

Extended abstract

The role of lower-level public health facilities to reducing socioeconomic disparity in institutional deliveries in India: Evidence from the nationally representative datasets, 2005-2021.

Introduction

Quality delivery care is a key strategy for achieving the goals of safe motherhood and child survival initiatives. India has observed substantial progress in reducing maternal mortality in the last three decades, from 398 in 1997-98 to 99 in 2020 (Meh et al., 2022); similarly, neonatal mortality has also significantly declined from 46 per 1,000 live births in 1997 to 22 per 1,000 live births in 2019 (Bhushan et al., 2024). These improvements are primarily attributed to increased utilization of antenatal care services, improved maternal education, routine vaccination coverage, and increased institutional birth deliveries - from 39% in 2005-06 and have risen to 89% in 2019-21 (Singh et al., 2019; Welaga et al., 2018; IIPS & ICF, 2017; IIPS & ICF, 2021). This rise is predominantly due to improved accessibility and enhancements in public healthcare facilities (Joe et al., 2018).

In India, lower-level health facilities, including primary health centers (PHCs) and community health centers (CHCs), are pivotal in delivering comprehensive maternal and child healthcare services. The primary healthcare sector in India has undergone a significant transformation, marked by improved facility infrastructure, enhanced service quality, and increased accessibility. Since the National Rural Health Mission (NRHM) launched in 2005, the capacity of lower-level public health facilities has significantly increased, leading to a substantial rise in institutional deliveries. Key initiatives under NRHM, particularly the Janani Suraksha Yojana (JSY), have provided financial incentives to encourage institutional deliveries, especially among socioeconomically disadvantaged groups (Rao, 2017).

Despite these successes, challenges remain, particularly in addressing socioeconomic inequalities in access to institutional delivery services. While initiatives like JSY have reduced these disparities, inequalities persist, with lower institutional delivery rates among poor, socially backward, and rural populations (Sarkar & Tigga, 2018). The births taking place at health facilities provide access to skilled birth professionals and crucial medical interventions that can address complications during childbirth. Lower-level health facilities, particularly PHCs and CHCs, are essential in bridging the gap between richer and poorer populations, especially in rural and

underserved areas. However, the contribution of these facilities to increasing institutional deliveries and reducing the rich-poor gap has not been sufficiently studied.

This paper has two primary objectives: 1) To assess the contribution of lower-level primary healthcare facilities to the increased utilization of institutional deliveries, and 2) To examine the trends in the rich-poor gap in the use of lower-level healthcare facilities for institutional deliveries.

Data & Methods

We used the data from the third, fourth, and fifth rounds of the National Family Health Surveys (NFHS), which were conducted during 2005–2006 (NFHS-3), 2015–2016 (NFHS-4), and 2019–2021 (NFHS-5), respectively. Institutional delivery is treated as the outcome variable in the study. The place of delivery was categorized as home, public health sector, private health sector, NGO/trust hospital, or others. Deliveries in any public or private health institution or NGO/trust hospital were classified as institutional deliveries. Women delivering in PHCs and CHCs were coded as '1', and those delivering at home or other locations as '0'. Based on the literature, multiple explanatory variables were included in the study, including, wealth index (poorest, poorer, middle, richer, richest), age of women (15-19 20-24 25-29 30-34 35-39 40-44 45-49), caste (SC, ST, OBC, and Others), religion (Hindu, Muslim, Others), Region (Southern, EAG & Assam, North-East, rest of India), and education status (no education, primary, secondary, higher).

In statistical analysis, descriptive statistics, logistic regression, and the Average Annual Rate of Change (AARC) method were used to analyze institutional deliveries, wealth-based inequalities, and socio-economic disparities in healthcare access across NFHS rounds.

