Tracking improvements and persisting inequalities in health services utilization for maternal and child health services in India: A trend analysis across NFHS-4 and 5

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Abstract

Background

In recent decades, despite much progress in maternal and child health service programming and coverage, the benefits of health services do not seem to have permeated equitably across communities due to intersectional elements such as socioeconomic, educational and demographic differences that exist in India. Reduction in MMR, NMR, and U5MR has often failed to reach National Health Policy (NHP) targets in many Indian states and is far short of the SDG goals for 2030. In this exploration, the aim is to assess the progress in the utilization of MCH services and disparities that exist in terms of utilization of health services and their role in advancing equity in health ailments across time periods of 2015-16 to 2019-21.

Methods

We examine socioeconomic determinants for the utilization of MCH services. Through analysing the fourth and fifth rounds of India's National Family Health Survey (NFHS), appropriate bivariate and multivariate analysis along with rate-ratio, concentration index, and logistic regression analysis were conducted.

Findings

Results indicate that 70% of women received ANC during the first trimester, 58% received more than three ANC visits, and 89% gave birth in a health facility. Among Indian States, the North-Eastern and Empowered Action Group (EAG) states witnessed the lowest utilization rates of MCH services. Belonging to the lowermost strata, belonging to the SC/ST caste, being of higher birth order, place of residence, being a Muslim was found to significantly influence the acceptance of MCH services.

Interpretation

It is noteworthy that despite a reduction in wealth inequality in India over the past five to six years, health disparities persist across various socio-demographic categories. The leading causes of women not opting for MCH services were found to be women's illiteracy, rural residence, poor wealth status, higher birth order, pregnancy at older ages, and less exposure to mass media. The evidence highlights that it is essential to address key determinants of health to achieve universal health coverage under India's NHP and larger SDG goals. The study highlights the imperative that policy interventions have to attempt to reach the most impoverished of the population if the central, transformative promise of the 2030 Agenda for SDGs is to be achieved.

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Keywords: maternal, child, health services, inequalities, utilization, SDGs, NFHS, India

Key Messages:

1.

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1. Introduction

Despite considerable advances in technology and healthcare delivery, progress among maternal and newborn mortality reduction has slowed globally, and millions of pregnant women and children face preventable deaths annually, predominantly in less developed regions of Africa and Asia.[1] While this can highlight the flat of the curve phenomenon that is common among developed nations, it is intriguing for a LMIC such as India, which is expected to reap the health benefits of economic growth and vice versa. Considering the national average, India has made significant progress in reducing the maternal mortality ratio (MMR) to 97 per 100,000 live births, steadily advancing on the track to achieve Sustainable Development Goals (SDG), with an MMR below 70 (SDG target 3□1) ahead of time, with eight states having already achieved this SDG target 3□1.[2] Furthermore, the under-five mortality rate (U5MR) has decreased to 32 per 1000 live births, and 11 Indian States/UTs have already met the target (SDGs 3□2) of reducing U5MR to less than 25 per 1000 live births by 2030. Neonatal Mortality Rate (NMR) had also declined to 20 by the year 2020. Six States/UTs have already attained the SDG target of reducing NMR to less than 12.[3]Despite declines in maternal and child mortality in recent years, there is still a need to largely address socioeconomic inequities and further reduction in maternal and child mortality rates. [4,5]Some regions and pockets within India consistently face greater disadvantages, particularly in terms of key indicators.[6–8] MMR ranges from 195 to 56 in eight EAG States and Assam, U5MR varies from eight in Kerala to 51 in Madhya Pradesh, and NMR ranges from four in Kerala to 31 in Madhya Pradesh [2,3]According to SRS 2020 estimates, the National Health Policy (NHP) targets of reducing MMR to 100 by 2020, reducing U5MR to 23, and neonatal mortality to 16 by 2025 seem challenging for many States.[9]The significant divergence in all three indicators based on geographical location and socioeconomic disparities underscores the imperative for the nation to consolidate its efforts on underperforming states and marginalized groups to achieve SDG and NHP targets for maternal and child mortality.

Enhanced initiatives in maternal and child healthcare (MCH) have significantly contributed to the reduction of maternal and child mortality rates in India.[10–12] These endeavours have prioritized aspects such as antenatal care (ANC), institutional delivery, and immunization during the past decades. Progress has been made over time in MCH outcomes, but challenges and disparities persist across different regions and socioeconomic groups. While the coverage of at least four ANC visits has increased in India from 1998 to 2016, there are still gaps in ANC utilization, particularly among women with lower education levels, belonging to lower wealth quintiles, residing in rural areas, and belonging to marginalized communities.[13] Women from poorer households and rural areas had higher odds of inadequate ANC visits.[14] Socioeconomic factors, such as education and wealth were also associated with the utilization of ANC services.[15] Economic status and place of residence were found to be more crucial determinants than access to healthcare facilities for institutional deliveries in India.[16]Full immunization coverage among children (12-23 months) in India has shown improvement over the years, but there are still deficits and disparities in coverage among different states and socioeconomic groups that need to be addressed.[17,18] Factors influencing full immunization coverage include maternal education, household wealth status, child size at birth, and accessibility to healthcare services.[17,19]

These studies suggest that there is a considerable difference in the spatial distribution and utilization of MCH services within the attained level of improvement in ANC check-ups, institutional deliveries, and immunization due to unequal distribution of resources and varied social, economic, and cultural factors. Closing socioeconomic gaps in healthcare access remains crucial for achieving the SDGs by 2030.[12] Efforts are needed to address inequities, strengthen health systems, and ensure the provision of quality MCH services to achieve the SDG targets in India [20–22]. This study attempts to measure the disparity in coverage of ANC, institutional delivery, child immunization, and advancement towards equity and examine the impact of selected socioeconomic determinants on the aforementioned indicators.

2. Materials and Methods

This study is based on comparative analysis across two rounds of the National Family Health Surveys, NFHS-4 (2015-16) and NFHS-5 (2019-21). Around 6□02 lakh households were covered in NFHS-4, with 699,686 women aged 15-49 from 640 districts across India. The NFHS-5 surveyed approximately 6.36 lakh households, including 726,828 women aged 15-49, to produce estimates for 707 districts. Details about the NFHS as designs, tools, protocols, and all relevant information are available in the public domain. The study considered four or more ANC check-ups, institutional delivery, and full immunization coverage of children aged 12 to 23 months as the outcome variables.

