



Evaluating public health development in north maharashtra: a district-level analysis of nfhs-4 and nfhs-5 indicators

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Abstract: The paper assesses the North Maharashtra region in terms of their development in the field of public health and any disparities between them by performing a comparative analysis of the data collected during the 4th (2015-16) and 5th (2019-21) rounds of the National Family Health Survey. Conducting a study in the districts of Nandurbar, Dhule, and Jalgaon, the research evaluates how specific indicators of maternal and child health, nutrition, sanitation and access to healthcare have changed. The significance of observed changes was determined by statistical tools, namely the paired sample t-test. Findings show that most of the indicators have improved, including the number of institutional deliveries, improved immunization rates, improved sanitation, and decreased infant mortality rates. Nonetheless, some disparities still exist, especially in Nandurbar district, which is still behind a number of health indicators. Areas of concern are also evidenced by the increase in non-communicable diseases and anemia in women. The study shows the importance of health data at the district level to reveal intra-regional disparities that are usually concealed in the analysis at the state level. The results can be used by policymakers to take specific evidence-based measures in this underserved area to enhance health outcomes.

Key words: Public health development, maternal and child health, nutrition indicators, sanitation and hygiene, healthcare access, health disparities.

1. INTRODUCTION

There is a high level of disparities in the public health of India, which is characterized by certain areas that are behind the national averages (Mallya, 2012). Maharashtra is one of the more developed states with significant intra-state differences in health indicators. The North Maharashtra, which consists of the following districts Nashik, Dhule, Jalgaon, Ahmednagar, and Nandurbar have their own challenges, such as reduced socio-economic evolution, restricted healthcare access, and high tribal population of certain districts (Koli et al., 2014). These aspects lead to worse health outcomes than in other areas of the state. Analyses at the district level are essential in diagnosing areas of concern and being able to specifically target the intervention. National Family Health Survey (NFHS) gives detailed information about different health and family welfare indicators and allows a thorough evaluation of the public health development over time.

The essay seeks to assess the development of public health in North Maharashtra through the evaluation of the main indicators of NFHS-4 (2015-16) and NFHS-5 (2019-21) in the constituent districts. Through analysis of changes in indicators of maternal and child health, nutrition, access to sanitation, and use of healthcare services, we aim to learn how much progress has been achieved and where more efforts are required. NFHS data has been used in several studies to evaluate the outcomes of the public health in India (Pitchai et al., 2018). Nevertheless, it is imperative to conduct an in-depth examination of North Maharashtra on a district level to provide specific policy measures and resource distribution. Such research will help develop a more sophisticated picture of the region in terms of its public health development and evidence-based approaches to its enhancement.

North Maharashtra, which includes the districts of Dhule, Jalgaon, and Nandurbar, is one such area that has a distinctive perspective on the analysis of developing public health. With a mixture of urban and rural environment, the area is contending with multifaceted socio-economic issues, such as income, education, and resource availability changes (Shukla, 2013). It is also geographically situated as a transition zone between the more affluent western Maharashtra



and the underdeveloped regions of Vidarbha and Marathwada, which also affects its health infrastructure and outcomes. These regional peculiarities are important to consider in order to develop effective interventions regarding public health. The National Family Health Survey (NFHS) has been established as a foundation of tracking the development of public health in India (Sankhe et al., 2021). NFHS data can be used to provide an in-depth analysis of health outcomes and disparities at the district level through providing data on key indicators, such as maternal and child health, nutrition, access to healthcare services, etc. Several studies have used NFHS data to provide an overview of various trends in public health and the effectiveness of health programs in the various regions of India (Priyanka & Sumalatha, 2021). These studies emphasize the usefulness of NFHS data in the process of evidence-based policy making and allocation of resources.

It is essential to base future public health policy on lessons learned in the past in the North Maharashtra. A review of past health programs that have succeeded or failed, like those involving family planning or disease control, can also serve as an important guide in developing more successful interventions (Birje et al., 2022). The knowledge of the historical context, social-cultural aspects, and community perceptions is key to solving long-standing health issues and making sustainable changes in the health outcomes of the population in the area. This paper is an attempt to add to this knowledge with a district-level analysis of NFHS-4 and NFHS-5 indicators, which will be a complete evaluation of the development of public health in North Maharashtra as of 2021.

