where further interventions are needed to accelerate improvements in child health outcomes. Given the strategic importance of improving child and neonatal health in North Eastern India, localized efforts can help in tailoring interventions.

Review of Indices to Track SDGs

The SDG Index and Dashboards (SDSN) (Sachs, 2022)

The SDG Index and Dashboards, developed by the Sustainable Development Solutions Network (SDSN) and the Bertelsmann Stiftung in 2016, are among the most widely recognized global initiatives for tracking SDG progress. This index tracks the performance of 193 UN States on all 17 SDGs. The index provides an aggregate score for each country based on various SDG indicators using a range of data sources, including UN datasets, World Bank data, and national statistics. It categorizes countries into “on track,” “moderate progress,” or “major challenges” based on their performance against SDG targets. This index serves as a global benchmarking tool, helping countries measure their performance relative to global goals and compare with peer nations.

Global Multidimensional Poverty Index (MPI) (UNDP, 2023)

The Multidimensional Poverty Index (MPI) is a significant tool for tracking SDG progress, particularly for SDG 1 - No Poverty. It was created by the Oxford Poverty and Human Development Initiative (OPHI) in collaboration with the United Nations Development Programme (UNDP). Although primarily focused on poverty, the MPI is closely aligned with various other SDG targets, such as those related to health, education, and living standards. The MPI assesses various dimensions of deprivation that individuals face at the same time and aggregates them into a single index score. It relies on household survey data from various sources such as the Demographic and Health Surveys (DHS) and the Multiple Indicator Cluster Surveys (MICS). According to Alkire and Santos (2014), ‘MPI helps countries track their progress on poverty reduction and related SDG targets, enabling them to address multidimensional poverty effectively and inclusively’.

The Human Development Index (HDI)

The Human Development Index (HDI), formulated by the United Nations Development Programme (UNDP) serves as an important precursor to SDG tracking, emphasizing health, education, and economic well-being. Many aspects of the HDI align closely with SDG targets, particularly those related to SDGs 3, 4, and 8 (health, education, and economic growth)(UNDP, 2024).

The SDG India Index

The SDG India Index and Dashboard was conceived and created by NITI Aayog to rank states and union territories based on a composite index for each individual goal and a combined index for all goals. The main aim was to foster a spirit of competition among states and Union Territories, driving faster action on the SDGs (Aayog, 2023). This initiative has not only promoted healthy competition but also stimulated benchmarking for development progress. In 2018, NITI Aayog launched the first edition of the SDG India Index and Dashboard (Baseline Report), marking the creation of the first government-led, subnational comprehensive index that incorporates social, economic, and environmental parameters. Three more editions of the Index (2019-20, 2021-22 and 2023-24) have been published till date. In the latest edition of the index the indicators have been refined to align with the National Indicator Framework (NIF), a comprehensive set of indicators to measure progress on SDGs at the national level developed by the Ministry of Statistics and Programme Implementation (MoSPI). Along with ranking states and UTs, these reports also emphasize the country's performance on each goal at the national level. This has not only fostered healthy competition but also stimulated benchmarking for development progress (Aayog, 2023). However, the four editions of the Index are not strictly comparable, as each year efforts are made to improve its quality by incorporating more and higher-quality indicators, providing a more comprehensive and accurate assessment (Aayog, 2023).

Methodology:-

Data

The National Family Health Survey (NFHS) in India provides comprehensive data on various health, social, and economic indicators. The survey is conducted by the International Institute for Population Sciences (IIPS), which serves as the nodal agency and is responsible for coordinating and overseeing the survey, including the design, data collection, and analysis. It is conducted under the Ministry of Health and Family Welfare (MoHFW), Government of India. The NFHS is one of India's largest health and demographic surveys and plays a key role in tracking health indicators, population dynamics, and the progress toward various national and global health goals. Five NFHSs have been conducted so far. In the most recent NFHS 5 survey conducted between 2019 and 2021, a total of 636,699 households in India were interviewed, achieving a response rate of 98%. Within these households, 724,115 women aged 15 to 49 years were successfully interviewed, with a response rate of 97%, and 101,839 men aged 15 to 54 years were interviewed, yielding a response rate of 92%. In addition to publishing a National Report, NFHS also publishes state wise data from this survey in the form of State Reports. For the present analysis, data on neonatal mortality and under five mortality was taken from the eight North East State Reports of NFHS 5.

Selection of Indicators

To develop indices for SDG 3.2, both Indicator 3.2.1 (under-five mortality rate) and Indicator 3.2.2 (neonatal mortality rate) were considered. Under-five mortality refers to the likelihood of dying before the age of five, measured as the number of children per 1,000 live births who die before their fifth birthday. Neonatal mortality, on the other hand, refers to the probability of dying within the first month of life, measured as the number of infants who die during the first 28 days per 1,000 live births.