2.1. Statistical Analysis

The study has computed some rate-ratios such as urban-rural ratio, caste ratio, and education ratios to assess the place of residence, caste, and education-based differentials for all outcomes. The value of these ratios will be one in case of an equal distribution of MCH indicators. For example, these ratios are measures for urban-rural by this given formula.

$$Urban - Rural\ Ratio\ for\ full\ immunization = \frac{Atlest\ 4\ ANC\ in\ rural\ area}{Atleast\ 4ANC\ in\ urban\ area}$$

The study has computed Concentration Indices (CI) to detect wealth-based inequality in coverage of maternal and child health services. The equation below gives the CI, which is computed as twice the (weighted) covariance of the health variables and a person's relative rank in terms of economic status, divided by the variable mean. The children are ranked in ascending order by household living standard in order to find out the cumulative fraction of, for example, children not fully immunized by their economic status.[23]

$$C = \frac{2}{\mu}\mathrm{cov}_w(y_i, R_i),$$

Where y_i is the health status of the i^{th} individual and R_i is the fractional rank of the i^{th} individual (for weighted data) in terms of *the index of household economic status*; μ is the (weighted) unconditional mean of the health variable of the sample and cov_w denotes the weighted covariance. It reveals the concentration of inequalities among the subgroups of the population. The weights are used to adjust for the design effect of the sample survey data. The value of CI lies between −1 and +1, where a negative value implies a concentration of outcome variables among disadvantageous groups and a positive value implies concentration among advantageous groups. A zero value of the concentration index implies no inequality. The study has plotted the Lorenz curve to give a graphical presentation of inequality.

Additionally, logistic regression analysis has been used to find out the probability of occurrence of maternal and child health services according to selected predictors. The logistic regression equation is given below.

$$l_n\left(^{p}/_{1-q}\right) = \alpha + \beta x1 + \beta x2 + \beta x3$$

Where, P: probability of occurrence of the event.

1-p: the probability of non-occurrence of the event.

p/1-q: is the odd ratio which is the probability of non-occurrence of the event.

x1, x2, and x3…. are predictor variables.

α: is intercept where there is no effect on any independent variable on the dependent variable.

β1, β2, β3 are coefficients

The analysis was conducted using STATA 16 and MS Excel.

3. Results

Levels and Trends for Maternal and Child Health Services in India

The trends of ANC coverage indicate an improvement in most of the States/UTs, except for ten states. States such as Goa and Tamil Nadu achieved an attendance rate of over 90% for four or more ANC visits. Nine of the states have fallen below the national average (58%), with declines being reported from states such as Tripura, Sikkim, Punjab, Andhra Pradesh, Telangana, and Kerala. Additionally, Jammu and Kashmir, Manipur, Kerala, Odisha, Delhi, Gujarat, and West Bengal had over 75% of four or more ANC attendance, meeting the SDG goal (SDG indicator 3.8.1) a decade ahead. In contrast, Nagaland and Bihar had less than 25%, and Arunachal Pradesh, Jharkhand, and Uttar Pradesh had less than 45%, indicating widespread disparities in ANC utilization across states.

An increase in the proportion of institutional deliveries was witnessed across all the States/UTs. However, proportions of institutional deliveries were lower than the national average (89%) in 12 Indian States/UTs. Kerala, Goa, Lakshadweep, Tamil Nadu, and Puducherry had the highest proportion of institutional deliveries, where all deliveries occurred in institutional settings in 2019–21. One of the SDG-3 goals is to increase the proportion of births attended by skilled health personnel by over 92% by 2030 (SDG indicator 3.1.2); 22 Indian States/UTs already achieved this target. The lowest coverage of institutional deliveries in the country was reported from Nagaland (46%), Meghalaya (58%), Jharkhand (76%), Bihar (76%) and Arunachal Pradesh (79%).

Except for 11 Indian States/UTs, the proportion of fully immunized status among 12-23 months children has increased between 2015-21. States with the highest declines in immunization coverage include Manipur, Meghalaya, Punjab, Kerala, Sikkim, West Bengal, Goa, etc. In 14 States/UTs, the coverage of full immunization was less than the national average in 2019-21. The highest proportion of fully immunized status was achieved in Ladakh, Jammu & Kashmir, Himachal Pradesh, and Andaman & Nicobar Islands, where more than 95% of children were fully immunized. One target of SDG-3 is to increase the coverage of full immunization among 12-23 months children by over 90% by 2030 (SDG indicator 3.b.1), Eleven Indian States/UTs have already met this goal. The lowest immunization coverage in the country (less than 80%)

was observed in Nagaland, Assam, Manipur, Arunachal Pradesh, Tripura, Uttarakhand, Jharkhand, and Delhi.

[Figure 1,2,3 about to be here]

Table 1 demonstrates that urban areas consistently exhibited higher rates of ANC visits compared to rural areas. Notably, the urban-rural gap narrowed (21 to 14 percentage points) during 2015-21. Figure 4 illustrates the ongoing urban-rural discrepancy in ANC coverage, consistently indicating a preference for urban women. However, it is notable that the urban-rural ratio decreased from 0□448 in 1992-93 to 0□796 in 2019-21. Similarly, all religious groups demonstrated increases in ANC utilization, with the gap between them diminishing. Disparities in ANC coverage was observed among different caste groups, with SC and ST women experiencing lower utilization; nevertheless, the most significant increase was seen among SC/ST women in 2019-21. The ratio of ANC coverage between ST and Other castes has declined from 0□513 to 0□898 over the past three decades due to a significant increase among ST women. Women from all wealth index categories experienced improvements in ANC visit rates, with the most substantial improvements observed among women from the poorest households. Despite a 17%-point increase in ANC coverage, the ratio shows stark inequality between the poorest and richest women, with the rate-ratio being 0□582 in 2019-21. The education-wise distribution indicates that there was a more pronounced increase in ANC among uneducated (28% to 40%) and primary educated women (45% to 53%), which indicates that the gap in ANC by education attainment is narrowing. However, the rate-ratio (0□561) shows that even in 2019-21, the number of ANC illiterate women is only about half that of the most educated women. Notable observations include age-based inequality in coverage of ANC visits reducing significantly, and higher education strongly correlating with a greater number of ANC visits. Although women who were pregnant for the first time tend to seek ANC more often than those with previous pregnancies, there has been a notable rise in ANC visits among high-birth-order pregnancies as well. In 2015-16, only 16% of sixth and above birth orders had four or more ANC visits, compared to 32% in 2019-21. Additionally, women with greater decision-making autonomy at home and exposure to media have higher rates of four or more ANC visits than their counterparts.