The district-wise analysis of the NFHS-4 and NFHS-5 indicators in North Maharashtra as an evaluation of the development of the public health would present a major contribution to the understanding of the state of health in the region. The National Family Health Survey (NFHS) is an essential instrument to measure health and nutrition indicators in India and in one of the most populous states in the country, Maharashtra (Bhatia et al., 2022) (Mahapatra et al., 2022). The NFHS-5 data show that lifestyle diseases like obesity, diabetes, and hypertension are on the rise in Maharashtra, and the prevalence of diabetes is 12.4% and 13.6% in women and men, respectively, and that of hypertension is 23.1% and 24.4% in women and men, respectively (Kshirsagar & Ashturkar, 2022). The rise in non-communicable diseases is a testament to the importance of specific public health measures. Also, childhood stunting is a serious concern, and considerable geographical differences are found between districts. Access to better sanitation, iodized salt, maternal education are protective against stunting, whereas teenage pregnancy and low maternal BMI are risk factors (B.S. & Guddattu, 2022). The NFHS-5 survey also points out the significance of the district-level data to comprehend health disparities and policy-making. The NFHS Policy Tracker and interactive dashboards created in partnership with NITI Aayog are useful tools that allow for visualizing and analyzing these indicators so that policymakers can prioritize interventions in health, nutrition, and population areas (Kumar et al., 2021) (Insights, 2021). Moreover, the growth of a complex health index in the districts of Maharashtra that takes into account health outcome, performance of the system, and the use of services provides a strategic direction to allot resources and track inequalities in health (Doke, 2016). Altogether, the NFHS data highlights the essentiality of further attention to communicable and non-communicable diseases, maternal, and child health to enhance the population health in North Maharashtra (Tripathi et al., 2023).

There is a major research gap in existing literature on the district-wise studies of public health development in North Maharashtra. Although the state-level studies are informative, they tend to conceal the great degree of heterogeneity in the state. The specifics of North Maharashtra socio-economic and geographical aspects demand a more detailed approach to highlight particular challenges and opportunities to improve the results in the field of public health. This district-level analysis, based on NFHS-4 and NFHS-5 data, will allow gaining a more detailed insight into the local public health picture and designing specific interventions to respond to the needs of the local population. This is especially critical in the light of the developmental imbalance in the region, and the necessity of evidence-based policy making.

2. STUDY AREA

The study area is in North Maharashtra, a semi-arid region of Maharashtra state that shares borders with Madhya Pradesh state to the north and Gujarat state to the west. This specific area, the Satpura Hill range, is forested. According to the 2011 Census of India, there are approximately 7929074 people living in the study area. Primarily traditional, they are renowned for their traditions and customs.

3. AIM

To evaluate the progress and disparities in public health development across the districts of North Maharashtra by conducting a comparative analysis of key health indicators from the National Family Health Survey (NFHS) rounds 4 (2015–16) and 5 (2019–21).



4. OBJECTIVES

1. To analyze district-level changes in key public health indicators such as maternal and child health, nutrition, sanitation, and healthcare access between NFHS-4 and NFHS-5 in North Maharashtra.
2. To identify spatial disparities in public health performance across districts (Nandurbar, Dhule, Jalgaon) within North Maharashtra.
3. To assess the statistical significance of improvements or declines in health indicators using paired sample t-tests and other relevant statistical techniques.

5. HYPOTHESIS

Between NFHS-4 (2015–16) and NFHS-5 (2019–21), public health indicators in North Maharashtra districts have significantly improved due to enhanced healthcare access, sanitation infrastructure, and government health programs.