Main findings

Table 1 shows a significant rise in the use of lower-level health facilities for births in India from 2005 to 2021, especially among the poorest households, increasing from 2.8% to 44.1% (NFHS-3 to 5). Notable gains were seen in EAG & Assam (36.4% to 44.1%) and among marginalized groups like Scheduled Tribes (3.5% to 42.9%) and Scheduled Castes (3.9% to 38.5%). Among the richest quintile, utilization also rose from 5% to 18%. In rural India, deliveries in CHCs/PHCs increased from 3.8% in 2001 to 43.7% in 2021, highlighting consistent improvements in healthcare access.

Table 2 shows the Average Annual Rate of Change (AARC) in births at lower-level facilities across three key policy periods in India from 2001 to 2021. Nationally, there was a 4.8% annual increase

during 2001-2005, followed by a surge to 26.4% during the NRHM period (2005-2012) due to expanded healthcare access and policies like ASHA.

Table 3 shows trends in absolute inequalities in deliveries at lower-level facilities across India and its states, measured by the Slope Index of Inequality (SII) from NFHS data (2005-2021). SII reflects the disparity in facility use between poor and rich households. Nationally, inequality decreased significantly, with SII increasing from 3.7% in 2005-06 to 27.4% in 2019-21, indicating that wealthier households increasingly used lower-level facilities, reducing access disparities. States like Punjab, Haryana (from -9.66% to -24.22%), Bihar (from 1.76% to -5.76%), Madhya Pradesh, and Gujarat also showed reduced inequalities. NFHS data from 2005 to 2021 revealed varied trends in facility use by wealth quintiles. The poorest quintile saw a rise in lower-level facility deliveries from 23.8% in NFHS-3 to 56.4% in NFHS-5, while the richest quintile increased from 5.3% to 17.3%. In the Southern region, poorer women were more likely to use lower-level facilities, with increases noted in Tamil Nadu (from 29.8% to 60.0%) and Karnataka (from 23.2% to 35.8%). Kerala consistently had low facility use across all quintiles, reflecting good overall access. Figure 1 presents funnel plots showing the utilization of lower-level facilities for total deliveries in the last 5 years according to NFHS-5, 2019-21 and highlights the variation in performance among states. The plots identify states with the lowest and highest percentages of deliveries in lower-level facilities, using the Indian average (referral line) as a baseline for comparison.

Discussion

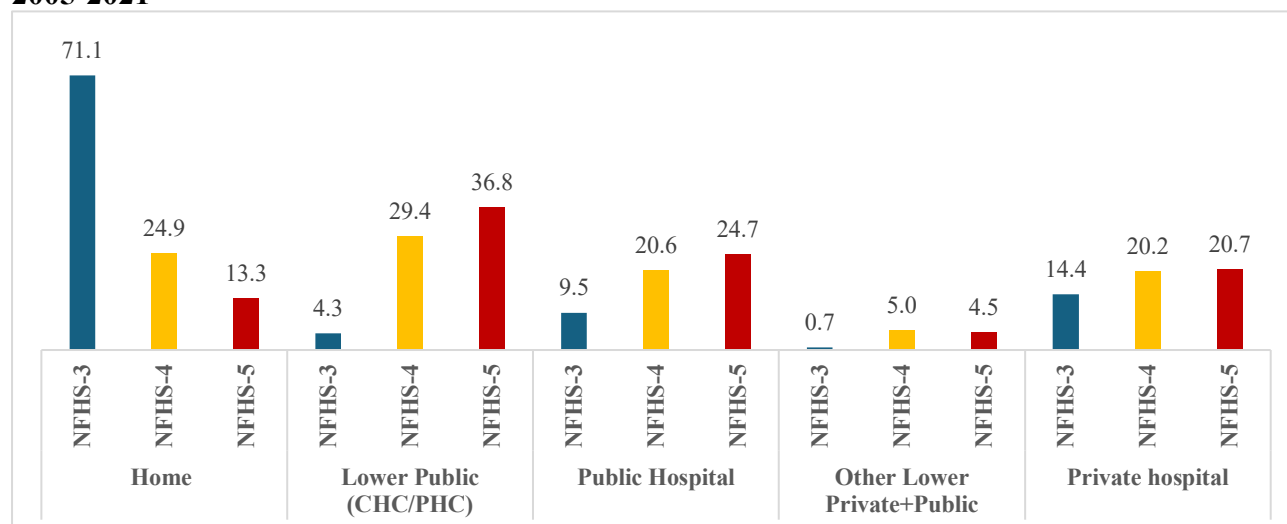
The study highlights significant progress in the utilization of lower-level health facilities (PHCs and CHCs) for institutional deliveries in India, particularly among socioeconomically disadvantaged groups. These findings underscore the success of initiatives like the NRHM and JSY in expanding access to maternal healthcare services. The increase in institutional deliveries among the poorest households and marginalized communities, such as Scheduled Tribes and Scheduled Castes, suggests that targeted financial incentives and the recruitment of frontline health workers have been effective strategies.

