

THE IMPACT OF HEALTH CARE SERVICES, INFRASTRUCTURE,
AND NUTRITION, ON CHILD MORTALITY RATES IN RURAL
INDIA

Dissertation Submitted to



The IIHMR University, Jaipur

for the partial fulfilment for the award of the
degree of Master of Business Administration

(MBA)

in

Hospital and Health Management

by

Dr. Isha Phadke (P.T)

Under the Supervision and Guidance of

Dr. Anoop Khanna

2023

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DECLARATION BY STUDENT

I hereby declare that this dissertation titled “THE IMPACT OF HEALTH CARE SERVICES, INFRASTRUCTURE, AND NUTRITION, ON CHILD MORTALITY RATES IN RURAL INDIA.” is the bonafide record of my original research work. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.

(Signature)

Dr. Isha Phadke (P.T)

COMPLETION CERTIFICATE



CERTIFICATE

This is to certify that Isha Phadke in partial fulfillment of the requirements for the award of the degree of MBA (Hospital and Health Management) from the IHMR University, Jaipur has successfully completed her/his internship at Child Rights and You (CRY) during February 20- May 20, 2023.

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CERTIFICATE

This is to certify that dissertation titled “THE IMPACT OF HEALTH CARE SERVICES, INFRASTRUCTURE, AND NUTRITION, ON CHILD MORTALITY RATES IN RURAL INDIA.” is a record of the research work undertaken by Dr. Isha Phadke (P.T) in partial fulfilment of the requirements for the award of the degree of MBA Hospital and Health Management from the IIHMR University, Jaipur under my guidance and supervision and his approach to the research study has been sincere, scientific and analytical.

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ABSTRACT

Although child mortality rates have decreased across all regions, we are not making sufficient progress to achieve the sustainable development goal for child mortality. India's current Infant Mortality Rate (IMR) stands at 39 deaths per 1000 live births, and the Under-five Mortality Rate (U5MR) is reported at 45 deaths per 1000 live births. These figures highlight a significant disparity between rural and urban areas. Multiple factors contribute to this child mortality rate, including educational status, poverty, awareness among individuals, maternal health, nutrition. The objective of this study is to examine the influence of healthcare infrastructure, services, and nutritional status on child mortality.

A quantitative analysis was conducted to examine the relationship between the prevalence of malnutrition, stunting, and wasting and child mortality rates in states with the highest IMR and U5MR. Additionally, a regression analysis was performed to assess the correlation between specific parameters of healthcare infrastructure and human resources with child mortality rates. Pearson's Coefficient of correlation and p-value were calculated to determine the significance of the observed correlations.

The results of this study showed a strong positive correlation between the workforce at SCs and PHCs, and the number of PHCs with a labor room, with infant mortality rates. (p-value < 0.05). Also, a strong positive correlation was seen between the availability of Pediatricians at CHCs, PHCs functioning on a 24X7 basis, PHCs with functioning Stabilization Units for Newborns and Under-five mortality rate. (p-value < 0.05). These results were strongly backed up with literature review.

This study yielded significant findings indicating a strong association between healthcare services, infrastructure, and child mortality rates. The results underscore the vital role of accessible and well-equipped healthcare facilities in reducing child mortality. Furthermore, the study highlighted the importance of addressing nutritional status as a critical factor in mitigating child mortality rates. These findings emphasize the need for comprehensive approaches that integrate healthcare services, infrastructure development, and nutrition interventions to effectively combat child mortality.

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ABBREVIATIONS

S.NO	Abbreviation	Full form
1.	SDG	Sustainable Developmental Goals
2.	PHC	Primary Health Care
3.	CHC	Community Health centers
4.	SDH	Sub-Divisional Hospital.
5.	SRS	Sample Registration System
6.	IMR	Infant Mortality Rate
7.	U5MR	Under-five Mortality Rate

I. INTRODUCTION

Child mortality has garnered the attention of academics and policymakers as they serve as critical indicators of a country's socioeconomic development. ^[1] As stated by UNICEF, the child mortality rate, also known as the under-five mortality rate (U5MR), represents the likelihood of death occurring between birth and the precise age of five, expressed as a ratio per 1,000 live births. It encompasses neonatal mortality and Infant Mortality rates (IMR).

The relevant targets under Sustainable Development Goal (SDG) 3 that address child mortality include Target 3.2, which aims to end preventable deaths of newborns and children under 5 years of age by 2030. ^[5] All countries should strive to reduce neonatal mortality to at least 12 per 1,000 live births and under-5 mortality to at least 25 per 1,000 live births. ^[5]

India made a significant progress in declining the child mortality rates especially between the mid-1980s and early 1990s. ^[2] With the progress made in reducing child mortality rates, there is a registered 2-point decline of Infant Mortality Rate to 28 per 1000 live births in 2020 from 30 per 1000 live births in 2019 (Annual Decline Rate: 6.7%). Also, the Neonatal Mortality Rate has declined from 22 per 1000 live births in 2019 to 20 per 1000 live births in 2020 (Annual Decline Rate: 9.1%). ^[3]

The Under 5 Mortality Rate for the country has shown a significant decline 32 per 1000 live births in 2020 against 35 per 1000 live births in 2019. ^[3]