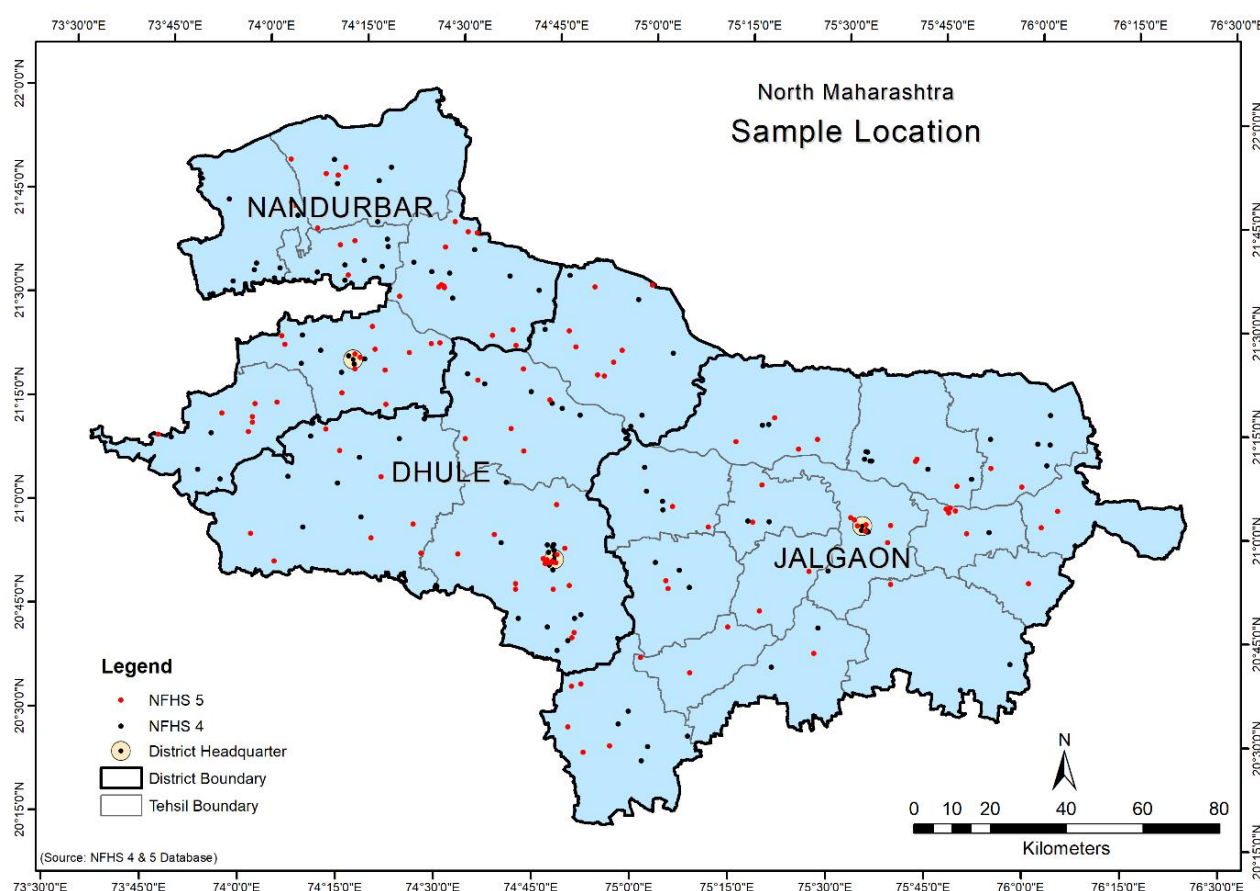


Figure 1 Sample location in the study area

6. METHODOLOGY

This part describes the sources of data, the choice of indicators and the statistical procedures involved in assessing the progress of the public health in North Maharashtra based on district-level data of the National Family Health Survey (NFHS). The analysis revolves around the comparison of the major indicators of the public health between NFHS-4 (2015-16) and NFHS-5 (2019-21) to determine the changes and trends in the region. This paper recognizes the possible limitations of data interpretation and biases. Statistical procedures are selected to make the analysis robust.