Encouragingly, the urban-rural gap in coverage of institutional delivery narrowed from 2015 to 2021, reducing from 21 to 14 percentage points. Disparities among different caste groups in institutional delivery coverage were evident as caste was found to be a determinant in reflecting the social position of the individual and social accessibility to various facilities. The most significant increase in institutional delivery was observed among SC/ST women in 2019-21. While inequality between the castes has decreased, the coverage of institutional birth varies from 82% among STs to 91% among Other Castes, in 2019-21. In 2019-21, the urban-rural ratio (0□925) and ST-other caste ratio (0□900) signify a narrowing of the gap in institutional delivery between places of residents and castes. Also, all religious groups experienced increases in institutional delivery, with the gap between them continuing to diminish over time. The coverage has improved substantially among Muslims as well; however, it still remains the lowest (84%). Similarly, women from all wealth categories experienced increases in institutional delivery rates, with the most substantial improvement observed among women from the poorest households (16 percentage points) over the richest households (two

percentage points). However, disparities remain across different wealth quintiles — for example institutional delivery coverage among the richest women was as high as 95%, while among the poorest women, it was 60%. This indicates a significant disparity in institutional delivery coverage between women from the poorest and richest socioeconomic backgrounds, with a poorest-richest ratio of 0□728 observed in 2019-21 (Figure 5). Additionally, women with higher education levels displayed greater utilization of institutional delivery services. However, it is worth noting that substantial gains of 12 and 10 percentage points were reported among non-educated and primary-educated women between the two survey periods, compared to only two percentage points for highly educated women and four percentage points for secondary-educated women. The rate-ratio of 0□728 in 2019-21 highlights a substantial gap in institutional delivery coverage between uneducated and highly educated women (Figure 5). Age-based inequalities in institutional delivery coverage also reduced significantly, though conversely, institutional delivery rates were lowest among women aged 35 and above in both rounds. Furthermore, women with greater decision-making autonomy at home and exposure to media reported higher rates of institutional deliveries compared to their counterparts. This highlights the role of empowerment and information symmetry in influencing healthcare-seeking behaviour among women.

Gender-based differences in fully immunized status were essentially non-existent. Lower birth order children consistently had higher full immunization rates, with the most significant improvements observed in higher birth order groups. Full immunization rates increased from 44% to 64% for sixth and above birth order children, from 52% to 71% for fourth to fifth birth order, from 62% to 77% for the second birth order, and from 68% to 80% for the first birth order during 2015-21. Children born in institutions were also more likely to receive recommended vaccinations compared to those born at home, although the gap between these groups decreased from 20 to 12 percentage points. Disparities in immunization by maternal age significantly reduced from 2015 to 2021, and exceeded 75% across all age groups, with the highest coverage being among children of mothers aged 20-24. Maternal education played a crucial role, with children of mothers holding secondary education (78%) and higher education (79%) having higher vaccination rates. In 2019-21, children of uneducated mothers experienced a 69% increase in immunization coverage, 17 percentage points higher than in NFHS-4. The rate-ratio (0□875) in 2019-21 suggests a persistent divergence in immunization coverage between children born to uneducated and highly educated women. ANC visits were associated with higher vaccine coverage; 81% of children whose mothers had four or more ANC visits were fully immunized, compared to 73% with fewer than four ANC visits and 62% with no ANC visits during 2019-21. Furthermore, children of mothers with greater autonomy in household decisions, and higher media exposure had higher rates of full immunization compared to their counterparts. The reported religion also significantly influenced child immunization, with Sikh, other, and Hindu children performing better in both surveys. All religions saw increased immunization rates, with Muslim children having the lowest rates in both years. Similarly, ST children showed a significant acceleration in full immunization compared to other caste groups. The rate-ratio for ST-other caste (1□008) and urban-rural (1□016) shows no disparity by caste and place of residence (figure 6). Wealth quintiles also

saw marked improvements, with the lowest quintile's full immunization rate increasing from 51% to 72%. The middle quintile had the highest rate (80%), followed by the rich.

[Table 1 to be inserted here]

[Figure 4,5,6 about to be here]

3.1.Inequality in the Utilization of Maternal and Child Health Services

Socioeconomic disparities are evident across all three indicators in the utilization of MCH services. Figure 7 illustrates the socioeconomic inequality in the utilization of ANC. Notably, the CI was positive in both rounds of the NFHS, indicating a higher prevalence of ANC coverage among women from higher socioeconomic households. However, it is encouraging to observe a reduction in this inequality over time (CI: 0□102 in 2019-21). Similarly, Figure 8 portrays the socioeconomic gap in institutional deliveries, revealing a similar pattern of higher prevalence among women of higher socioeconomic status, albeit with a reduction in inequity over time (CI: 0□059 in 2019-21). Furthermore, Figure 9 underscores the inequality in the coverage of full immunization, with decreasing CI values between 2015-16 and 2019-21, indicating a positive trend toward reducing disparities in child immunization across socioeconomic strata. Nonetheless, there is a discernible decrease in the inequality of MCH services coverage between the two NFHS rounds.