However, despite these achievements, disparities persist. The rich-poor gap in access to institutional deliveries has narrowed, but it has not been eliminated, particularly in rural and underserved regions. The slowed growth rate in the utilization of lower-level facilities during the

NHM/RMNCH+A period suggests the need for renewed policy focus and resource allocation to sustain and further improve access.

This study provides evidence that strengthening primary healthcare systems can significantly contribute to reducing maternal and neonatal mortality and promoting health equity. Policymakers should consider enhancing the quality and accessibility of lower-level facilities to bridge remaining gaps. Future interventions should focus on addressing persistent socioeconomic inequalities and ensuring that all women, regardless of their background, have access to quality delivery care.

Figure 1: Percentage distribution of delivery facilities for births in rural India, NFHS, 2005-2021



*Other lower public private included- govt dispensary, public UHC/UHP/UFWC, sub-centre, Govt AYUSH hospital, other public health facility, private AYUSH hospital, other private health facility

Table 1: Percentage distribution of births in lower level facility (CHC, and PHC) by socio-demographic Characteristics, Rural India, NFHS, 2005-21

Wealth Index	NFHS-3	NFHS-4	NFHS-5
Poorest	2.8	33.8	44.1
Poorer	4.3	33.6	41.0
Middle	5.3	27.3	33.6
Richer	5.8	19.9	26.5
Richest	4.6	13.7	17.7
Region			
Southern	5.0	14.8	21.2
EAG & Assam	3.7	36.4	44.1
North-east	3.8	18.3	18.7
Rest of India	5.5	19.2	25.9
Caste			
SC	3.9	31.1	38.5
ST	3.5	33.8	42.9
OBC	4.3	29.8	36.8
Others	4.9	23.4	30.8
Religion			
Hindu	4.6	31.0	38.1
Muslim	3.0	23.3	34.2
Others	2.9	17.6	19.6
Education status			

No education	3.1	31.6	41.7
Primary	5.5	31.5	42.3
Secondary	6.1	28.2	35.6
Higher	5.0	19.5	24.3
Age of women			
15-19	4.7	31.1	39.0
20-24	5.2	30.4	38.3
25-29	4.1	29.4	36.9
30-34	3.3	28.1	33.9
35-39	2.6	27.6	34.6
40-44	2.1	24.0	34.2
45-49	0.5	25.6	35.4
Total	4.3	29.4	36.8

Table 2: Average annual rate of change (AARC) by policy period for births in lower level facility during 2001-21 (NFHS), with, Rural India, and states of India