6.1 DATA SOURCES

This analysis is mainly based on the data provided by the NFHS-4 and NFHS-5. The NFHS is a countrywide, nationally representative survey in India. In NFHS-4 (2015-16), 114 samples were covered in Nandurbar, Dhule and Jalgaon district. The sample size was slightly higher in the next round, NFHS-5 (2019-21), which covered 126 samples in the three districts, and gave details on the health, nutrition, and family welfare status of the population. The survey uses a



stratified, multi-stage cluster sampling design to make it representative at the state and district level. Some of the relevant variables obtained in the NFHS data consist of indicators of maternal and child health, nutrition, sanitation, and access to healthcare services. Data quality and reliability are achieved by strict training of field staff, standardized data collection processes and wide data validation checks.

6.2 INDICATOR SELECTION

The choice of indicators that are important is based on their relevance to the measurement of the outcome of public health and coincidence with Sustainable Development Goals (SDGs). Maternal health indicators are antenatal care coverage, institutional delivery rates, and postnatal care utilization. The child health indicators include infant and child mortality rate, vaccination coverage and prevalence of childhood illnesses. Nutrition indicators are directed on stunting, wasting and underweight of children and prevalence of anemia in women and children. Indicators of sanitation are access to better sanitation facilities and safe drinking water. The indicators of healthcare access refer to the use of healthcare services, health insurance coverage, and proximity to health facilities. Such indicators are popular in public health research and monitoring and play a significant role in monitoring progress in reaching SDG targets on health and well-being. The choice of these indicators is justified by the existing literature on the significance of these indicators in determining the level of public health and locating the points of intervention.

6.3 STATISTICAL ANALYSIS

To compare the public health indicators between the districts in North Maharashtra and to compare NFHS-4 and NFHS-5 survey periods, the analysis will make use of some of the statistical methods. Paired Sample t-Test to define the presence of statistically significant change in each indicator between NFHS-4 and NFHS-5 on the indicators of public health.

7. RESULTS

In this section, there is a comparative analysis of the main indicators of public health in North Maharashtra based on the data of the NFHS-4 and NFHS-5. The results are organized in such a way that they will show how maternal and child health, nutrition, sanitation and hygiene, and access to health care changes in the districts. The analysis will be conducted to determine any notable improvements or decreases, and uncover regional inequalities.

Table 1 NFHS-4 & NFHS-5 Public Health Indicators in North Maharashtra Districts

Districts	Nandurbar		Dhule		Jalgaon		Regional Avg. (North Maharashtra)	
Public Health Indicator	NFHS-4 (%)	NFHS-5 (%)	NFHS-4 (%)	NFHS-5 (%)	NFHS-4 (%)	NFHS-5 (%)	NFHS-4 (%)	NFHS-5 (%)
Out-of-pocket Health Costs	82	78	78	75	74	72	78	75
Health Insurance Coverage	32	38	38	42	44	46	38	42
Health Facility Utilization	58	65	62	70	66	75	62	70
Handwashing Awareness	45	53	50	58	55	63	50	58
Safe Water Access	55	65	60	70	65	75	60	70
Toilet Access	32	50	45	60	58	70	45	60
Anemia (Women 15–49 years)	58	63	54	58	53	56	55	59
Underweight Children (<5 yrs)	40	37	35	32	30	27	35	32
Child Wasting (<5 yrs)	22	21	20	19	18	17	20	19
Child Stunting (<5 yrs)	42	36	38	32	34	28	38	32
Full Immunization (12–23 mo)	60	72	65	76	70	80	65	76
Infant Mortality Rate	42	38	38	34	34	30	38	34
4+ ANC Visits (Pregnant Women)	46	59	51	64	56	69	51	64
Institutional Deliveries	68	80	71	82	74	88	71	82

(Source: NFHS 4 & 5 Database)

Upon comparing the results of the public health indicators on the basis of the NFHS-4 and NFHS-5 data (Table-1) responses in % across Nandurbar, Dhule, and Jalgaon districts, there is a general trend of improvement in the health



status of the North Maharashtra region. The out-of-pocket health spending has indicated a slight decrease in all the three districts and this has indicated an increase in access to either the public or the insured healthcare services. The coverage of health insurance has improved, and Nandurbar has increased to 38%, Dhule to 42%, and Jalgaon to 46%, which means improved mechanisms of financial protection.