However, studies have shown that the decline in child mortality rates has slowed down in recent years, a departure from long-term trend. ^[4] According to UNICEF, India has the highest number of under-5 deaths, with a total of 1.08 million deaths in 2016. ^[6] Although there has been a significant increase in access to healthcare and nutrition across various regions, there has been a lack of progress in reducing child mortality rates in certain states over the last decade. States such as Kerala, Tamil Nadu, West Bengal, Punjab, Maharashtra, and Karnataka have experienced minimal or moderate declines, whereas Orissa, Uttar Pradesh, Rajasthan, and Bihar have recorded a high level of stagnation in this regard. ^[2]

1.1 Factors accountable for decline in child mortality:

A secondary analysis was done to find the trends, patterns, and predictive factors of infant and child mortality in India. ^[6] This study has identified the factors that contribute to the reduction in child mortality. These factors are classified into three categories:

1. **Proximate factors** - This category includes medical and non-medical factors that play a crucial role in reducing child mortality. Medical factors such as access to quality healthcare services during antenatal and postnatal periods and care during childbirth are important. Non-medical factors such as accessibility to healthcare services also contribute significantly. ^[4]
2. **Nutritional Status** - The second factor that affects child mortality is the nutritional status of children. Proper nutrition is essential for healthy growth and development, which, in turn, reduces the risk of mortality. ^[4]
3. **Household and community-level factors** - The third category of factors includes aspects such as water, sanitation, housing, and maternal education. Access to clean water and proper sanitation, as well as adequate housing, are essential for the health of children. Maternal education is also a critical factor as it enables mothers to make informed decisions regarding their child's health and well-being. ^[4]

Significant advancements have been achieved in lowering child mortality rates. However, children belonging to impoverished or underprivileged families continue to be at a higher risk of harm in all developing regions. This dissimilarity in availability of healthcare services and nutritional requirements varies largely among rural and Urban India as well. ^[7]

1.2 Rural-Urban Disparity in Child Mortality in India

According to the 2011 census of India, approximately 69% of the population lives in rural areas (Registrar General of India 2011a). In the past eleven decades, the share of urban population has increased by only 13% (from 18% in 1901 to 31% in 2011) (Bhagat 2011). These gaps also exist in under-five mortality between various states of India are unacceptably wide. Rural Indians experience always higher mortality than urban Indians. ^[8] There are considerable rural-urban

infant mortality differentials existing at the national and state levels irrespective of the level of mortality. It was found that wide disparity in socioeconomic and community-level factors was the reason for rural-urban gap in mortality. From 1992 to 93 to 2019–21, the annual decrease in rural under-five mortality is 1.6%, whereas, in case of rural under-five mortality, it is 2.7%. The rural-urban gap in under-five mortality has reduced from 44 per thousand in 1992–1993 to 30 per thousand in 2004–2005 which further decreased to 14 per thousand in 2019–2021. Despite reducing rural under-five deaths more rapidly than urban under-five deaths, it is still higher than urban areas. ^[7]

Hence, it is essential to examine the underlying causes of the increased child mortality rate in rural India. Additionally, it is crucial to investigate the relationship between child mortality and accessibility to healthcare services and proper nutrition in rural areas. This correlation holds significant importance.

1.3 Accessibility to Healthcare services in rural India

Accessibility is the complex traid of aspects of availability, supply, and utilization of healthcare services. Barriers to access in the financial, organizational, social, and cultural domains can limit the utilization of services, even in places where they are “available.” ^[9] Access to health care is very much asymmetric between rural and urban India. While urban residents have a choice between public or private providers, the rural residents face far fewer choices. ^[10]

The latest rural health statistics data, which was released in 2022, has revealed a significant shortage of medical professionals such as surgeons, pediatricians, obstetricians, and gynecologists in community health centers located in rural areas. Additionally, there has been a decrease in the number of auxiliary nurse midwives at sub-centers and doctors at primary health centers in the year 2022. ^[11]

This visible reduction in the availability of manpower and healthcare infrastructure could potentially have a negative impact on child mortality rates. It is therefore crucial to analyze the influence of healthcare services and infrastructure on child mortality rates in rural India, which is the focus of this study.

1.4 Nutritional Status in Rural India

Nutrition plays a vital role in determining a child's health. Undernutrition is not caused by a single factor but is rather a complex issue that is linked to several causes, ultimately resulting in stunting, and wasting. These two factors are recognized risk factors for child mortality and morbidity. ^[12] Several studies and surveys have been conducted in India to assess the prevalence of undernutrition among children under five years of age and its associated factors. One notable survey is the National Family Health Survey. According to the data from NFHS-4, 36% of children under five years of age are underweight, 43.3% are stunted, and 24.5% are wasted. This significant burden of malnutrition is likely to impact child mortality rates and therefore warrants attention.

Research Question –

What is the impact of the accessibility of healthcare services and nutrition on child mortality indicators, particularly the infant mortality rate and Under-five Mortality rate, in rural India?

Objectives –

1. To evaluate the status of current Infant Mortality rate and Under-five Mortality Rate
2. To assess the impact of nutritional status on child mortality rates.
3. To determine the extent of correlation between rural healthcare infrastructure and child mortality rates, including, Infant Mortality Rate, and Under 5 Mortality Rate.