[Figure 7,8,9 about to be here]

3.2.Determinants of Maternal and Child Health Services in India

Table 2 shows the results of binary logistic regression analysis examining the determinants of all three selected MCH indicators. Higher birth orders were associated with a decreased likelihood of having four or more ANC visits, indicating a trend of diminishing ANC utilization with an increasing number of pregnancies. Conversely, older women were more likely to have four or more ANC visits compared to those below 20 years. Furthermore, education emerges as a strong determinant, with women having higher levels of education being significantly more likely to have four or more ANC visits compared to those with no schooling (ORs ranging from 1□232 to 1□401). Moreover, disparities are observed based on place of residence, with rural women being less likely to have four or more ANC visits compared to urban women (OR 0□881). Religious differences also play a role, with Muslim and Christian women being less likely to achieve recommended ANC visits compared to Hindu women. Similarly, variations are observed across different castes, with other caste (OR 1□116) and ST women (OR 1□36) significantly more likely to get the recommended number of ANC than SCs. Moreover, women from the richest households (OR 1□732), richer households (OR 1□633), and middle households (OR 1□47) were more likely to utilize at least four ANC visits compared to the poorest women.

Women who had less than three ANC visits were 2□4 times and those with at least four ANC visits were 4□2 times more likely to choose institutional setup for delivery than no ANC visits. Notably, higher birth orders were linked with decreased odds of institutional delivery, suggesting a diminishing trend in institutional childbirth with increasing parity. Conversely, older women, particularly those aged 30-34 (OR 1□637) and 35+ (OR 1□647), exhibited a greater likelihood of opting for institutional deliveries compared to their younger counterparts. Similarly, education emerges as a significant determinant, with women attaining higher educational levels showing notably increased odds of choosing institutional deliveries compared to those with no schooling. Furthermore, socioeconomic disparities were observed, with women from the richest households (OR 3□467), richer (OR 2□648), middle (OR

2□054), and poorer (OR 1□501) demonstrating heightened probabilities of selecting institutional deliveries compared to the poorest women.

Children born in institutional settings exhibited a 1□4 times higher likelihood of achieving all recommended vaccinations compared to their counterparts. Similarly, children whose mothers attended fewer than three ANC visits displayed 1□7 times, and children whose mothers attended four or more ANC visits exhibited 2□5 times higher chances of achieving full immunization compared to no ANC visits. Higher birth orders were associated with decreased odds of attaining full immunization. Conversely, older mothers exhibited higher probabilities of achieving full immunization for their children compared to younger mothers. Furthermore, education emerges as a pivotal determinant, with women attaining higher educational levels exhibiting significantly heightened odds of ensuring full immunization for their children compared to those with no schooling (ORs ranging from 1□16 to 1□652). Rural children exhibit a higher likelihood (OR 1□308) of achieving full immunization compared to urban children. Religious differences also played a role, with Sikh (OR 0□806), Muslim (OR 0□785), and Christian (OR 0□667) children demonstrating reduced probabilities of ensuring full immunization for Hindus. Furthermore, socioeconomic disparities were apparent, with children from the richest (OR 1□155), richer (OR 1□179), and middle households (OR 1□117) demonstrating higher probabilities of ensuring full immunization for their children compared to the poorest.

[Table 2 to be inserted here]

4. Discussion

Child survival has significantly increased in recent years due to a long history of programs that aim to significantly reduce maternal and child mortality by addressing various aspects.Still, India has the highest numbers of maternal and under-five fatalities in the globe, and accelerated progress is needed.[2,3,24]Trends in ANC utilization showed improvement in most States/UTs, except for ten, increase in institutional delivery in all States/UTs, with a significant improvement of 40 percentage points, and the proportion of full Immunization has increased except for 11 States/UTs during 2005-21. This advancement in MCH services is attributed to interventions through the National Health Mission.[25,26] Furthermore, a diverse range of interventions aimed at enhancing maternal and child healthcare in India have been implemented. These include programs such as the Pradhan Mantri Surakshit Matritva Abhiyan (PMSMA) and the Pradhan Mantri Matru Vandana Yojana (PMMVY), which strive to ensure comprehensive antenatal care of high quality while alleviating financial burdens on women.[27]Governmental efforts extend to schemes like the Janani Suraksha Yojana (JSY) and the Janani Shishu Suraksha Karyakram (JSSK), which incentivize institutional childbirth and mitigate direct expenses.[28] Moreover, initiatives such as the Surakshit Matritva Anushasan (SUMAN) program underscore the commitment to delivering dignified and respectful healthcare services. Concurrently, the Labour Room Quality Improvement Initiative (LaQshya) is dedicated to refining the standard of care during labor, with both SUMAN and LaQshya aiming to curtail maternal and neonatal mortality and morbidity rates while enhancing delivery care quality.[29] Additional strategies involve strengthening delivery points and establishing Birth Waiting Homes (BWH) in remote and tribal regions to promote institutional

delivery. Endeavors such as the Universal Immunization Programme (UIP), Mission Indradhanush, and Intensified Mission Indradhanush (IMI) have substantially bolstered immunization coverage, targeting pockets of low immunization rates and hard-to-reach areas.[30,31]

Despite these improvements, inequalities in ANC, institutional delivery, and immunization persist, with considerable variations between States and socio-economic groups. Coverage of MCH services in the North-Eastern States, EAG States, Himachal Pradesh, Haryana, and Maharashtra are not satisfactory as compared to other States of the country. Many of these poor-performing states are characterized by elevated levels of MMR, U5MR, and NMR. The high incidence of maternal and child mortality underscores critical deficiencies in MCH services in the above States. Overall, the data demonstrates a positive trend toward increased ANC utilization across various demographic categories in India over the study period. While disparities persist, particularly at the outset of the analysis, there has been significant progress in reducing gaps between categories. This indicates strides towards achieving more equitable access to maternal healthcare services, essential for promoting the well-being of mothers and children nationwide. Based on the evidence, this study provides evidence that factors such as lower education levels, poverty, rural residence, low mass media exposure, and lower decision-making autonomy in households have a negative impact on the utilization of ANC services. These factors play a pivotal role in promoting maternal healthcare utilization.[32–34] Additionally, belonging to SC/ST castes contributes to the underutilization of ANC services. To improve access to ANC services, interventions addressing poverty, infrastructure development, and education are paramount [35].