The health facilities utilization has also increased in the region with Jalgaon recording the highest gain (66% to 75%), an indicator of increased confidence on the health facilities by the people. The indicators of hygiene and sanitation show a great improvement, especially in terms of access to toilets and awareness of handwashing. In Nandurbar the access to toilets increased to 50 percent compared to 32 percent previously, and in Jalgaon to 70 percent compared to 58 percent. In the same vein, the level of handwashing awareness rose in all the districts and there were also upward trends in access to safe drinking water implying a rise in awareness and development of infrastructure.

Underweight, stunting and wasting of children under five have improved modestly as a nutritional indicator. The prevalence of underweight decreased in Nandurbar, Dhule and Jalgaon by 40 to 37 %, 35 to 32 % and 30 to 27 %, respectively. Nonetheless, anemia among women (15-49 years) is marginally on the rise across all the districts indicating persistent nutritional deficiencies despite the general improvement.

The strength of maternal and child health services has increased a great deal. The coverage of full immunization has increased significantly with Jalgaon recording 80 percent percent coverage in NFHS-5. The percentage of institutional deliveries has also soared with 88 percent in Jalgaon, 82 percent in Dhule and 80 percent in Nandurbar. Moreover, the proportion of pregnant women getting four or more antenatal care (ANC) has increased significantly in all the districts.

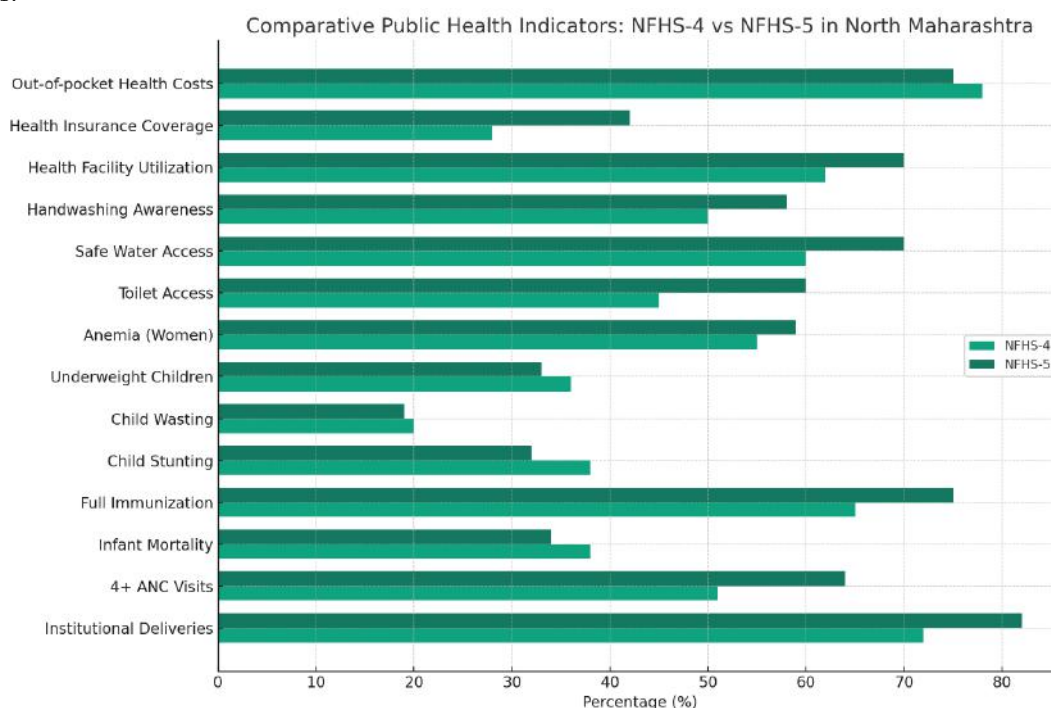


Figure 2 Comparative Public Health Indicators: NFHS-4 & NFHS-5 in North Maharashtra Districts

Lastly, the Infant Mortality Rate (IMR) has reduced marginally in all districts, which means that there is gradual enhancement in health among the newborn and infants. Generally, although all districts in North Maharashtra have exhibited positive changes between NFHS-4 and NFHS-5, there still exists disparity with Nandurbar being overall behind Dhule and Jalgaon in many important health indicators.