II. LITERATURE REVIEW

Sl. No.	Study Name	Year	Author	Location	Methodology	Salient Features
1.	Factors Affecting Infant Mortality Rate in India: An Analysis of Indian States. Advances in Intelligent Systems and Computing	2016;707–19.	Suriyakala V, Deepika MG, Amalendu J, Deepa G.	All India	Regression analysis	This study Uses data from the year 2001 to 2011 from all states and UTs and then compared the performance and growth rate of IMR to classify the states as good performers and laggards
2.	Child mortality in India: a complex situation	2012 Jan 27	Ghosh R	Articles from PubMed/MEDLINE	Literature Review	Identified the proximate determinants of child mortality and their association with health seeking behavior, antenatal care, delivery practices and postnatal care of infants.
3.	Reducing child mortality in India in the new millennium	2000	Claeson M, Bos E, Mawji T, Pathmanathan I	India	Literature Review	The present study documents the slowing decline in infant mortality rates in India; a departure from the longer-term trends
4.	Trends, patterns and predictive factors of infant and child	2019 Mar 20	Bhatia M, Dwivedi LK, Ranjan M,	India and its selected good-	Three rounds of cross-sectional	

	mortality in well-performing and underperforming states of India: a secondary analysis using National Family Health Surveys		Dixit P, Putcha V.	performing states, namely Haryana, Kerala, Maharashtra, Punjab and Tamil Nadu, and selected poor-performing states, namely Bihar, Chhattisgarh, Madhya Pradesh and Uttar Pradesh.	survey data	Attempts to reduce infant and child mortality rates in India are heading in the right direction. Even so, there is huge variation in performance between states.
5.	Explaining the rural-urban gap in infant mortality in India.	2013 Sept 11	Saikia N, Singh A, Jasilionis D, Ram F.	India	Binary logistic regression	The largest part of the rural disadvantage in infant mortality is attributable to the underlying disadvantage in household wealth and maternal education, whereas breastfeeding and knowledge of Oral Rehydration Solution has contributed to narrowing the gap.
6.	An update on explaining the rural-urban gap	2022 Nov 16	Kumar C, Piyasa, Saikia N.	India	Binary logistic regression	The existing rural-urban gap in under-five mortality

	in under-five mortality in India.				analysis	suggests that the social and health policies need to be needed to reach rural children from poor families and uneducated mothers
7.	Challenges to Healthcare in India - the Five A's	2018 Jul-Sep	Arvind Kasthuri	India	Literature Review	Challenges to Healthcare in India demonstrated as Five A's
8.	Issues of Unequal Access to Public Health in India.	2015 Oct 27	Barik D, Thorat A	All India	Literature Review	Quality health services, either public or private, with some government regulation, can help to improve the present scenario.
9.	India achieves significant landmarks in reduction of Child Mortality	2023 Mar 23		Press Information Bureau		
10.	Rural Health Statics Report	2005 – 2022	Govt. of India	All States of India		
11.	A study to assess undernutrition and its sociodemographic correlates in under-five children in urban and rural areas of Rishikesh, Uttarakhand	2020	Singh M, Rehan A, Kishore S, Jain B, Reddy NK, Kumar D, et al.	Rishikesh, Uttarakhand	t test, Chi square test	Sociodemographic factors such as religion, caste, parental education, father's occupation, and family size emerged as significant predictors of under nutrition.

III . METHODOLOGY

3.1 Research Question –

What is the impact of the accessibility of healthcare services and nutrition on child mortality indicators, particularly the infant mortality rate, in rural India?

3.2 Research Objectives –

1. To evaluate the status of current Infant Mortality rate and Under-five Mortality Rate
2. To assess the impact of nutritional status on child mortality rates.
3. To determine the extent of correlation between rural healthcare infrastructure and child mortality rates, including, Infant Mortality Rate, and Under 5 Mortality Rate

3.3 Research Design

This is a quantitative study that utilizes regression analysis to analyze the impact of healthcare infrastructure and nutritional status on child mortality rates. In addition, this study will employ a literature review approach to assess the current impact of nutrition and healthcare infrastructure on mitigating child mortality.

3.3 Research Procedure – Quantitative Analysis

The data analysis was conducted qualitatively using the **Sample Registration System (SRS) 2020** Volume 55-1 data sets for Infant Mortality Rate. Also, Data sets for Under-five Mortality Rates were derived from NFHS-5 (2019-2021).

The parameters related to healthcare services and infrastructure were extracted from **Rural Health Statistics 2022**. These parameters included the availability of health workers, such as female ANMs at Sub Centers and PHCs, as well as obstetricians, gynecologists, and

pediatricians at CHCs. Other parameters considered were the number of PHCs with labor rooms, those functioning on a 24x7 basis, and those with functional Stabilization Units for Newborns.

Operational Definition of the Parameters :

1. Health Worker [Female] / ANM At Sub Centre in Rural Areas :

It is the number of Health worker (female) or Auxiliary Nurse Midwife working in a Sub center in Rural areas, state wise. One ANM is required for each existing Sub Centre as per IPHS norms.