AARC for policy period	2001-2005 (Part of RCH-I)	2005-12 (RCH-II/ NRHM)	2012-21 (NHM/RMNCH+A)	2001-2021
Jammu & Kashmir	3.85	2.58	1.32	2.44
Himachal Pradesh	31.82	11.13	13.70	16.91
Punjab	15.15	11.73	-17.84	0.00
Uttarakhand	47.74	30.60	3.61	22.85
Haryana	60.20	8.02	3.65	22.53
Rajasthan	1.90	23.77	4.06	10.87
Uttar Pradesh	8.14	31.99	3.30	14.89
Bihar	13.99	54.83	3.67	27.16
Sikkim	16.48	23.94	-1.46	13.22
Arunachal	1.16	24.12	13.38	14.76
Nagaland	-17.33	47.08	12.26	19.64
Manipur	43.37	1.08	-1.26	10.20
Mizoram	21.70	-2.42	4.61	5.74
Tripura	-16.44	29.28	-9.14	4.96
Meghalaya	-34.66	38.48	1.02	8.05
Assam	2.63	42.94	-1.51	17.77
West Bengal	-5.58	22.86	9.74	11.54
Jharkhand	-11.16	8.63	5.70	23.29
Orissa	6.46	18.68	-0.35	8.09
Chhattisgarh	15.15	49.63	1.74	22.21
Madhya Pradesh	20.00	25.49	4.81	15.63
Gujarat	-11.67	23.89	3.84	8.45

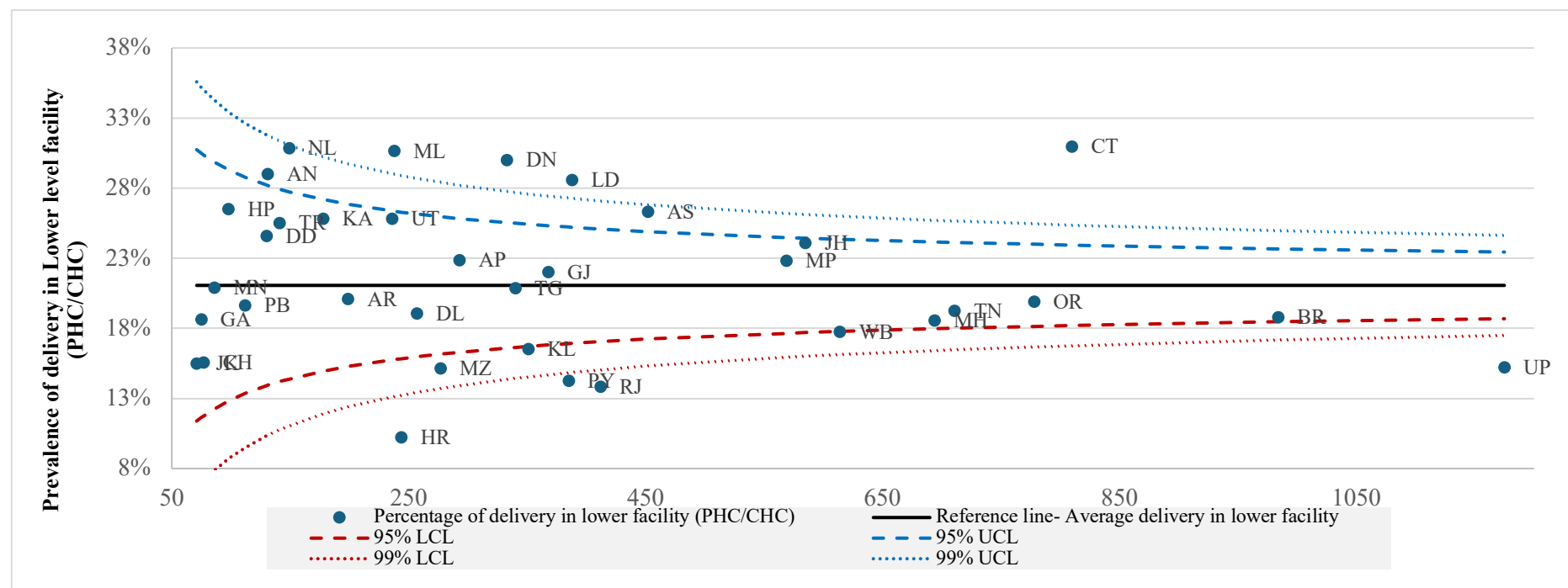
Maharashtra	-9.04	17.15	-1.26	4.49
Andhra Pradesh	33.59	28.32	5.33	21.45
Karnataka	9.03	3.14	9.20	6.67
Goa	2.38	29.54	-33.02	1.07
Kerala	-39.42	-8.98	20.88	-1.10
Tamil Nadu	16.35	10.91	5.35	9.71
India	4.75	26.36	5.02	12.83