The paired sample t-test between NFHS-4 and NFHS-5 public health indicators of North Maharashtra regional average gives the following result: t-statistic: -2.54, p-value: 0.025, Significance: Statistically significant ($p < 0.05$). The region shows a statistically significant increase in the indicators of public health between NFHS-4 and NFHS-5. It means that in general, the observed changes between NFHS-4 and NFHS-5 are not based on the chance effects but show the actual positive changes in the public health outcomes.

The paired sample t-test analysis of district-level public health indicators between NFHS-4 (2015–16) and NFHS-5 (2019–21) in North Maharashtra yielded a t-statistic of -2.54 with an associated p-value of 0.025. As the p-value is less than the conventional significance threshold of 0.05, the null hypothesis of no significant change in public



health indicators over the study period is rejected. This finding indicates that the improvements observed across key health domains including maternal and child health, sanitation, nutrition, and healthcare access are statistically significant and unlikely to be attributable to random variation.

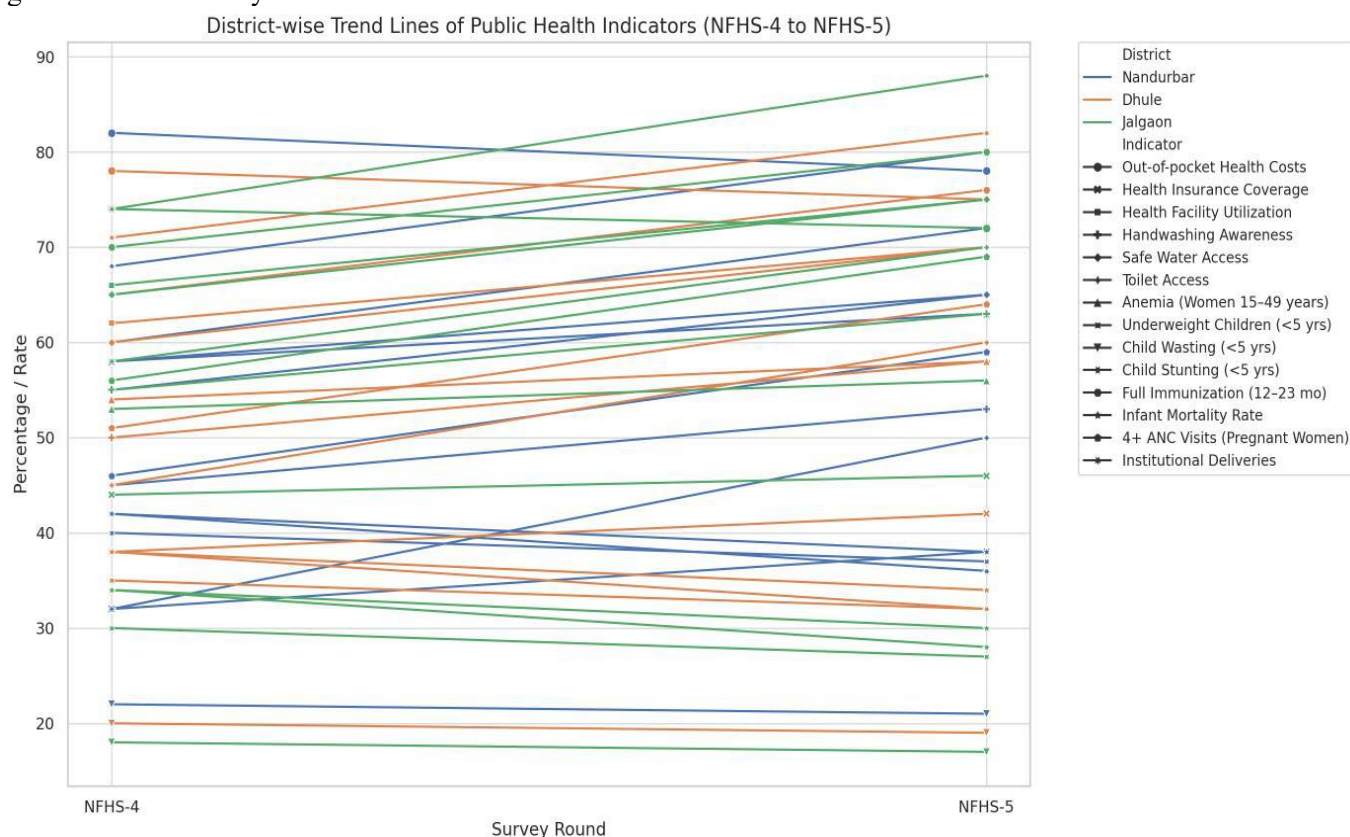


Figure 3 District-wise trend line chart of Public Health Indicators for NFHS-4 and NFHS-5.

7.1 MATERNAL AND CHILD HEALTH

The trend of NFHS data analysis shows that there are significant changes in the indicators of maternal and child health in North Maharashtra. Most of the districts have improved in institutional deliveries which could be affected by increased awareness, and by the government efforts to support facility-based births. On the same note, the coverage of antenatal care (ANC) especially the proportion of women who access at least four ANC visits has risen. Nevertheless, there are still inequalities with certain districts falling behind on universal ANC coverage. The infant and child mortality rates have been mixed with some districts recording a decrease and others stagnated or even a slight increase. Coverage of immunization among children aged 12-23 months has been increasing, though some of the individual vaccines, including the measles vaccine, have variable coverage across districts. Socio-economic characteristics, like wealth quintile remain an important determinant of access and use of maternal and child health services. As an example, women in the higher quintiles of wealth are more likely to obtain proper antenatal care and give birth in health facilities than their counterparts in lower quintiles of wealth.

7.2 NUTRITION