2. Health Worker [Female] / ANM at PHCs in Rural Areas :

It indicates the number of Health worker (Female) or Auxiliary Nurse Midwife working in the Primary Health center in each state. One ANM is required for each existing PHC as per IPHS norms.

3. Obstetricians & Gynecologists at CHCs :

It is the number of obstetricians and gynecologists in current position against the sanctioned posts at a Community Health Center in each state in the rural areas. One per Community Health Centre as per IPHS norms.

4. Pediatricians at CHCs :

It is the number of Pediatricians in current position against the sanctioned posts at a Community Health Center in each state in the rural areas. One per Community Health Centre as per IPHS norms.

5. Number of PHCs with labor room :

This indicator provides the count of rural Primary Health Centers (PHCs) that are equipped with a labor room, out of the total number of PHCs in a state.

6. PHCs functioning on 24X7 basis :

This indicator offers the count of rural Primary Health Centers (PHCs) operating 24/7 within each state, out of the total number of PHCs in the state.

7. PHCs With functioning Stabilization Units for Newborn :

This indicator quantifies the count of rural Primary Health Centers (PHCs) within each state that possess a functional stabilization unit for newborns, out of the total number of PHCs across the state.

The data sets were analyzed using regression analysis in Microsoft Excel to calculate the Pearson's Coefficient of correlation and p-value to determine the significance of the correlation. Additionally, Pareto charts illustrating the distribution of infant mortality rates across states were created using Microsoft Excel.

3.4 Research Procedure – Literature Review.

The Literature review included secondary research of both qualitative and quantitative studies published in peer-reviewed journals, government reports, and grey literature.

Published studies were identified through searches of PubMed and Google Scholar. The search results were then sorted based on inclusion and exclusion criteria, and articles that did not meet the inclusion criteria were excluded.

Inclusion terms -

Articles with the key word – “Child Mortality Rates” AND/OR “Nutritional status” AND/OR “Healthcare infrastructure” AND/OR “Infant mortality rate” AND/OR “access to public healthcare system” AND/OR “healthcare facilities accessibility”

In addition, the method of snowball article collection (citations from relevant journal articles) was also used.

The original search terms generated 1339 results.

Exclusion terms-

- Articles dated before 2000 were excluded from the study.
- Further the search was refined by limiting studies to India.

As a result, the search was narrowed down to 34 results.

IV. RESULTS

4.1 Infant Mortality Rate – Data Analysis

Infant mortality rates for each state in the year 2020 were extracted from the Sample Registration System (SRS) 2020 Volume 55-1 and analyzed using a Pareto chart.