Table 3: Trends in absolute inequalities (Slope index of inequality(SII), %) in delivery in lower level facility by household wealth index in Rural India, and states, NFHS (2005-21)

State	2005-06	2015-16	2019-21
Jammu & Kashmir	18.91*(2.43 35.39)	2.59 (-2.60 7.78)	15.34*(9.53 21.15)
Himachal Pradesh	2.57 (-14.83 19.98)	-4.75 (-13.80 4.29)	-5.86 (-14.79 3.07)
Punjab	1.57 (-13.60 16.74)	-39.50*(-46.02 -32.97)	-46.26*(-51.92 -40.59)
Uttarakhand	-28.77*(-50.54 -7.00)	0.49 (-5.83 6.00)	-9.63*(-18.1 -1.10)
Haryana	-9.66 (-29.93 10.61)	-16.57*(-22.07 -11.07)	-24.22*(-29.27 -19.18)
Delhi	-19.39 (-68.17 29.39)	0.83 (-23.49 25.16)	-41.18*(-78.95 -3.00)
Rajasthan	-16.5 (-33.75 0.75)	3.08 (0.23 5.94)	6.99*(4.21 9.77)
Uttar Pradesh	-1.24 (-10.17 7.68)	-2.76*(-4.66 -0.86)	-5.20*(-7.02 -3.37)
Bihar	1.76 (-11.41 14.93)	-6.86*(-9.55 -4.16)	-5.76*(-8.66 -2.86)
Sikkim	6.30 (-12.55 25.15)	-9.30 (-24.14 5.54)	14.05 (-5.15 33.24)
Arunachal	0.32 (-32.7 33.34)	3.25 (-6.26 12.76)	-7.32*(-14.15 -0.48)
Nagaland	-31.97 (-68.41 4.47)	-11.99 (-24.94 0.96)	4.07 (-10.7 18.84)
Manipur	-21.63*(-37.70 -5.50)	-10.59*(-18.55 -2.62)	-29.21*(-38.73 -19.69)
Mizoram	-8.85 (-36.02 18.50)	2.09 (-10.06 14.25)	9.67 (-3.39 22.72)
Tripura	14.00 (-9.33 37.33)	18.54*(5.49 31.60)	2.72 (-6.95 12.39)
Meghalaya	-16.75 (-44.58 11.07)	-15.17*(-22.98 -7.36)	-16.39*(-24.63 -8.14)
Assam	-33.88*(-54.86 -12.89)	5.65*(1.67 9.63)	9.73*(5.33 14.14)
West Bengal	-19.79*(-35.00 -4.57)	-10.75*(-17.62 -3.88)	-3.73 (-9.67 2.22)
Jharkhand	-30.48*(-57.39 -3.50)	-0.54 (-4.72 3.63)	-0.41 (-4.98 4.16)
Orissa	12.36 (-3.74 28.47)	8.56*(4.77 12.36)	13.47*(9.11 17.83)
Chhattisgarh	-19.28 (-56.34 17.77)	2.35 (-2.24 6.92)	8.18*(3.22 13.14)
Madhya Pradesh	20.42*(1.28 39.55)	5.33*(2.49 8.17)	5.49*(2.31 8.67)
Gujarat	-17.72*(-28.80 -6.64)	-7.4*(-11.21 -3.58)	-14.61*(-18.67 -10.55)
Maharashtra	-13.30*(-26.15 -0.44)	-24.67*(-29.35 -20.00)	-20.73*(-26.28 -15.18)
Andhra Pradesh	-29.09*(-42.62 -15.55)	-10.79*(-15.16 -6.42)	-20.71*(-25.42 -15.99)
Karnataka	-23.61*(-35.13 -12.09)	-24.57*(-30.07 -19.07)	-9.83*(-15.01 -4.65)
Goa	-67.37*(-77.76 -56.97)	-45.36*(-66.93 -23.78)	-38.41*(-67.33 -9.48)
Kerala	-56.66*(-66.44 -46.89)	-47.68*(-55.81 -39.54)	-51.6*(-58.67 -44.52)
Tamil Nadu	-45.63*(-56.55 -34.70)	-33.42*(-38.68 -28.16)	-28.82*(-35.70 -21.94)
India	3.74* (2.80 4.50)	-19.21 * (-20.00 -18.30)	-27.40* (-28.30 -26.40)