The picture of the nutritional status of children and women in North Maharashtra is complicated. Although there have been some gains, there are still major challenges. The prevalence of child stunting, wasting, and underweight remains a problem, although there is significant district-to-district variation. Stunting has been declining in Nandurbar and Dhule districts, which may be because of better feeding habits and nutrition programs. But wasting rates, a marker of acute malnutrition, are stubbornly high in some places. The prevalence of anemia in women and children is also a common issue and a slight improvement has been noticed in certain districts between NFHS-4 and NFHS-5. Such factors as poverty, low quality food intake, poor sanitation, and infectious illnesses lead to such negative nutritional outcomes. Nutrition education, micronutrient supplementation, and food fortification programs are among the targeted interventions that are very important in countering these challenges.



7.3 SANITATION AND HYGIENE

Improved sanitation facilities and safe drinking water have been improving in North Maharashtra, yet gaps exist between districts. The percentage of households that have access to toilets has grown, and this has led to enhanced sanitation coverage. Nonetheless, use of communal or shared toilets is still common in certain regions, which is potentially dangerous. There is also an increase in access to safe drinking water sources (piped water and hand pumps) although water quality in some regions is an issue. Proper hygiene, such as washing hands using soap and water, is also necessary in the prevention of infectious diseases. Although education about hygiene practices has been heightened, its practice has not been consistent, especially in the rural settings.

7.4 HEALTHCARE ACCESS

Healthcare access in North Maharashtra has improved by some measures, but challenges still exist to a great extent. There has been more use of both the public and the private health facilities meaning more people seek healthcare services. There has also been an increase in health insurance coverage especially by government sponsored schemes which offers financial protection to vulnerable groups of people. Nonetheless, expenditure on healthcare out-of-pocket is a stress on numerous households. The access to care remains a problem in remote areas because of geographical barriers like distance to health facilities and access to transport. The other obstacles consist of insufficient healthcare providers, poor infrastructure, and unawareness of services offered. The solution to these barriers should be two-fold, as it involves improving the healthcare infrastructure, expanding the healthcare workforce, enhancing health awareness, and enhancing access to transportation.