Index Construction

Baseline values of neonatal and under five mortality rates (NMR and UFMR) for the eight states have been taken from the NFHS 3 Survey 2005-2006, conducted in the five years preceding the survey that is approximately from 2001 to 2005 (table I). Current values have been taken from the latest NFHS 5, 2019-21 (table I). Both the baseline values and the current values have been taken from the state reports of NFHS (IIPF and ICF, 2021). The targets were set as 25 for under five mortality and 12 for neonatal mortality in accordance with the global targets set by the UN. The data has been normalized by using the min-max normalization process. After normalizing all the indicators, separate indices have been constructed for neonatal and under five mortality. Since a lower normalized index in this case indicates better performance, the progress indices were calculated by inverting the normalized value to represent progress. These were finally aggregated using a simple arithmetic mean with equal weights to form a composite index for SDG 3.2 for each of the states in the North East.

Table I:- NMR and UFMR from NFHS 3 and NFHS 5.

States	NFHS 3 (Baseline)		NFHS 5	
	Under Five Mortality Rate	Neonatal Mortality Rate	Under Five Mortality Rate	Neonatal Mortality Rate
Arunachal Pradesh	87.7	34	18.8	7.7
Assam	85	45.5	39.1	22.5
Manipur	41.9	18.7	30	17.2
Meghalaya	70.5	23.6	40	19.8
Mizoram	52.9	16.3	24	11.4
Nagaland	64.7	19.8	33	10.2
Sikkim	40.1	19.4	11.2	5
Tripura	59.2	33.1	43.3	22.9

(Source: NFHS V India Report)

Results:-

The under five mortality indices, neonatal mortality indices for the two indicators of SDG 3.2 and the composite indices for all the eight states considered in the study are given in table II. Values that exceeded one were rounded off. For example UFMR and NMR for Arunachal Pradesh were both below the target resulting in the indices exceeding one. These were therefore rounded off.

Table II:- Mortality Indices constructed for SDG 3.2.

States	Under Five Mortality Index (Indicator 3.2.1)	Neonatal Mortality Index (Indicator 3.2.2)	Composite Index for SDG 3.2
Arunachal Pradesh	1.00	1.00	1.00
Assam	0.77	0.69	0.73
Manipur	0.70	0.22	0.46
Meghalaya	0.67	0.33	0.50
Mizoram	1.00	1.00	1.00
Nagaland	0.80	1.00	0.90
Sikkim	1.00	1.00	1.00
Tripura	0.46	0.48	0.47

The SDG India Index, developed by the NITI Aayog, employs a color-coded system to illustrate the progress of a state or union territory in achieving each of the SDGs (Aayog, 2023). Colors are used to categorize regions into different performance levels based on their index scores. The categories based on the scores are given in table III.

Table III:- Categories as per NITI Aayog classification.

	Score	Category	Colour Code
1.	100	Achiever	Green
2.	65-99	Front Runner	Light Green
3.	50-64	Performer	Yellow
4.	0- 49	Aspirant	Red

(Source: SDG India Index 2023-24: Towards Viksit Bharat, Niti Aayog)

Table IV: Categories as per classification in table III

	State	Category as per SDG Index 3.2
1.	Arunachal Pradesh	Achiever
2.	Assam	Front Runner
3.	Manipur	Aspirant
4.	Meghalaya	Performer
5.	Mizoram	Achiever
6.	Nagaland	Achiever
7.	Sikkim	Achiever
8.	Tripura	Aspirant

Table IV presents the categories of the eight states for the constructed SDG Index 3.2 as per the classification in table III.

Figure I:- Under five mortality Index Scores based on constructed indices for the North Eastern states.

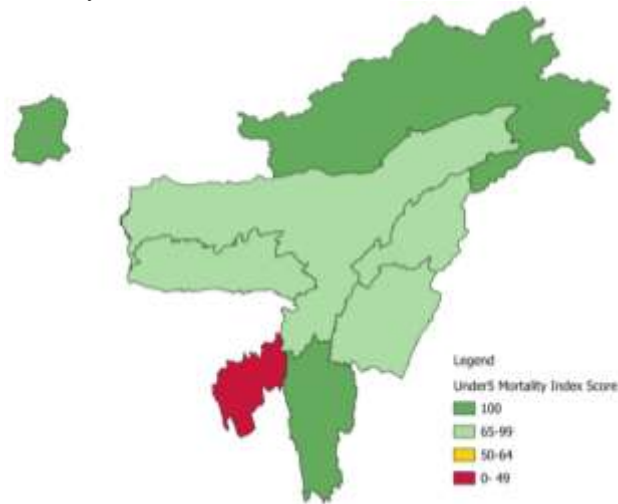


Figure II:- Neonatal Mortality Index Scores based on constructed indices for the North Eastern states.