*p<0.05

Figure 3 : Institutional Births in lower level facility, Rural India, NFHS, 2019-21



Note: State codes in Appendix. The following states are merged together for NFHS 5: Andhra Pradesh and Telangana

References

- Bhushan, H., Ram, U., Scott, K., Blanchard, A. K., Kumar, P., Agarwal, R., ... & Ramesh, B. M. (2024). Making the health system work for over 25 million births annually: drivers of the notable decline in maternal and newborn mortality in India. *BMJ Global Health*, 9(Suppl 2), e011411.
- International Institute for Population Sciences (IIPS) & Macro International. (2007). *National Family Health Survey (NFHS-3), 2005–06: India: Volume I*. Mumbai: IIPS.
- International Institute for Population Sciences (IIPS) & ICF. (2017). *National Family Health Survey (NFHS-4), 2015–16: India*. Mumbai: IIPS.
- International Institute for Population Sciences (IIPS) & ICF. (2021). *National Family Health Survey (NFHS-5), 2019–21: India*. Mumbai: IIPS.
- Joe, W., Perkins, J. M., Kumar, S., Rajpal, S., & Subramanian, S. V. (2018). Institutional delivery in India, 2004–14: Unravelling the equity-enhancing contributions of the public sector. *Health Policy and Planning*, 33(5), 645–653. <https://doi.org/10.1093/heapol/czy029>
- Meh, C., Sharma, A., Ram, U., Fadel, S., Correa, N., Snelgrove, J. W., ... & Jha, P. (2022). Trends in maternal mortality in India over two decades in nationally representative surveys. *BJOG: An International Journal of Obstetrics & Gynaecology*, 129(4), 550-561.
- Ministry of Health and Family Welfare (MoHFW). (2022). Rural Health Statistics 2021-22. Statistics Division. Government of India. Accessed through: <https://hmis.mohfw.gov.in/downloadfile?filepath=publications/Rural-Health-Statistics/RHS%202021-22.pdf>.
- NITI Aayog. (2023). *National Health Mission: Impact and learnings for future - A NITI Aayog study*. National Institution for Transforming India (NITI Aayog). Retrieved August 10, 2024, from <https://policycommons.net/artifacts/4772364/national-health-mission/5608469/>
- Rao, K. S. (2017). Revitalizing rural primary healthcare: The National Rural Health Mission. In *Do we care? India's health system* (online edn). Oxford Academic. <https://doi.org/10.1093/acprof:oso/9780199469543.003.0005>.
- Sarkar, P., & Tigga, N. S. (2018). Social inequality and institutional deliveries. *Social Change*, 48(1), 85-103.
- Singh, A., Kumar, K., & Singh, A. (2019). What explains the decline in neonatal mortality in India in the last three decades? Evidence from three rounds of NFHS surveys. *Studies in family planning*, 50(4), 337-355.
- Weitzman, A. (2017). The effects of women's education on maternal health: Evidence from Peru. *Social science & medicine*, 180, 1-9.
- Welaga, P., Debpuur, C., Aaby, P., Hodgson, A., Azongo, D. K., Benn, C. S., & Oduro, A. R. (2018). Is the decline in neonatal mortality in northern Ghana, 1996–2012, associated with the decline in the age of BCG vaccination? An ecological study. *BMJ open*, 8(12), e023752.