5. **Conclusions**:

Institutional deliveries in India have significantly increased over the past three decades; 22 States/UTs have already surpassed the 2030 SDG target. However, challenges persist, notably in a few North-Eastern and EAG States, where institutional delivery rates remain below 80%, these States are not likely to achieve the NHP target of 92% coverage of Institutional delivery by 2025. Women belonging to SC/ST castes had a 50% lower chance of an institutional birth compared to other castes.[36] . Additionally, a study found that the caste group was significantly associated with access to institutional delivery, with structural determinants like caste, wealth, and education playing a role. [37]. However, the socioeconomic gap in institutional deliveries between the richest and poorest women decreased. Economic status plays a significant role in the choice between private for-profit or public facilities for childbirth. Factors such as no ANC visits, rural place of residence, lower socioeconomic status, belonging to disadvantaged social groups, low level of education, and higher birth order were associated with lower utilization of institutional delivery.[38,39].

Similarly, children of higher birth order consistently displayed lower rates of full immunization, alongside an increasing trend in immunization rates for children born in institutions compared to those born at home.[40–42] Maternal factors, including age, education, and ANC visits, significantly impacted immunization rates, with higher maternal education and more ANC visits associated with increased coverage.[43,44] In addition, maternal autonomy in

household decisions and media exposure were correlated with higher vaccination rates.[45] Wealth quintiles witnessed marked improvements, particularly among the lowest quintile, though disparities persisted across different wealth groups.[40,42,45,46] Future efforts should focus on addressing these disparities to improve maternal and infant health outcomes [47,48].

Overall, while there have been temporal improvements, enduring disparities persist, emphasizing the need for targeted interventions to ensure equitable access to ANC, safe childbirth practices, and vaccination across all regions. It is essential to address key determinants to achieve the international commitment to universal health coverage under the NHP and SDGs. The government has to first reach those who are furthest behind, which is the central, transformative promise of the 2030 Agenda for SDGs. The study suggests that increasing the availability of obstetric services alone will not be a panacea in mitigating the problem of low utilization of MCH services. Additionally, there should be a focus on increasing demand for existing services including educational and counseling services. MCH care facilities need to be improved, pertaining to the quality of care and physical accessibility of services in rural areas. Existing regional variation in the utilization of MCH care services demands locating highly focused districts for better implementation of programmes. The findings emphasize the crucial need to enhance knowledge and the importance of MCH service utilization through frontline health workers and Health and Wellness Centres, especially among socioeconomically disadvantaged populations.

Ethical statement. The study utilised a secondary data set with no identifiable information on the survey participants. This dataset is available in the public domain for research use; hence no approval was required from any institutional review board as there is no question of human subject protection in this case.

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Table 1: Level and trend of 4 and more ANC, Institutional Deliveries, and Full Immunization (12–23-month children) by selected Background Characteristics in India, 2015-21

Background Characteristics		4 or more ANC Visits		Institutional Deliveries		Full Immunization	
		2015-16	2019-21	2015-16	2019-21	2015-16	2019-21
Sex of Child	Male					62.8	77.6
	Female					62.9	76.7
ANC visits	No visit			56.9	70.3	41.0	62.1
	Less than 3			77.7	86.3	59.5	72.9
	4 or above			91.2	94.4	71.1	81.6
Place of Birth	Institutional					65.9	78.4
	Non-Institutional					45.6	65.6
Place of residence	Urban	66.4	68.6	88.7	93.8	65.2	76.3
	Rural	44.8	54.5	75.1	86.7	60.5	77.2
Religion	Hindu	50.8	58.6	80.9	89.5	63.3	78.1
	Muslim	48.8	57.0	69.2	84.3	55.6	71.9
	Christian	62.1	65.1	78.6	83.4	52.2	78.4
	Sikh	67.6	59.6	92.5	96.1	89.4	81.7
	Others	66.2	62.5	75.3	86.5	62.6	80.6
Caste	Scheduled castes	48.7	55.3	78.4	87.3	63.4	77.4
	Scheduled tribe	45.6	57.7	68.1	82.3	54.1	77.0
	OBC	48.2	57.2	79.8	89.3	62.9	77.6
	Others	60.6	64.2	83.4	91.4	64.4	76.4
Wealth Index	Poorest	25.0	41.8	59.6	76.2	51.1	72.1
	Poorer	44.4	53.5	75.2	87.2	58.7	76.3
	Middle	57.2	62.6	85.0	92.3	64.9	80.2
	Richer	65.8	67.5	90.6	95.4	68.1	80.0
	Richest	73.0	71.8	95.3	97.4	72.6	78.8
Age at Births in years (in years)	Less than 20	54.7	59.5	81.7	89.3	63.1	76.6
	20-24	53.38	57.9	81.2	89.7	64.2	77.7
	25-29	52.4	59.8	79.4	89.0	62.1	77.1
	30-34	47.9	59.8	75.3	87.6	61.6	76.8
	35+	36.9	55.5	63.7	81.8	55.9	75.1
Education	No schooling	28.0	39.9	61.6	74.8	52.4	69.1
	Primary school	45.4	53.2	73.6	84.3	61.3	76.0
	Secondary school	61.0	62.5	88.0	92.6	67.3	79.7
	Higher	72.9	71.1	96.4	97.9	71.4	79.0
Birth Order	1	61.6	65.3	88.2	94.1	68.0	79.9
	2-3	52.1	58.5	77.8	88.1	62.3	76.7
	4-5	28.7	42.5	60.6	75.1	52.0	71.3
	6+	16.0	31.6	48.3	63.7	44.4	64.1
Decides on Respondent 's Health care	Someone else	48.6	56.2	79.0	89.2	60.3	76.8
	Respondent alone or with Husband	56.8	59.6	80.7	88.2	64.8	78.6
Decides large household purchases	Someone else	48.9	57.2	78.7	88.4	62.0	77.7
	Respondent alone or with Husband	56.9	59.4	80.9	88.4	64.2	78.4
Decides on visits to family relative	Someone else	46.7	55.0	77.5	88.0	61.0	75.1
	Respondent alone or with Husband	57.6	60.0	81.4	88.5	64.6	79.2
Decides what to do with money husband earns	Someone else	51.7	57.4	79.3	88.8	60.3	77.2
	Respondent alone or with Husband	56.3	59.4	80.8	88.2	65.1	78.7
Household decision making	No	45.6	53.7	77.3	88.0	59.1	75.1
	Yes	56.3	59.9	80.8	88.5	64.5	78.7
Frequency of reading newspaper or magazine	Not at all	43.1	54.2	72.8	85.8	58.2	76.4
	Less than once a week	61.3	66.5	88.5	94.4	69.2	80.0
	At least once a week	69.8	71.1	94.0	97.4	68.5	77.5
Frequency of listening to radio	Not at all	50.8	57.9	78.4	88.1	61.8	77.2
	Less than once a week	49.4	61.3	80.5	91.3	63.4	76.7
	At least once a week	56.4	66.1	83.8	94.2	64.5	77.3
Frequency of watching television	Not at all	26.2	43.4	62.5	79.4	52.2	71.8
	Less than once a week	38.7	58.1	72.9	89.7	58.2	77.8
	At least once a week	63.5	68.0	87.8	94.5	67.0	80.5
Exposer of Mass media	No	24.4	41.9	60.9	78.3	51.0	71.4
	Yes	60.0	64.5	85.6	92.7	65.6	79.4
India		**51.2**	**58.5**	**78.9**	**88.6**	**61.6**	**77.2**