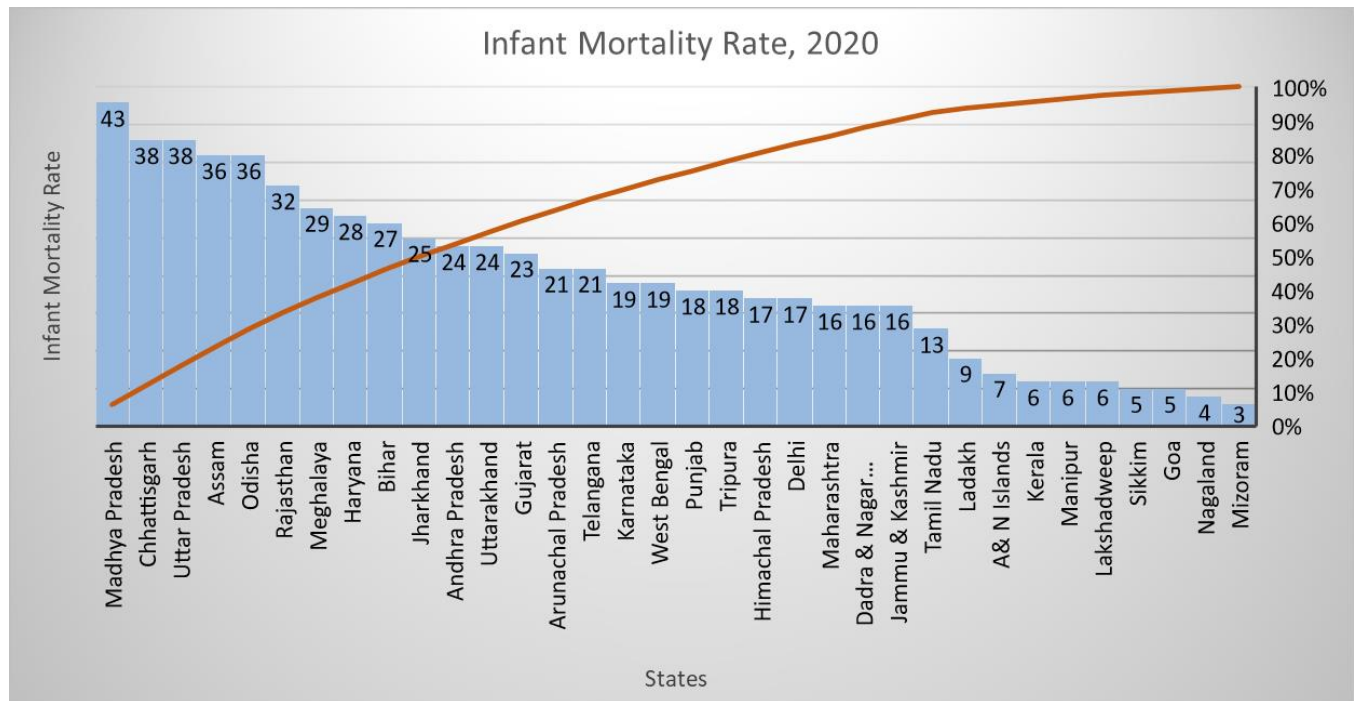


Figure 4.1 Pareto chart demonstration Infant Mortality Rate, 2020

The chart revealed that five states account for 80% of the total infant mortality rate in India. Specifically, Madhya Pradesh, Chhattisgarh, Uttar Pradesh, Assam, and Odisha were found to have the highest infant mortality rates.

4.2 Under-five Mortality Rate – Data Analysis

The National Family Health Survey-5, conducted from 2019-2022, provides state-wise data on Under-Five Mortality Rate. To identify the top five states that contribute the most to the overall Under-Five Mortality Rate in India, a Pareto chart was created based on this data analysis.

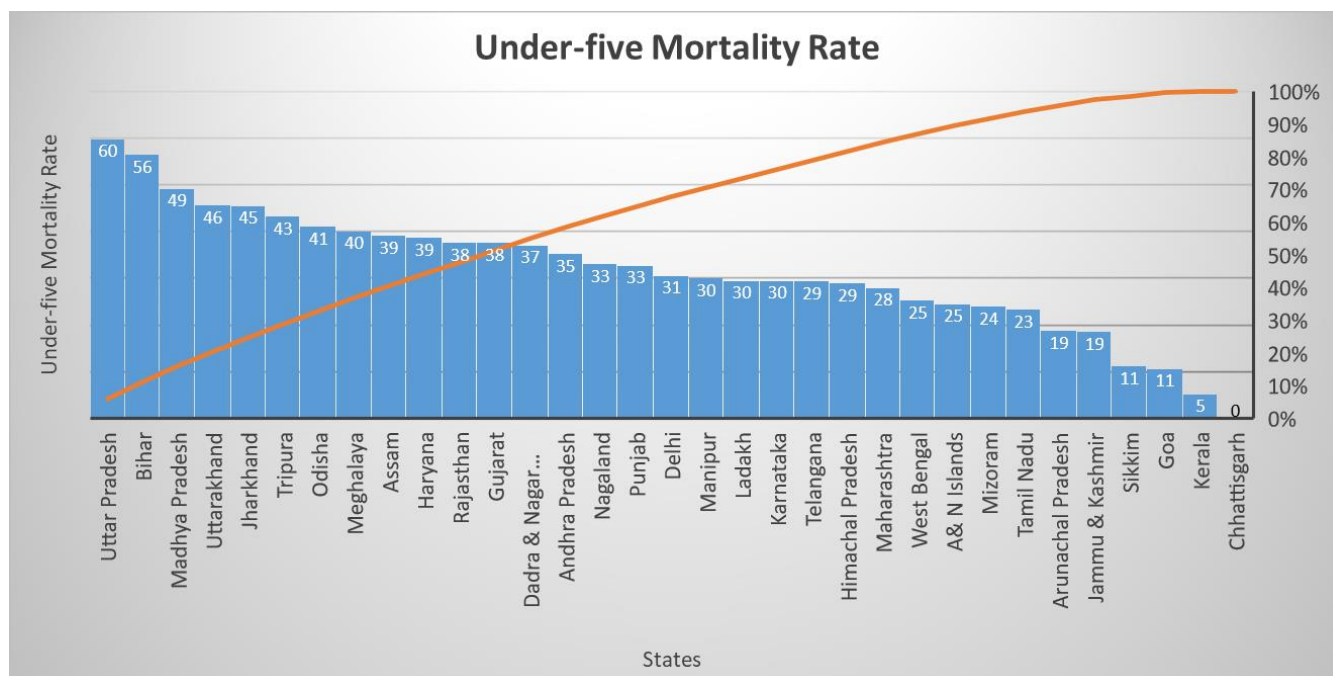


Figure 4.2 – Pareto chart demonstration Under-five Mortality Rate

According to the chart above, the states with the highest Under-Five Mortality Rates are Uttar Pradesh, Bihar, Madhya Pradesh, Uttarakhand, and Jharkhand. These five states are responsible for 70-80% of the overall Under-Five Mortality Rate.

Both Pareto charts, Figure 1, and Figure 2, illustrate the states with the highest Infant Mortality Rate and Under-Five Mortality Rate. These states include Madhya Pradesh, Chhattisgarh, Bihar, Uttar Pradesh, Assam, Uttarakhand, Jharkhand, and Odisha. These findings suggest the need for targeted interventions to improve healthcare services and reduce mortality rates in these regions.

4.3 Prevalence of Malnutrition with respect to Child Mortality rates in Rural Area

The Comprehensive National Nutrition Survey (2016-2018) identified malnutrition as a critical factor in achieving India's maternal and child mortality reduction targets. These findings underscore the importance of addressing malnutrition as a key strategy for improving the health outcomes of and children (under the age of five years) in India.