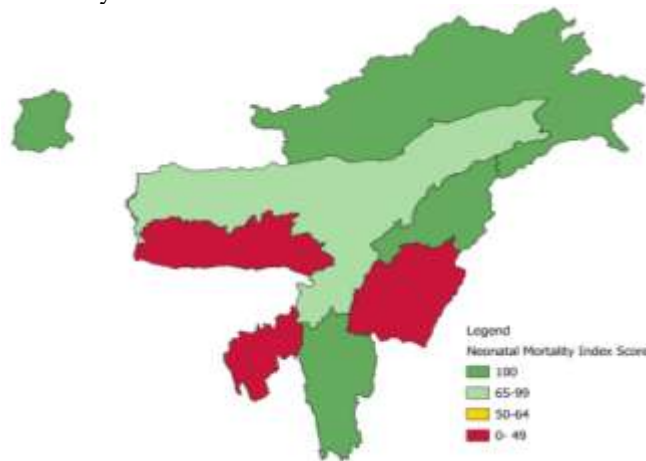
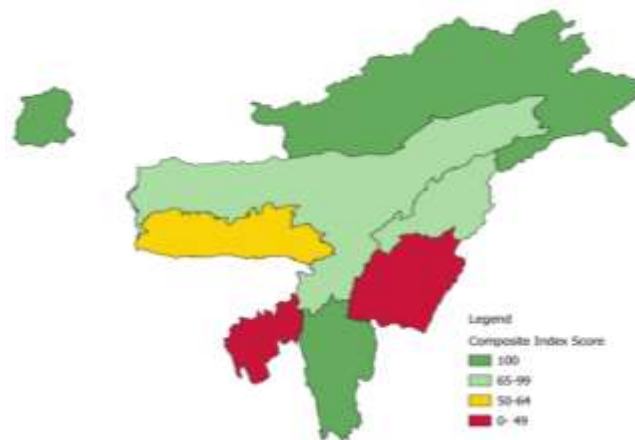


Figure III:- Composite Index Score based on constructed indices for the North Eastern states.



The North Eastern states exhibit substantial variation in performance on both under five and neonatal mortality indicators (figure I, II, III):

- Arunachal Pradesh, Mizoram, Nagaland and Sikkim are classified as "Achievers" in terms of both NMR and UFMR, having achieved or exceeded the SDG 3.2 targets for reducing child mortality.
- Assam, one of the largest states in the region, continues to face challenges with higher child mortality rates, placing it in the "Performer" category for under-five mortality.
- Tripura, while showing improvement, is still classified as an "Aspirant" state, indicating significant progress is needed to meet SDG 3.2 targets.
- States such as Manipur and Meghalaya show mixed progress, performing better on one index while lagging on the other.

The composite index based on the two indicators of SDG 3.2 reflects these variations (figure III), allowing for a comparison of progress across the states, while the separate indices for both indicators highlights the specific areas where each state needs to focus its efforts. The results highlight the necessity for focused interventions in states like Assam and Tripura, while also showcasing the achievements of states like Mizoram and Nagaland, which have made considerable progress in reducing child mortality.

Discussion:-

Separate indices enhance accountability by clearly showing progress or lack thereof for each specific target. In contrast, aggregate indices might hide underperformance in certain targets when performance is averaged out with better results in other areas (Booyesen, 2002) as is evident from the results of the study. When different aspects of health are assessed individually, policies can be more tailored to address specific needs. Separate indices allow for targeted interventions (Ghosh et. al., 2019). For example, if the neonatal mortality index shows poor performance as in the case of Meghalaya and Manipur, the government can design specific neonatal care programs rather than generalized healthcare reforms for these states. In a country like India, some regions may struggle more with communicable diseases (e.g., malaria in the North East), while others might face higher non-communicable diseases (e.g., heart diseases in urban areas). Separate indices for each target allow regional governments to address the health priorities that are most relevant to their context. Different SDG targets often require different types of data (United Nations, 2017). Maternal and child health data may come from household surveys, health facility reports, and demographic data while non-communicable disease tracking requires data on risk factors like tobacco and alcohol consumption, obesity, and physical activity, often sourced from health surveys and lifestyle studies. By having separate indices, each target can utilize appropriate and contextually relevant indicators, methodologies, and data sources (OECD, 2008). Separate indices tend to be more sensitive to changes within each target area and are more likely to capture and highlight even small gains or setbacks within individual targets, providing more timely and actionable insights. A small improvement in neonatal care could lead to a significant change in the neonatal mortality index. However, when combined into a broader SDG 3 index, the improvement might not have the same visibility. Health budgets are often limited, and separating the indices helps to ensure that resources are directed towards the targets that are lagging the most or have the greatest impact. A state performing well on universal health coverage (SDG 3.8) but poorly on maternal mortality (SDG 3.1) might need to shift some resources from general health programs to targeted maternal health interventions.

Conclusion:-

In conclusion, this paper develops separate indices for neonatal mortality and under-five mortality in the eight North Eastern states of India, based on data from the NFHS surveys, to assess progress toward achieving SDG 3.2. The results show significant variation in child mortality rates across the region, with states like Mizoram, Nagaland, and Arunachal Pradesh making substantial progress, while others, particularly Assam and Tripura, still face challenges in meeting the SDG targets.

By constructing indices for each indicator, this study highlights the limitations of using composite health indices based on all indicators, which may obscure specific areas of underperformance. The findings emphasize the need for more focused interventions and customized health policies in states with higher mortality rates to further decrease child deaths. The localized approach of this study provides a clearer picture of progress, enabling more effective decision-making and resource allocation in the pursuit of SDG 3.2 in North Eastern India.

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