Table 2: Logistic Regression (odds ratio) showing Determinants of four or more ANC, ANC in the first trimester, Institutional delivery, and full immunization coverage in India 2019-21

Determinants		Four or more ANC	Institutional Delivery	Full Immunization (12-23 months)
Place of Birth	Institutional®			
	Non-Institutional			1.441***
Sex of Child	Male ®			
	Female			0.971
ANC visits	No visit®			
	Less than 3		2.363***	1.666***
	4 and Above		4.153***	2.504***
Birth Order	1st ®			
	2-3	0.807***	0.505***	0.885***
	4-5	0.577***	0.306***	0.809***
	6+	0.445***	0.222***	0.66***
Age at the time of birth (Years)	Less than 20 ®			
	20-24	1.043*	1.161***	1.188***
	25-29	1.219***	1.349***	1.244***
	30-34	1.385***	1.637***	1.357***
	35+	1.535***	1.647***	1.445***
Education	No schooling ®			
	Primary	1.232***	1.193***	1.163***
	Secondary	1.373***	1.652***	1.278***
	Higher	1.401***	2.584***	1.16***
Frequency of reading newspaper or magazine	Not at all ®			
	Less than a week	1.101***	1.136***	1.069*
	At least once a week	1.087***	1.476***	0.918*
Frequency of listening to radio	Not at all ®			
	Less than a week	0.978	0.859***	0.863***
	At least once a week	1.044	0.92	0.932
Frequency of watching television	Not at all ®			
	Less than a week	1.319***	1.197***	1.161***
	At least once a week	1.621***	1.428***	1.306***
Place of residence	Urban ®			
	Rural	0.881***	0.945**	1.308***
Religion	Hindu ®			
	Muslim	1.043**	0.752***	0.785***
	Christian	0.549***	0.311***	0.667***
	Sikh	0.732***	1.423***	0.806**
	Others	0.553***	0.623***	0.894
Caste	Scheduled Castes ®			
	Scheduled Tribe	1.36***	0.786***	1.081*
	OBC	1.004	1.113***	1.012
	Others	1.116***	0.942*	0.979
Wealth Index	Poorest ®			
	Poorer	1.234***	1.501***	1.024
	Middle	1.47***	2.054***	1.117***
	Richer	1.633***	2.648***	1.179***
	Richest	1.732***	3.467***	1.155**

*Note: ®Reference category; Level of Significant ***P<0.01, ** P<0.05, *<0.1*

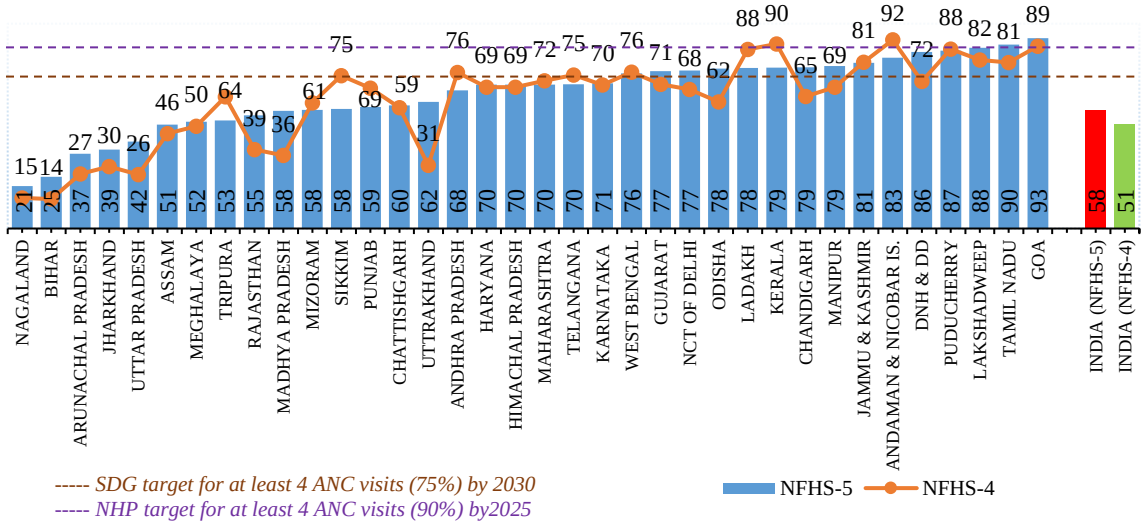

Figure 1: State wise trend of four and more antenatal care visits over different rounds of NFHS