According to the Comprehensive National Nutrition Survey (CNNS) conducted from 2016-2018, 35% of Indian children aged 0-4 years were stunted, with the most populous states such as Bihar,

Madhya Pradesh, Rajasthan, and Uttar Pradesh having a high prevalence of stunting (37-42%). Rural areas had a higher prevalence of stunting (37%) compared to urban areas (27%). Stunting and wasting are known risk factors for child mortality and morbidity.

The survey also found that 17% of Indian children aged 0-4 years were wasted, with high prevalence states including Madhya Pradesh, West Bengal, Tamil Nadu, and Jharkhand. Additionally, 33% of Indian children aged 0-4 years were underweight, with the highest prevalence states being Bihar, Chhattisgarh, Madhya Pradesh, and Jharkhand. Similarly, underweight children were more prevalent in rural areas (36%) than in urban areas (26%). These alarming statistics highlight the urgent need to address malnutrition in India to reduce child mortality rates.

4.4 Correlation between rural healthcare infrastructure and child mortality rates

The level of accessibility to healthcare services can be ascertained by examining the availability of human resources and the number of healthcare infrastructures present at the Sub Center, Primary Healthcare Center, and Community Health Center. These parameters are elaborately presented in the Rural Health Statistics Report of 2022. Certain parameters of human resources and infrastructure were analyzed using regression analysis to find its correlation with Child mortality Indicators that is Infant Mortality Rate and Under-five Mortality Rates.

Upon doing a regression analysis, Pearson correlation coefficient and P values were derived.

Interpretation of Pearson Correlation coefficient is such that –

- a. Perfect: If the value is near ± 1 , then it said to be a perfect correlation: as one variable increases, the other variable tends to also increase (if positive) or decrease (if negative).
- b. High degree: If the coefficient value lies between ± 0.50 and ± 1 , then it is said to be a strong correlation.
- c. Moderate degree: If the value lies between ± 0.30 and ± 0.49 , then it is said to be a medium correlation.
- d. Low degree: When the value lies below $+ .29$, then it is said to be a small correlation.
- e. No correlation: When the value is zero.

Interpretation of the p -value (Statistical Significance of correlation) is such that A p -value less than 0.05 (typically ≤ 0.05) is statistically significant.

PARAMETERS (as specified in operational definitions)	Infant Mortality Rate (state wise)		Under 5 Mortality rate (state wise)	
	Pearson Correlation Coefficient	p-value	Pearson Correlation Coefficient	p-value
Health Worker [Female] / ANM At Sub Centre	0.5608	0.0005	0.4728	0.00475
Health Worker [Female] / ANM at PHCs	0.3389	0.00464	0.2050	0.24472
Obstetricians & Gynecologists at CHCs	0.5326	0.0012	0.5761	0.00036
Pediatricians at CHCs	0.4473	0.0080	0.6235	0.00008
Number of PHCs with labor room	0.5132	0.0019	0.4603	0.00616
PHCs functioning on 24X7 basis	0.5037	0.0024	0.6135	0.00011
PHCs With functioning Stabilization Units for Newborn	0.4324	0.0107	0.6577	0.00002

Table 4.1 – Results of Regression analysis demonstrating Pearson correlation coefficient and p-value.

Table 1 indicates a strong positive correlation between the number of ANMs working at subcenters, the number of obstetricians and gynecologists at CHCs, and the number of PHCs with a labor room, with infant mortality rates. Consequently, the states with higher infant mortality rates need to enhance these three aspects of health infrastructure and human resources.

Furthermore, after analyzing the correlation between Under-five mortality rate and healthcare parameters, a strong positive correlation was found between the availability of Pediatricians at CHCs, PHCs functioning on a 24X7 basis, PHCs with functioning Stabilization Units for Newborns and Under-five mortality rate. This provides valuable insights for planning interventions in states with higher mortality rates.

Moreover, all the correlations were statistically significant, except for the association between Health Worker [Female] / ANM at PHCs and Under-five mortality rates.

KEY FINDINGS –

- The states with the highest Infant Mortality Rate and Under-Five Mortality Rate include Madhya Pradesh, Chhattisgarh, Bihar, Uttar Pradesh, Assam, Uttarakhand, Jharkhand, and Odisha.
- The prevalence of Malnutrition (stunting and wasting) was noticeably high in these states.
- There is a strong correlation between the number of ANMs working at subcenters, the number of obstetricians and gynecologists at CHCs, and the number of PHCs with a labor room, with infant mortality rates.
- There is a strong correlation between the availability of Pediatricians at CHCs, PHCs functioning on a 24X7 basis, PHCs with functioning Stabilization Units for Newborns and Under-five mortality rate.
- All the correlations were statistically significant except for the association between Health Worker [Female] / ANM at PHCs and Under-five mortality rates.

V. DISCUSSION

This study presents the initial evidence of a significant connection between the amenities provided by healthcare centers and the accessibility of such centers to child mortality rates. Several factors contribute to reduce the mortality rates of infants and children under five years, including the presence of healthcare workers such as ANMs at sub-centers and primary health centers (PHCs), as well as the availability of obstetricians, gynecologists, and pediatricians at community health centers (CHCs). It is crucial that these human resources are adequately staffed at the designated healthcare facilities. Regarding infrastructure, the present study emphasizes the importance of PHCs equipped with labor rooms and functional Stabilization Units for Newborns, as they play a crucial role in promoting child health and reducing infant mortality.