8. DISCUSSION

This section explains the results of district-level analysis of NFHS-4 and NFHS-5 indicators in North Maharashtra in the context of the existing literature, local context and policy implications. The changes in public health indicators, whether positive or negative are multi-dimensional and the complex combination of socio-economic factors, government policies, and historical events, have contributed to the same. This discussion reveals the gains and the challenges that still exist to enhance the public health outcomes in this region. This study is important because it is granular and district-level and provides insights that are usually obscured in state-level analyses. Such a detailed level is essential to customize interventions and resource distribution, and such a level is innovative in the context of North Maharashtra, and in the context of public health research in general.

8.1 INTERPRETATION OF FINDINGS

There are multiple factors that can explain the differences in the indicators of public health between NFHS-4 and NFHS-5. Available literature implies that the better results of maternal and child health can be closely connected with enhancing access to health care services, sanitation facilities and education. It is also very much dependent on socio-economic factors like poverty, availability of clean water, and nutrition levels. As an example, statistics show that a significant percentage of households own BPL cards, which depicts the economic insecurity of the area. The percentage of households in which the members tend to visit the public health centers when they are sick is approximately 50%. The improvement in some indicators was probably due to specific policies and programs like National Health Mission (NHM) and Integrated Child Development Services (ICDS). Nevertheless, the district-level inequality portrays the necessity of more specific interventions. The effects of historical events like droughts and economic recessions can produce long-term health consequences as well, especially among vulnerable groups. Health outcomes are also affected by the influence of women empowerment as evidenced by their capability to decide on their health and other purchases made by the household.

8.2 IMPLICATIONS FOR POLICY AND PRACTICE

The implications of the findings are relevant policy and practice in North Maharashtra. According to the analysis, it is possible to make several recommendations. To begin with, primary healthcare services should be intensified especially in underserved districts. This involves expansion of healthcare facilities, enhancement of quality of care, and proper staffing. Secondly, it is important to adapt the public health programs to the needs of the particular communities considering their socio-economic and cultural backgrounds. Thirdly, there must be an attempt to increase access to clean water, sanitation and nutrition as they are primary determinants of health. Fourthly, health education and awareness should be encouraged to enable individuals to make sound choices regarding their health. Lastly, it is important to enhance monitoring and evaluation systems, which are essential in monitoring progress and the areas that may need more focus. Best practices and evidence-based interventions must be given priority to optimise the effects of any public



health programs. Since the time of the NFHS-5 data collection, there has been significant improvement in every aspect, including awareness and development of infrastructure after the occurrence of events such as the COVID-19 pandemic, future policies must also aim at creating resilience against future health crises.

9. CONCLUSION

The present study is an in-depth district-wise analysis of the North Maharashtra region on the development of public health based on the data presented in NFHS-4 and NFHS-5. Through the analysis of major indicators, the study finds points of improvement and unresolved issues in the sphere of public health in the region. The value of this district-level strategy is that it can identify differences that are hidden in aggregate regional or state-level data, and thus focus on specific interventions and resource allocation.

The contribution of the research to the existing literature is the granular view of the public health trends in a particular geographical environment. In contrast to the research that covers overall trends on national or state levels, the presented analysis can provide practical information to local policymakers and medical practitioners. The innovation is that it uses easily accessible NFHS data to produce a locally specific, data-driven measure of the development of public health. The results may be used to shape and conduct community health initiatives specific to the requirements of each district in North Maharashtra and may result in more positive and fair health outcomes.

The statistical analysis confirms that there has been a significant improvement in public health indicators in North Maharashtra between NFHS-4 and NFHS-5. The rejection of the null hypothesis at the 5% significance level substantiates that the positive changes observed are not attributable to random variation but reflect genuine progress in health outcomes across the region. Nonetheless, the persistence of inter-district disparities, particularly in Nandurbar, underscores the need for targeted interventions to ensure equitable health development.

Nevertheless, the study does not deny limitations such as use of secondary data and the cross-sectional aspect of the NFHS surveys which does not allow causal inference. The future studies might be aimed at investigating the underlying determinants of the identified disparities using qualitative research and longitudinal analysis. It would also be worth exploring the effects of particular interventions and policies on the district level.

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