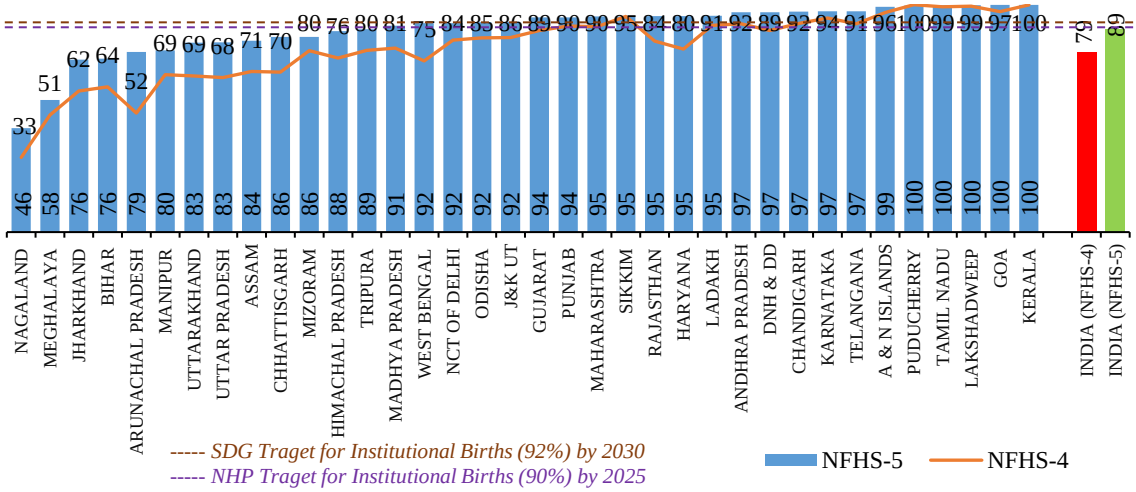

Figure 2: State wise trend of Institutional Deliveries over different rounds of NFHS

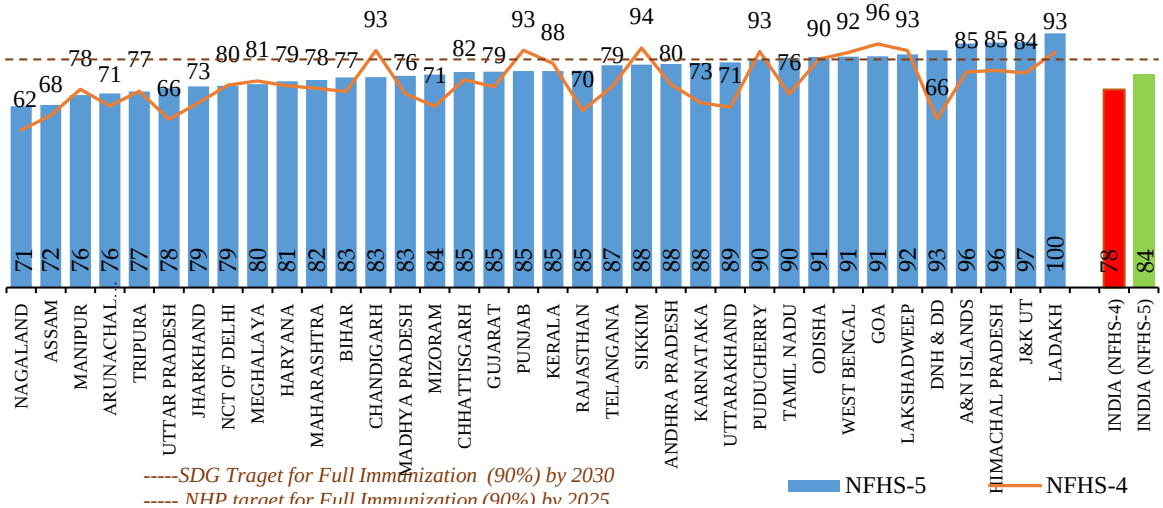

Figure 3: State wise trend of Full Immunization among 12-23 Months children over different rounds of NFHS