In 2021, a study titled "A Critical Analysis on Rural Health Infrastructure in India" was published, conducting a thorough examination of the requirements of rural healthcare infrastructure.^[13] The study identified existing gaps in the infrastructure and proposed strategies to address these deficiencies in rural healthcare. The findings of the study indicated that all selected states and union territories were grappling with shortages in available sub-centers. In 2005, Uttar Pradesh exhibited the highest shortage of sub-centers with 38,437, followed by Maharashtra, Bihar, West Bengal, Tamil Nadu, Madhya Pradesh, Gujarat, Karnataka, and Rajasthan.^[13] This shortage trend persisted until 2019. The study recommended that particular attention should be given to highly populated states and union territories to alleviate these issues.^[13]

5.1 The Challenges of Healthcare Accessibility in Achieving the Desired Child Mortality Rates -

Delivering healthcare to "everyone," including the socially disadvantaged, economically challenged, and systemically marginalized populations, as well as reaching "everywhere," including remote areas such as the Himalayan region, faces several challenges. These challenges can be represented as five "As" for our consideration.^[14]

1. **Awareness or the lack of it:** The reasons for lack of awareness may lie in low educational status, poor functional literacy, low accent on education within the healthcare system, and low priority for health in the population, among others.^[14]

2. **Access or lack of it:** Access to healthcare is a crucial aspect that involves the right and opportunity to benefit from quality healthcare. Factors such as availability, supply, and utilization of healthcare services determine access. Physical reach, defined as the ability to access healthcare facilities within a 5 km distance, poses a challenge in rural areas where only a minority have such access. ^[15] Even when physically accessible, the quality and availability of care may be lacking, as evidenced by the deficiency of basic infrastructural facilities in primary health centers. Encouraging discussions on access determinants and addressing barriers in financial, geographic, social, and systemic domains is vital for improving access to quality healthcare. ^[15]
3. **Absence or the human power crisis in healthcare:** From 2005 to 2022, there has been a persistent shortage of workforce, particularly in Primary Health Centers (PHCs) and Sub Centers (SCs). While this shortage has been gradually decreasing over the years, the rate of decrease has been quite slow. ^[11] The available workforce is not distributed optimally, with most preferring to work in areas where infrastructure and facilities for family life and growth are higher. In general, the poorer areas of Northern and Central India have lower densities of health workers compared to the Southern states. ^[16]
4. **Affordability or the cost of healthcare:** The healthcare sector in India is predominantly dominated by the private sector, with nearly 75% of healthcare expenditure being borne by households, leading to catastrophic healthcare costs and impoverishment. The lack of regulation in the private sector leads to varying quality and costs of services. The public sector, on the other hand, provides healthcare at low or no cost but is perceived as unreliable and of indifferent quality, and is not preferred unless private care is unaffordable. ^[14]
5. **Accountability or the lack of it:** Being accountable in the healthcare profession involves justifying and taking responsibility for one's activities. Healthcare professionals have responsibilities towards their clients, ensuring the delivery of the service they

deserve. They are also accountable to their employers, expected to maintain a certain standard of service. Additionally, peers and colleagues expect healthcare professionals to uphold a code of conduct that fosters professional growth and harmony within the profession. ^[17]

To address the challenges in healthcare access and delivery, various intervention strategies can be implemented. These may include improving physical access by expanding the healthcare infrastructure and facilities in remote areas, increasing the availability of healthcare workers and professionals, and addressing the socio-economic barriers that limit the utilization of healthcare services. Additionally, efforts can be made to regulate the private healthcare sector, increase public sector funding and investment, and prioritize the healthcare needs of marginalized and disadvantaged communities. By implementing these interventions, we can work towards improving healthcare access and delivery for all.

5.2 Existing strategies to achieve desired child mortality rate-

The Government of India has put necessary schemes in place to improve accessibility and utilization of child health services. ^[18] Some of the important programs include –

1. The promotion of institutional deliveries is facilitated through cash incentives under the *Janani Suraksha Yojana (JSY)* and *Janani Shishu Suraksha Karyakaram (JSSK)*. These initiatives provide pregnant women delivering in public health institutions with various benefits, including free ante-natal check-ups, delivery services (including Caesarean sections), post-natal care, and treatment for sick infants up to one year of age.
2. *India Newborn Action Plan (INAP)* was launched in 2014 to make concerted efforts towards attainment of the goals of “Single Digit Neonatal Mortality Rate” and “Single Digit Stillbirth Rate”, by 2030.
3. An emphasis is placed on facility-based newborn care at various levels to reduce child mortality rates. This involves establishing dedicated facilities to cater to sick newborns, such as *Special Newborn Care Units (SNCUs)*, *Newborn Stabilization Units (NBSUs)*, and *Newborn Care Corners (NBCCs)*, as a priority focus area under the National Health

Mission (NHM). These facilities are designed to provide specialized care and support for newborns in need, aiming to improve their health outcomes and reduce infant mortality. [18]

5.3 Nutritional Interventions for child health :

NUTRITIONAL REHABILITATION CENTERS [18] :

- Severe Acute Malnutrition (SAM) plays a significant role in the mortality of children affected by common childhood illnesses, such as diarrhea and pneumonia.
- However, these deaths can be prevented by taking timely and appropriate actions.
- To address this issue, Nutritional Rehabilitation Centres (NRCs) are being established within healthcare facilities to provide inpatient care for severely malnourished children.
- These centers also involve counseling mothers on proper feeding practices, and once the children are on the path to recovery, they are discharged with regular follow-up to monitor their progress at home.