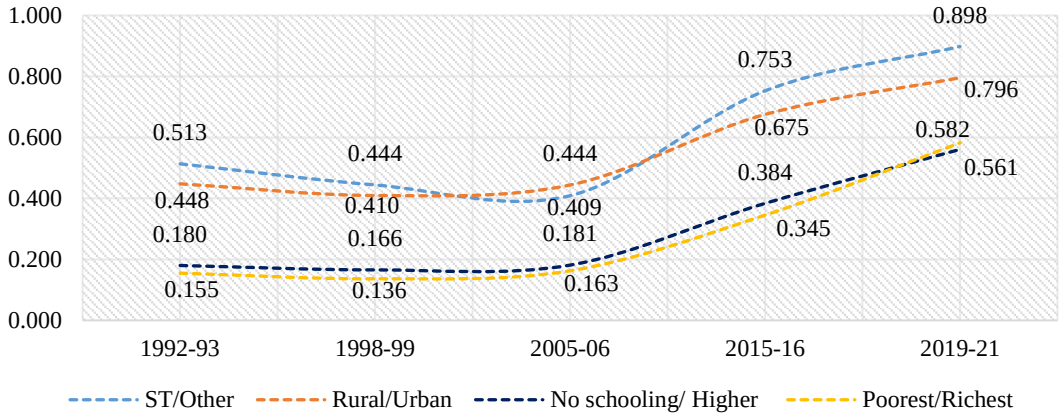

Figure 4: Rate- ratio for Four or more ANC visits

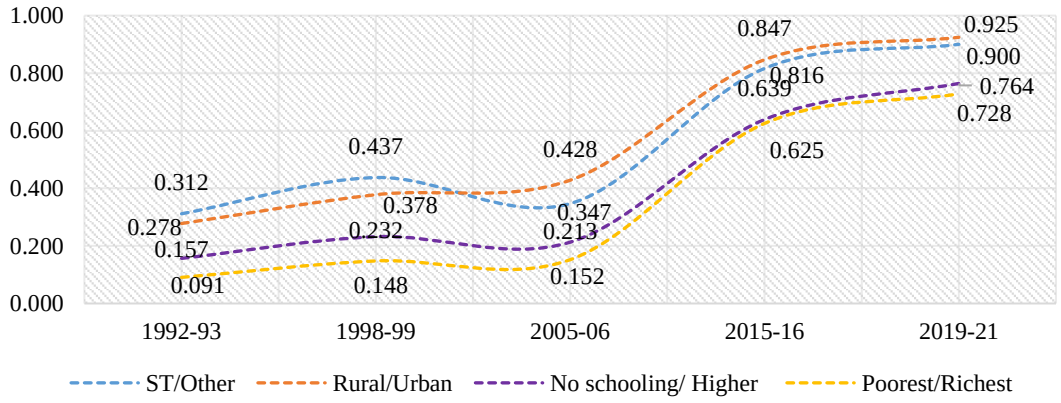

Figure 5: Rate- ratio for Institutional Delivery

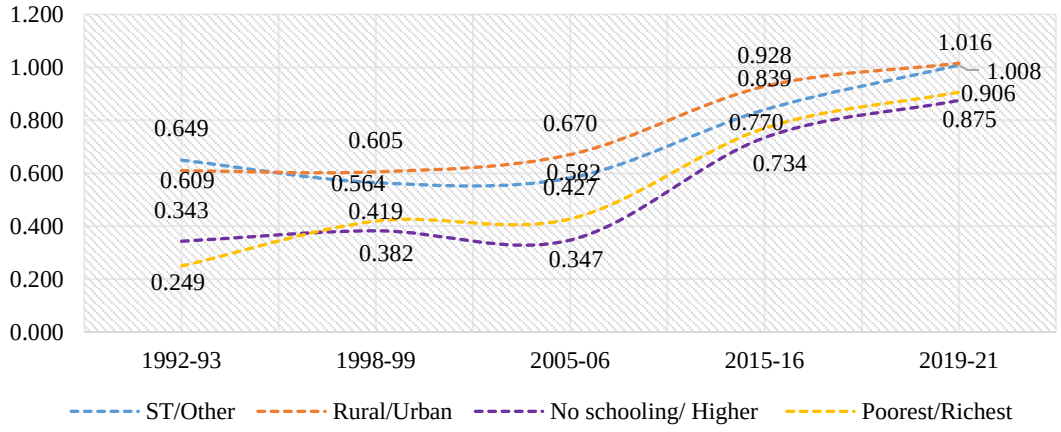

Figure 6: Rate- ratio for Full immunization (12–23-month children) coverage

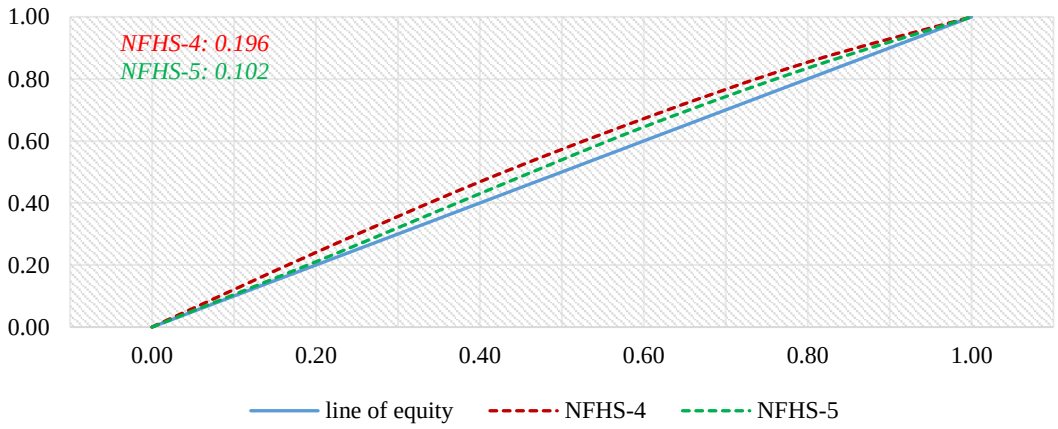

Figure 7: Concentration Index and Lorenz curve for Four or more ANC coverage

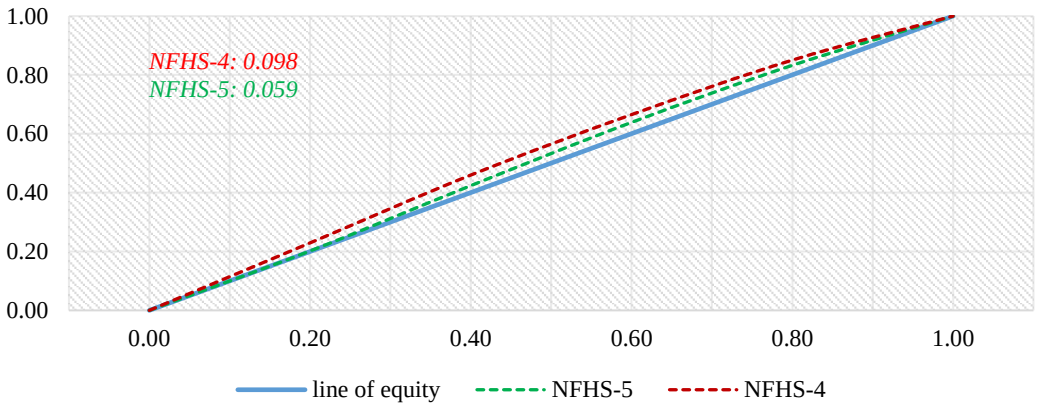

Figure 8: Concentration Index and Lorenz curve for Institutional deliveries coverage

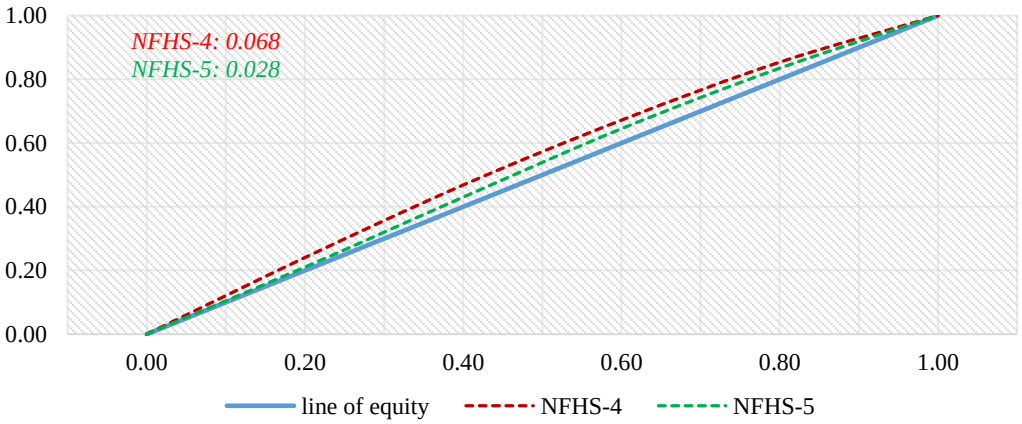

Figure 9: Concentration Index and Lorenz curve Full immunization (12–23-month children) coverage