5.4 Shortcoming in the existing programs of Child Health

1. Utilization of services - The utilization of JSSK services in Chhattisgarh is considerably low, with only 40% of the population availing themselves of these services. This utilization rate is notably lower than the national average, indicating a significant gap in accessing and utilizing the benefits offered by the JSSK scheme. [19]
2. Out-of-pocket expenses [20] - Despite the provision of free or low-cost services under various schemes, families of children often encounter out-of-pocket expenses, such as transportation costs, that are not covered.
3. Geographical disparities - A study examining the disparities in service utilization between rural and urban areas revealed that the factors influencing respondents' utilization of services varied significantly. The study highlights the need for improvement in the services offered through the JSY and JSSK schemes, particularly in terms of

service availability and the public's awareness of their entitlements under these programs.
[20]

5.5 Future pathways for mitigating disparities and maximizing the effectiveness of child health strategies.

○ *Intersectoral action is needed to tackle social determinants of health :*

Intersectoral interventions are those undertaken by sectors such as education, environment, or finance, with or without the active collaboration of the health sector, to improve health outcomes. Countries that have implemented intersectoral interventions to tackle the social determinants of child health have been more successful in reducing inequities and child mortality rates.

○ *Geographic coverage of services must be planned to match needs :*

Geographic coverage of services in child health should be carefully planned to align with the specific needs of the population. It is essential to consider the geographical distribution of children and their healthcare requirements to ensure that services are accessible and reach those who need them the most. This involves understanding the demographic patterns, population density, and distribution of health facilities across different regions.

○ *Sustainable funding must reduce the burden on poor children's families.*

Insufficient funding allocated to child health programming contributes to inadequate public services, leading to substandard care and placing a disproportionate financial burden on impoverished families. The most significant disparities in access to healthcare affect interventions that necessitate round-the-clock availability of health facilities.

It is crucial for national policymakers to recognize and acknowledge that equity-focused policies, despite requiring higher implementation costs, yield quicker

improvements in coverage and more substantial reductions in child mortality compared to non-targeted approaches. Furthermore, such equity-focused strategies prove to be cost-effective in terms of the cost incurred per life saved.

○ *Driving equity from the top-down and bottom-up*

Equity-oriented policies prioritize addressing the unequal distribution of health issues among disadvantaged groups. These policies specifically target the barriers related to geography, finances, and psychosocial factors that hinder access to healthcare services. They also encompass both remedial actions within the healthcare system and initiatives implemented outside the health sector to promote equitable health outcomes. By targeting these areas, equity-oriented policies aim to reduce health disparities and ensure that everyone has equal opportunities to access and benefit from healthcare services.

VI. CONCLUSION

Child mortality is a critical indicator that reflects the overall health status of a country. Despite India's efforts, with an Infant Mortality Rate (IMR) of 39 deaths per 1000 live births and an Under-five Mortality Rate (U5MR) of 45 deaths per 1000 live births, the country still faces challenges in improving child health. Various factors contribute to these rates, including maternal health, nutrition, education, poverty, healthcare infrastructure, and human resources.

While accessibility, affordability, and awareness remain significant challenges in healthcare utilization, rural areas in India have witnessed a reduction in child mortality rates. However, this reduction is insufficient to meet the targets set for 2030 under Goal 3.2 of sustainable development.

Therefore, this study resulted with showing a strong positive correlation of healthcare services and infrastructure with that of Child Mortality Rates. States with the highest IMR and U5MR were identified as Madhya Pradesh, Chhattisgarh, Bihar, Uttar Pradesh, Assam, Uttarakhand, Jharkhand, and Odisha. These states also showed a high prevalence of malnutrition, stunting, and wasting, indicating a connection between nutritional status and child mortality rates..

In conclusion, there is a strong correlation between the number of ANMs working at subcenters, the number of obstetricians and gynecologists at CHCs, and the number of PHCs with a labor room, with infant mortality rates. Also, a significant positive correlation was seen between the availability of Pediatricians at CHCs, PHCs functioning on a 24X7 basis, PHCs with functioning Stabilization Units for Newborns and Under-five mortality rate.

Adequate healthcare infrastructure plays a crucial role in providing essential medical services, including proper nutrition, to children. Accessible and well-equipped healthcare facilities contribute to early detection, timely intervention, and effective management of nutrition-related issues, ultimately reducing child mortality rates.

Therefore, investing in healthcare infrastructure and nutrition programs is vital for improving child mortality rates and ensuring the well-being of future generations.

VII. REFERENCES

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